Ralph W. Liebing

The Other Architecture

Tasks of Practice beyond Design

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PREFACE

This is new! This long-standing! This effort, strange as it may sound, really is a combination of some information which is new to a text yet longstanding via word of mouth instruction and on the job training. It is long past due for this to be formalized to provide a good founding for the readers and a setting of context in their careers.

At the same time, a good portion of the book [Part 2] is long-standing, well-established and time tested information – some who misunderstand or have differing perspective may choose to dismiss it or render it obsolete. Nothing can be further from the truth when trying to teach or inform those coming new to the professional. Despite its tenure, it is still valid and "fresh", applicable to today's documents – namely the working drawings – as it was to yesterday's. It is standards of process, and resource information that is not tired to style, era, or subject to rapid change – it is basic information on which solid, pointed, and pertinent documentation can be based, and with which valuable construction communication can be achieved.

The latter portion is from a previous book by the author, that has been placed aside by the previous publisher solely because the market has shifted and the book's value as a "college text" [for university level professionals schools] has eroded and dissolved. Over the 33-year life and 4 editions of that book things have changed, no doubt. But the inherent value of its contents live on as reliable resources for those working in the professional architectural office. That academic instruction now resides, primarily in the community colleges, 2-yrar technical schools and institutes, and other similar instructional programs apart from the full degree programs of the university level colleges/schools of architecture.

It needs to be pointed out, however that it is the location of the instruction that has shifted and changed, and not the content of fundamental, standard-oriented information that remains perfectly pertinent and needs to be available to students no matter their level, academic standing, or instructional atmosphere. The information will enhance their education and their professional knowledge for the long term and give them a solid understanding of the architectural profession and its programs and processes that lie beyond the creation and development of the design concept. It certainly is not a situation of obsolescence or "old-school" methodology, with no current relevance! Indeed, the contents of this book is aimed at providing at least minimal level, awareness-type information for the students so they know more about the tasks, functions and documentation needs of project AFTER the final design is established and approved – the functions, if you will, that carry the project from concept to functional reality, fully functional for the owners and executed to the owner's satisfaction.

Our initial direction remains the same as for the original book, but with added emphasis. We have tried to embrace a larger segment of information about the profession of architecture primarily because the readers all may not be on the path of a career in architecture, but rather as ancillary personnel supporting the professional effort. The text though will not impair or prove of no value to those in professional schools, as it is fundamental, basic and resource-level information that they too can utilize.

Our basic aim was to inform as well as retain and set forth a location for basic documentation production information that has been used and will continue to be used – in direct content and as principle—in the future, no matter the motif or production program for the documentation.

Ralph W. Liebing

Cincinnati, Ohio, United States
September, 2010

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PART ONE

The Profession

At the present time, the schools of architectural offer very little instruction regarding the overall and daily practice of the profession and the numerous services and aspects of the profession itself.

This lack of information shortchanges the student, graduate and intern in that they have no fundamental understanding of the full reach of the profession and the work it performs. This, in turn, leaves the new professionals without a grounding in the profession overall, and places them at the mercy of the small amount and range of information provided during their academic experience.

Undoubtedly there is a vast array of information to be gathered, about architecture and practice, through points of learning and experience in a variety of projects over years of practice. This all cannot be captured in any one book, or series, but rather is part of the knowledge one gathers and retains, applying when appropriate and combining with similar knowledge residing in the minds of others.

Architecture is not accomplished by calculated steps that ensure success. Rather it is done by sensitivity to requirements, creativity in concept fashioning, and through the talent and ingenuity of the designer, appropriate documentation and skilled construction.

The primary direction of this book is merely to alert readers [students, emerging professionals, and others] of these facts, and to open the discussion about some of the practical, but necessary aspects of practice that exist as fundamental issues, concepts, and principles, but must carefully and appropriately applied, with specificity, once the design concept is solidified — in essence, "the Other Architecture"!

Results and benefits produced by this book will be directed to both students and young professionals for better insight and understanding of their chosen profession. Perhaps it can be deemed as another "education player" in that it provides at least some wider view of the profession and the various niches and tasks involved with the total practice and career prospects/planning that permits greater appreciation and concentration on the varied roles for architects – on projects, and in the office or other work environments.

The following portion of the book is directed, in general terms [variations do existing in some areas], toward providing some perspective and broader information about the profession, the services its offers and the overall reach of the profession. This is not complete as there is a vast amount of information that needs to be covered, but time and space restrict such expression. The following, hopefully, will provides some useful insight into the profession as it functions overall and in addition to the function of project design — i.e., The "Other" Architecture beyond the design of projects!

"The role of the draftsman in the formation of the modern profession has mostly been ignored. The iconic persona of 'the architect' has historically depended, nonetheless, upon the ranks of subordinate workers whose anonymous efforts have supported the imaginary façade of singular genius by which their own identities have been effaced".

Professor George Barnett Johnston, PhD, RA
College of Architecture
Georgia Institute of Technology

Ed. Note
although "draftsman" is quoted here with historic context, we aknowledge "drafter" would be propwer today

IN THE CONTEXT

Let us, for a minute, explore a couple of questions – what is an architect? What do architects do?

Fundamentally, architects are persons engaged in a profession, which is responsible for the design and construction of various buildings, and other structures, which provide shelter for human use, occupancy, protection, and property. This is, by definition, a wide-ranging and rigorous endeavor, much of which is not common knowledge among the general public.

These two elements, in a sense, compete with each other. The precise nature of engineering [where calculations are made and appropriate solutions applied in a direct and defined manner] can be expressed in a manner than contains aesthetic elements which are pleasant to the eye, create attractive massing, and still meet the ″solutions″ demanded by the engineering. This is the realm of the architect – in a world beyond the fundamental engineering, enhancing it but still meeting its desired function and operation.

The two elements – architecture and engineering – reside side-by-side. They support each, as well as compete with each in some ways. Engineering has become increasingly complex, due to the new equipment, computerization, more complicated needs, and projects that boggle the minds in their own complexity. Engineering from the academic to the professional continues to solve the problems of society, and to provide the convenience which the public demands in its structure and life style. Where there is a problem, or where an unresolved situation occurs, engineering, of one sort or another [there are numerous types of engineering] will be equal to the challenge, and will solve the problem rather quickly.

In one aspect architecture provides the enclosure for the engineering systems – in another it creates the need for the engineered systems. An industrial plant of massive, complicated, and expensive intertwined runs of piping and ductwork [used in the manufacture of the various products] needs protection from the elements, and protection, facilities, and planned circulation for the personnel who will run the plant. It is here where the architect aids the construction, and brings together the ancillary [but necessary] elements of the building. It is here where safety and convenience are introduced to assist the engineering functions and the personnel – beyond the mere engineering/production functions. And in addition, with the owner's approval, the whole of this plant can be made into a facility that enhances and projects the image of the company or corporation to the outside public. This makes the plant a "good neighbor" to the community, something that every plant owner and operator seeks, since employees live in that community, and the community resources are needed by the plant.

The architect, however, is engaged in a tremendous array of projects – banks, schools, stores, condominiums, high-rise office buildings, fire stations, parking garages, stadiums, museums, day care centers, hospitals, and residences, among them. Here, in varying degrees elements other than engineering play a major part in the conception and documentation of the project. Aesthetics and other human concerns must be assessed and addressed – satisfactorily – to provide a successful project. Comfort, convenience and image take a much greater role in the design of these facilities. An electric power plant is not open to the public, and doesn't need to attract users to itself – a shopping center is all about the public, and attracting people for the conduct of their business and shopping. It is obvious that the design – and the architect – require entirely different approaches and design tools in this.

In this, architectural education takes on a more all-encompassing demeanor, where the architect is specifically trained to take a broader, overall view of a project. This view is not just focused on a specific function within the building, but extends to the entire building, its grounds, and its surroundings. It also encompasses the use of a ″team″ environment, where the expertise of others is gathered and combined, by the architect into the project design and work, which fully addresses the client's demands, wishes, desires, needs and whims. As well as their budget and time schedule.

The architect is trained [in 4-8 year college programs, with baccalaureate or master's degrees] in the fundamentals of building design from both an artistic and an engineering viewpoint – literally architects are a combination of artist and engineer. Many contest that this is also the fundamental shortcoming of architects, in that they tend, quite often, to over-emphasize or maximize the artistic, at the expense of realistic engineering features.

The education and training, though, produces in the largest number, persons who respect both aspects, but are able to combine them successfully to the satisfaction of their clients. Other than for purely utilitarian facilities, most owners/clients seek some sort of image enhancing features in their projects. The charge to the architect, then, is to devise a scheme [design concept], which incorporates all the requirements and at the same time presents a very pleasing appearance. In a large sense, the architect literally ″leads‵ the client to a design solution, which is unique and strictly an image from the mind and talent of the architect.

Disasters, of historic proportions, have taught government in the various jurisdictions [states, counties, cities, townships, villages, etc.] that it has an interest in and a function for providing a safe environment for their citizenry. Since each individual cannot demand a level of safety, the local government takes the need for ″public safety‵ and establishes a minimum level of safety. Subsequent to several very destructive events, building codes were enacted, as the law of the community, and the standard to which all structures must be designed. This was presented as the minimum amount or level of safety required to prevent further disasters of the type and magnitude that caused the enactment in the first place.

Actually, building codes date back to the time of King Hammurabi, who saw the need for control of construction to protect the citizens [who had no recourse to protect themselves]. Hammurabi's code was strict and had harsh [by today's standard] penalties for poor or substandard construction. Although not addressing or setting construction standards, per se, the code mandated such retribution as death for any builder whose project collapsed and caused the death of an occupant. Similar penalties were applied to the injury or death of other parties.

Changes in community life and housing also caused changes in the codes. When fire was established within houses, thatched roofs quickly became victims; housing close by one another, allowed fire to run rampant through entire blocks in cities, progressing from house to house. Even today, new construction materials or methods cause modifications of the codes, so their basic premise is retained. That premise, for building codes, is that where a hazard is or could be made present, there must be proper and commensurate protection for occupants and the general public. This is a change from early 20th century codes, which protected property, not people.

The states began to see value in establishing standards for architects, just as they do for doctors and lawyers [this has now expended to barbers, veterinary technicians, and similar persons who treat or work with the public in general]. Basically, this is seated in an established educational sequence, testing for ability, and providing a method of registration. In the latter, a periodic renewal of the registration [license, if you will] allows the state to keep tabs on the professional. Each profession has a code of ethics by which practice is to be accomplished – this involves the setting of certain distinct points or hallmarks for each practitioner to follow to maintain correct professional demeanor and operation.

Architects, through their registration program, come by another aspect of work, rather unlike any other of the major learned professions. In an effort to provide the best quality construction possible, the registered architect is required to practice in a fully lawful manner. This means that the work produced by the architects MUST be in compliance with the applicable building codes and other rules, regulations, ordinances and codes. In fact, practice in a manner other than this is basis for legal action and suspension of the registration.

While doctors and other licensed professionals are bound [primarily by ethics] to give their best effort for their clients, none have the onus of a direct legal tie to ″public health, safety and welfare‵ as contained in the architects' charge. Some states have now added laws whereby certain facilities MUST be designed by registered architects [or engineers], and no building permit will issue without the correct design responsibility. This elevates the quality of design, and with continued involvement of the architect, the actual construction. The latter comes about through the enforcement of the contract documents on the part of the architect – i.e., part of the architects' charge is to monitor the Owner-Contractor contract to see that equitable and proper actions takes place through efforts of BOTH parties.

In this scenario, the government's inherent interest in safe construction [the basic concept beyond building codes] is carried to execution, by having the architect responsible for seeing that code compliance is built as an integral part of the project.

Although the general context of the architect may be changed, by different project delivery systems, the fundamental charge remains unchanged. There are situations where there are now legal questions as to just how these two elements are resolved, in a legal and protective manner. Certainly, the delivery systems cannot obviate standing law, and re-configure the professional's standing, status, and responsibilities. However, there is need for a wider and more open discussion of this information, and hopefully a better understanding by all parties.

At the present time, two aspects of professional architectural education are quite disturbing. Both have to do with individual "budding" professionals and what information they need to carry into their career work. Many academics decry the idea that they are "preparing students for the work place", when reality shows this is exactly what education, in large part, is all about – the instilling of fundamental knowledge, application techniques and problem solving [no matter the type] to situations that arise in the workplace.

These two issues currently in question are:
1. Lack of breadth of knowledge of the practice/profession as a whole – i.e., what ALL is involved with the profession and its work, and how the new graduate, intern or hire fits into this scheme. Also, the aspects of work that exist well beyond and are not directly project related, like business operations, managing an office, marketing, etc. [as well as the "nice-to-know" more academic information and knowledge that round out the well-informed and properly accomplished professional.

2. The loss of information and full understanding regarding the intent and content of working drawings used for the construction of the project as designed ad approved by the owner – i.e., the basic communication instruments used to convey design information to the field personnel for actual construction. The computer and various software program have drastically changed the relationship of drafter to drawings, to the point that the artificial display is just that and rather meaningless in terms of quality, type of line, line weight, etc to the drafter. Many CAD technicians simply copy hand sketches [produced like in the "old days"] and have little construction knowledge to really understand, augment the drawings or even ask relevant questions. This disconnect between construction knowledge and graphic function is much more than unfortunate and is perpetuating the erosion of quality and relevance in the final iteration of the drawings.
These are, in a way, quite interesting – one lacks fuller disclosure of the students' choice of profession, and the other confounds the proper expression of the work that student/employees will encounter, immediately upon their hire into professional offices. It is both perplexing and stupefying that the profession at large and the larger part of the academic preparation efforts, for entering the profession, both seem to choose to ignore the very basis required for merely entering on a course of action that is replete with unknowns.

On the first issue, anyone entering a new line of work or profession – and especially young people looking toward choosing a new profession – should have open and full access to a complete, comprehensive and accurate description and review of their choices. It is incredulous to believe that it is not both rational and reasonable for the young student-professional to be entitled to and at least exposed to the entirety of the profession. This entitlement is made even more important since the student usually has very little information, and virtually no concept of the profession overall. They are attracted by some portion of the work [design, perhaps] on the basis of minimal personal interest [I like to draw!], fascination with the computer [and its capacity to create various graphic images, including buildings], some sort of aptitude testing, or advise or encouragement of peers, counselors, family members or others. In this, a good many of the students come to find out that their choice is bad – not to their expectations, or not aimed at their own personal goal[s] in their life's work. They simply need more than superficial information; and also need deeper understanding at the outset [decision-making time]!

This need not, however, include all of the nuances of the profession that could be the proverbial everything-you-ever-wanted-to-know concept about things experienced along

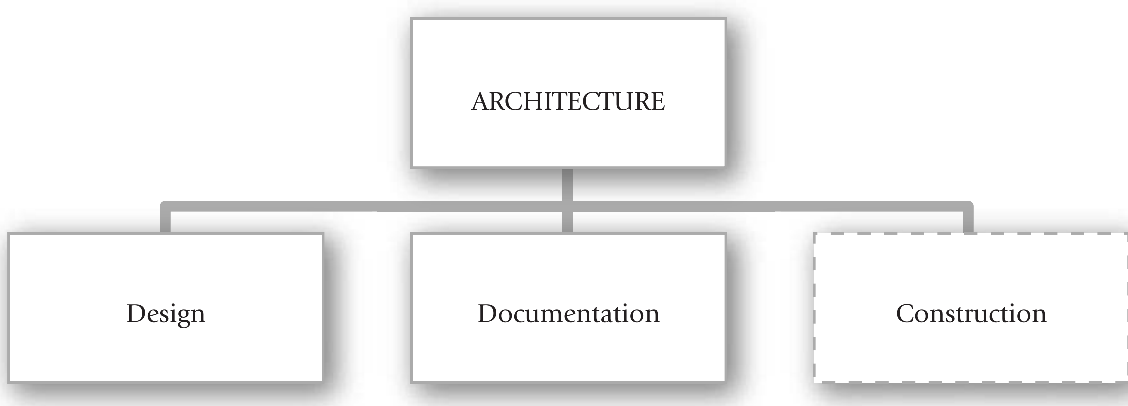


Fig. 1-1
In the most general terms, this chart shows the three primary functions required to produce examples of architecture, be the design concept good, "bad" or indifferent. Regardless of that concept, the following function must/will occur – on every project – and they, too, can be quite varied in quality. But here the point is that the offset in the horizontal line is proper and pertinent in that it defines the point of differential between the work of the design professional and that of the constructor[s].

one's career. However, there is a need to be aware of the grossly general truism, "There is something with every job"? This is not to indicate a dark or devious nature – a threatening or insidiousness, but rather a simple fact that architecture is, indeed, a complex, and wide-ranging profession and not all about design. Surely, a prospective architect, in the bud of entering college level instruction, should at least have some idea about the whole of the chosen profession – perhaps a right to know and to pick a career path when academic training, graduation and internship have been negotiated.

To know there is much beyond "designing" by drawing house plans, or admiring the drama and breath-taking inspirations of but a few world-renown "starchitects". To realize that many, many very fine careers have been pursued, without acclaim, but with both satisfaction [on part of client and architect] and overall success – the happiness of achievement.

Believe that there should be no discouragement in the fact that not every architecture student will become widely published; overly wealthy; a world-wide household name; and a celebrity become of immoderate proportions. Yet architects are not mired in only grunt work and near poverty! But surely the most cursory review of the breadth of services that the profession offers, the many aspects and facets of practice, a basic legal discussion about responsibility and liability [the professional "standard of care", for example], and assuredly the innumerable tasks and skills performed by or required of professionals.

The profession is NOT a straight line, where one reaches a plateau level and merely continues along that path until retirement. The side issues and opportunities are marvelous, exciting and should be part of the menu or palate "offered" each student from day one in college, until their graduation.

Much can and will happen – and each student should be at least mildly aware of what they can be – in general terms. And this instruction need not be a distraction from the development of skills required, knowledge required, and general education – but assuredly, it should be part and parcel of every curricula. Architecture cannot be taught, properly in miniscule microcosm of its entire impact.

No one should be placed in a position where they must commit to anything, be it a purchase, work place, or certainly a career, on a whim or a guess about what all may be involved. Of course, for a life's work one must be doubly cautious and caring, so their illusion of the prospect and its reality come in fairly close alignment. To make a deep, lasting, important and expensive choice in the commitment to a professions only to find out later that either one is not attuned to such work, or has no deep interest in it, is quite devastating and costly – and becoming more so with each passing year.

Students contemplating a career in architecture need to have a glimpse, at least, of the full breadth of the profession. They need a true reality check to ensure that their interest and attraction is not based on a single aspect of the work, only to become

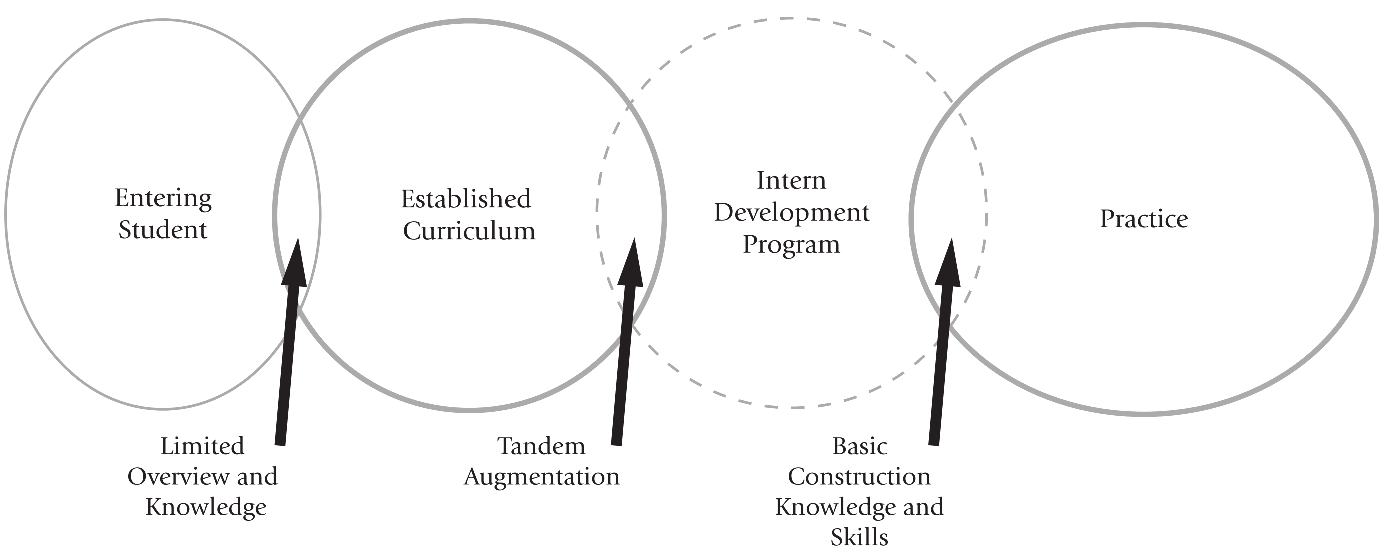


Fig. 1-2
Chart shows the progression that one follows to gather information and levels of knowledge required to practice in the various work phases of architecture

quite disillusioned later when their aspirations are not fulfilled and their career path is forestalled or directed elsewhere.

Analogies abound in various other professions, where it is easily seen that one must be at least aware of all facets of the work before choosing a specific and limited niche or role in the profession. In any profession, it is virtually impossible to be equally expert in every aspect of the work and the conducting of the practice. So it is in architecture.

Hence, one needs to be made aware of all aspects, prospects and reality, so the initial choice can be intelligently modified or directed toward that place where the person is best suited, deeply interested, and functionally astute. To "know about all" is not to have full, in-depth knowledge, but is to acknowledge the existence of the various ancillary elements and be able to understand their inter-functioning and their working relationships. Professional work is usually not a singular function, with narrow focus, but indeed, is a mosaic of work tasks, performed by persons well qualified in those tasks, flexible and adaptable, working in tandem and as a team to achieve the final product or deliverables to the concerned parties.

Professional education is compounded by the need for such a wide range of information and knowledge and the need to understand the adaptive use of that data for specific functions, results, and operation. Certainly, it is far removed from some educational efforts that concentrate on more isolated functions.

In regard to the working drawings, many resources contain most valuable information that is necessary and used to support and assist various work functions. Often a good deal of this information is virtually timeless, and remains in spite of great changes in other things. Information, for example, remains intact no matter how it is reproduced, or what type of equipment is used to reproduce it. The information stands on its own, invaluable to the staff of the design professionals in the course of accomplishing various tasks now and in the future – much like the past. This information is not stigmatized, nor dated – it stands as is, time proven and valid!

This is not to tenaciously hold onto the past as the "only way" to do this work. Rather it is information that needs not be recreated, or found again to move forward. Basically we categorize this as "reference material" and it includes standard information for use in or as guide lines on how tasks may be accomplished – again without regard to the methodology or equipment involved. In fact, some functions done manually, using this material, and also be done using some sort of equipment or machine – but based on and utilizing identical reference information. This information is not obsolete, passé, or improper. Rather it is a resource that can be used repetitively without having to resort to deep research, re-invention or time-consuming new development. It is a "place to start" and a place to establish some fundamentals to aid the smooth, seamless flow of new information into the project documents .In addition, it does nothing to inhibit new thinking, design, innovation, or development.

THE REALITY

It's a matter of fairness! It is clear in the quotation by Professor Johnston!

In its larger part, architecture, as a profession, is far more extensive and intensive than just the much proclaimed design function and the eventual project design concept. It is this breadth that is not adequately [if at all] brought out to students, and often is lost along the way to graduates and interns. Hence, there is an imposing amount of information that is not offered to, or readily available, which serves to explain all of the profession – that which is most valuable in career planning and understanding one's context in the profession.

It is both fair [to the future architects] and important to the success of the budding architects AND their profession in the future, that more information and understanding be provided, or at least referenced [but made compulsory for individual research or study]. It is imperative here to expand on a wider array of the aspects involved with this breadth in overall reach and the services provided by the profession – to give a more balanced and less skewed perspective.

Architectural design is not self-fulfilling! Design does not, and cannot become architecture until and unless it is processed through progression of tasks and procedures, and different phases of work. There is a continuing need to facilitate the execution and realization of the design trough documentation and of course, construction. This text, in Part 2, will address the production of contract [working] drawings, one of the major functions facilitating the construction of architecture – and the function that the vast majority of new professionals will be assigned in, at least, their initial employment in a professional office. But first the discussion is about the some aspects of the profession that surround and encase both design and working drawings.

It is more a matter of fairness! True understanding begins with the acquisition of information and knowledge, accompanied by explanation and discussion.

It is only natural that anyone contemplating a new work position, entering an educational program or a profession [and especially young people looking toward choosing a new lifelong profession] has a curiosity about what all they may be "getting into" and what they will face immediately and have to negotiate to be successful. In that, one needs to seek out, and should find ready access to comprehensive and accurate information, including a full and complete orientation about their choices, any alternatives, and what all lies beyond them. Most of the time, this information is easy to find as most professions or companies are open and free with such information as a service to any inquirers. Without such information and explanation [which is unthinkable] the person is left to drawing whatever founded or unfounded conclusions that may wish – a shortchanging of pertinent knowledge. Hence the task of this effort – an expanded view of the project production and documentation process!

The person should know, in general, what all is involved, what variations and opportunities exist, and what can be expected both by the student/staffer ad the instructor/employer. This would appear to be a mutual responsibility where this information is either sought out by the person, or is part of any advice to such persons by others [academic advisors, professionals, etc.] But actually this is unfair to the person seeking information [since they do not know what to look for] and is ill-advised and flatly inappropriate to be allowed to languish and go undone by the other more knowledgeable persons. To start any of these ventures without some insight into at least a general overview of the entire undertaking is misleading and just wrong!

No one, really, should be placed in the position of taking a job or entering a profession without knowing something of what all is entailed. Students embarking on professional educations should be given some overview of the chosen profession in its totality – a realistic perspective of what lies with the profession's purview and work and what "could" be involved somewhere in each person's career life. Many dismiss this as "nice to know" information when in reality it is "must know" information. There is a distinct need to change the prevailing veiled, if not hidden innuendo that "everyone will become as designer" to "everyone will have the capacity to design, but may function in some other capacity". Indeed not every architectural graduate will become an architect – there are too many other, ancillary careers that play off of an architectural background. Too many other areas to contribute! And too, the big hitter firms do not have representatives at the gates of the convocation halls or stadiums to pull out [and hire on the spot] those we excelled in design.

There is a prevailing need to expand and balance the understanding about the profession of architecture beyond the academic concept of "design-design-design" [in the same context as "location-location-location" in real estate] as not only the primary, but sole cons ideration. While this certainly, does not apply to every school, it does apply to all too many, in varying degrees. The result is most unfortunate!

Why is it so complex and contentious?
What is so hard to understand?

It is not a competition! It is not one against or over the other! It is not a matter of one better than or more important than! Basically, it IS a matter of mutual respect and understanding, since both are trying to achieve the same end.

Design and project documentation are interrelated, necessary to each other, and virtually inseparable.

Without documentation, a design concept in the form of a rendering has no essence or context beyond the back side of the board it is on!

And without both a concept, documentation is risky – merely starting to draw something and hope something eventually comes to be!

And without both a concept, and documentation, it is risky to merely start building something and hope something eventually comes to be!

It has long been held that the architect is by nature and function a "generalist", as opposed to a specialist. This is the basic premise that cast the architect as the leader of the project team. Having the greater breadth and depth of knowledge about the project, from its inception, the architect must perform a number of functions from the start of the project until its completion. It's for other disciplines to function as narrow-scope specialists who possess high skill and expertise in limited areas of the project [e.g., structural, civil, and electrical engineering; mechanical building services; landscaping, and similar functions].

The architect, even for a modest project, must have at least a working knowledge of some 500,000 different items – from materials, to devices, implements, systems, equipment, assemblies, etc., and the proper use of them in concert or singularly, correctly detailed and applied to serve the clients' needs in the more positive and cost effective manner. No small task, and far more difficult when the project work becomes increasingly complex and convoluted. While the role of the architect has changed and evolved through the years, it still entails numerous functions, and not merely one of "design only" – and then walking away from further involvement in project execution. Many people, from some architects themselves to clients and others tend to advocate the limited role due to prestige or cost consideration, but truly the architect "needs" to be involved in the totality of the project to ensure correct execution of the basic concept [as approved by the client/owner]. In some jurisdictions, architect participation during construction is a requirement – including specific parameters for oversight inspections, observation of actual work, and filing of substantiating reports.

Obvious in this is the direction that architectural education must follow the same multi-purpose path to instruct, direct, guide, educate/train and otherwise prepare the young professionals in a manner that will support what is expected on them in their career/practice. This is not a matter of options for the schools, or choices for students. This is a direct cause-and-effect situation – an absolute necessity! A legal mandate!

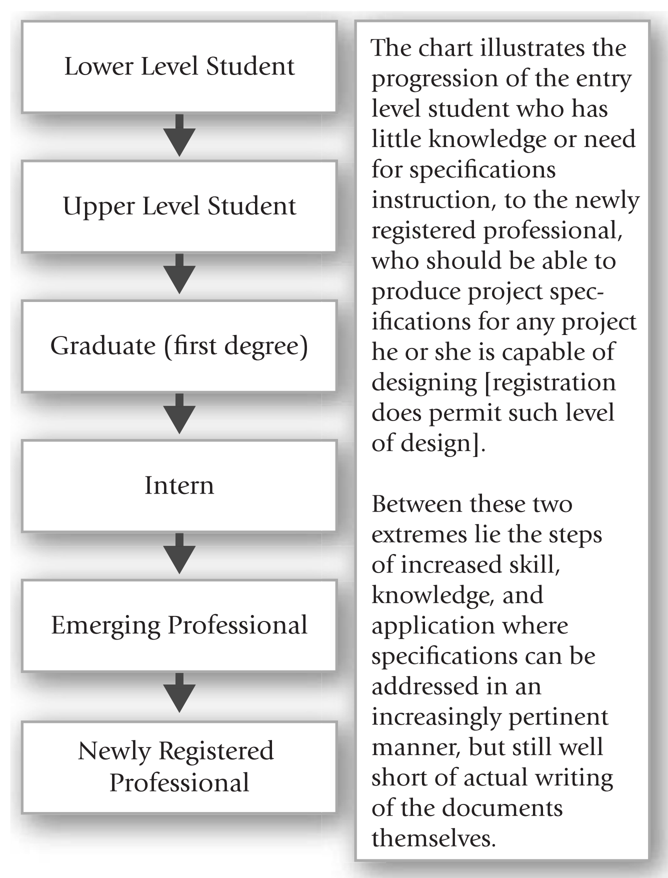


Fig. 2-1
Chart depicts the various steps required in the development of an architect and the relationship of the level acquired knowledge at each step

The dearth of information made available to students of architecture [including graduates and interns] creates a wholly inadequate exposure to a full and comprehensive view and understanding of the profession – in total [see Preface]. In the unfortunate but traditionally pervasive zeal to portray architects only as the project designers, no real effort is mounted to illustrate the complete picture of the work done on a project from inception in the office to completed project in the field. There is a lasting impression on the part of the more insightful student that something else happens, but there is little if any information about that process.

Much can be gained by having more enlightened young professionals. They can more fully understand and participate in their work and contribute to their office work. The current situation is without sound reasoning and is really a happenstance reflection of shifting responsibility [without commensurate coordination, cooperation and action], allocation of time to ancillary issues, and the lack of inclusion of the professional office in the requisite further education of graduates and new hires. There is, apparently a "second agenda" within the profession that is, for some reason, vague and rather hidden away.

But there is no one, or organization that sees the distribution of pertinent profession-wide information about architecture. Colleges are both restricted in time, but also immersed in the design aspect as to provide no viable outlet for the necessary added information. The single professional office has neither time nor money for this, and "assumes" the employee will "pick up the other information along the way"! Neither has a mandate; neither has an obligation to do this; neither has inclination! Hence the gap or lack of information persists with barely any effort toward changing things. One area where a fuller explanation of architecture can be viewed is the 6-part document available at: https://www.acsa-arch.org/students/studentsguide.aspx. This is a thread about architectural education and practice. But even here this information is a different sort of overview and now directed toward actual hands-on practice tasking.

Is there really an "other" architecture: a "second" profession of architecture; or is that more myth, legend, fiction, or pure untruth? Or is it unspoken reality?

These questions are rarely, if ever asked in the academic preparation of architects, nor is the broader topic. Reality holds that the training and education of ALL architects entails certain limits but must always utilize high efforts in teaching theory and design. It is as if design is not only the pre-eminent issue, but the sole issue in training and developing architects. Indeed, can a person be considered or, indeed, be an architect and never design a building or other structure?

Architecture like all of the other "learned professions" follows the general definition to a large extent.

	Programming	**Design**	**Design Development**	**Document Production**	**Bidding**	**Construction**
University College [accredited] BArch	fair Separate instruction; or set by Instructor	Heavy Emphasis	Minimal formal instruction	Little if any instruction; spotty as some schools do offer this work	Part of Practice instruction, if at all	Seen as the result of other course work, not as the primary work
Tech, College [may be accredited] BS in Arch	Usually set by Instructor	Moderate with more balance with other aspects				
2-yr College Allied Associates*	Minimum as full projects are limited	Minimum to adequate to support other work				
Community College Allied Associates*	Minimum as full projects are limited	Minimum to adequate to support other work				
Technical Institute Allied Associates*	Minimum as full projects are limited	Minimum to adequate to support other work				
* Architectural program is usually a minor course of study, attached to a primary engineering curricula						

Fig. 2-2
A comparison of the type of instruction and the level of expertise required in various architectural programs in a variety of academic facilities

*"A **profession** is a vocation founded upon specialized educational training, the purpose of which is to supply disinterested counsel and service to others, or a direct and definite compensation, wholly apart from expectation of other business gain". [emphasis added]*

– Sidney Webb, Esq.
English Attorney and Politician
1859-1912

It can be argued that the difference between a profession and a "skill" is that the profession demands as wider range of knowledge than the skill – a range that covers many skills and not honed in very specific functions and narrow array of required knowledge. In fact a tremendous amount and range of information is necessary – it is the degree of such knowledge that makes the primary difference.

The important factor is that the people directly involved – in either skill or profession – must have and understand all of the information required for their specific work or the range of work they encounter. This allows for deep insight, full function, and expert work as may be necessary to achieve the requirements or goals uniquely set for each project.

Even today [after many centuries] the profession of "architecture", by definition, has a direct acknowledgement that the profession has two basic elements. The definitions utilize the words "art and science", as the separate but interconnected efforts required to produce architecture, as seen in:

Architecture: The art and science of designing and building structures or large groups of structures, in keeping with aesthetic and functional criteria. [italics added]

- Cyril M. Harris
"Dictionary of Architecture and Construction"

This basic definition is reinforced by the following:

*"…..the architect **must** approach design with a fundamental grasp of building materials and methodology……the architect must have an expertise in construction along with design ability".*

- American Institute of Architects,
Paper submitted for 1993 Walter Wagner
Education Forum

But these watchwords also have significant historical precedents. As far back as 25 BC, Roman architect/ engineer Marcus Vitruvius Pollio [Vitruvius], in his pivotal and highly regarded writing, De architectura [now called Vitruvius' "Ten Books of Architecture"] used the words "theory" and "practice" to describe the work involved – rough equivalents to modern "art" and "science". Hence, despite the passage of over 2000 years, the most insightful, highly accurate and enduring basic perceptions remain very much intact. The names may change, but still appear in interrelated pairings, much as follows;

Theory → Art → Design

Practice → Science → Technical

Today these terms have evolved into "Design" and "Technical", where the previous two words in their order [like art and theory] are combined into a single all-inclusive term.

Vitruvius' tremendous insight is revealed in his Books, expressed in his writing about architecture;

"Theory and practice are its parents. Theory is the result of that reasoning which demonstrates and explains that the material wrought has been so converted as to answer the end proposed. Hence, the theoretic architect fails to grasp the shadow instead of the substance.

1 Project Programming	2 Schematic [Preliminary] Design	3 Design Development	4 Production of Contract Documents	5 Bidding and Contract Award	6 Construction of Project Work

Fig. 2-3
Display showing the full range and sequence of work phases required in every architectural project, from inception to completion

TRADITIONAL PHASES OF WORK

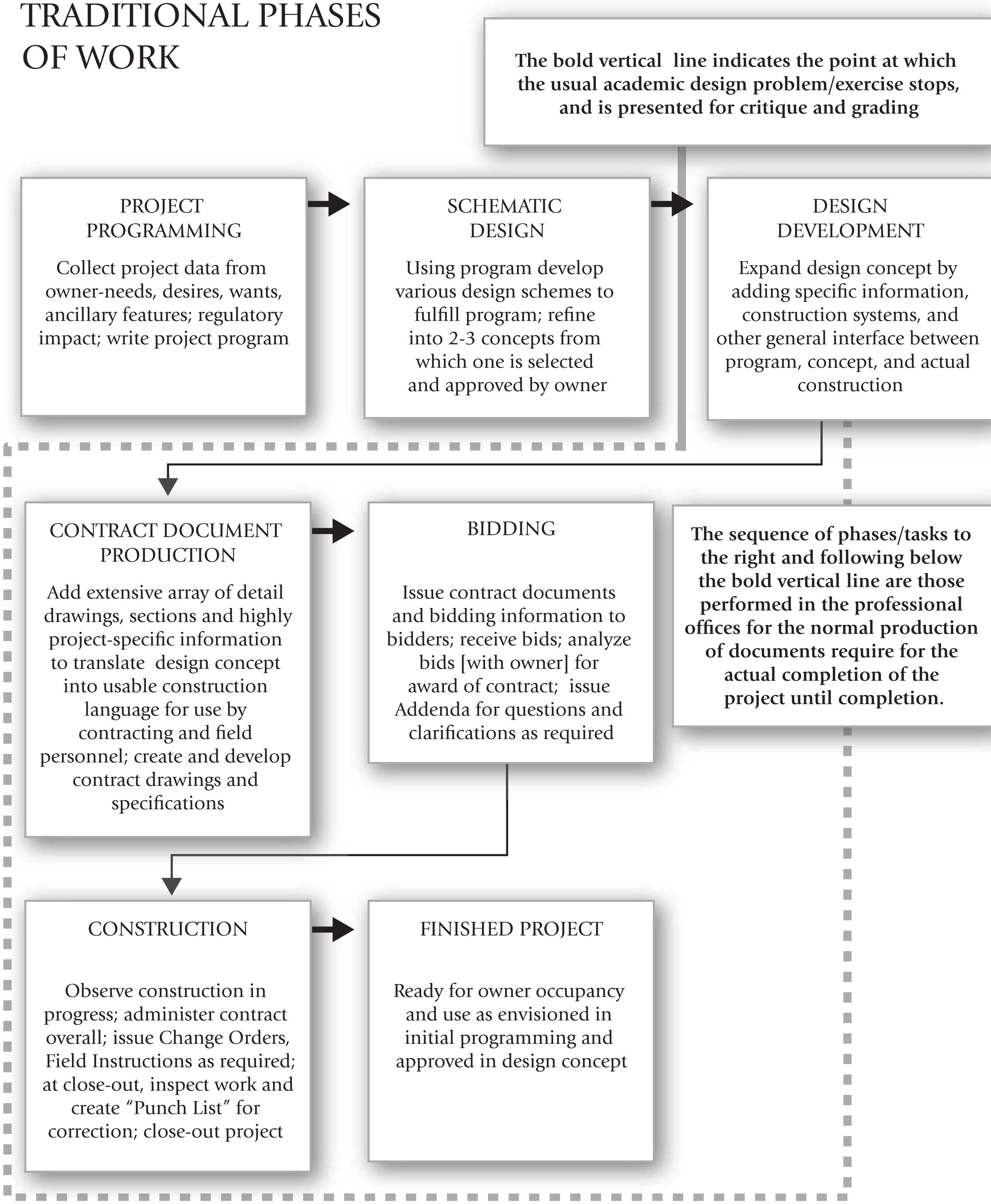


Fig. 2-4
An expansion of information about the architectural work phases and the division between academic work and instruction and the remainder of the sequence

Practice is the frequent and continued contemplation of the mode of executing any given work, or of the mere operation of the hands, for the conversion of the material in the best and readiest way. The mere practical architect is not able to assign sufficient reasons for the forms he adopts.

But he who is theoretic as well as practical, is therefore doubly armed; able not only to prove the propriety of his design, but equally so to carry it into execution".

- Marcus Vitruvius Pollio
1st century BC, Roman architect,
Engineer, writer and artilleryman

Three other more current quotations from varied sources bring the point of two aspects in architecture into even sharper focus:

"Concept and implementation must be seamlessly related if the built work is to be architecture and not just a building."

- J. Patrick Rand, FAIA
Distinguished Professor of Architecture,
North Carolina State University

"…the act of architecture is not finished when the design is done, but when the building is built! However, most students see, and are taught, that a design is the end product."

- Gerald G. Weisbach, FAIA,
Architect/Attorney,
San Francisco, California.

"Architects, on the average, must select 1,500 products and make over 17,000 decisions on what is best for the project and the owner. That's 17,000 answers to 17,000 questions (…) an architect cannot know every detail of every product. By nature, they are generalists, but they carry a complex of responsibilities. Architects are the design creators who desperately need trusted product information (…) to help them determine the right product[s] for their project."

- Dan Ouellette,
STONE WORLD magazine,
May, 2003

The open recognition of the two aspects of architecture are crucial to understanding the whole of the profession's work, its' impact, direction, intent, and production. In reality neither aspect can survive on its own and still be works of architecture. The design and concept requires functions, tasks and work to bring it to full reality. And the technical work may be able to produce structures and buildings, but the chance of them being "architecture" is doubtful. That is not to say that engineering-oriented construction work is necessarily suspect or repugnant, it is just that highly aesthetic design quite often is not a primary consideration or concern. Architecture, in its fullest extent, exists and is both conceived and produced daily as the many projects work their way from mere ideas and needs to real and functional buildings/structures.

The dilemma the profession finds itself in can be explained to a large degree in the following series of quotes:

"Most schools of architecture, almost all awards programs sponsored by architects, and many professional journals in the United States perpetuate the attitude that architecture-as-art is uniquely exciting, intellectually satisfying, and worthy of recognition.

Although skilled job captains are often valued for their knowledge, architecture-as-science is generally regarded as burdensome, something of which we try to learn only the minimum required, and then only because we must. There is almost no recognition of the idea that the science of architecture might involve imagination, creativity, or design skills, or be interesting in its own right.

Finally, architecture-as-practice is seen as something to be learned from one's employers after graduation, although the difficulty many firms have stabilizing their work load or providing for lean times suggests that practice is rarely learned adequately this way. Even more critical to the success of any project is the ability of an architect to develop strong working relationships with the clients, users, governmental agencies and other parties who influence the project.

Without understanding architecture-as-practice, few architects will be able to produce projects that achieve their design potential. Architects will be neither the generalists nor the Renaissance men and women that they claim to be, so long as they are produced by a system that overwhelmingly, and almost exclusively, emphasizes proficiency in architecture-as-art."

Barry Yatt, FAIA, CSI, CDT
Associate Dean for Undergraduate Studies, Professor
The Catholic University of America

To properly practice architecture, a person needs to be aware of and know about the wide array of services, skills, and data

Fig. 2-5
What is missing? Displayed are the work phases addressed in the schools, and the actual construction [undertaken by construction personnel, and not the architect[s]

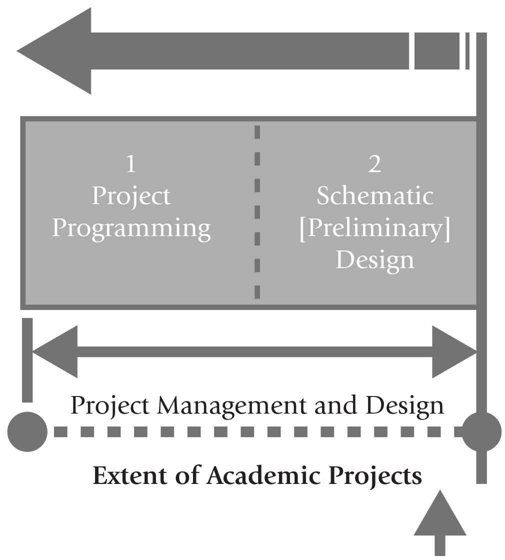


Fig. 2-6
Chart showing the various aspects of project work phases that are addressed in academic programs

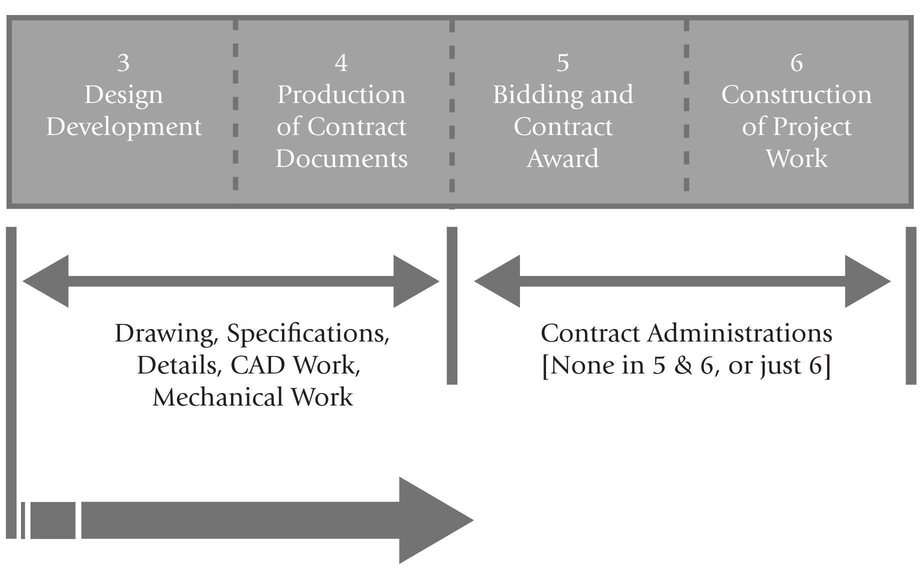


Fig. 2-7
Display of the project work phases, the documents and work involved in the phases [shown as "missing" in Figure 2-5] which are requisite to bringing any design concept to reality

required to be utilized in projects – and how the combination varies from project to project depending n what results are required. This is a factor that cannot be compromised, short-changed or overlooked, since it strikes at the core of the profession, and its basic intent and function. While every practitioner does not necessarily engage every aspect on every project, it is still incumbent to understand and have ready access to all of the information. This intent of this effort is to produce a book that deals with some of the more distinguishable [but still overlooked] issues and aspects within the architectural profession; and the educational system/process that produces valid graduates, interns and eventually candidates for registration [licensing] as architects [and ancillary personnel]. It is not an effort directed at in-depth discussion of the whole of the profession or construction industry [although there may be a level of interest in the contents and issues].

Due to the pervasive and egregious lack of full disclosure, appropriate balance, uniformity, [and with wholesale disparity in the curricula of architectural schools] and no other applicable criteria requiring it, professional practice instruction has commonly been minimized if not eliminated. This is instruction that looks at various aspects of practice, some more in depth than others, but usually with some introduction and discussion on most all circumstances, tasks and areas of work that one can encounter in practice. For the most part it is explanatory, with some courses utilizing specific exercises and restricted areas of exploration.

While there may be some valid reasons that impact the reasoning or deletion of selected instruction, to a degree, it appears that this gap in information is severely short-changing the students and the budding professionals. The profession, overall, is taught [if at all] and explained in an inordinately narrow context and indeed relies heavily and disproportionally if not totally [and unfortunately] on solely the theory and design of projects. This severely inhibits overview and understanding of the broad range of the profession and its many and varied services – concerns that are vital to every registered architect in one way or another at some time. It virtually is "tying one's hand behind the back" and impairing total comprehension. And regrettably it leaves it solely to the student to find, become aware of and secure the necessary information to provide some depth of understanding of the various tasks and responsibilities of the profession. It is a rather shocking and incongruent breech of propriety to allow professional education to be eroded away and to eliminate the very information and knowledge needed to construct buildings in a safe and sound manner – particularly when the legal charge to the architect is "the protection of public health, safety and welfare". It is extremely difficult, if not impossible to justify such as shortsighted and basically illegal stance! The following chart illustrates the areas where little if any instruction is provided in the professional education process for architects. Taken over the expanse of its full extent, every project is the result of a series of work phases, each executed based on information and development in the previous one and by offering added information and insight to the project work. The following chart shows the complete sequence:

Actually, little programming [Phase 1] takes place in the academic projects since in the main, the programs for the various projects are set primarily by faculty for selected and specific learning points, exploration and investigation, open thinking and conceptualizing, and are not predicated on a "real" client or necessarily specific project parameters. They are usually exercises to investigate, experience and drive home certain points of theory or design. In some schools, programming is a formal block of study offered in addition to the primary degree curriculum [a minor or added program of course works]. The schools emphasize and demand heavy work and concentration in Phase 2, but never fully explain the limits of that work and what is not accomplished for the project, overall. The pre-eminent dedication to design and theory maybe longstanding but offers a curious short-changing of the students, who certainly seek and are under the impression they will receive a fully rounded professional education. The concept of work in the Phase 2 section can be justified to some extend as allowing the student to both experience the investigatory aspects of practice, and the methodology or process of actually designing a concept to meet the requirements. The problem though is that the entire curriculum, in many cases, is based on this premise, and therefore allows very little time for the examination and experiencing of the other aspects required in practice. Unfortunately, a singular skill in design, no matter how highly developed, will not provide one with opportunity to do the other work or to readily find employment outside of design.

Students usually will see and learn little [without practice instruction] of the work in Phase 5, and the process of bringing the contractor on line and starting construction, based on valid bidding. Of course, during actual construction [Phase 6] there are but few opportunities for the student to work and learn, as more often than not today, the design professional is not a participant in the actual construction process. Where that does occur, the student may gain some minimal and sporadic insight and experience. At a minimum, however, the student should be aware of this information, with some limited added detail.

In addition, as seen in the following graphic, the basic phases of work simply do not appear when applied to the academic sequence. This book will concentrate on the work done in

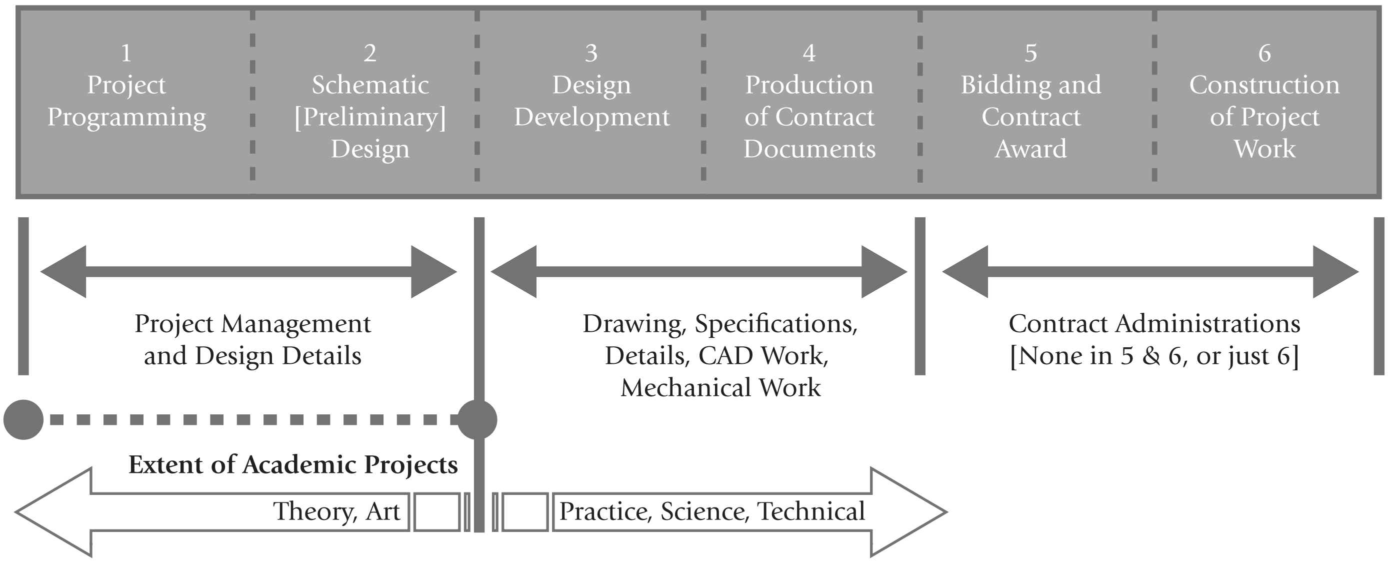


Fig. 2-8
The combined full range of basic work phases of documents and activities involved to produce architectural projects

	Secondary / Vocational School	Collegiate Schools	Community / Technical Colleges	Intern. Development Program	Offices
CONCEPTUAL [Programming, Design, Approved Concept]	Little, if any, and then small projects	Yes	Little if any and then small projects	More than likely not	More than likely not, initially
PRACTICAL [Drafting, Detailing Draw. Docs Specifications]	Mainly formal instruction on CAD operations	Assume CAD skills; nothing on others ←*	→ Some CAD and drafting; little, if any on detailing; less on specs	Requires exposure to and function but no instruction per se	Will train as required in addition or instead of IDP
ADMINISTRATIVE [Practice/Business aspects, Marketing, Office Functions]	No	Little if any	No	Requires exposure to and some function but no instruction per se	Only as required by job position; some mentoring

*Lack of direct interface, coordination and reciprocal credits, etc. here is a major problem and genesis of disconnect in ability to understand and create documents; collegiate students must make unrelated and separate effort [optional] in community college programs for technical instruction

Fig. 2-9
Table showing the categories [and types] of instruction required in architectural practice, and where such instruction is located in the academic facilities and programs. Note the double-headed arrow and the associated note. This is a crucial element currently of concern in the profession.

subsequent to development of the preliminary design [Work Phases that would be numbered as 3, 4, and 5 on the chart]. While very vital phases of the project work, the schools, in general, provide little if any formal instruction – the primary shortcoming currently present in the educational sequence. However, it is the primary areas where upper level student, graduates, interns and recently registered professionals will find their work assignments in the offices. A closer look [as seen in the following illustration] reveals the very confined instruction provided by the schools.

Of course, the processes of acquiring construction knowledge in the form of specific information about materials, devices, systems and methods all are left out of all too many of the current collegiate programs. Hence, what exists subsequent to Phase Number 2 is a very mysterious void in the minds and skill of young professionals. Of the numerous aspects to the practice of architecture, two stand out as the premier tasks, crucial to the work and success of the profession's members and practitioners. These are, of course, design and documentation! The two are encased in the many, many events, programs, tasks and actives within the profession that are manifest daily in the working architectural office. But for discussion the two are easily extracted and open for examination. The design function and related activities, as discussed, create the basis for the project and set out what is to be accomplished. The illustration, just as a quick review/reminder of the factors involved, briefly offers information about the principles that can be brought to bear on the program to create that singular design concept that the owner will see the best solution, overall – and will be willing to formally approve for construction.

At this juncture in the project's progression, the documentation phase is brought to bear in full force and effect – and the following discussion of the project working drawings. While some very generalized, undetailed and preliminary "design" drawings have been produced, their content must be expanded, refined and translated into information meaningful and useful to the contractors and the various personnel involved. Therein lies the process of documentation.

It is the crucial aspects of the work in Phases 3 and 4 that will be the primary focus of Part 2 of this book.

To progress through this sequence requires an array of services, skills, tasks, correct and flexible application of construction knowledge and the ability to envision not only the project as a whole, but as a coherent and coordinated sum of its many parts – and how each of these is conceived. depicted, described and executed, Vital too, is the ability to convert concept to reality and to also covert design lexicon to usable construction language. The correct, proper and continual communication of the latter, from design professional to trade workers on the job site is crucial.

Construction is NOT improvisation, free-lanced or done by whim! It is SCRIPTED and DIRECTED by well-honed drawings and specifications! This is easily seen in the following illustration, which depicts the entire project process and what tasks, knowledge and information are involved – projects certainly will vary, in many ways, but this process and sequence will not!

One fact is fairly evident but worth repeating. It is extremely difficult, if not impossible, to be equally expert in each and every aspect of each work phases. The amount of information required in each is massive – monumental – and being augmented, changed and re-applied on a daily basis. The dynamics of this defy knowing it all. In addition, this is not a menu for setting the course of one's career, but it is a set of checkpoints to understand that no matter where is functioning in the process/sequence, other professionals are working on other services and tasks. This, of course, is a direct harbinger of the concept of team work within offices for production of the projects. Knowing, generally, what all is involved gives a insight and understanding to every student, young professional and practitioner – it is a means of fixing one "place" in the total effort, an also sets out the requisite lines of intercommunication with the office. It takes the individual out of the singular isolated position and gives grounding or "place" and task.

In this, the matters of correct and requisite project documentation, detailing, selection of products and materials and reality of applying construction knowledge has been allowed to merely "slip down" to the informal, school-by-school, unorganized/uncoordinated and unrelated determination of the 2-year and other community colleges. Their lack of interface with university level schools of architecture create myriad problems – to the individual student seeking additional education. Certainly administrators, faculty and students in those facilities are capable of meeting the challenges involved, but it is not their assigned legal task to oversee correct construction and the projects overall. Too, much of such instruction was a result of trying to adapt CAD to the construction industry. In all too many cases, the instruction, while it is at least there, is generally inadequate in coverage and depth to serve the needs of very complex and elaborate projects.

Over the course of the last decade or so, the instruction required for the technical education of architects has been changed in intensity, scope and venue. Most large schools [connected with universities in the U.S.] have been challenged to increase the level of liberal arts education, in their professional programs. The concept of teaching and developing the whole person has been a resounding theme which in many places has been accompanied by mandated instruction. In this, and with the exponential increase in computer operations, the professional schools [and in particular, architecture schools] have basically abdicated their approach to professional education by changing their emphasis, focus, direction, level and breadth of education. To meet the challenge of "whole-person" education, the professional criteria has been compromised and reduced to a dangerously minimum level. Associated with that has been the rather minimized criteria developed and used by the National Architectural Accrediting Board [NAAB] in evaluating the schools for accreditation [a degree from such a school is required in most states for registration]. Often this criteria does not completely address state laws which tend to call for the registration to ensure correct design and construction, by knowledgeable, competent and tested personnel, who then are authorized [capable or not] to design any building. Of course, few newly registered architects design massive projects, but the basic principle is set by law – and in that they SHOULD be fully able to do such work.

Oddly enough, the number of work positions in professional offices for designers is highly restricted, meaning most university level graduates must come to grips with work producing the documentation work [where they have far less skill]. In essence and effect the academic sequence is falling well short of meeting the requisite needs of the profession. Instruction for the technical topics and skill is not included but rather has now fallen to the Intern Development Program [IDP] of the NCARB [in a fairly loose, open-ended and unsatisfying manner] and the 2-year and community college programs.

In fact, out of increasing necessity a new element is being introduced, called in various venues, architectural "science" or "technology" [for want of better terms]. These programs are intended to be a "bridge" between the theory phase of the university programs and the requisite "nuts and bolts" construction phase of projects. These terms in reality are unsatisfying in that they are being used and applied for such a wide range of blocks of knowledge and expertise. At any rate, in the United States an increasing number of "Architectural Technologists" are being trained and developed and called upon to produce the project documentation. An admirable effort, but extremely foolish and preposterous, overall, to say the least! It creates a hybrid-type situation where one tier of personnel has training in design [and can achieve state registration], but not documentation, while the alternate tier has the instruction and insight into documentation but not into design [and may well not be eligible for registration]. Neither tier has a decent level of insight into the breadth and myriad aspects of the profession as a whole. And we have a situation where it is extremely difficult to place liability and responsibility for over legal compliance. The fundamental issue with registra-

EXAMPLES OF MASSIVE CONSTRUCTION PROJECTS IN VARIOUS HISTORIC ERAS

1. Egyptian pyramids at Cheops
2. Parthenon/Greek structures of the Golden Age of Pericles
3. Pantheon/domes over Roman buildings
4. The Roman Colosseum
5. Roman aqueducts
6. Pueblo Cliff Dwellings; SW USA
7. Azte/Inca/Myan pyramids/structures
8. Hagia Sophia
9. Notre Dame/Chartres/Cologne/ Salisbury; Gothic cathedrals in Europe
10. Persian ziggurats
11. St. Paul's Caethdral
12. Houses of Parliment
13. St. Pater's Bascilica. Rome
14. Great Wall of China
15. Empire State Building of 1930s
16. Chrysler Building
17. Woolworth Building
18. Washington Monument
19. Westminster Abbey
20. Alaskan pipeline
21. Industrial plants that house aircraft construction; automobile assembly; long and convoluted production lines
22. Variety of high-rise buildings around the world; Petronas Towers/ World Trade Center/Sear Tower/ TransAmerican Bldg.
23. Aswan Dam in Egypt; Three-Gorges Dam in China
24. Hoover and Grand Coolidge dams in U.S.
25. Panama Canal; Suez canal
26. Brooklyn/Holland/Lincoln/Euro/Golden Gate/Various bridges and tunnels, traversing rivers, gorges
27. Navigational locks and dams on various streams
28. Guggenheim Museum, New York City
29. Imperial Hotel, Tokyo
30. Johnson Wax Building, Racine, WI

31. Lever House/Seagram/ Hancock office buildings
32. Modern stadiums; Camden Yards. Jacobs Field, Olympic facilities, National Football League and major college stadiums
33. Ship yards and dry docks and docking facilities
34. Castles, fortresses and military fortifications
35. Eiffel Tower, Paris, France
36. Space craft launching facilities; Cape Canaveral; Vandenberg AFB
37. Railroad tunnels, yards, trestles
38. Power generating facilities; Robert Moses Plant, Buffalo, NY; TVA complex; nuclear plants
39. India's Taj Mahal
40. Thomas Jefferson's Monticello
41. "Onion-domes" in Russia
42. New Mormon tabernacle in Salt Lake City
43. Crystal Cathedral [Garden Grove, CA Church]
44. Gateway Arch
45. Crystal Palace
46. Robie House
47. Falling Water
48. Flat Iron Building
49. Farnsworth House
50. Sydney Opera Hous
51. Kansai International Airport/Chek Lap Kok/Dulles/Denver
52. Air Force Academy Chapel

Fig. 2-10

A list of large and extensive projects, from many eras, to illustrate the vastness of the reach of architecture as profession and to stimulate thinking about what all in the way of information, knowledge, skill, documents/graphics and communication were required for the construction of each.

tion is competency to practice in all phases of practice. The message is that the law requires one to be tested and if successful, to participate any the registrant desires in the practice of architecture. It is a technical matter, and one to verify that subsequent work will adequately protect 'public health, safety and welfare". Hence registration has long been the end goal of architecture students [along, perhaps, with having their own practice].

(B) "Practice of Architecture" – providing or offering to provide those service, hereinafter described, in connection with the design and construction, enlargement, or alteration of a building or group of buildings and the space within and the site surrounding such buildings, which have as their principal purpose human occupancy or habitation, except where otherwise exempted by sections 3781.06 to 3781.18 and 3791.04 of the Revised Code. The services referred to include pre-design, programming, planning, providing designs, drawings, specifications and other technical submissions, the administration of construction contracts, and the coordination of any elements of technical submissions prepared by others including, as appropriate and without limitation, consulting engineers; providing that the practice of architecture shall not include the practice of engineering as defined in Chapter 4733. of the Revised Code, but a registered architect may perform such engineering work as is incidental to the practice of architecture.

(I) "Responsible control" – means that amount of control and detailed professional knowledge of the content of technical submissions during their preparation as is ordinarily exercised by a registered architect applying the required professional standard of care, including but not limited to an architect's integration of information from manufacturers, suppliers, installers, the architect's consultants, owners, contractors, or other sources the architect reasonably trusts that is incidental to and intended to be incorporated into the architect's technical submissions when the architect has coordinated and reviewed such information. Other review, or reviewing and correction, of technical submissions after they have been prepared by others does not constitute the exercise of responsible control because the reviewer has neither control over nor detailed professional knowledge of the content of such submissions throughout their preparation.

Fig. 2-11

A sample of state enabling legislation [law] for architects, that illustrates the concept and direction the state government wants for architects serving its citizens and how protection isprovided through the expertise, competency and activities of the architects.

This concept has eroded to some degree, as various factors, including changes in attitudes, have caused students, interns, etc. to seek out practice without the process of registration.

Job opportunities abound and often do not require registration as they did in past times. The chosen task of this book is not to be revolutionary, but rather to upgrade information, knowledge and skill in those who document projects, and to give them a broader perspective of their work and the tasks of the architectural profession overall [but not all of these can be addressed].

While the prospective architect is steeped in design theory and skill, there is no formal direction [via instruction] on how to proceed "from here to there" – from the preliminary, approved design concept to a finished project. The intervening documentation process remains a virtual enigma – a threatening void that few are able to approach or fill properly. In addition there is no resource for the coming to know about, understand and producing the contract documents [namely drawings and specifications] required for construction.

[Specifications and their production are topics separate, apart and unto themselves. They are essential as the third Contract Document [with the construction contract and the working drawings]. They complement and supplement the drawings and provide information for the construction of the project that cannot be shown graphically. They and the drawings are really inseparable and necessary to both documenting the project and for communicating required information to the other participants on the project. They are well addressed by the Construction Specification Institute [CSI] and other resources and will not be part of this book except where the drawings necessarily interface with the specifications. This also is intended to limit the volume of the book].

Quite often even interns with their degrees in hand, speak out in frustration that they do not see or understand the overall profession and feel ill at ease with their specific pending and future role in it. They have received no valid indication of what procedures, processes, and tasks [and job positions] lay beyond the development of architectural design concepts, and the production of only conceptual illustrations.

Within the profession it is well known and recognized that "architects" practice under that title but do not each perform all of the very tasks, and do not make identical contributions to projects and their office. The extremely wide range of professional services available, the many and varied tasks and skills required, and the various working positions within the offices are not readily apparent and are too often never revealed to the students. Basically, too many students graduate [and even complete internship] without realizing or knowing the full depth and breadth of their chosen profession. This is an obvious impairment to career planning as well as the development of needed skills and even the seeking of work positions in the practicing offices.

Of course, work experience plays a major factor in the development of the architect [and there is no suggestion that the profession schools teach "all there is to know about … "] but at this juncture more fundamental understanding of the profession is requisite to the young professional approaching the job market and looking ahead at work and tasks that offer both interesting opportunities, but advancement and areas of contribution too.

Some other books begin to address this issue, but usually within the context of design [portrayed as the sole and ultimate contribution] or in such a generalized overview, that details of the hands-on work, within the office and the project work is not fully explored or explained. Some look into the business operation of a professional office.

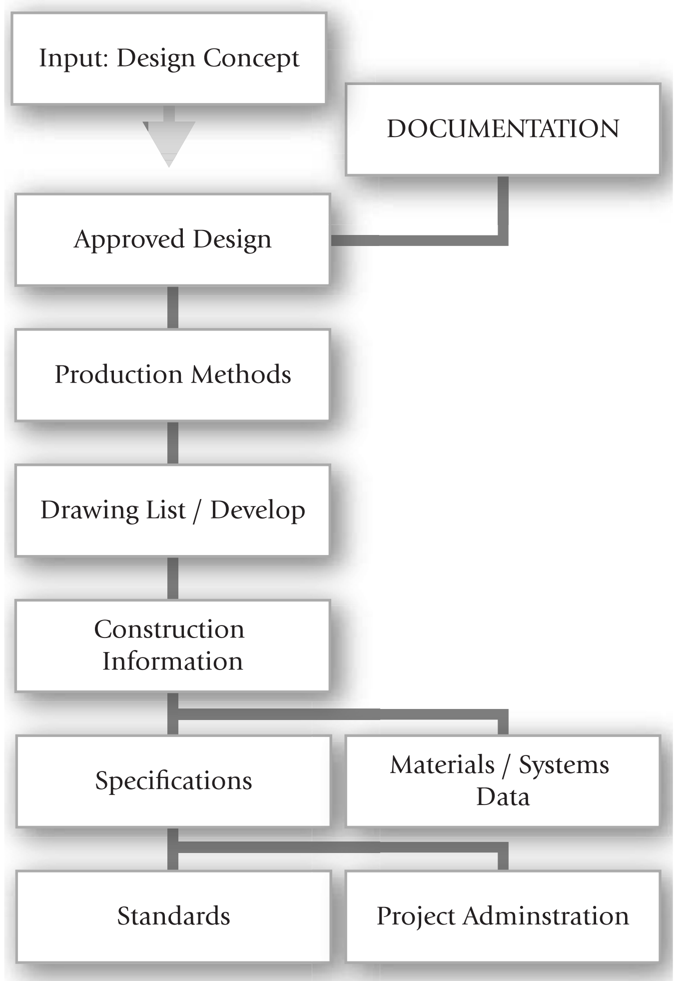


Fig. 2-12
Chart illustrating the various elements of the "other" architecture that is active in the production of project documentation suitable for use in the construction process

None, we suggest, address the services provided by, the duties of, and the contribution within the design development and document production functions of the office. It is here where the design concept is faithfully transformed into usable construction documents, through inclusion of appropriate technology and construction knowledge and information, ready for bidding and actual construction. Yet it is here where there is a dearth of information conveyed to the student or graduate professional, and is exactly the place the young and budding professional will find their niche, at least initially in their career. Also, this is the place where they need information to begin to formulate their career path, and realize their ambitions.

The profession has but the one title and is generally considered to be a single, cohesive entity - one group of people known collectively as “architects”. Reality also make it known that there are several varieties of architects all gathered under the collected title of the profession – still architects, per se, but in various roles, under function-oriented titles and actually a form of specialization or specialists within the profession [even though they are fully registered, practice as “architects”]. This is why you hear of so few of the 88,000+ members of the American Institute of Architects, and the other 30,000+ architects in the United States [and similarly world-wide] – it is only the design oriented professional who work at the cutting edge who gain the publicity. For each of them, there is a host of others who support their design efforts, and get them built.

It is, of course, impossible to stand at the start of a career and plot out exactly what sequence of positions one will pursue. Times and perspectives change, as do opportunities and changes in the work and profession overall. However, it is good to note that a wide variety of professional “niches” is available, for the choosing, so to speak, in order for a person to successful follow at least a minimal career path.

A refined and distinctive definition or job position must be assigned to each of the staff positions [a partial list follows; without priority or chronological context] in or related to an architectural office [even though every title/position is not necessarily present in every office].

Where do think you fit now? What is your fundamental ambition? What is your ultimate goal in this list?

	GENERAL	FORMATTING / LANGUAGE	TECHNICAL	LEGAL
INTRODUCTORY	Information/instruction on the basic concept, development, need for, and use of specifications; presentation to orient and create interest in specifications and their creation/ writing, for lay persons, students and potential spec writers			
ENTRY LEVEL	Information sources and resources, types;	Basics and foundation of good spec writing-language, techniques, types of information, etc.; MF04 familiarity and use	Sources for support and regulatory info; technical attributes	
INTERMEDIATE	Increased understanding of the specifications process, its intent and the content required; also relationship to other documents	Skill in working with established format and fitting new work into the correct format and manner	Assess, revise or create pertinent technical Sections to fully meet project requirements	Interface of sections to Divisions and all to Div. 01 and other Contract Documents
ADVANCED			Supervise research and writing of complex technical Sections, and complex project parameters	Knowledge to resolve or seek proper advice on legal issues, format and language changes to support unusual circumstances

Fig. 2-13
Overview of education required for a person to understand and produce proper project specifications that supplement and complement the drawings, through use of non-graphic [written word] means

Speaking directly to the differing but more prevalent roles of architects, the following is a good expression:

A "design architect" is one who is responsible for the design.

A "project architect" is one who is responsible for ensuring the design is built correctly and who administers building contracts. [In a variety of circumstances like small offices, and non-specialist architectural practices the "project architect" may also be the "design architect"] For the most part, these titles may be used to describe specific job positions, in the office, but otherwise the term "architect" is used to include all those who are part of profession, registered by law, but engaged in a variety of tasks.

Also, realize that various combinations of these titles can be connected with any one person [Resource Architect-Specifier for example]. Some titles represent jobs, or positions under the umbrella term, "architects" [some fully registered; some trained but not registered] who work at jobs outside the professional office. These various job titles also indicate the breadth of activities in the normal professional offices, and the work within the numerous services offered, ad available to clients. While titles and tasks do not necessarily match, there is some indication of variety of work carried on in a typical office, on a daily basis.

This not an attempt to create "architect*" [with an asterisk] to denote a specific, narrow-scope specialty or special niche,

Co-op Student
Graduate architect
Intern
Registered Architect
Sole Proprietor
Partner
Principal
Junior Partner
Senior Associate
Senior Architect
Associate
Junior Associate
Marketing Associate
Business Developm't
Project Development
Lead Architect
Discipline Lead
Chief Drafter
Chief Designer
Project Manager
Project Lead
Project Architect
Designer
Resource Architect
Administrative Architect
Staff Architect
Job Captain
Specifications Writer
Contract Administrator

On-site Project Rep
Clerk-of-the-Works
Construction Manager
Drafter
CAD Drafter/Operator/ Technician
Graphic Illustrator
Architectural Delineator
Material Sales
Manufacturers' Rep
Technical Rep
Materials R&D
Educator
Instructor/Professor
Regulatory Official
Governm't Architect
Corporate Project
Manager
Corporate Architect
Forensic Investigator
Expert Witness
Consultant
Programmer
Value/Cost-Cycle Engineer
Estimator
Project Expediter
Organization Architect
Building Manager
Real Estate Manager

Fig. 2-14
Incomplete listing of job positions or other work areas that can be filled by those trained as architects, whether working inside or in conjunction with the practice of the profession [could be characterized as "types" of architects, if the profession was practiced with specialties like medicine]

Modern Architectural Practice must handle:

- greater complexity in all aspect of projects
- unresolved/vacillating/undefined program issues
- projects requiring maximum effort in achieve marginal success
- close, continual scrutiny of almost impossibly tight budgeting; "cheaper/better/faster"
- heavy-handed non-architectural managing
- necessity to make changes in process to meet varied poorly defined project delivery systems
- lack of firm control and direction
- need to recoup firm project leadership
- increased legal exposure via lack of understanding by/action of others
- the constant threat of a litigious mentality
- threat of domination by other disciplines
- lack of respect for professional effort, contribution
- diminution into subsidiary role
- ignorance of and penchant to ignore regulations
- tight hiring market and ill-prepared hires requiring added instruction beyond "normal" OJT
- need for a flexible mentality/function in a variety of practice modes and situations
- calls for team, but action negating it

Fig. 2-15
List of changes, challenges and situations that face modern day practice, and which impact the architect, no matter what level or location is involved; indicates the dynamics of the profession and the ever-changing atmosphere of practice.

nor is it advocacy for title modifiers like, "M.D. or General Surgeon". Rather it is a direction to point out that architects! work in and are most active and influential in other aspects of projects than design, and those efforts are necessary to the proper documentation and construction of the projects. They are invaluable; necessary; and require the highest expertise for success in all of the work. Every student and young professional needs to know – and understand – this.

This list, in itself, points up the breadth of the profession and the various narrow opportunities for architects. Each area is valid and has its prescribed direction that is well served by an architectural background and education. Yet these are not all exposed much less discussed in the schools of architecture, where heavy emphasis is placed on design and the design effort – and professional practice instruction is sparse if it exists at all. While there may be some validity to heightened exposure to design principles, it would seem not to rise to the level that valuable instruction on other ancillary aspects of practice are excluded.

In view of the fact that the same type of talent, knowledge and skill is required to produce the entire range of projects, architecture must be a process that is varied to the desires of the client and the results anticipated. This, in no way, demeans the direction and work of any individual architect.

Rather it speaks to the specific challenge of each and every project and the flexibility required to resolve the issues and produce a meaningful design for the client. It also indicates that project parameters vary and change, over a very wide range – and project goals are different but still need to please and satisfy the client. But there is one leveling process that all projects must negotiate – the process of construction.
At some point, no matter the type of project, the status and talent of the architect, or the drama of its design, every project must traverse the construction sequence. Here the project – design and all – is almost literally turned over to the constructors for their execution of the requisite hands-on work. The route to producing "architecture" of any style, type, or level of design accomplishment, is a collaboration of tasks, work items, application of varied skills some dangerous; some roughly hewn, back-breaking, and rudimentary; others dirty, greasy, oily, awkward; still others labor-intensive using human-power in place sophisticated machinery or technology. Projects cycle in stages where, at times, one wonders if the final project will ever match the original design concept: but most projects do. In this, the design professional is not relegated to the position of bystander, but there are various levels of participation. Therefore, it is necessary that the professionals know, understand and fully appreciate the complete extent of the project and the process of construction. There is need to be flexible,

decisive, strong, instructional and educational, a good manager, and the correct interface between Owner/Client and Contractor.

The intent is to provide a broader discussion, for student and young professional, about the practice of architecture, as it exists within the professional office – and in other ancillary employment areas. The book provides a wider view and an array of considerations for prospective and younger professionals who are not exposed to them in their academic sequence or perhaps even in their office. The effort will be made to put forth information that can be directly applied to the areas of work, individual tasks, progression and advanceman on a career path, under-girding and augmenting of education, continuing education and similar efforts that will expedite the expertise and professionalism of the individual.
So the next question is:

"How does the design concept created by the designer, for a new piece of architecture, transcend and "become" a reality?"

The intent is to answer this question.

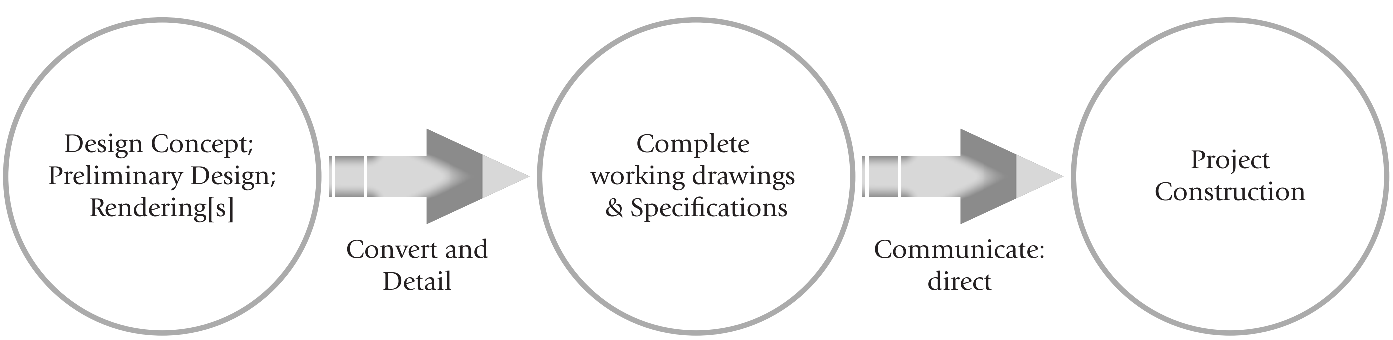


Fig. 2-16
Chart depicting the progressive sequence of work required by the progression in the production of architectural projects through the development and use of detailed information and correct and timely communication

UNDERSTANDING THE PROFESSION OF ARCHITECTURE

Fundamental understanding of how the profession of architecture functions and produces projects, must necessarily start with an overview of the various elements, factions, organizations or "players" that form part of it.

The profession of architecture has a vast and wide reach and a deep impact on daily life worldwide – if only on a project by project basis! It takes an extensive effort to try to describe and properly discuss the totality of the profession in all of its various aspects or professional services. Much of the related knowledge can only be gained over a period of time, and with various project conditions, allied experiences and study.

The more immediate "whole" of the profession is the discussion about the progression of projects from inception to completion – herein lies the work tasks of the students, graduates, interns and staffers of every ilk. Of course, there is much beyond this professional work, but that is not a functionary part of the everyday work of the professional office. Therefore it is most regrettable that these facts are not presented to students entering the schools, and only becomes known [in part and in broad variations] through a period of time and experience – and then in a sort of hit or miss manner! The student is shortchanged and led into a situation much like walking in the dark!

ARCHITECTURAL EDUCATION, REGISTRATION AND PRACTICE: THE "PLAYERS"

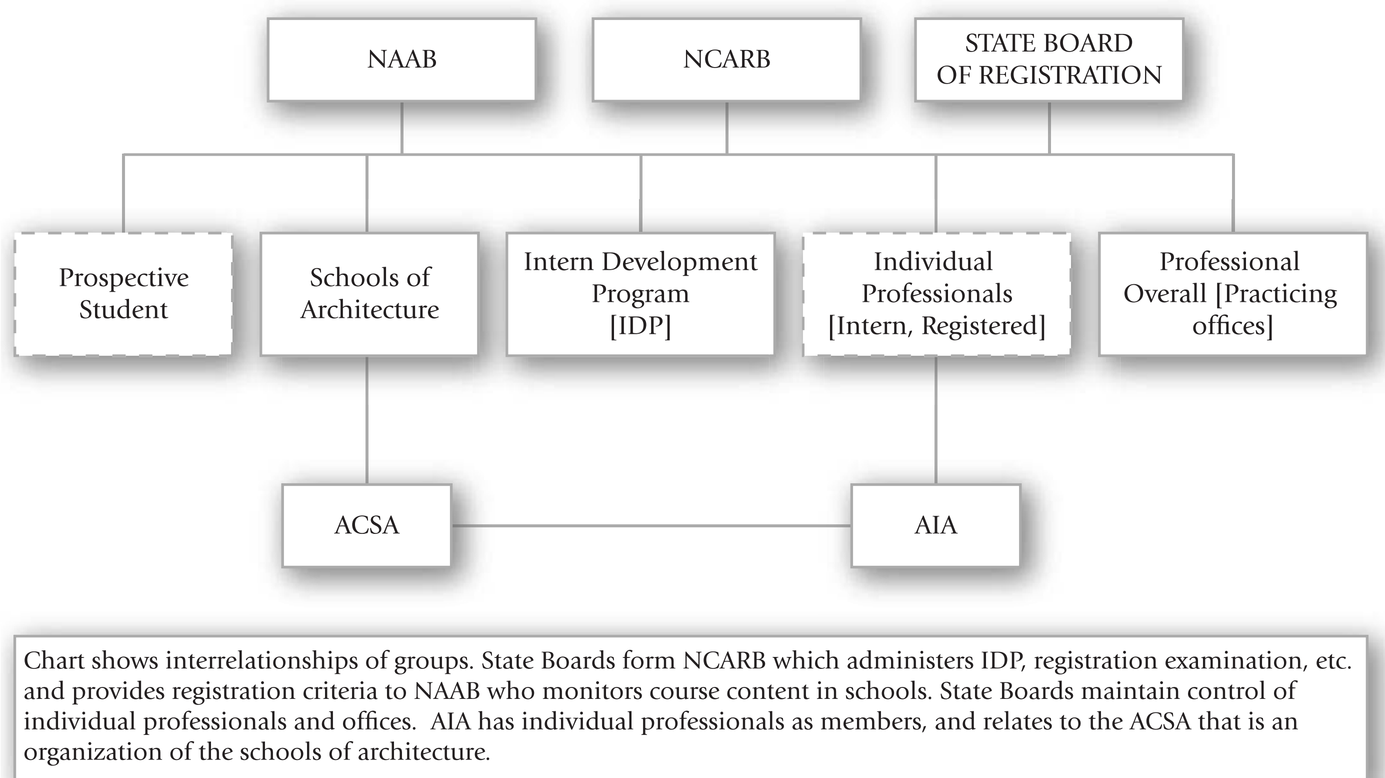


Fig. 3-1
Chart showing all of the "players" in the profession of architecture, from education to practicing professionals, and their interrelationships

The self-appointed task of relieving this situation is the charge of this book.

But then, architecture is the profession largely unrecognized by the general public. There simply is not a general understanding of the profession, its work and its impact, on not only communities but on personal experience. In the past, for example, a high school course might be listed as "architectural drawing", but even that was a mystery to most people. Even this has all but disappeared as computerized drafting and CAD rapidly gain prominence and popularity with students. Yet even with these changes, it is still the profession's task, bound and directed by law, to protect "the health, safety and welfare" of the same general public. In addition it is the profession that has a daily impact [again unrecognized] on the life and lifestyle of every person – it creates the built environment in which we all live, work, play, and exist.

Despite some instances of exposure [as in "architect designed" homes, and the vocation of some father-figures in family situation TV shows, etc.] architects still operate in relative obscurity. Some homes may be conceived by architects, but they are used as examples or "models" for what can be done, and followed up with modification and use by the home builders – with no involvement of the architect. Such drawings [usually just the floor plans] are available in magazines and newspaper and on-line. Many have associated schemes for ordering the actual drawings, but these present some added risk in that they are not revised to the specific site conditions where the new house may be built – added design and drafting work, locally is required.

Various factors have led to the situation where architect-designed residences are largely those for up-scale families, and involve rather sizable budgets [even though the more modest houses can easily benefit from the insight of the architect; see later discussion].The public observes and uses many types of facilities, from small to quite formidable, but never really embraces the idea that these too were conceived by an architect, who created a solution to a stated set of circumstances and followed with proper documentation to facilitate the construction. Many of these projects have direct impact on daily live – shopping centers, hospitals, schools, stores, places of worship, etc. and in that impact the life of each person who enters and uses them. Still there is no direct interrelationship that causes the public to understand and respect the architects for what they do provide overall.

Architecture is by no means, "new" and is far older than many vocations of other professions – many of the engineering disciplines, information technology, and the other jobs that have developed over the centuries. Yet architecture has impact on each of these too, just as on the individual. The impact and influence is wide spread, deep, and imposing – and yet is never or rarely realized and understood. Architecture has a very long productive and rich history! And it is still available to those seeking quality, aesthetic flavoring and individualistic design and function.

For centuries, it was the architect who was the leader of the design and construction team – the point-person who was first hired by the client for the project, first to engage the client to ascertain distinct needs, wants, and desires relative to the project. The architect often, then, hired the various discipline consultants' who designed and documented various systems and aspects of the project. Combined, this team of architect and consultants produced the design concept which the client approved and which was the basis for the construction documents that showed and directed the contractors in the actual work f erecting or building the project.

Then various considerations, circumstances or "other things" began to unravel the on-going status of the architect. When urban renewal came into its heyday in the United States, the urban planner came to the fore for the initial project contact and to develop the overall, long-term, wide-ranging scheme for the client's entire development solutions. The architect was "reduced" to designing the individual buildings, which were fitted into the "grand" planning scheme.

Fig. 3-2
This is but one small example of the tremendous variations that can be found in architecture. Any cursory review will be replete with examples of the richness, the innovation, the excellence of design, the charm, glitz, strong aesthetics and the works of the marvelous imaginative minds of designers. The illustration, here, is a small bank building [note the drive-thru to the right]; compare this to other small banks you've seen!

Then came an explosion of costly litigation, due to the change in societal attitudes, where "I'll sue" became the immediate solution to any problem. Although never in the position to produce perfection [even the courts acknowledged this unless the contract called for it] every one of the smallest "glitches" or problems with the construction involved or could be attributed to the architect – often on the most tenuous of grounds. It was the era of "sue everyone" and let the courts sort out those responsible. But the cost and amount of time required just to be removed from such suits were extremely high and damaging to practicing offices – even those who wisely had insurance.

Professional liability insurance [so called "errors and omissions" insurance] for architects became a prohibitive cost factor when premiums were raised frequently, unevenly, and dramatically [300-400 per cent was not uncommon], even with no claims involved. The one resource the architect had, was to opt out of the construction sequence, and limit liability exposure by simply not participating in, or being available for any work in the actual construction phase. The architectural office became a mere document production element, producing drawings and specifications – nothing more. This left the owner and contractor[s] to do as they wished with not only the design concept, but how it was executed. Still, in all too m any cases, architects were forced to defend themselves in lawsuits, mostly frivolous but nonetheless costly to defend or demur from.

This has evolved into reliance on more rigorous risk management as a way to provide the necessary documents and expertise, but at minimal risk exposure. With a wide open field for the basis of law suits, the professionals are continuing to address how they provide their services without opening

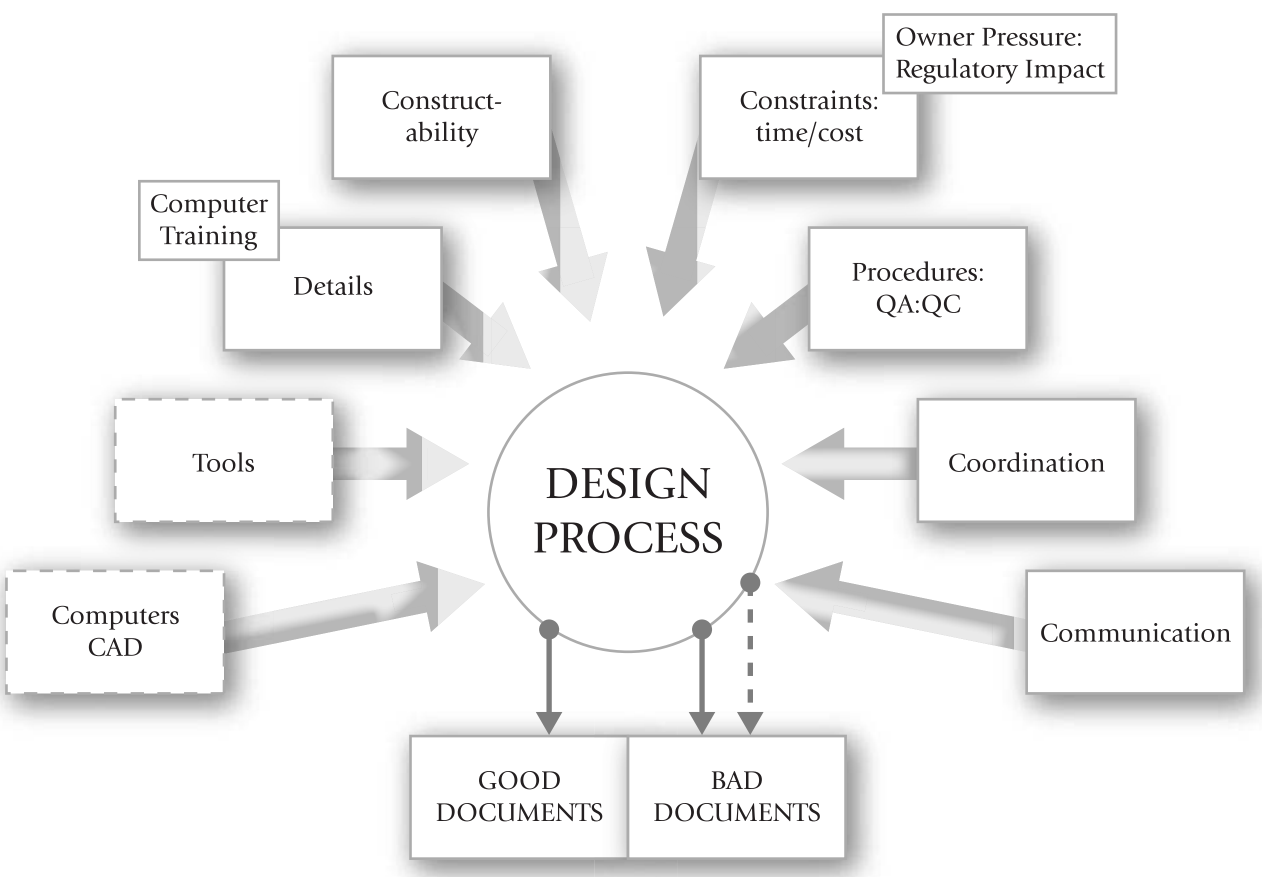


Fig. 3-2a
Display showing the numerous influences on the design process that provides varying input, impact and parameters on how the design concept can be or is created and developed. Assess and relate the items on this chart with the photograph above – how did the design concept evolve from the owner's requirements? How was the building constructed? What portions had to be modified, adjusted or resolved during the design process to meet other parameters? etc.

themselves, needlessly, to risks. In essence this effort toward a very lean, rapid, reliable and studious approach to documentation [rarely are offices sued over design problem – most suits are created in the technical aspects of projects], i.e., failures or glitches in the actual construction or performance of the structure itself.

At about the same time, the owners, more and more, were seeking a source of single responsibility for their projects. If they had a problem, they wanted to make one phone call and a single person to "unload" the problem on – not a litany of various and interrelated disciplines. Hence came the development of new and varied project delivery systems – construction management in a series of varied project delivery systems, design/build, bridging, partnering and other mutations, many of which further reduced the impact and professional status of the architect. The architect merely became one of many, the one responsible for the design and documents, with little direct influence or great import – OK, a "drafting service", if you must!

In some aspects, architects have been abdicating their position and status through the years. In the 1950s, single-family housing was lost [except to moonlighting architects] since the fees required to operate offices were too high for the budgets allotted to the houses. In part, to, there was a strain of elitism that became inflated, and caused the profession to loose traction with owners, public officials, and private citizens. The work of the architect has always been tenuous, and lacked recognition, simply because very few people in the general populace have had occasion to work with them or use their services. Therefore, few knew of the critical impact the architect had on everyday life, with design, coloring, a sense of aesthetics, safety, and creation of various atmospheres – few realized how they were, indeed, "touched by", of influenced by architects in their daily lives. After all, stores, churches, schools, offices buildings of all types, public facilities, etc., were architect-designed. Their function, utility, appearance and usefulness all were by-products of the architectural effort. There were not many places where architects were not – fewer yet where both architects and engineer were absent.

It is, I think, fair to say that, despite the fact that the membership of the American institute of Architects [AIA] is closing in on 90,000, and there is a far greater number of architects who are not AIA members, that the profession in many ways is floundering and declining in some aspects – trying to find its place, trying to re-gain its position, status, and influence, and trying to correctly direct its efforts in the new, and ever-changing climate of today's business. There is a host of comments and insight in the various topics listed in www.archsoc.com.kcas . No small part of this on-going dilemma [this has been openly discussed since the '80s] is the relationship and working arrangement of the several elements of the profession – the schools, the agencies, the professional associations, the professional regulatory groups, the local scene [individual architects, the firms and offices, and the chapters of the AIA], and the profession overall [as disorganized as it is].

Many talk, as we are, about the situation, but there is no collective effort to do something to modify the approaches, the direction and the seeming need for major restructuring of how the profession functions. Of course, some architects remain high profile, overly rhetorical, signature personages [commonly called "signature architects" or "starchitects"], who, with their work are roundly discussed, pro and con, and usually become points of controversy in one manner or another. Some make handsome incomes; but their number is small. Often such offices struggle since they do not always have a backlog of "bread and butter projects" [with recurring and continual income] to help support the operation during lapses in their "signature" work. In addition, in the main there are a rather limited number of clients who can afford and subscribe to the highly individualistic projects which are usually quite costly, late in being completed, and too often contain errant construction that plagues the owners almost from the start – a most disquieting scenario!

For the majority of the professional practitioners the striving to "get work" and produce work of quality and compliance is much more of a struggle. So, too, the profession overall [except for a small, but growing number of individuals] has lost sight of its "farm system" – the schools of architecture. Overall the professional educational system is, in polite terms, "divergent" – or commonly, chaotic! Too many programs are misdirected, parochial, and driven by people who all too often are really not in the mainstream of active, daily professional practice. There has been, and remains, a major, deep, and confounding gap between what the schools teach, and what the profession really needs. Even the needs of the profession are not always the needs or desires of the offices.

Before delving into further discussion, it seems appropriate to list the various "players" or entities with make up or contribute to the profession of architecture:

- *The prospective students looking at program options and other considerations influencing selection of school*
- *The schools [collectively and individually]*
- *The students in the schools*
- *The groups overseeing the educational system*
- *The graduate architects*
- *The agencies with regulatory control over the profession*

- *The groups servicing the post-graduate and examination squence for the regulatory agencies*
- *The individual practitioner [employee or principal]*
- *The professional association[s]*
- *The professional offices [all types and sizes]*
- *The whole of the profession*

Now with the above there is a need to seek out and investigate the bottom line parameters and the single scenario that all of the "players" should be addressing, collectively, and in their individual perspectives, approaches and efforts;

On the day that the "new architect" receives the letter confirming full registration, permission to purchase a professional registration embossing seal, rubber stamp, and letterhead; and to be called "architect", with the full rights, privileges and responsibilities of a Registered Architect [RA], there is an air of great accomplishment, as well as both expectance and omnipotence. In that, what is fundamentally expected?

No matter what school was attended; no matter whether working in office or as an individual; no matter what type, complexity, or size of project involved; no matter the other many aspects of practice – the new architect has been examined, and is deemed "verified", to be, and is expected to be fully capable, by the registering state, of executing any such project! Registration has long been held as the ultimate goal of the architecture student. Of course, it is only the most pompous, ill-advised, mis-directed, unthinking and blundering new architect who would think to venture out on such a course! BUT, what must this person be capable of doing to accomplish that, and to meet the full mandate to "protect the health, safety and welfare of the general public" [the basis of all registration laws]? To achieve this, what information, knowledge, skill, insight, intuition, ability, understanding, and other professional expertise must be in place to be called upon for use?

Some may consider this as an unrealistic scenario but nonetheless it is the correct posture of the "new architect", and a distinct possibility, if not a probability. Some will ignore their basic intuition, for various reasons, and attempt to produce any work that comes to them.

The wiser heads will, of course, demur, but this is the point at which all of the players and all of their efforts MUST be directed – in concert, fitting all of the individual pieces together just as in a completed jigsaw puzzle. While the ultimate use may be in doubt, or variant, there is a distinct need to provide the fundamentals for the new professionals, across the board, no matter what route to success they may take. One simply cannot rely on skill in one area of practice, without understanding how that skill fits, is utilized, or contributes to the professional effort. Each skill and each person is a part of the whole endeavor.

Let's examine each "piece" or "player" and their situation:

PROSPECTIVE STUDENTS:
The student approaching college, today, has a vast store of information, and developing skills, which really need to be refined, honed or focused. Many come from backgrounds steeped in computer usage, whether the simple rudiments of word processing, the graphic expressions of various CAD software programs, or various skills associated with the vast array of computer programs. Any formal computer instruction is quite superficial, as what they have received has instilled the operational aspect of the work, but not necessarily the di-

Example of format and information for the professional seal of an architect—state regulations vary, but usually a rubber stamp is required in addition to a steel embossing seal

KARL R. THOMPSON
Registered Architect
1724 Uptown Street
Any Town, OO 11111

Typical information for a professional letterhead – style and format is not regulated, but many states require that a sample letterhead be on file [and used

Fig. 3-3
Upon registration the new architects is required to purchase certain items that carry verification of the new status, and which are used in varying ways; for example, the seal is required on documents produced by the architect [requirements vary with state laws]

rected and refined direction – i.e., one may be quite skilled in computer operations, without being able to function well within a specific effort, such as architecture. Education-for-profit schools and institutes operate on promoting programs that "sell "easily – CAD is prime example. The usual instruction in community college and other associate degree programs have more focus, but still short of direct relationships to architectural uses.

The secondary or vocational school graduates are so taken by – and immersed in – their exposure to, and instruction in the computer that they easily "jump" at the opportunity to continue to show and expand their computer skills in a post-secondary sequence. So they are, indeed, "easy sells" for course work that involves the computer. But all too many come to swell the chorus of discontent about inadequate, limited, or too-narrow instruction, with no substantive technology component – i.e., a lack of focus, lack of required ancillary knowledge [for example, construction materials, systems, methods, techniques, detailing, problem solving, etc.] and directed applications.

Many CAD classes, for example, teach a wide variety of disciplines with little depth, and often quite devoid of need technical knowledge. The student, quite enamored of the computer itself, does not realize the lack of specifics [being quite successful in the more cursory instruction], and almost assuredly does not realize the lack of applicable or necessary technical knowledge. In addition, there is no architecture-specific instruction in the secondary sequence to aid the student of understanding the profession. There is simply a dearth, if not total void of information that provides any level of insight to the profession, for the prospective student. Hence, the students come by the fallacious impression that architecture is his or her profession of choice based on a shortsighted, inadequate, and glamorized view. A most dangerous decision, based on all but a total gross lack of understanding of the profession, and its work, overall. No wonder we know of embittered graduates, interns and indeed, new professionals.

With this background the incoming student has a false sense of readiness, and little if any insight as to what needs to happen and what will happen. This is literally a "ripe mind" for the picking. Hence, the schools, in their own individualized manner, create their specific rationale and approach to the profession, and provide this to the student as the complete profession. Of course, will claim there is no misdirection, or illusions spun, but the lack of full disclosure belies the reality. Perhaps the schools see no need for them to take any more of this very limited time to offer some overall instruction, regarding the profession, but that is a very shortsighted view that really shortchanges the student. There is a need, in advance of the selection of the profession and certainly before the selection of the school, for clear, complete and comprehensive information about the profession which addresses ALL of its work, all of its influence, all of its efforts, and all of the personnel efforts required within it. A "full disclosure" statement" that allows the student from the "get-go" to understand the nuances of the profession, and to allow them to plan their course through the various elements involved. This is not a document to prescribe or direct one toward "a specialty", similar to medicine, but rather an open display of what all the profession is about, and what it is into when producing its projects. In short, the title of this effort could be "Practice Instruction".

This is not a matter of the human trait of "fear of the unknown". It is wondering what one's future could be; how to achieve your own personal goals; and how to be successful without expending larger than needed amounts of money, and floundering from one program to another. It is a matter of trying to match one's desires with a professional philosophy and education.

THE SCHOOLS:

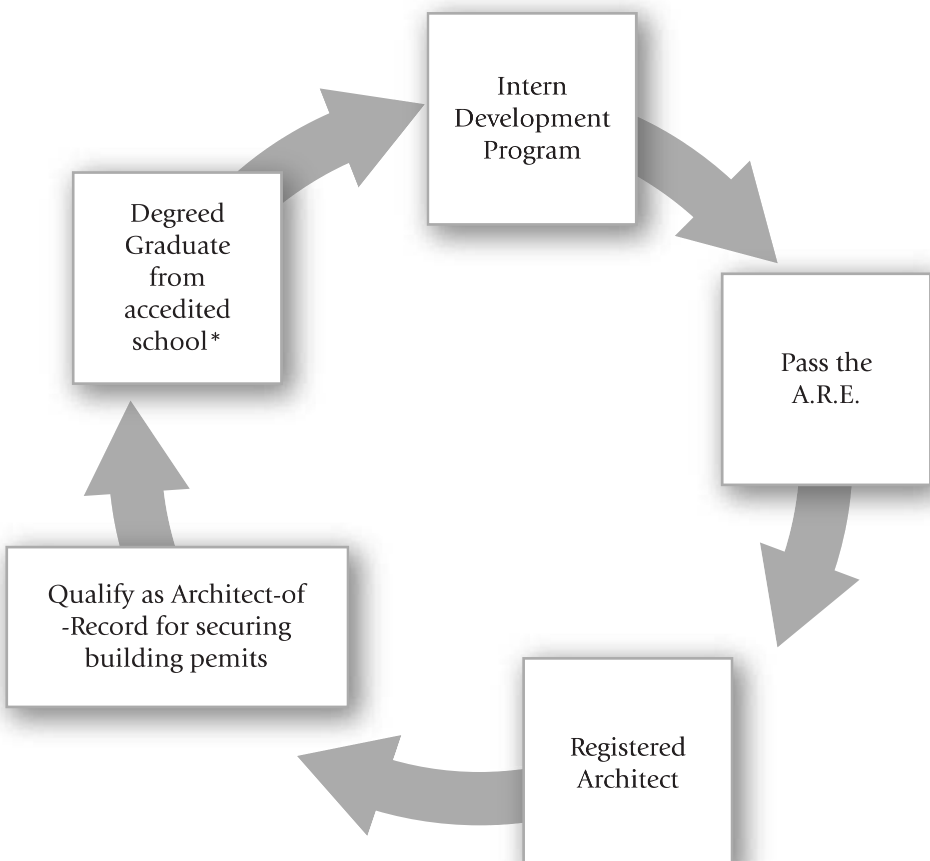
The schools of architecture varying widely in their concept of, and approach to education and their philosophy regarding what is to be taught in order to achieve a graduate that meets their perspective. Each school has its own, distinct approach to this sequence. In many cases, the curriculum in place is the result of facility input, perhaps built on the tradition of the school, but more than likely without any direction from the university itself. In other words, the faculty has become the originator of the courses, their general content, and the sequence in which they are taught.

Certainly where faculty has wide and well-founded backgrounds on educational principles, this scenario works better. But too often, this is not true, and the curriculum becomes a combination of the pet peeves, and the rhetoric of the strongest of the faculty members – those with tenure, and with very expressive and strongly-held, often-controversial convictions. Many times, this happens to be faculty who have not practiced, and have devoted their careers strictly to academic endeavors. All too easily, then, the evolving curriculum will be theory-oriented, and quite short of technical information and instruction. Generally, such schools are characterized as "design" or "art" schools [mainly to indicate their narrower and almost exclusive approach, and high emphasis on theory and design]

Other schools develop more balance in their curricula by sheer power of will, or a pre-ordained determination to be more "generalist", or more all-encompassing in their instruction [profession-wide, so to speak]. Of course, theory is part of this thinking, but not in the proportion of time allotted in the previous example. The generalist approach is a sincere desire to try to teach as much as possible about the many facets of the profession, with balance in the instruction to provide a very comprehensive view, with proper proportioning of the many takes and efforts involved.

By and large, it is a philosophical difference that drives the schools to provide an academic program, which is not directly related to the whole of practice. Having experienced the fact that they are not capable [due to time limitations] to teach "everything-you-wanted-to-know-about-architecture", the schools have carved narrow-scope niches for themselves where they can function within their perceptions of the profession, and in their restricted areas of practice. This, of course, creates a situation, which by and large, the recent interns decry when questioned, or allowed to write essays about their experiences and impressions.

It would seem quite obvious that there is a need for more communication – open, full-ranged, clear, and eminently on point as to all of the phases, aspects and nuances of practice. This is not try to teach all of this [which cannot be done even in an elongated academic effort], one must practice and learn many things] but rather to enlighten and orient the student and prospective student so they overview the profession and begin to understand it, and the personnel who function within it.



* Traditionally a degree from an accredited school of architecture has been requred for regstration. Some states are now changing their rerqurements and a degree is no longer required [check requirements of each state individually]

Fig. 3-4
Chart shows the overall development of the architect to the point where one can be an "Architect of Record" [an indication of responsible control] for the entire project, with legal accrued implications

THE STUDENTS IN THE SCHOOLS:

Although most schools allow a limited number of elective courses, in the main the architecture curricula are usually a "force-feeding" of courses and course content. Fundamentally, this is a result of the formulation of the curriculum, and the concepts and philosophies involved. Quite often, the curriculum is developed, in large measure by the faculty, largely with relative little direction or guidance from the college [where this is a school or department of a larger college] or the university overall.

Rarely is there a directive or statement of direction that acts as the driving or overriding goal or measure of the curriculum, except what comes from the faculty members. Department Heads, and Deans do provide some general concept such that the school's overall complexion is one of a "design school", or a "generalist" school. Heavy emphasis on design, and its support structure, theory, is quite prevalent, and really tends to produce graduates steeped in that framework, at the expense of other aspects of the profession.

In this atmosphere, the students are "led" [driven?] through a sequence of courses, interconnected to provide a semblance of continuity, and a progression of involvement, based on the previously acquired information, instruction and skill level. Many students, through other resources and interests, are able to inject their own educational concepts, by seeking added counseling, resources, outlets, information – often in direct challenges to the faculty and course contents. The students are resourceful in finding allied and ancillary causes, and directions for their efforts. These can tend to divert full attention to the stated curriculum, but may also, if carefully managed and selected, enhance the profession education.

Some student have other inputs that can call upon to aid them in directing their "own destiny" so to speak by taking elective courses that may not be purely architectural, but which satisfy the added direction the student is seeking, professionally. But most student dedicate themselves to negotiating the rigorous curriculum set out for them.

Whether by their own initiative or the information from others, students usually come late to the realization that there are other, added resources open to them – many of those which will truly enhance their skills and breadth of knowledge. Even in finding such resources, there is a lack of coordination and interconnection between them and the college curriculum, such that credit is not acceptable or transferable to the degree program. This leaves the student with better information for their professional work even if not included in their basic education – rather a travesty, but nonetheless reality! Students who sense the existence of other educational outlets and come to their own realization, and act upon it for their own good and betterment, are to be admired in many ways!

In all of this, there are needs that the students have that are not being met by many of the current curricula. This is simply a foundation of understanding of the profession, overall, and as a whole. Little effort is made to teach "practice" as a business venture, in a manner that the student can understand the many facets of the profession, the full range of work within it, and the choices open to them for seeking their own personal place of satisfaction.

At the point when students and interns become aware of what is there for them to learn that is not part of any academic effort and is not part of what academics will bring to them, they will, must should pick up and be responsible for their own education.. Additionally, they must know what their options are, and how this all fits into their education, and career planning, as well as the profession as a whole. This is the shameful situation that no one seems to want to address and is leading students away from architecture, in particular, and leading to the gradual loss of influence and demise of the AIA, CSI, etc. The excitement is BIM and LEED – basically fads that may become part of career work but which do have an overall professional impact.

THE GROUPS OVERSEEING THE EDUCATIONAL SYSTEM:

The fundamental premise behind architectural education [whether the schools like it or not] is the formal recognition of every student and graduate as a practicing, registered architect. Many of the schools proclaim their work purely as higher education of the person, which is not work oriented or directed toward registration [somewhat of a disconnect in concepts].

So in some respects it is quite odd that the educational system for architecture is primarily overseen by the National Architectural Accrediting Board [NAAB]. It must be understood that professional registration, in most states, is tied directly to a degree from an "accredited" school – a linkage that flies in the face of academic declarations.

This organization is specifically responsible for investigating and accreditation programs, based on a set of criteria established as the base for such action. The program touches every aspect of the academic operation, from the physical plant to the course content of the student work, environment, results, successes, and ancillary accomplishments. Basically, is the entire academic program and its support system producing an environment and opportunity for student success, and graduation of students who have achieved at least minimal competence in most profession matters [few, if any schools teach "everything" regarding the profession]?

Moving further through the pecking order we see that, in large token, the NAAB is driven by the National Council of Architectural Registration Boards [NCARB] which is a combine of the various state agencies responsible for registration of architects. Hence, what NAAB requires of the schools is mandated, in the main by the state registration agencies, which issue the formal registration to successful applicants. This sequence openly shows that the schools may be drawn into the whole process, "kicking and screaming", since they have not really accept the fact of what they are expected to produce – graduates fully competent to practice, and achieve proper registration.

THE GRADUATE ARCHITECTS:
The "graduate architect" is set free of the academic challenges into a world of mystique and confusion, in many ways. Usually, the graduate has a mind-set toward pursuing the profession and registration, or in searching out other avenues of expression. Often the graduate is left without any real definition of the various paths available, their consequences and the options open. Of course, the major thrust is to find a job, and if necessary, enter the formal Intern Development Program [IDP] sequence of work tasks and accomplishments. Again, though, while this appears to be a prescribed and "normal" path, many graduates come to more confusion and high levels of frustration with themselves, and their relationship to their job, IDP, and the profession overall. There seems to be an air that they have progressed [?] from one fixed or mandated program into another.

But the IDP operates on a different level, with different objectives, and certainly in a format quite strange to the graduate. The office organization and environment is the new "strange" elements that the graduate must acclimate to. Then there is need to ascertain how the office and members of the staff will assist and monitor the work done in light of the IDP requirements. Although most offices welcome graduates and subscribe to the IDP, many others do not provide much guidance, assistance or correct direction in the IDP. It is, too often, treated as a necessary nuisance, and an encumbrance to the requisite "use" of the graduates in productive ways.

Unfortunately, the graduate is in a position of strange environment, having to ask for assistance outside the normal office operation, and quite unsure of exactly how all this comes together, to their good and status.

In addition, the graduate is placed in a situation there must ensure that they meet the rigors of the IDP, and have an opportunity to work in the specifics task outlined in the IDP program. Here again, the graduate, new to the office, and the whole work environment is being made to ask for specific job-related tasks so they can fulfill the IDP requirements. The office may, or may not, look kindly on this, and many indeed, do not cooperate all that much. Hence the graduate is left further adrift in moving through the required program.

THE AGENCIES WITH REGULATORY CONTROL OVER THE PROFESSION:
The states to a large degree have given over to NCARB their function of examining and assessing applicants for registration. The whole process revolves around the Architectural Registration Examination [A.R.E.]. This is a standardized examination intended to examine all phases of practice, and to assess the knowledge of the applicants in each area. Basically, it tests minimal competence of the applicants, who upon successful completion of the examination, are recommended to the state of first registration, that the applicant is capable to function as an architect. Of course, the state agency has the final acceptance of the applicant, and may consider their criteria, besides the ARE if they so choose.

While NCARB is comprised on most of the states, it does not have all states as members. Some have pulled back from membership over disagreement with the NCARB approach and handling of some matters. This presents an added problem for some interns and those seeking registration, as does the fact that many states had added requirement over and above what they enforce through NCARB. It is unfortunate that there is some disparity in this portion of the regulations, but they are merely things that have to be dealt with and resolved; there is no obvious realignment in the works.

THE GROUPS SERVICING THE REGULATORY AGENCIES:
Just a few years ago, there were open hostilities between the AIA and the NCARB over the very issue of examining and recommending certification of new applicants. Several rather scathing articles were written, but since one agency does not control the other they each merely "did battle" and then went back to what they had been doing. Therein lies one of the most important but confounding problems with the architects' education and registration. The process encompasses a number of agencies or groups, none of which has any enforcement power over the other. The primary tie is between the state agencies [for registration] and the National Council of Architectural Registration Boards [NCARB]. The state agencies are collective members of NCARB, which is the primary operational/administrative agencies that handles the "paper work" and the examination involved with registration. Each state retains control of its own process and the state agency issues the proper registration documents.

In turn NCARB, through its control of both the content and administration of the Architectural Registration Examination [A.R.E.], as directed by the member states, passes the multiple requirements onto the National Architectural Accrediting Board [NAAB], This Board is set up in a posture that requires adoption of guidelines, parameters and measures for school accreditation. In the main, these are very minimal in effect and allow for a good level of latitude in school curricula. Enforcement programs survey and assess the schools to ensure that they provide proper instruction [if only at a bare minimum level] which covers A.R.E. topics. So bare minimum instruction is provided in some schools; others are able to skirt it, and include other instruction of the school's choice.

The whole of the process appears to be tightly controlled, while in reality it is far too open-ended, and without enforcement "teeth". In the end, the states get compliance with their laws, even if the process is quite convoluted.

NCARB has been emboldened by the status given over by the state authorities, which in the final analysis control the registration of architects. That fact, and the abdication of "power" to NCARB have created an entity [NCARB], which often appears, and acts in an overbearing, uncompromising, ponderous and rather arbitrary manner. There has been a history of including requirements for registration that are not technical in nature, and rather subjective. Of course, the computerizing of the A.R.E., and the higher cost had really served to aggravate many in the profession, while confounding many seeking to take the exam. Just a few years ago only 17 % of recent graduates sat for the exam, despite that fact that it may be taken any time throughout the year, and in isolated topic format.

THE INDIVIDUAL PRACTITIONER:
Having finally negotiated the path to registration, the individual practitioner is free to pursue his/her career as seen fit. In a growing number of states, there are requirements for continuing professional education as a pre-requisite for renewal of the registration. The sources of such education are many and varied. Some seem too easy and rather inconsequential [as to educational value; i.e., getting credit for little effort in gaining little of value for the pursuit of the practice].

Fundamentally, the registration of the professional opens the way to most professional benefits, and certainly elevates the individual to the point of being a full-fledged architect, in theory able to answer a professional or project pursuit. Of course, one easily and early recognizes the information not yet in hand, and the need for added mentoring or tutorage – the mere accumulation of knowledge from personal experience and other professionals. In reality, professional education is an on-going, daily process as new developments and situations arise on projects. Of course, those in control want a more tangible program, which can be tracked and tested to ensure that the education is of value and has the essentials of such a program.

THE PROFESSIONAL ASSOCIATION[S]:
Currently there are three [3] associations for architects – the American Institute of Architects [AIA]; the Society of Registered Architects [SRA]; and the Association of Licensed Architects [ALA]. They all seek to provide a format/program for architects to meet, exchange ideas, and combine for mutual benefit, be it legislation, statements on issues, policies or conditions, or other outlets pertinent to the profession.

The AIA is the older, larger and far more powerful association, with a membership of some 88,000 of the 102.000 architects in the United States. The organization is quite active in Washington, DC, and the federal level issues, while providing various degrees of supports for many, many issues important to its members, the nationally established chapters, and ostensibly to the profession, as a whole. In addition to the national organization, there are chapters in larger cities, or regions, and state level organizations in all states. This tiered organization allows the AIA to address, input, and participate in issues and situations from the local to the national level.

But there is here, as in any large organization, as disparity of views, may feeling that the national unit pays precious little attention to the local chapters and their effort; that the national staff is too strongly oriented toward the national and legislative agenda, and level, and has little taste for really servicing it outlying membership.

However, the fact remains that there is resource opportunities that the members can tap if necessary. Standardized project documents is one major area, where members can purchase and use highly esteemed and reliable documents, thus negating the need for local development of contracts, etc. – which is risky business at best.

THE PROFESSIONAL OFFICES:
The practicing office is the "front-line" of the profession! It is, of course, here is where projects are acquired, designed, documented, and overseen while under construction. This is culmination of the theory of the schools, the direction of the business and professional effort supported by the AIA, and other resources, and the application of individual experience. All of this comes together, in every project, to produce a satisfactory project, as the client desires.

It is to the benefit of the office, over the long term, to hire young, and budding professionals – "new blood" so to speak –

to engender renewed spirit and perspective into the office activities. The varied expertise, and the varied outlooks of these hires bring the office its future. Of course, the older hands run the office because of their years and the solutions they have found and developed to satisfy their clients. But with the years, clients change, styles and trends come and go, and keeping abreast of things, and being in the mainstream of practice are absolutely vital to the office. One cannot become stale, or so ground into one way of "doing things" or the office will stagnate, wither and die.

Offices have always been on the watch for new, young professional to hire and embrace. Each usually is seen as a long-term investment, which will stay with the firm and develop through its efforts, and eventually become part of the hierarchy. But this sequence is begun with the office seeking basic drafting assistance – those who can "crank out" good drawings, quickly and properly. Oh, yes, a minimum wage is also sought, perhaps too often and too little.

Whether they choose to acknowledge it or not, the office is a place of education and instruction. Each office has its own standards and procedures for the production of work. These must be learned by the new hire, and adjustments made as necessary in personal work.

The office may be "patient" with this situation, knowing that its demands may be different or unique to the new professionals.

But rare is the office that really understands and feels its place in the education scheme. Most all offices want maximum output, in shorter and shorter time frames, and at minimum production cost [which then maximizes profit even though fees are static]. Now this is not so different from the regular hiring situation, but it seems that in the architectural office, that low wages are the norm for new professionals, interns, and drafters.

In addition, offices shy away from education except where it is a direct benefit to the office. Hence the Intern Development Program [IDP] has a history of successes and failures. Even while expressing support for the intern program, many office renege on their commitment to the consternation of the intern – tragic! In addition, the IDP is not rife with dishonesty where offices mere sign-off without requiring the interns to perform the task prescribed by NCARB.

While this moves the intern toward registration, it drastically short-changes them by not giving them the background, knowledge and experience they need [even this early in their careers].

THE WHOLE OF THE PROFESSION:
The best approach to understanding the whole of the profession is to realize that what appears to be cohesion is really not the reality. The AIA professes to "speak for the profession" merely by the fact that its 88,000 members represent the majority of the registered architects in the United States. The "network" of the AIA starts with the local chapter, which is usually apart from the statewide organization, which, in turn, is seen as a major element of the national organization.

The organizational appearance that is in place, though, in basic truth belies the reality. Chapters and state units have ties to the national organization, but much of the work is not too well coordinated, and many of the separate units are made to operate with little "trickle down" support – the national AIA is so strongly Washington oriented that it does not serve it grassroots elements, or its individual members, very well.

This has long been a "sticking point" with many members, who may simply renew membership in a perfunctory manner, or just to be able to use "AIA" on their letterheads and after their names. Another matter of appearance – belonging to the better-known architectural organization, although not really being an active, involved and supportive member. Many too are increasing disillusioned by the fact that to belong to the "AIA", you must belong – and pay dues to – three separate organization – local, state and national. In times of tight economies, this expenditure is often is purged.

In truth the "whole of the profession" is the amalgam of all individual practitioners, their offices, all of their staffs, and to a good degree, all of the support personnel who serve the professionals [consultants, vendors, suppliers, manufacturers' representatives, sales reps, trainers, trade associations, educational sources, etc.].

Another "appearance" is the illusion that there is no architecture is "good" unless it has been published, primarily in THE RECORD [The Architectural Record, the house organ of the AIA], ARCHITECTURE magazine, and other publications where a small number of projects are published. In the main, these are projects that are "different" in any number of ways – unique, impressive, striking, eccentric, somewhat bizarre, out of the ordinary, strikingly unconventional, and most unorthodox. This is not to say that all projects must be the same, but rather that those published represent a small fraction of the total production of the profession and are those with deliberate dramatic aesthetic aspects. They are "examples" not exemplars, and do not represent trends, styles or specific directions. Freedom of design still resides in the mind of every designer working to meet project requirements. But reality easily shows that for every published story there are perhaps thousands of other, highly successful projects that receive "no ink". Since the schools point to the publications as the hallmarks of good work, and since the student is immersed in theory, design, and the need for distinctive design [read, publication], unpublished projects are given little regard. Indeed, often, a lot of good architecture is overlooking simply because it occurs in the heartland of the United Sates, and is done by a "non-signature" architect. It is too bad that there is no real active, and prevailing voice for the profession overall, instead or in addition to the AIA voice. The added voice could do wonders in public education, keeping track of successful projects, and in creating public relationships and understanding in local projects, local architects, and local talent.

The profession is massive, and unwieldy – unfortunately. No single organization is available to work "for the whole profession", straight-up, openly and accurately. Awards given projects usually come from the local chapters, not from other groups celebrating successes in design, accommodations, and community influence. Rare is the occurrence of praise for projects outside of the profession. So while the general public is even more massive, more unwieldy and certainly less informed, the profession of architecture remains in the shadows of no appreciation, under-utilization, and both low respect and low esteem.

Is all darkness? No, every year the schools of architecture graduate in the order of 14,000 bright new, eager minds who, 1] want to change things, 2] want to become successful in their own minds, and 3] feel a certain drive to do good work, within their chosen profession, to the good of their community, and humankind in general. The profession, and the elements that impact this new, fresh infusion of talent needs to understand what is contained in it, what it can do, and how best to utilize it.

But with a diploma in hand, the architectural graduate has more to do. First, if the "fire" still exists to become a fully registered architect, the graduate must engage and traverse the Intern Development Program [IDP]. This, for all intents and purposes is an interface process injected between the degree and the registration. The program was developed by and is controlled by the National Council of Architectural Registration Boards [NCARB].

This is an organization whose members are the boards in the various states that control professional registration for architects. It has taken on a collective demeanor in lieu of each state having and promulgating its own, parochial process. The member-boards have pooled their directions in the Council and through their subscriptive memberships authorized NCARB to act as the agency that assesses and examines applicants for registration. NCARB has taken on some very questionable and quirky requirements not directly related to technical and professional competency and adequacy of architectural skill.

It is long standing that the state registration boards have deemed it advisable [if not necessary] to require a period of experience, while working in the profession, after graduation. Since the registration process of application and experience review and written examination, and the granting of full credentials literally enables the new architect to engage, design and accomplish "any project", the states wanted to ensure that at least some of the gap of knowledge left by gross variations in the academic preparations was filled, through office experience – the proverbial "OJT". Since the registration includes the charge of "protection of public, health, safety and welfare", there is an inherent element of necessity that ensures that the new architect is, indeed, skilled and capable [even if only at a minimal level] to produce designs and documentation meeting that charge.

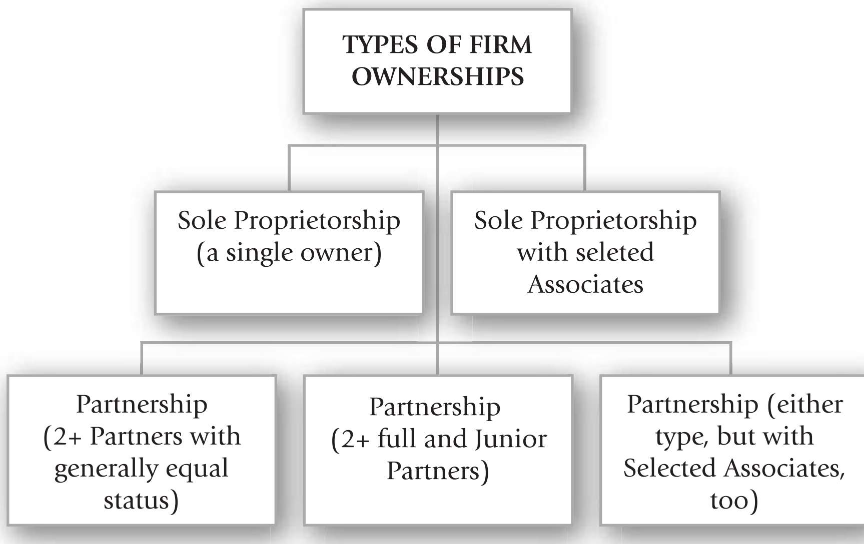
Which brings up a very interesting point:

What, exactly, should the new graduate architect be capable of doing?

- *Any conceivable project?*
- *Designing only?*
- *CAD operations using input from others?*
- *Menial related tasks?*

One wonders and hesitates.

The lingering problem is that all of the various factions are separate and autonomous and quite independently minded. The lack of a "let's-sit-down-and work-this-out" attitude and direction plagues the profession. Each faction has its prescribed direction goal and program, but there is no collective action to focus these efforts to better serve the profession. There is still in-fighting, irritation, parochialism, perhaps organizational intimidation and strident stubbornness on the part of some people and agencies, holding tight to their position and losing sight of the needs of the profession – and its members. And in addition, is the situation where one agency appears to be overbearing toward others, directing or requiring other than correct and coordinated effort and relations – again for the overall good of the profession. It remains unclear how this will ever be resolved since there are entrenched thoughts and programs, protective turfdoms, mandated interrelationships [that perpetuate isolated perspectives] and the lack of organization on the part of the various elements of the profession itself. The AIA has the greater number of architects as members, but appears to being continually directing its efforts in other directions than in upgrading and re-establishing some of the rightful functions and status of the professionals at the grass roots level – and for those who may well be future members. The organization has a maze of programs and documents many of which are under-utilized by individual architects who are remote to and sort of disassociated from the organization. Even local chapters are left, often, to fend for themselves since continuing grass-roots efforts by the overriding national operatives is wanting at best.



For the legal protection and limiting the liability exposure of the individuals involved, any of these organizations can be incorporated. Their liability is then limited to the total of the investment in the corporation and not to the total of their personal holdings.

Fig. 3-5
This chart shows a series of office organization [i.e., ownership configurations] that can be used for architects' office. Of course, there are many variations of these, but those shown are the basic examples commonly used

To understand the overall atmosphere in offices and the changes that have occurred, one has only to look at a career during the middle third of the 20th century. Here the staff could vary from those wearing sleeve garters, changeable plastic collars and green eye-shades, smoking a pipe, to those of the post war update in styles. The "typical" architect late in the period, was distinguished by a rough tweed sport coat with elbow pads, flannel trousers or khakis, bow ties, and button-down oxford shirts [the pipe remained]. The offices varied from hanging inverted funnel-like incandescent lights to fluorescent task lighting [mounted directly on the typical four-legged, wooden drafting boards/tables or wood slabs/doors on adjustable trestle boards]. Many were air-conditioned only over a period of time; and the spittoons slowly disappeared. And transition was made from T-squares and triangles to drafting machines; the drafting media changed from ink on line to pencil on 1000H rag paper or vellum; then to "grease" lead on Mylar. Ruling pens gave way to "Rapidograph" [fountain-like] pens, to stick lead in lead holders. Specifications went from blueprinted back-carbon onion skins to mimeograph images.

Fig. 3-6
A short overview of the appearance and working atmosphere of a typical architect's office in the past [pre-computer] to illustrate the general nature of the offices and personnel

But still, all of the organizations, noted in the chart above, seem to have no particular inclination to try to resolve lingering issues, including a basic/core curriculum adopted on a uniform basis [required as part of accreditation process], better curriculum development attuned to the profession's specific obligations and efforts, commonality of purpose, focused direction, coordination of purposes and programs and overall improvement of the status of the individual, be they student, graduate, intern, new registrant or in early stages of practice.

Simply, far too much still is left unsaid and retains the onus on the individual to know enough to seek out and find what they don't know, need or want – and with little in the way of signposts, and collective directions, much less in direct guidance and discussion.

BASIC PREMISE

There is strong indication [although strangely unspoken] about a basic premise that could be developed behind the concept of a "second" or "other" architecture. And this concept could be the crux of the criteria used to guide [to a degree] the education of prospective architects.

Prior to delving into the discussion of this concept there is need to address the little, if any, recognition of, or initiative to really come to grips with basic and uniform architectural education and what all, indeed, it should provide the budding architect – fundamentally!

It certainly seems both rational and reasonable that the young student-professional is entitled to and should be at least exposed to the entirety of the profession. This need not, however, include all of the nuances of the profession that could be the proverbial everything-you-ever-wanted-to-know concept about things experienced along one's career. However, there is a need to be aware of the grossly general truism, "There is something with every job"? This is not to indicate a dark or devious nature – a threatening or insidiousness, but rather a simple fact that architecture is, indeed, not all about design.

Surely, a prospective architect, in the bud of entering college level instruction, should at least have some idea about the whole of the chosen profession – perhaps a right to know and to pick a career path when academic training, graduation and internship have been negotiated. To know there is much beyond "designing" by drawing house plans, or admiring the drama and breath-taking inspirations of but a few world-renown "starchitects". To realize that many, many very fine careers have been pursued, without acclaim, but with both satisfaction [on part of client and architect] and overall success – the happiness of achievement.

The need is to believe that there should be no discouragement in the fact that not every architecture student will become widely published; overly wealthy; a world-wide household name; or a celebrity become of immoderate proportions. Or that most architects are not mired in only grunt work and near poverty! As seen earlier there is myriad job positions that can be explored and filled, but none of these should ever be perceived as part of the "other" or "second" architecture. That scenario simply does not exist, in spite of the fact that those working in the document production aspects of the profession [besides design] often go without due recognition. They are invaluable to the process of documentation, and indeed, to the execution of work and production of the project.

But surely the most cursory review of the breadth of services that the profession offers, the many aspects and facets of practice, a basic legal discussion about responsibility and liability [the professional "standard of care", for example], and assuredly the innumerable tasks and skills performed by or required of professionals.

The profession is NOT a straight line, where one reaches a plateau level and merely continues along that path until retirement. The side issues and opportunities are marvelous, exciting and should be part of the menu or palate "offered" each student from day one in college, until their graduation. Much can and will happen – and each student should be at least minimally aware of what they can be – in general terms. And this instruction need not be a distraction from the development of skills required, knowledge required, and general education – but assuredly, it should be part and parcel of every curricula. Architecture cannot be taught, properly, in miniscule microcosm of its entire impact.

The rather convoluted approach to what the education should be, is best viewed from the terminal point – the formal professional registration of the qualified architect [this is the ultimate goal although not all graduates choose to become registered, for various reason; nonetheless the academic preparation should still be present]. Each state [or other political governmental entity] enacts laws that regulate the profession of architecture, via criteria for that registration [or licensing, as many call it]. This is a formal process whereby the prospective architect/applicant applies for registration and must meet certain hallmarks set out in the law. That law is set by the jurisdiction as the legislative body sees fit [along with, of course, strong and insightful testimony from practicing professions – i.e., what should be the basic level of competence for a person to become registered [note. competency, not necessarily just education]

The most fundamental question is, "What should an architect know; how much is required; and when should this all be known. When should formal education or instruction regarding the matters occur?

Although somewhat skewed over the last few years, it is usually understood that the architect must be registered to enjoy the full distinction of the profession and to be permitted to engage in any project available. Registration laws were established to test the technical aplomb of the applicants – to see whether or not they had the minimally basic information and ability to literally design and document any project regardless of size and complexity. Underscoring this level was the requirement for a degree from an accredited college or school of architecture. This requirement was intended to set a standard of achievement in the academics based on not so much a standardized curriculum as on instruction of suitable quality and value provided to all registrations applicants.

The more information [creative and technical insight, construction knowledge, production skill [manual or computerized] and flexible application] that a young architect can bring to an office, the better the chance for being hired. Some people are highly sensitive about this fact in that academics are not set a "job-preparation" sequence, even though the end result is just that. Flatly, employers want new employees to be immediately productive, and are not looking to the necessity to continue or augment professional education. In the main, it is the administrative skills that the young architect will gather from practicing and being exposed to the legal and management aspects of work. So that one piece of the total architect information can be placed in the office in large measure – whether by formal instruction or mere oversight and exposed for personal gathering of the information.

Recognizing, several years ago, that academics were not covering all of the necessary material required for registration

PREDESIGN		DESIGN		
1	2	3	4	5
Predesign Services	**Site Analysis Services**	**Schematic Design Services**	**Design Development Services**	**Contract Documents Services**
Project Administration	Project Administration	**Project Adminsitration**	**Project Administration**	**Project Administration**
Disciplines Coordination Document Checking	Disciplines Coordination Document Checking	**Disciplines Coordination Document Checking**	**Disciplines Coordination Document Checking**	**Disciplines Coordination Document Checking**
Agency Consulting Review / Approval	Agency Consulting Review / Approval	**Agency Consulting**	**Agency Consulting Review / Approval**	**Agency Consulting Review / Approval**
Coordination of Owner	Coordination of Owner-supplied data	**Coordination of Owner-supplied data**	**Coordination of Owner-supplied data**	**Coordination of Owner-Supplied data**
Programming	Site Analysis and Selecting	**Architectural Overall Design Concept / Presentation**	**Architectural Design / Documentation**	**Architectural Design / Documentation**
Space Schematics / Flow Diagrams	Site Development and Planning	**Structural Preliminary Design Layout**	**Structural Design / Documentation**	**Structural Design / Documentation**
Existing Facilities Survey	Detailed Site Utilization Studies	**Mechanical Design Layout**	**Mechanical Design / Documentation**	**Mechanical Design / Documentation**
Marketing Studies	On-site Utility Studies	**Electrical Design Layout**	**Electrical Design / Documentation**	**Electrical Design / Documentation**
Economic Feasability Studies	On-Site Utility Studies	Civil Site Plan Layout from Survey Data	Civil Design / Documentation	Civil Design / Documentation
Project Financing	Enviromental Studies / Reports	Landscape Design	Landscape Design / Documentation	Landscape Design / Documentation
Project Development Scheduling	Zoning Processing Assistance	Interior Design / Documentation	Interior Design / Documentation	Interior Design / Documentation
Project Budgeting	Project Delopment Scheduling	Materials Research / Specifications	**Materials Research / Specifications**	**Materials Research / Specifications**
Presentations	Project Budgeting	Project Development Scheduling	Project Development Scheduling	Special Bidding Documentation / Scheduling
	Presentations	Statement of Probable Construction Cost	Refined Statement of Probable Construction cost	Final Statement of Probable Construction cost
		Presentations	Program and Concept Reviews / Presentations	Progress, Review, Checking Presentations

Fig. 4-1a ▲ / b ▶

These charts show a listing of professional services that can be provided by architects in various phases of work. Those in bold face are basic services and normally provided by standard contracts; the others listed are available [optional] but need to be negotiated with the owner and adjustments made n work scope and fee [cost of services] and practice, the National Board of Architectural Registration Boards [NCARB] set up an intern development program [IDP]. This 3-year program was initially made mandatory subsequent to graduate but prior to even writing the now-universal registration examination [some timing changes have occurred]. Problems developed in that hands-on control of the program was lacking and some requirements were so imposing they were virtually impossible to fill – and besides they required employer assistance which was not that forth coming. Hence the program was weakened, true and accurate results as desired were not achieved and there is now some disarray in the program.

Unfortunately, too, even with internship behind them, many young budding professionals were at a loss to find themselves, their relationship to the profession, their fit into office staffs, and in a position to really understand career planning. The remoteness of the IDP [with no intermediate control and oversight] simply became and remains a rather inadequate tool in the process. But one that is still unavoidable!

In most jurisdictions [states and territories] the primary requirement is a degree from an "accredited" school of architecture. This narrows the choice of schools to those that have successfully achieved a mandated level of expertise in their curricula and associated instruction. At the present time it is the National Architectural Accrediting Board [NAAB] that sets the criteria for such accreditation and provides the sequence for on-site evaluation and investigation of each program and how well it meets the prescribed criteria in preparing their students. There currently are wide variations in curricula, since the basic criteria requirements are very loosely and minimally

CONSTRUCTION		POST	SUPPLEMENTAL	
6	7	8	9	9a
Bidding / Negotiating Services	**Construction Contract Admin. Services**	**Postconstruction Services**	**Supplemental Services**	**Supplemental Services [cont'd]**
Project Administration	**Project Administration**	**Project Administration**	**Special Studies**	**Leasing Brochure**
Disciplines Coordination Document Checking	**Disciplines Coordination Document Checking**	Disciplines Coordination Document Checking	**Renderings**	**Expert Witness**
Agency Consulting Review / Approval	**Agency Consulting Review / Approval**	Agency Consulting Review / Approval	**Model Construction**	**Computer Applications**
Coordination of Ownser supplied Data	**Coordination of Ownser supplied Data**	Coordination of Ownser supplied Data	**Life Cycle Cost Analysis**	**Material and Systems Testing**
Bidding Materials	**Office Construction Administration**	**Maintenance and operational Program-ming**	**Value Analysis**	**Demolition Services**
Addenda	**Construction Field Observa-tion**	**Start-up Assistance**	**Quantity Surveys**	**Mock-up services**
Bidding Negitations	Project Representation	**Record Drawings**	**Detailed Construction**	**Still Photography**
Analysis of Alternates / Substitutions	Inspection Coordination	**Warranty Review**	**Cost Estimates / Energy Studies**	**Motion Pictures and Video Tapes**
Special Bidding Services	Supplemental Documents	Postconstruction Evalutation [POE]	Environmental Monitoring	Coordination with Non-Design professionals
Bid Evaluation	**Quotation Requests / Change Orders**		Tenant-related Services	Special Disciplines
Construction Contract Agree-ments	Project Schedule Monitoring		Graphics Design	Special Building Type Consultation
	Construction Cost Monitoring		**Fine Arts and Crafts Services**	
Special Bidding Services	**Project Closeout**		Special Furnishings Design	
			Non-Building Equipment Selection	
			Project Promotion	
			Public Relations	
Key: **Bold Face** Basic services contained in AIA's standard Owner-Architect Agreement [AIA B141]				

drawn. Providing a minimum compliance level ascertained is both optional and quite varied in content [neither NAAB nor any other agency or group sets out a mandatory, uniform curriculum; these usually come out of each school, college or university – many times simply from the school's own faculty including some registered professionals]. Hence, accreditation is not uniform and the academic work and desired results also varied even to the point of directed emphasis and title of degree awarded – in many aspects an unfortunate situation.

In addition, over the last years, states have liberally changed their requirements to include graduates from non-accredited programs as applicants for registration [usually contained under such legal language as, "…or other equivalent architectural education"; which is what?]. And in fact, more recently, some states have eliminated the need for a degree entirely which seems to uncut the validity and creditability of registration. To say nothing of failing to meet the basic legal reasoning for such registration – proven competence to design and control construction for structures that "protect public health safety and welfare". This may sound like continual harping on this issue, but IT IS STILL the primary focus of the enabling laws enacted by the various state legislatures for viable communities via safe construction. There was no expressed requirement for design, but certainly this is part of the desired results intended.

[In addition, registration is a worthy and noble professional goal! It is highly recommended as a way to substantiate and illustrate one's achievements, attained credentials, level of professional/ technical expertise – even if minimal – and understanding of requisite professional responsibilities.]

In 1932, the ACSA, American Institute of Architects [AIA[, and National Council of Architectural Registration Boards [NCARB] established the NAAB and gave it the authority to accredit schools of architecture nationally. The NAAB's founding agreement of 1940 announced its intention to create an integrated system of architecture education. NAAB's Board of Directors is currently composed of three members each of the ACSA, NCARB, AIAS and AIA with two public members.

The first attempt to establish national standards in architecture education came with the founding of the Association of Collegiate Schools of Architecture [ACSA] in 1912 and its adoption two years later of "standard minima," which schools had to meet to be granted membership. For eighteen years, while the standard minima were in place, membership in the ACSA was the tacit equivalent to accreditation, a practice common among other professions at that time and still in use today. However in 1932, the ACSA abandoned the use of standard minima, causing an eight-year hiatus in the profession's nati-

Fig. 4-2
Photo of an architectural office, circa 1940.
Gentleman in foreground, drafting, is typical of era – glasses, pipe, drafting apron, collar and tie, and manual drafting

onal system of education-a hiatus brought to an end when ***the ACSA, American Institute of Architects [AIA], and National Council of Architectural Registration Boards [NCARB] established the National Architectural Accrediting Board [NAAB], and gave it the authority to accredit schools of architecture nationally. The NAAB's founding agreement of 1940 announced its intention to create an integrated system of architecture education*** that would allow schools with varying resources and circumstances to develop according to their particular needs. Over time, as architecture education and practice became more complex, the NAAB continued-and still continues-to revise its accrediting process in response to the advice of its various constituencies. At first, ad hoc committees were formed to address specific concerns identified by one of the organizations within architecture, allied professional organizations, or regional and federal agencies. Today, the process of review and revision has become a formalized process of validation. The NAAB initially accredited schools of architecture; today it accredits the professional degree programs within schools, although other programs are reviewed on an advisory basis when they are identified by a school as being relevant to its professional program. In addition, accrediting standards have evolved to include general studies in combination with professional and elective studies, outcome-based performance criteria for evaluating student work, and procedures for guiding the accreditation process.

This is a circular set-up whereby the AIA seemingly represents the whole of the profession [although not every registered architects in the U.S. is a member], the ACSA the schools, the NCARB the state registration boards, and the NAAB gathers comments, etc. and folds them into a criteria, agreeable to the others. The groups not represented are non-AIA architects and offices, the current and prospective students, the graduates and interns, and the young [as yet unregistered professionals].

The actual concepts [in-place] are that, 1] the profession, as a whole, establishes what it "wants" from new hires and new registrants, 2] the schools do what they deem necessary or "correct", and, 3] the states set the requirements that they want met – whether the profession and the schools like them or not. The schools are left to try to establish and maintain their accreditation while not reducing their academic standing and giving themselves over to "training students to be hired" [i.e., the technical school credo]. A very curious set of circumstances, since the ultimate goal of college students and graduates is to be prepared to the point where they are employable! The basic academic thinking is that the college instruction should address the higher values of the profession, and an educationally well rounded person and not get into or address at all, the proverbial "real world" issues that tend to restrict full-blown uninhibited thinking.

And not without inner irritation and less than cohesive acceptance of all aspects. At any rate this process has deteriorated to

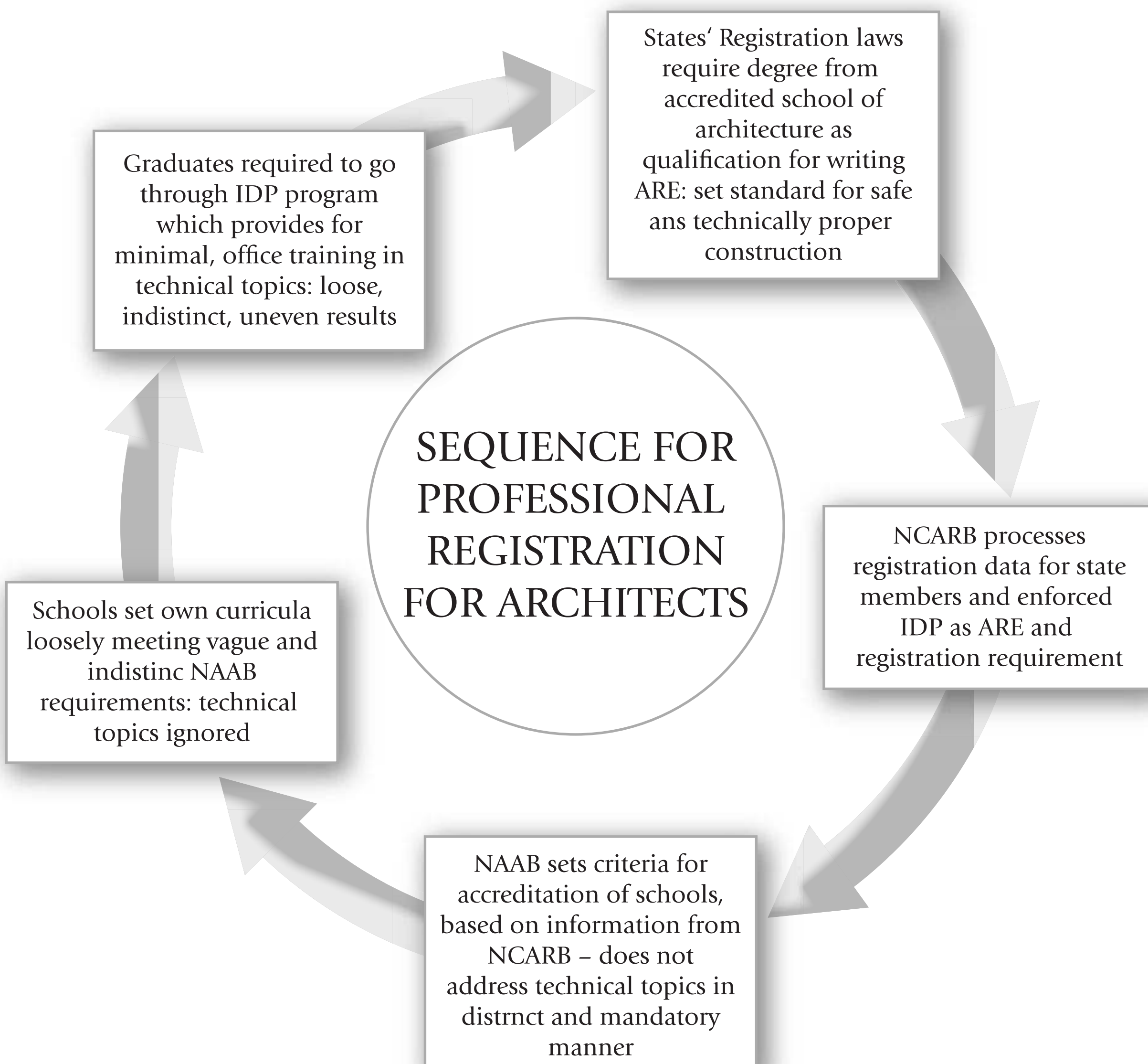


Fig. 4-3
Chart depicts the route one must take to secure registration or licensing as an architect under state laws

a good degree with some agencies overstepping their prescribed bounds, and others failing to understand their total mission and not that which merely perpetuates their own image and standing. The issue at the fundamental level is what responsibility each, and collectively all, of these groups have to the students, new, in-progress, graduated, or moving early in a career.

It is left for these persons to fill in the "blanks" and find out for themselves how the profession works, overall, and they can track a career to their liking and expertise – to find the specific niche where they will practice. Yes, the situation is that specific and for the vast majority of practitioners – if not all – far less than adequate understanding, expertise and activity in every aspect of practice. The reach of the profession is that wide that virtually none have been able to get their arms around all of it successfully. Too often interns come away from schools in a fog in regard to where they, what they can or should do, and what the future holds for them. They feel inadequate to employment in the profession, and worry about how to approach and fashion their careers. They, in many instances, lack the insight to know what all the profession is about, what all services it offers, and what all skill, techniques and expertise is required. They remain unsure of how to apply their academic training, which appears to be askew of reality in the professional offices.

Hence, diploma in hand, these young, budding professionals having made it through the academics, fall short of what the profession seems to want from them, and face a period [three years] of uncertainty in the requisite Intern Development Program [IDP]. This program is applicable in all state registration sequences and is administered by the National Council of Architectural Registration Boards [NCARB]. This group's membership is the various states' boards of registration for architects, who have collectively abdicated testing and evaluation of applicants to NCARB [many states have other added requirements]. There are wide-spread comments and information that even IDP is aside from the real world practice and the requirements of that program are not easily achieved – many offices simply do not facilitate meaning IDP thresholds. In fact, that threshold may be somewhat idealistic, artificial, unrealistic and lack creditability in that they were developed apart from voices in active practice. Simply, the working offices were not brought into the process of developing IDP – its development was strictly a function of the regulatory boards and NCARB. So the IDP has fallen into disrepair and is replete with falsified documentation, where elements of the program are not completed or achieved and employers merely "sign-off" for the sake of helping the intern achieve the prescribed tasks [without doing the work or without the requisite instruction and mentoring].

In all of this, there is a pervasive need for students understand early-on in their academic careers that architects do not practice like doctors.

Professions operate differently than production lines jobs. Because of the tremendous amount of information that forms the overall reach of the profession; most professions are practiced in selected portions. For example, in medicine a doctor is trained as an M.D. [basically a "generalist doctor"] with extensive but general overall medical knowledge. Then there is a period of residency in which the doctor narrows his/her purview to a selected specialty of the profession – i.e., family medicine, general surgery, cardiology, pediatrics, internal medicine, psychology, etc. There are no architectural counterparts to cardiologists, surgeons, radiologist, etc. Rather architects practice simply as "architect.

Much the same is true in the practice of law. The difference is the graduate from law school [a course of study after a pre-law, or other educational major] with the overall generalized information will migrate to a selected portion of the law – litigation, corporate, real estate, divorce, construction, etc. – in the office, and will hone the skills in those areas in an on-going manner by concentrating on the study and expansion of knowledge in that one area. Of course, different factors in that single area may call upon the general legal knowledge in some instances [e.g., a contract is basically the same no matter what scenario it is covering].

This concept is supported by the professional registrations laws in each state. These establish a level of achievement [degree requirements, internship, and examination] that in reality allows the architect, of even just a few hours registration, to practice and design literally any building. Of course, this is highly inadvisable and rather inappropriate as any, even young, architects know the complications that some buildings can involve. So while gaining the open-ended registration, reality is simply the architect can, with proper other discipline support, be engaged to "do" any building. the risk involved needs to be assessed, understood and certainly met before one simply "walks the plank" of doing a very risky and complex project – simply matter of feeling not egotistic arrogance and professional empowerment, but competency for the task.

Architecture, at this time, has yet another format that is in place, not by determination but by circumstances more than anything else.

Architects are trained in single sequence [an added master's degree is optional] of overwhelming proportion in design – the *skill of formulating an overall scheme for the image, shape and aesthetic appearance of the proposed project. Due to the severe time restrictions imposed on colleges by other academic requirements, little is taught, in depth, about the remainder of the profession [except in some isolated cases, where practice and technical instruction is given some modest attention]. The architect graduate is steeped in design, but for the most part has no depth of knowledge about how to bring their dens schemes to functional reality as a finished and occupiable building.*

In essence, teaching only design is akin to teaching a surgeon how to do but one type of operation, and a lawyer how to try one type of legal case. The resulting limitation on the individual is most unfortunate and can impair a productive career. In all of these examples, the necessary added knowledge and skill is vital to success and a decent contribution to employer, project and career.

In a rather dysfunctional system, the architectural graduates need the additional information but have few resources while internship is rather universally required, which is intended to augment the academic sequence and enhance it by providing methods for acquiring the remaining information. The format of internship [the Intern Development Program [IDP of the NCARB] is intended to function through the system whereby the office that employs the intern is to provide the "instructional opportunities" for the intern to acquire the information. The level of such acquisition is intended to be sufficient to allow success in writing the A.R.E. Among other problems, the IDP has proved fairly unreliable and the employing offices have not completely accepted their role[at their cost] as educational providers.

Statistics in the recent past, show as few as 17 % of the architecture graduates and interns have chosen to take the Architectural Registration Examination [ARE]. Mainly, the reason for this [as cited by many who are eligible] is the cost of the computerized examination. There also appears to be a high rate of disinterest in becoming registered, both because of the perceived value in it and the ability to function with the full range of professional practice capacities, including design, without it. In decades passed, it was a normal, logical, and unquestioned situation where registration was the goal of almost all students/graduates/interns.

Now it appears that relaxed office hiring requirements, and paths to contribute in the office in other formats, have both dissuaded registration as a necessity and has fostered an entirely new layer of personnel. This also can be a reflection that office production costs can be reduced [previously achieving registration was usually good for a salary increase commensurate with the new standing in the profession]. And then, too, respect for the achievement of registration has slipped drastically and appears to be something many simply ignore as being unimportant – again a direct reflection of the lack of understanding about the profession, overall.

THE DIRECTION

Architecture, like any of the learned professions, is an extensive and complex array of information, knowledge and skills developed, adapted, applied and brought to bear to various aspects of project.

In its larger part, architecture as a profession is far more extensive and intensive than just the much proclaimed design function and the eventual project design concept. It is this breadth that is not adequately [if at all] brought out to students, and often is lost along the way to graduates and interns. Hence, there is an imposing amount of information that is not offered to, or readily available, which serves to explain all of the profession – that which is most valuable in career planning and understanding one's context in the profession.

It is both a matter of fairness [to the future architects] and importance to the success of the budding architects AND their profession in the future, that more information and understanding be emplaced. It is the function here to expand on some of the aspects involved with this breadth in overall reach and the services provided by the profession – to give a more balanced and less skewed perspective. The text in Part 2 will address the production of contract [working] drawings, one of the major functions facilitating the construction of architecture – and the function that the vast majority of new professionals will be assigned in, at least, their initial employment in a professional office. But first the discussion is about the some aspects of the profession that surround and encase both design and working drawings. Architecture like all of the other "learned profession" follows the general definition to a large extent.

Professional
A person of high education and training, and expert and specialized knowledge in field where excellent in manual/practical and literary skills are prerequisite to producing high quality work in [examples]: creations, products, services, presentations, consultancy, primary/other research, administrative, or other work endeavors. Involves a high standard of professional ethics, behavior and work activities while carrying out one's profession [as an employee, self-employed person, career, enterprise, business, company, or partnership/associate/colleague, etc.].

The professional owes a higher duty to a client, often a privilege of confidentiality, as well as a duty not to abandon the client just because he or she may not be able to pay or remunerate the professional. Often the professional is required to put the interest of the client ahead of his own interests.

It can be argued that the difference between a profession and a "skill" is that the profession demands as wider range of knowledge than the skill – a range that covers many skills and not honed in very specific functions and narrow array of required knowledge. In fact a tremendous amount and range of information is necessary – it is the degree of such knowledge that makes the primary difference. The important factor is that the people directly involved – in either skill or profession – must have and understand all of the information required for their specific work or the range of work they encounter. This allows for deep insight, full function, and expert work as may be necessary to achieve the requirements or goals uniquely set for each project. Even today [after many centuries] the profession of "architecture", by definition, has a direct acknowledgement that the profession has two basic elements, is usually shown to embrace two very distinct "requirements" or aspects of work, For example: The definitions utilize the words "art and science", as the separate but interconnected efforts required to produce architecture, as seen in:

Architecture
The art and science of designing and building structures or large groups of structures, in keeping with aesthetic and functional criteria

- Cyril M. Harris
"Dictionary of Architecture and Construction"

This basic definition is reinforced by the following:

" … the architect must approach design with a fundamental grasp of building materials and methodology (…) the architect must have an expertise in construction along with design ability".

- American Institute of Architects,
Paper submitted for1993 Walter Wagner
Education Forum

The open recognition of the two aspects of architecture are crucial to understanding the whole of the profession's work, its' impact, direction, intent, and production. In reality neither aspect can survive on its own and still be works of architecture. The design and concept requires functions, tasks and work to bring it to full reality. And the technical work may be able to produce structures and buildings, but the chance of them being "architecture" is doubtful. That is not to say that engineering-oriented construction work is necessarily suspect or repugnant, it is just that highly aesthetic design quite often is not a primary consideration or concern.

Architecture, in its fullest extent, exists and is both conceived and produced daily as the many projects work their way from mere ideas and needs to real and functional buildings/structures.

To properly practice architecture, a person needs to be aware of and know about the wide array of services, skills, and data required to be utilized in projects – and how the combination varies from project to project depending n what results are required. This is a factor that cannot be compromised, short-changed or overlooked, since it strikes at the core of the profession, and its basic intent and function. While every practitioner does not necessarily engage every aspect on every project, it is still incumbent to understand and have ready access to all of the information.

This intent is to produce a book that deals with some of the more distinguishable [but still overlooked] issues and aspects within the architectural profession; and the educational system/process that produces valid graduates, interns and eventually candidates for registration [licensing] as architects [and ancillary personnel]. It is not an effort directed at in-depth discussion of the whole of the profession or construction industry [although there may be a level of interest in the contents and issues].

Due to the pervasive and egregious lack of full disclosure, appropriate balance, uniformity, [and with wholesale disparity in the curricula of architectural schools] and no other applicable criteria requiring it, professional practice instruction has commonly been minimized if not eliminated.

This is instruction that looks at various aspects of practice, some more in depth than others, but usually with some introduction and discussion on most all circumstances, tasks and areas of work that one can encounter in practice. For the most part it is explanatory, with some courses utilizing specific exercises and restricted areas of exploration.

While there may be some valid reasons that impact the reasoning or deletion of selected instruction, to a limited degree, it appears that allowing and perpetuating a major breech and this gap in information is severely short-changing the students and the budding professionals. The profession, overall beyond design , is taught [if at all] and explained in an inordinately narrow context. Indeed, if it relies heavily and disproportionally if not totally [and unfortunately] on solely the theory and design of projects. This severely inhibits overview and understanding of the broad range of the profession and its many and varied services – concerns that are vital to every registered architect in one way or another at some time. It virtually is "tying one's hand behind the back" and impairing total comprehension. And regrettably it leaves it solely to the student to find, become aware of and secure the necessary information to provide some depth of understanding of the various tasks and responsibilities of the profession.

It is a rather shocking and incongruent breech of propriety to allow professional education to be eroded away and to eliminate the very information and knowledge needed to construct buildings in a safe and sound manner – particularly when the legal charge to the architect is "the protection of public health, safety and welfare". It is extremely difficult, if not impossible to justify such as shortsighted and basically illegal stance! The following chart illustrates the areas where little if any instruction is provided in the professional education process for architects.

It is obvious that without the full 6 complement of work phases [6 overall] no project will ever be developed in full. Even in the current climate where project delivery systems* are widely utilized, there is a need to provide detailed "explanation" of the design concept, and production of useable construction information for use by the trade workers on the job site.

How does that get done, and who produces the information?

* Project Delivery Systems are various combinations of personnel, personnel relationships, obligations activities and contract requirements used in establishing contracts for projects. There are many different formats available for selection by the Owners, to their best interests. Documentation changes in some of the formats, but still is vital to the project's construction phase.

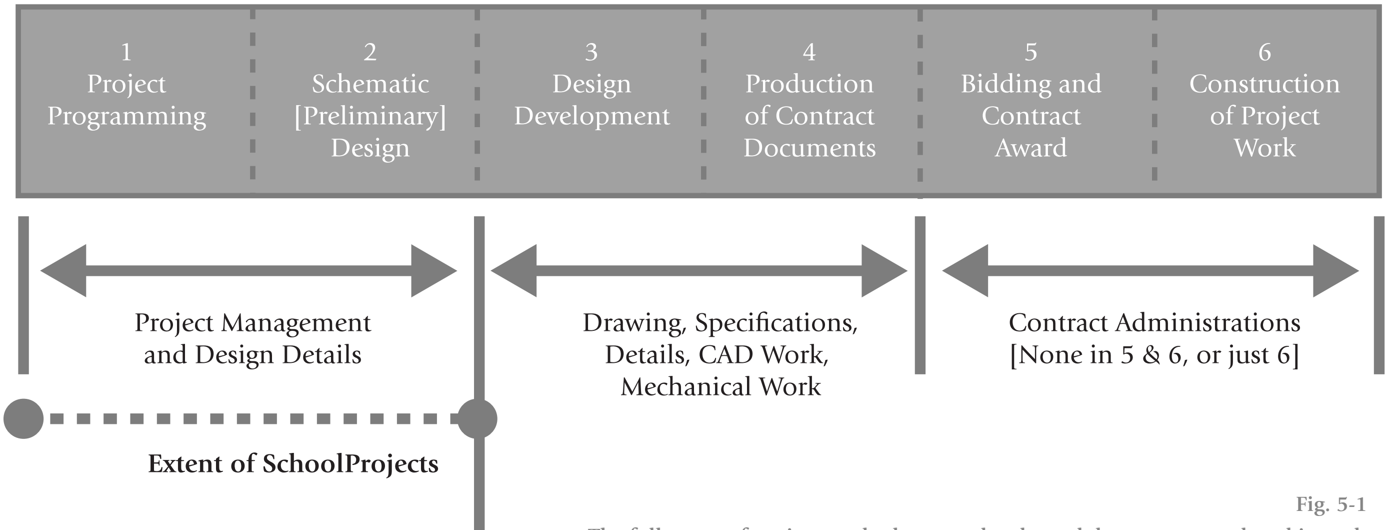


Fig. 5-1
The full range of project work phases and tasks and documents produced in each

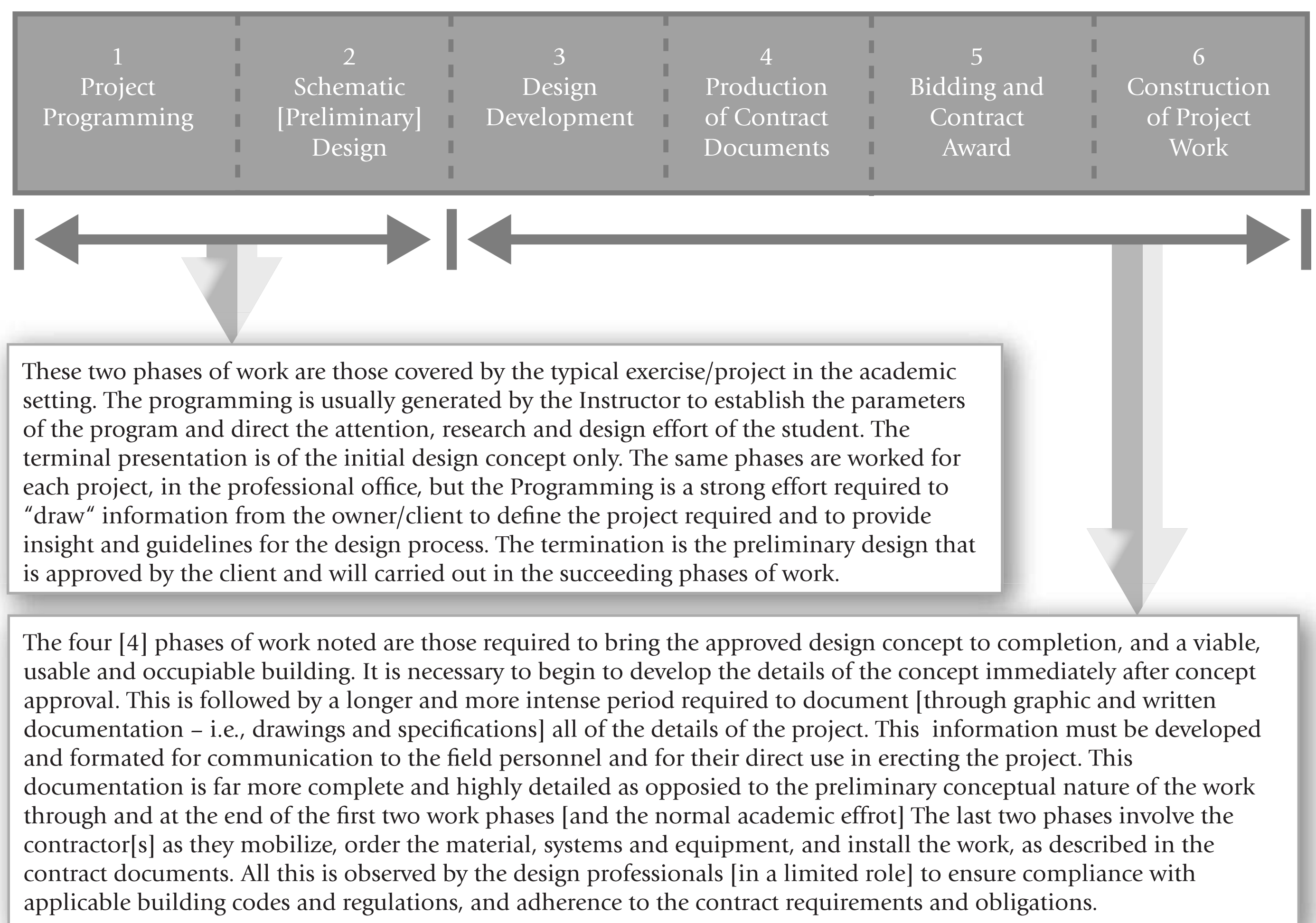


Fig. 5-2
Relationship of work phases to instruction and work required

ON BECOMING AN ARCHITECT

Architecture
The Profession, overall, and the practice thereof, have not and are NOT fully explored or addressed [some aspects, are never mentioned] in the academic sequences – no matter which school you attended!

There should not be, and usually is not, any illusion in the mind of any architectural graduate, intern or young professional in this regard!

The pre-collegiate perception is that the typical architectural curriculum will encompass the full palate of information required to become an architect. Subsequent to the receipt of one's diploma and degree from an architectural program, it becomes almost immediately apparent, and then remains, that an undefined, mysterious and rather vague program and process needs to be negotiated. To the graduate, this is both irritating and confounding – so much work having been done, and hardships endured, all to be short of the true goal. How, indeed, does one proceed from diploma to registration seal? The mandatory sequence is to pursue the 3-year Intern Development Program [IDP]; pass the Architectural Registration Examination [A.R.E.].; buy an embossing seal and rubber stamp; create and print a nifty letterhead; then, PRACTICE!

BUT !!!!

How exactly does one fit, along that sequence, into the profession as a whole, and the professional office in particular?

How does one contribute in a meaningful manner - to the satisfaction of one's ambition and employer?

Is there a stigma in "starting at the bottom"? If so, how imposing is it?

What is the "right of passage"? Is there "busy work", and mundane, no-brainer work that must be endured, experienced and done to lend credibility to a person's abilities?

What, exactly, are your expectations, and how do you justify them?

More and more graduates and interns are expressing their deep concerns and frustrations over this situation. It is, indeed, a most unfortunate situation that needs attention and resolution. This is need for clear, air-clearing, and direct discussion of all items and concerns so career choices, and understanding can be accomplished in harmony with the commitment may so far [by each graduate]. The profession and the offices gain absolutely nothing by perpetuating any array of disgruntled new professionals.

The public is far more familiar with the medical profession than with architecture. Certainly it is reasonable to determine that more people are exposed to doctors than to architects, in the normal run of life. In addition, the medical profession has been portrayed and literally glamorized in film and on television. This has been done to the point that we all know the dreads of being an intern, working hellacious hours, and learning tremendous numbers and complexities of lessons. Then sweating out where the best residency will come, in order for one to establish the specialty of choice in what is perceived to be the best teaching environment.

But very little, if any, of this comes in regard to the architectural graduate. Other than grainy re-runs of the motion picture, *The Fountainhead* [1949; based on book by same name by Ayn Rand, 1943, – "An uncompromising, visionary architect struggles to maintain his integrity and individualism despite personal, professional and economic pressures to conform to popular demands... "], no real in-depth exploration of the profession [fallacious as Howard Roark turned out to be] is available. Oh sure, Mike Brady [of the "Brady Bunch", the TV situation comedy] was an architect, but never really was shown in a work situation. There have been other portrayals of architects, but only in very tangential ways, to give the illusion of an added, elevated professional status – but none showing the real substance of the profession. So in the public venue there is little to go on, but somehow there has been a glamour that has arisen around the profession and the title, "architect". Perhaps more mystery than glamour!

With this background and the vague notions about architect, it is no wonder that students who "migrate" to the profession chose and enter schools with little knowledge or understanding of what lies ahead, and what is to be accomplished. Most, unfortunately, find the way most confounding, confusing, and flat out difficult – even those who has a relative who is in the profession but was "schooled" several years ago [yes, things do change and rapidly!].

A high level of fascination has been developed by the computerization of the old "mechanical drawing" course in junior-high, vocational and high schools. The change over came early and in mass, due largely to the introduction and use of computers in the home – young children of school age had early access to them! [Perhaps by using games, but this led directly a high level of computer skill] Now the "vocational" educational instruction programs are loaded with computers, which in turn are loaded with software simply lying dormant waiting to spew architecture about at the click of a mouse"! Herein lies the beginning of the wholesale *infatuation* with, and unparalleled reliance on CAD – the tremendous misunderstanding and misdirection of its use, and wholesale misrepresentation of what architecture and architects are really all about. The very rapid and continual iteration of new "drafting" software, and easy access to it has served to exasperate the situation to the point that many college architectural programs no longer even spend time to address the computer, etc. This was basically left to the student to select, use and do as they wish in producing what the schools' require as problem solutions. Hence, the projected work force we now see is trained in very diverse ways and with the need for a built-in learning curve to transition to new and different software [also, many times this involves moving backward as every architectural office is not capable or of a mind to embrace every new software "opportunity".

There is, of course, a sense of great relief among graduates when the rigors of the academic program are completed, and one moves to the next segment of one's professional life. The problem is that that next portion is not very distinct and clear; it is not specific and directed as is the curricula of the academics. There are some requirements, before one becomes a registered professional, but the accomplishment of the tasks in that process is uncertain, and generalized. In fact, it has become increasingly murky as to whether or not one should even pursue registration at all. This, of course, is a personal determination, but in recent years the number of applicants

HAND AND CAD

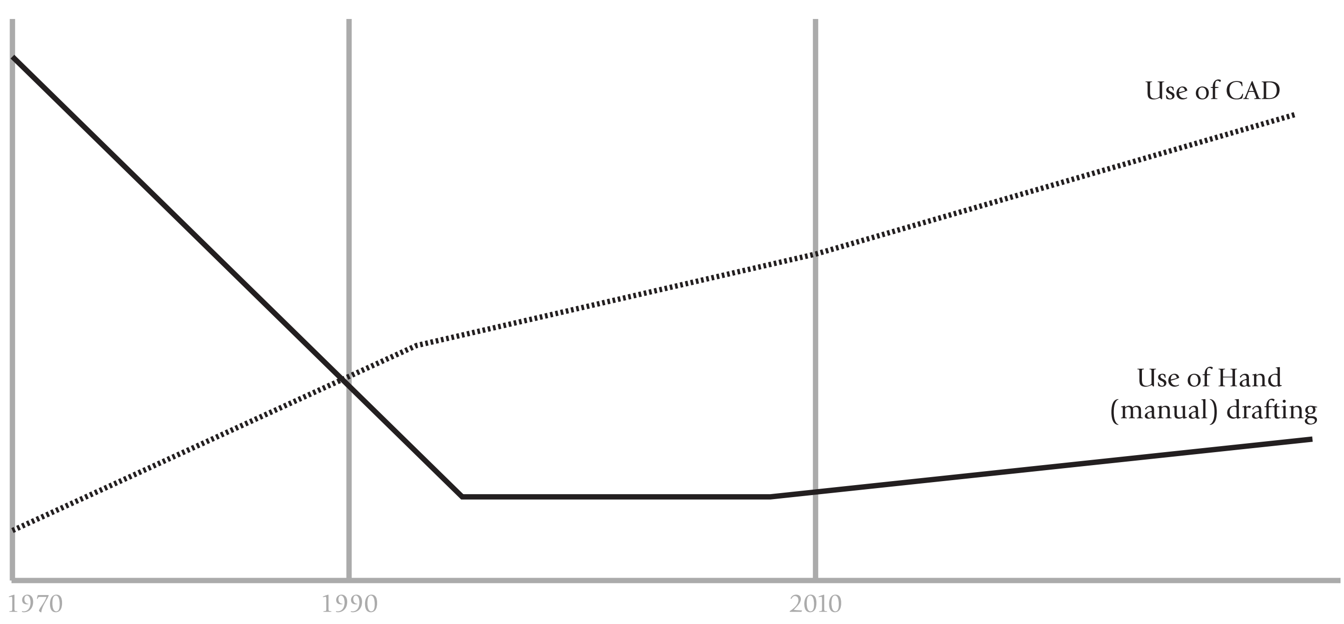


Fig. 6-1
Using 1970 as the base date, chart illustrates how hand [manual] drafting methods were reduced in use, while the computer was used in dramatic fashion for the production of project document. Note, though, that hand drafting [really rough sketches now] continues in use as a basis for CAD presentation, where the architect is required to create the details and other drawings for the CAD personnel who do not have the technical construction knowledge

to take the A.R.E. has been as low as 17 %. This is attributed mainly due to cost of the exam, time required for study and writing and actual importance and value of the program in one's career. Opting out of the registration process does, however, severely restrict one's professional options later on.

Certainly there is notice, at least, that some milestones are yet to be accomplished but the method to passing through these events is not at all clear. What has occurred is that the registration agencies in the various states have developed programs and requirements over the last few decades that vary one from another. Primarily they enacted an "experience factor" as they perceived the need. These periods varied in time from one to several years- but they were not uniform among the states. This caused registrants to find problems in trying to gain reciprocal registration from more than one state.

The basic idea was that since registration verifies that one is worthy and capable of being a fully qualified architect, capable of designing literally any building, there is need to have a background of work experience. A background of strictly academic preparation was deemed to be inadequate to the tasks of "designing, documenting and erecting buildings".

There had been cases in which young architects were able to take, and pass the registration examination prior to graduation and receipt of their degrees. In fact, some were able to place their registration stamp impressions on their terminal projects or thesis! Hence, the concern became more prevalent and more imposing. States, one by one, added the experience factor by either delaying the writing of the exam until after that period, or by allowing only the more academic portions of the exam to be taken immediately after the graduation [history, structures, design, primarily]. The basic concern was that the state verification of one's professional expertise cannot and should not be based solely on the academics, and that, indeed, public health safety and welfare in construction requires an experienced "hand" – hence the work experience requirements prior to full registration.

When the state registration boards combined and formed the National Council of Architectural Registration Boards [NCARB] in 1970, they moved toward and later formalized the required experience factors, and the registration examination, they also wanted to implement some more formal and recordable training or experience term. This lead to the inception and development of the NCARB program called "Intern Development Program [IDP]". This program was conceived to be a "gap-filling" program of sorts, whereby office experience would serve to further instructed and educate the graduate architect in the aspects and nuances of the profession.

This book will not delve into, explore or explain the IDP, but rather will try to explain the rationale involved, and what the basic intention is. It is basically "explicitly inexplicit", providing a matrix of tasks and requirements but not a highly enforceable program, and one which has no buy-in from each firm. The experience provided varies quite widely from firm to firm, depending on the interest, philosophy and commitment of the principals of the firm. This unpredictable nature only tends to compound the frustration and disillusionment of the interns.

Everyone must understand that the graduate needs to transition over the whole spectrum and perspective of one's career, work, and future. Most schools do not include much, if any, instruction in the technical aspects of practice, nor in the general practice or business aspects. And the professional offices do not perceive themselves to be "teaching units". So the intent, basically of the IDP is to require that the intern engage in such tasks as will provide some experience in the prescribed areas of practice. This can be seen as a "forced" transition, but more realistically it is a statement – i.e., graduates lack all they need to practice as registered architects so, the IDP provides practical ways for them to gain all the additional knowledge and insight that is required [beyond that included in the academic curricula]. At least, in this, there is recognition that completion of the academics does not arm one with all the required professional knowledge and skills required for successful practice. But this recognition in the form of a suspect system belies a relevant, and viable program of direct and lasting benefit. The inability to really enforce the program [and its results] is the confounding problem and the one that has yet to be "made whole", positive, productive, and generally uniform [in depth and coverage].

The underlying problem though is that professional offices are reluctant to take time [and spend money] to "teach" interns. The particular concern is that the office must teach at their expense, only to have the intern move to another office that the benefits from the gained knowledge. This is somewhat of a "squirrelly" concept since the teaching office could make an effort to retain the interns, but often is "out bid" by another office, hence the teaching office loses both money and a trained employee.

Individually, the intern must grasp the fact that they are not "whole", professionally, and that despite their fondest ambitions, there are other blocks of knowledge that they must be aware of, if not expert in.

The bracket of time between mid-19th century and mid-20th century is quite telling in the idiosyncratic relationship between design and documentation within the profession of ar-

INTERN DEVELOPMENT PROGRAM			
Area of Work	**Min. Units req'd.**	**Hours req'd.**	**Discussion of Work which may be available or allowed by the professional office**
1. Programming	10	80	There is little likelihood that an Intern will be permitted to take a direct part in programming: note taking at meetings, and assisting with programming exhibits under supervision of others may be available. This is a good area for academic formats
2. Site/Environmental Analysis	10	80	The Intern, here too, more than likely can participate through research for material, and for general information and perhaps some base drawings. Conclusive work would be minimal; overall effort must be guided by someone else to point out crucial elements, and the type of solutions required.
3. Schematic Design	15	120	Here the intern could be utilized to research the various elements of the project for sizing, perhaps for relationships, etc. which could then be incorporated by the designer. Using various sources and watching some formulation of the design would be by-products of the effort.
4. Engrg. Systems Coordination	15	120	The experience here would be in direct relationship to how closely the disciplines are aligned. Primarily this would be in the range of research and data gathering under the eye of others.
5. Bldg. Cost Analysis	10	80	Participation here could be high, in that material quantity take-off could be an intern's chores. With minimal input and a decent level of technical expertise the estimating information could be gathered for use by others.
6. Code Research	15	120	Due to the nature of the code language, the intern may be used solely to find inserts, and similar research; little chance for decision making or other work directly imposing on project work. This is an excellent area for an academic format
7. Design Development	40	320	An intern with good production skills may see direct involvement in the development of the design drawings and the precursors to the working drawings. Probably this would be in the basic depiction of details produced by others, and not in the direct production of details from the beginning
8. Construction Docu-ments	135	1080	This effort would parallel that in DD, but could be more intense, and could increase as the expertise of the intern increase; this is the crux of the internship, and the place where the most can be done and learned; also the most can be contributed. However, some academic grounding, formatting and instruction on basics is most useful; discuss concept, intent, content, etc.
9. Specs/Matls Research	15	120	This area is best achieved in an academic format, for the most part. Without experience the intern would be hardput to write specs, or to properly research materials and select them. Could be guided effort, but contribution would be minimal even with increased office assistance
10. Document Check'g / Coordin.	10	80	Some experience could be gained here, but not knowing what to look for makes both aspects hard to execute. May be some opportunity in some limited ways, but as last line of defense for office, would think participation would be low. Some basic academic formatting is advisable.
Electives from Areas 1-10	75	600	This "call" is almost totally predicated on what the office needs. Would be nice if the interns could select these areas to suit their interests, but that cannot be guaranteed
11. Bidding/Contract Negotiations	10	80	Compiling and distributing bid documents, etc. is about the limit of experience here. May be permitted to "sit in" on bidding, etc. but negotiations is another thing; would seem to be a difficult area to accomplish
12. Construction Phase- Office	15	120	The experience in this phase will be confined to observing how the project work is administered and handled in the office-- change orders, shop drawings, RFIs, etc. The intern can be a party in rather restricted ways, but can gain some understanding of these procedures
13. Construction Phase- Observation	15	120	Academic format in contract administration is advisable. Then intern could be assigned to work on the site in a clerking or other admin. position. If given some guidance there is an opportunity to directly relate drawings and other requirements to actual work [by observation], but without experienced direction this may be lost.
Electives from Areas 11-13	30	240	This "call" is almost totally predicated on what the office needs. Would be nice if the interns could select these areas to suit their interests, but that cannot be guaranteed
14. Project Management	15	120	The opportunity to be part of this process must be opened to the intern by the office principals. Actual participation may be minimal and in the form of reading and observing rather than contributing directly.
15. Office Management	10	80	While done in a different environment, the effort here would be similar to that for Project Management, but with differing goals and procedures.
Electives from Areas 14-15	10	80	This "call" is almost totally predicated on what the office needs. Would be nice if the interns could select these areas to suit their interests, but that cannot be guaranteed
16. Professional & Community Service	10	80	This is an element that is difficult to understand, since it does not contribute to the technical expertise of the intern. Registration is a function of technical competence, and not character assessment – but apparently the requirements still must be met. Academic format for professional practice instruction is advisable.
17. Teaching-Research-Grad. Degree-other related	0	0	Seems odd that this is included and then assessed no value; it is unclear what is intended by the program in this area.
Minimum Total Units Required	465	3720	
Elective Units	235	1880	
TOTAL UNITS REQUIRED	700	5600	At the rate of 2,080 hours per work year, full-time assignment to IDP tasks would require min. 2.67 years to fulfill all IDP requirements

KNOWLEDGE OF PROFESSION + DESIGN SKILL + CONSTRUCTION KNOWLEDGE + APPLICATION SKILL + COMPUTER SKILLS

= COMPLETE ARCHITECT

Fig. 6-3
To be a “complete architect” requires one to have knowledge, understanding, skill and experience in several areas of endeavor. To have a minimal level of requirements in any one weakens the overall expertise and shortchanges the architect. Everyone is not equally expert in every area, but functional knowledge and skill is required in each for a balanced approach to the profession

chitecture. Drafting as a sub-profession rose in identification, separation and use from the Civil War era and was maximized in the 1900-1930 period. It was then too, and a direct result of what was known as the “manual training” period of drafting instruction. As time progressed it showed the gap that started and grew between the architect as a singular entity and the architect as designer, supported by drafting personnel as documenters!

The Depression, of course, adversely impacted the professions and created whole different approaches, but it did not even attempt to resolve the gap between professionals – the primary issue was jobs, for all professionals.. The Beaux Arts influence was heavily design driven but never really included any further expansion of the designer/drafter situation. The overwhelming issue was the “correctness” of the design with little allusion to technology [how do you building the design]. The Bauhaus School introduced and was based heavily on a new approach to the relationship of design and technology whereby the usually hidden parts of buildings were left exposed and became design elements. Again, not a solution but a situation requiring closer harmony between designer and drafter.

With the introduction of the computer and it meteoric usage, the drafter, complete with instruction and knowledge base for use in the documentation process, were lost for the most part. The perception came that as long as one could manipulate the computer the documentation solution [i.e., details, sections, application of construction materials and devices, etc] would somehow automatically appear even though they then reside in neither human mind nor in the mechanical brain of the computer.

Hence, the dilemma still being addressed today – with an unfortunate lack of urgency! The perception that this identical situation no longer has influence today, or that it does not even exist is wholly erroneous and becoming more and more vexing! Actually, it is somewhat more egregious and complex in that skill and knowledge are even more dispersed and directed instruction is all but totally lacking.

The chart shows, pointedly, that there is an array of attributes required to be a “complete architect”, i.e., one who has at least a working knowledge of the various tasks noted. One does not necessarily have to be expert in each and every area [we all have our “favorite” or “pet” areas where we find our professional niche and satisfaction in what we can provide for each project], but it is essential that one have a good level of understanding and knowledge in each area. Practice requires the ability to interrelate information, apply t appropriately and to provide information, direction and instruction as required. In doing all that, one cannot be devoid of a decent level of understanding of what, ALL, can be brought to bear, adjusted to circumstances and applied to a specific projects – from inventive uses in design to in-depth detailing of the construction, to evaluating the propriety of the work when executed in the field.

The problem though is that current training is not directed to this set of attributes and is producing personnel who really have no grasp of what is involved, much less how all this functions to work together on every project.

This entire process has become much more imposing than it had been in years passed. Mainly there are so many more systems, methods, and combination of techniques that can be used, that one must be able to at least know them and function as well as possible in them all. Office standards, procedures, processes and standards vary – widely, distinctly, imposingly, and individually. There is absolutely no doubt that basic knowledge of the numerous construction systems,

◀ Fig. 6-2
Charts noting the requirements of the Intern Development Program [IDP] which is required after graduation [and acquisition of a degree] and prior to taking the Architectural Registration Examination [A.R.E.]. Not the several areas of experience required where academic instruction was not forthcoming

materials and methods is vitally essential so one can deal with whatever choices are made and incorporated into the project at hand – and what will come in the next project to be worked. In like manner, the methods for document production of communication of project/construction information.

The greatest cliché one runs into is "not knowing all that you don't know". Simply, this is recognition that there is so much to learn, know and develop. Perhaps the best piece of information in this is where to find the answer you need. Some of these are in books, and products literature, some in the memory banks of colleagues, mentors, and older practitioners, and some best done in a formal classroom like setting! At any rate, one has, simply has to develop a large array of information, and retain the same to be called upon as necessary in the future. Time is the only factor in this – all the information need not be gained at one time, but is literally accumulated and built upon over the period of a career.

In addition, one must come to know the aspect of a complete practice. This is not only to know how an office works, but also to be able to assess what segment[s] one chooses to pursue and engage in. It is the rare individual who conquers and practices equally well in all aspects of practice. In his high aplomb as an architect, Frank Lloyd Wright was a very poor businessman, and went bankrupt several times over.

This is not to say that one cannot achieve equal expertise in all phases of practice – it is just that this is extremely difficult. Most likely the best example is the very strenuous effort required to sustain a "one-person office", where one has to find work, produce the work, monitor the work, while at the same time finding the next project to do – and making a decent living! Some are not only capable of doing this, but usually succeed so long as they maintain a narrow range of projects, a good stable of contacts/sources/clients, some "bread-and-butter" clients, and more than likely a residential work pattern.

A full general practice requires such breadth of knowledge and work that is very difficult to perform well with a single professional effort. This is an opportunity for interns, in that the registered professional can always use decent "hands" to perform the more common or mundane work involved in every project.

What kind of architects are there?

What kind of architects do you want to be?

How do you fashion your career toward that goal?

Usually one will, wittingly or unwittingly come to find their niche in practice– that point or aspect of work where one can work comfortable [feeling fully capable of producing good work] and where one is satisfied both to one's self and to their employer. Finding this spot is important and vital to the overall success and sense of accomplishment on the part of the person. Such niches are design [of course, but a rare task for interns and young professionals], detailing, field observation, marketing, etc. Specifications writing sorely needs new professionals, but rarely are a young person drawn to this task – and it does take a good background in knowing, understanding and combining materials, products and systems [yet another level of learning].

It is necessary for the young architect to gain basic knowledge, information and understanding of all of the aspects of practice, so they can be prepared to meet the challenges that come. One need not be expert in every area of practice, but one must be fundamentally sound, with enough information to know what is required.

Architects do not practice in specialties like doctors, on an individual basis. However, like doctors, there is need for an "M.D. of architecture", whereby one becomes involved with the overall concept and basic knowledge of every function and phases of work and projects. The basic title which acknowledges fundamental skill and expertise is the "R.A.", of the registered architect – fully examined and meeting state laws for practice. It is then the projects that shape how each staff architect will participate, and to what level or depth they will be involved. With a strong footing in fundamentals one can then expand as necessary, for each project, changes as the needs of various projects require. This Is not, however, to indicate that the architect is a "jack-of-all-trades", but it is necessary to know what others are or will be doing on other portions of the project, or in the office practice.

We tend to move to those tasks where we find personal satisfactory and expertise. We are NOT all the same, but we all spring from the same source, and with the same basic direction and resources [all we have to do is find them and utilize them, properly]. Really this stems from the concept of "team", where we must know not only our specific job, but also the job and tasks of all of the other members of our team. We must respect what they are doing and what parameters encompass them, and what inhibitions constraint them. It is within this mutual understanding and respect that we will find true satisfaction, group success, and winning projects for our office – not indicated by the plaques on the wall, but by the looks, comments, and expressed satisfaction of the client. If we do not come to this level of mutual understanding then we function as individual divas, consumed by our tasks and with no regard for what others need from us, and more importantly, what we really need from them. We all come with differing background, academic direction, interests and records, but we must personally hone these to fit our assigned chores.

A “designer” who knows little of construction will tend to design n a state of make-believe, not that construction constraints design – rather that the necessary construction will produce the required elements, but at a tremendous impact on other aspects of the project. Nothing is gained in this type of situation except animosity and confusion – and the need to re-work at cost to the office.

Of course, we dream great dreams for every project. But at some point the realization of that great dream becomes the task of others who must share the dream and understand other parts of it. We do not reduce our personal ambitions or skills, but we need to relatively direct them for the overall good of the office, and each project we work on.

Architecture, like the other professions is not a single, unified entity, with common goals, achievements, and direction? The answer is ″no“, but many may claim otherwise.

Architecture is as fragmented as any profession, with many aspects which tend to create their own sub-professions; niches where one can be said, ″to practice architecture“, but in reality where one practices a single, rather self-styled portion of architecture. To better explain this premise, the following is a listing of a few architecturally oriented ″professions“:

- Teaching in an architectural program
- Serving as critic, reviewer, or project consultant
- Offering service through a ″signature“ firm
- Create and develop working drawings
- Specification writing
- Field observation and contract administration
- Research and development
- Business development professional
- Architectural designer
- Participating in a narrowly drawn specialty practice
- Project manager
- Mentor/trainer

Architects, unlike doctors, do not train for or practice in a formally prescribed specialty, but almost without exception, they each seek a niche or position, professionally, where they can function throughout a career. This is not particularly bad, since the mere complexity of the work and the profession really prevents one from becoming a practitioner equally expert in every area of practice. This allows one to seek solace [?] in a particular niche, since one ″niche“ can well support another ″niche“ in a complementary manner to provide an overall program of satisfactory practice at a level certainly well above ″adequate“. More precisely, every architectural firm has a staff, which combines quite varied viewpoints and perspectives, as well as individual talents, in a manner that supports the firm effort, and more than likely a successful practice. That success is in the eye of the professionals who contribute to it.

The mention of several professions merely acknowledges that not every graduate from an architectural program works in the profession, and eventually becomes a principal in a firm [perhaps one developed by the practitioner]. Many graduates work in tangential fields which touch architecture in some way, but which are not direct contributing factors to the profession.

From the bygone days when the ″architect“ was truly a Master Builder, the profession has evolved through many quite different eras. In each such era there were predominant practitioners who excelled by virtue of their talent, and quite often by the clientele they were to both attract, and please. That very premise – attracting and pleasing clients – remains, even today, as the crux of the profession overall.

As Master Builder, the architect was given status as the ultimate authority over a project – designing it, and seeing that it was built faithfully to the desires, design, and professional whims of the architect. Obviously the client gave great breadth and power to the architect, usually with some sort of implied threat or penalty should the final project not meet with the favor of the client [today, we just sue!].

The profession took on the air of elitism, and was seen as a ″gentlemen's“ or “ivory palace” profession“ early in the 20th century. The persona and personality of the architect became the primary determiner – and their skill in selling their design concepts and styles was ramped.[They “knew” what their clients needed!] The work was not mainstream, for the most part, but was the result of clients whose tastes, fortunes, or needs outstripped the ″design“ ability of a contractor or artisan. The members of the general public never knew about, or realized the impact of the profession, despite the fact that they are daily influenced by the architects' effort – the ways are subtle, and for the most part, taken quite for granted.

For many years, and particularly when projects began to take on more massive, wide-ranging and multiple building dimensions, the architect moved in a quasi-Master Builder posture to ″leader of the project team“. Here the architect would assemble consultants of various expertise to combine and contribute to the grand design scheme. The architects' effort was directed toward overall coordination of both the technical effort and design – to the eventual outcome in the way of a finely tuned, well placed and coordinated facility, which serves the client's needs to a tee – basically a tailor-made suit to fit the nuances of the client's business in a way to expand productivity, image, and of course, profit.

With this the architect came to be the expert regarding all occupancies, and life styles; business ventures, health care facilities, educational facilities, and even industrial complexes. Housing, particularly single-family housing [at first the primary source of commissions], was slowly lost as fewer and fewer mansions were built, and where prefabrication and streamlined work procedures came out of World War II. Some high-end houses were done, but relatively few practices were able to sustain themselves doing just houses.

As community-wide planning became a more refined and specific field of work, the architect began to lose the team leader role, in favor of the planner, who possessed even greater depth of foresight [?] and a wider penchant to produce for ″the now‶, and for ″the future‶. Architects became building designers almost exclusively.

Unlike medicine, architecture is not a ″needed‶ profession, per se. A person can easily live a lifetime and never ″need‶, work with, be exposed to, or really understand the work of architects. Yet, architecture is around us all, every day, impacts our lives and activities in most all of the places and environments we encounter daily. The work is so subtle, ″hidden‶, and has never been explained or taught in the educational system, that it is simple lack of awareness and knowledge which relegates architecture to be ″the unseen/hidden profession‶!

In spite of this, there is a good portion of business people who understand the value of the architect. They continue to utilize the expertise that is available from architects. In this, they receive projects that meet their needs, fulfill their dreams, and aid the progression of their businesses. But while this is occurring, there is little contributed to the profession overall. The impact of private commissions [projects or jobs, to the architect] is restricted to the client and the immediate populace in some impacted by the project[employees, families, surrounding neighbors, and general community, for example]. Little, if anything, comes of this in the way of elevating the status of the architect and the contribution made.

Of course, there is some openness and exposure, via media coverage, of new buildings and other structures, primarily when they are completed and ready for use. Usually though, the emphasis is on the function or occupancy and not on the concept or reality of the design and architectural elements. Coverage often is aimed at a ″show and tell‶ sequence [a snapshot in time], which plays off of the new, out-of-the-ordinary, controversial, and unique aspects of projects. Also, the media loves to create new debates over such things a public financing of very revolutionary buildings, which appear to be quite pricey just because of their unusual appearance.

A case can be made that the profession itself is the root of its own problems. The most prevalent and annoying problem with the profession is its own inability to define its role, to establish its value, to be more commonly known and understood, to resolve its proper public face, and to provide a consistent, directed and appropriate educational process. There are simply too many opinions as to what architecture really is. There is some much irrelevant discussion that murkiness engulfs the profession, and mocks its intrinsic value.

Primary in this malaise is the lack of a cohesive direction for all architects, no matter which aspect or niche they choose to engage in. There is continual need to justify the mere existence of architects, and their work; there is so little respect for their contribution. Even within project teams, the architect is minimized, and yes, demonized by the other design professions and disciplines. Because by definition the architect deals in at least some ″artistic‶ considerations, the work is seen as voguish, bohemian, weird, superficial, unneeded, and a nuisance which causes the other professions to become immersed in solutions which are needlessly complex.

The problem in and beyond all this, is that there has been no valid measure of the profession. There is nothing that serves to represent the profession – nothing ″typical‶ or ″representative‶ of the effort. The small segment that does receive exposure is miniscule compared to the total professional work, at any given time. And placed side-by-side, there would be a grand discrepancy between what is deemed ″current style‶ and the mainstream work being produced, successfully, but without fanfare.

Oddly enough, though, the architect is usually the first of the design professions to be brought into a project. Their work, similar to ancient times, initially shapes the project and places the parameters of size, function, construction, and aesthetics in place. Literally, it defines the project, and provides the overall scope of the work to be done to create the finished project.

But because the principles used in creating architecture are quite subjective, and are not based on formulas, which provide specific and singular answers, even the clients tend to look askance at the architect's work. Too often, the perception is that all architectural work is overly costly, embellished, festooned, and located on the edge of reality. It is a mystery, even within the profession, as to how some architects [the ″signature" architects or "starchitects"] can convince their clients to support and pay for the cutting edge design we see so often. Certainly the professional must play to the image consciousness of the client, rather than to the more sedate, businesslike reality that the vast majority of clients embrace.

Yet the media, and even the trade publications within the profession, place high, if not exclusive emphasis on the unique, the "odd", the eccentric, the idiosyncratic, the extraordinary, and what they choose to portray as the "cutting edge" work and not on the "normal" work of the profession. Some seem to seek only the style-setting, the trendy, and the controversial. However, high profile projects are but a small proportion of the total architecture produced in any one year. There are thousands of project, which receive little if any media coverage, and then usually at the local level. Yet these projects meet the true and fundamental intent of the profession – projects attuned to, and meeting the client's needs and wishes, in both time and budget abiding ways, and to the full satisfaction of the client. It is curious that the very life-blood of the profession is all but ignored, and is left to be quietly celebrated by satisfied clients, and fulfilled [and hopefully profitable] professionals.

While this vast body of work is pursued and accomplished on a daily occurrence, the profession is still known by, and evaluated on the high profile instances, where excess cost, impropriety, and unusual appearance are the prime virtues. It is this very point where the profession itself finds no peace, and tends to break apart into the sub-professions, and the inability to resolve its problems in a singular manner which crosses all philosophical lines. Indeed is there a cast system in the profession, where successfully pursuing a career, and make a real contribution, architecturally in the community, is forgotten, and ruled out as the true representation of the profession? And where only the flamboyant, dramatic, revolutionary, eccentric, and extreme projects are celebrated and rewarded. This, of course, is quite unfortunate. Everything from the basic

CATEGORIES OF CONSTRUCTION			
Residential: Housing	**Nonresidential**	**Engineering Facilities**	**Industrial Facilities**
Single-familiy residences	Instructional structures	Water treatment plants	Heavy industrial plants
Multi-familiy residences	Educationa, day care	Sewage treatment and	Refineries, Oil Well Platforms
Apartments	schools, universities	drainage facilities and systems	Chemical, Bio-chemical Plants
Condominums	Light manufacturing	Utility structures and pipe lines	Milles, Smelters
Elder Care/Retirement Facilities	Commercial establishments	Transmission Towers	Power generating plants
Long-term care facilities	Hotels/Motels, Resorts	Navigational facilities, Ports, canals	Processing/Fabrication Facilities
High-rise Residences	Religous structures	Reclamation projects	Warehouses
Townhouse/Row houses	Agricultural buildings	Marine structures	Aircraft/Auto Assembly Plants
	Recreational facilities	Tunnels and bridges	General manufacturing- all types
	Medical buildings, hospitals	Highways and streets	Pharmaceutical Plants
	Offices, Business Uses	Air, Rail Transportation facilities	
		Military facilities	

Fig. 6-4
The areas of expertise noted for complete architects is required to adapt to, to service properly and to actively address the issues that arise in the many categories of work projects pursued by architects. One must be flexible, adaptive, innovative and at the same time consistent and fully adequate to the task of documenting the correct and suitable construction required

educational effort to the high awards of the profession hinges, for the most part on the celebrated projects. Some are elected Fellows in the AIA based on other professional efforts – service to the institute, education, etc. – but the vast number of architects practice privately, quietly and quite competently! Those who succeed [and they are many] do so because they are able to deliver high quality service to their clients, and projects which meet the expectations of those clients, and serve their needs and solve their problems quite well.

This is the face of architecture, which few acknowledge, and fewer still seem to understand. To be successful in this, we simply must rise far above what we bring into the profession. In that, IDP has a direct meaning, but we must force it to be meaningful. We must seek to make it as imposing on ourselves as the academic program we successfully completed. And then as employee we must continue to expand our knowledge and skills to become ever more important and contributory to the work of the office – and to each project we ″touch‶.

That is to say that the "practice" of the profession is strongly a matter of personal dedication, and commitment. There is no place for merely "getting by" in the sequence of any project – no matter what function you perform. The mark of a true professional is in doing the right thing, for the right reason, at the right time. The following quote is quite apropos:

> *Professionalism is a personal attribute that one acquires.*
>
> *It cannot be inherited.*
>
> *It cannot be bequeathed.*
>
> *Only they, having made the acquisition, who put to use that knowledge that skill,and with all of their ability, and complete dedication of purpose, Can truly be called a "Professional".*
>
> **- R.E. Onstad**

No matter what professional niche one occupies, or what specific area of practice participates in, one can be – indeed, should be! – a professional. The word does not equate to only "designers", nor to signature architects; not solely to Sullivan, Wright, Johnson, Rudolph, Obata, Yamasaki, Kassabaum, van der Rohe, Stone, Graves, Koolhaas, Mayne or Gehry. Rather it can be achieved by, and properly "awarded" to each and every individual architect who simply chooses to act, work, and contribute with propriety, courtesy, skill, cooperation, and sense of team. Professionalism relates to the manner in which acts, works and carries on any portion of practice – it is NOT a reflection product or project produced. It can be said that some major and well known projects have taken a highly contentious path to reality – irritating; properly coordinated; over budget; poor quality in construction related to poor documentation; short of client requirements and expectations; open breeches of contract and money disputes.

This carries over into the extremes of the legal and court system. Many suits are resolved over the issues of the Standard of Professional Care [or similar names]. This is a crucial but unwritten principle that asks if the person in question acted in a fully prudent manner, under the given circumstances. Usually testimony will be taken, from both sides, as to whether or not the architect "acted in a manner similar to that of other brother/sister architects would act, within the general region of the practices, under similar circumstances."

In general, meeting the Standard of Care entails asking and properly answering some questions:

Is this the right thing to do?
Is it the best for the circumstances, as I know them?
Is my reasoning explainable to others?
Can I defend this decision/position?
Have I apportioned the risk properly?
Have I taken, unnecessarily, too much risk
for myself or my client?
Am I genuinely comfortable with this decision?
Will the outcome be favorable?

Now, of course, this is and needs to be a mental process. And a good deal of it comes from the personal values we hold, as we got them from our parents, relatives, teachers, or those we admire. In the main, these are good and high-minded – attributes that need to be reinforced, and strongly held, particularly in the face of adversity. We are what they are, and how we act within this matrix fashions our professional demeanor.

Both the AIA and most state registration laws include Codes of Ethics that add to the parameters we encounter and must engage. None require extreme measures, or strenuous effort, but rather simple good sense, fairness, and recognition that legal and successful practices are noble directions. In a word, we do not have to be radical, in any direction, to be successful architects.

By the way – what is a successful architect?

Virtually every graduate from architecture school has the goal of establishing a new practice, and doing a continuum of work that is noteworthy, if not revolutionary and trend-setting. Certainly such an attitude is fostered in the schools, and when coupled with the youthful idealism of the student, becomes a direction; or a drive; or certainly a dream – but may be not reality.

The reality is not purposely set in place to squash the idealism and enthusiasm, but rather is simply a matter of fact. What facts?

- *Getting a job in a viable firm, but in a position other than "designer".*
- *Working in a variety of positions to achieve a well-rounded background.*
- *Gaining valuable experience in all phases of practice, that can be called upon later.*
- *Becoming knowledge in those phases to the point of seeing/ recognizing alternatives.*
- *Creating acquaintances and network with others, of different disciples, whom you may call upon for help, or work later.*
- *Acquiring "side" or moonlighting" projects that develop a client base and a backlog of work if possible.*

Now all of this must be carried on in addition to the work required by the employer. That experience will provide some of the information and background outlined above. However, the earlier in your career the more remote you will be to the business end of the practice – the non-architectural work of running an office.

In the first instance cited, getting a job – you will make a decision as to what type of office and work you want to do? Do you want to work for a large, prestigious firm? Do you want to do a specific type of work? Will you only work for the highest dollar offered, or for the best benefits? What balance you desire between these three aspects of your career?

Actually these decisions are so fundamental that they apply to any career path you choose – your own firm or not.

Often decisions will be required or will come to you as opportunities that you never envisioned in the plan for your career. There have been students at the University of Cincinnati who "co-oped" [student in a cooperative program, working part time and alternating with school sessions throughout the academic effort] with a firm and spent their entire career thereafter with that firm. They progressed through "the ranks" to become principals on one level or another. Other people move often for a variety of reasons – money, location, type of work, tenure, offers from friends/classmates, marry their former boss's offspring, health, do public service, reach.

At any rate, we begin to see that choices and decisions matter in how we pursue our career, and what return or satisfaction and fulfillment we receive. This comes home in even a more personal manner in that we also tend to precipitate to certain tasks more than others – different phases of the whole work of the office. There is no stigma here. It is not "pigeon-holing or "type-casting", with associated restrictions. This is the migration to your "personal niche" in the office, and quite possibly in your whole career. This is not to say that you cannot change from time to time, but merely that we, each, move to professional locations where we are, 1] comfortable, 2] successful, 3] best fulfilled, and 4] satisfied professionally and personally.

For example, in the whole array of comprehensive services, where do you wish to work? Why? What can you offer to that work?

In this day and age it is impossible to plan and track your entire career. The Depression mentality is fading as our elders pass away. They sought a job first, and then did everything they could to stay with that job and company for their entire work life. Moving from job to job was often only a remote possibility. Having suffered through the joblessness of the depression [1929-1937], getting – and holding – a job was paramount! Many a person worked at tasks they hated, but feared to leave.

Now with a more mobile society and with a "throw-away" mentality [who still darns socks???] it is very difficult to foresee one's whole career and work life. Think of a canoe trip down a winding and bending stream, where often the conditions around the next bend are unseen, and often quite different from where you are now. The "scenery" changes time after time after time …

Such a perspective should lead to the realization that we need to develop our skills, and the more skills we have [although in varying degree of accomplishment] the better and "more marketable" we are, when faced with career changes. In this, one needs to know and understand how the profession works, and what all it encompasses.

In answering these questions, we each must also come to realize the whole range and breadth of the profession, and the numerous variations within it. Our enthusiasm and the academic environment tend to lead us to think and believe, actually, that the whole of architecture is contained in the projects that are published and widely acclaimed. But the reality is that these are a small minority of the total work produced by the profession over any period of time. Also, we need to understand that the more prominent architects – the historic and "signature" professionals – do not have the totality of their practices published, acclaimed, or winning awards.

Every office ventures to create a set of clients and projects, which become on-going, or repetitive. These are known as "bread and butter" work, whereby the professional firm can rely of having a fairly continual line of projects from the same client. This is developed by producing good work and coming to know the clients and their operations in detail. Simply, the client is postured to think of no one else when they contemplate construction. Added to this is the line of projects that the firm comes-by, through marketing, searching, responding, interviewing, and other project development activities. Larger and more experienced offices often have full-time marketing staffs that do nothing but seek out new clients and projects. And quite often these folks are architects in their own right, who simply like the sales aspect of the profession, and bring understanding of the profession to the project search – they know what project production is about!

Overall, though, on any given day, in the United States alone, there are thousands of projects in architectural offices – newly arrived; in programming; in design; in project documentation; in bidding; in construction with contract administration; finishing out; and being finalized in opening ceremonies. Few of these will reach beyond their close-in effect, but they will, in the large measure, serve and satisfy the client in-

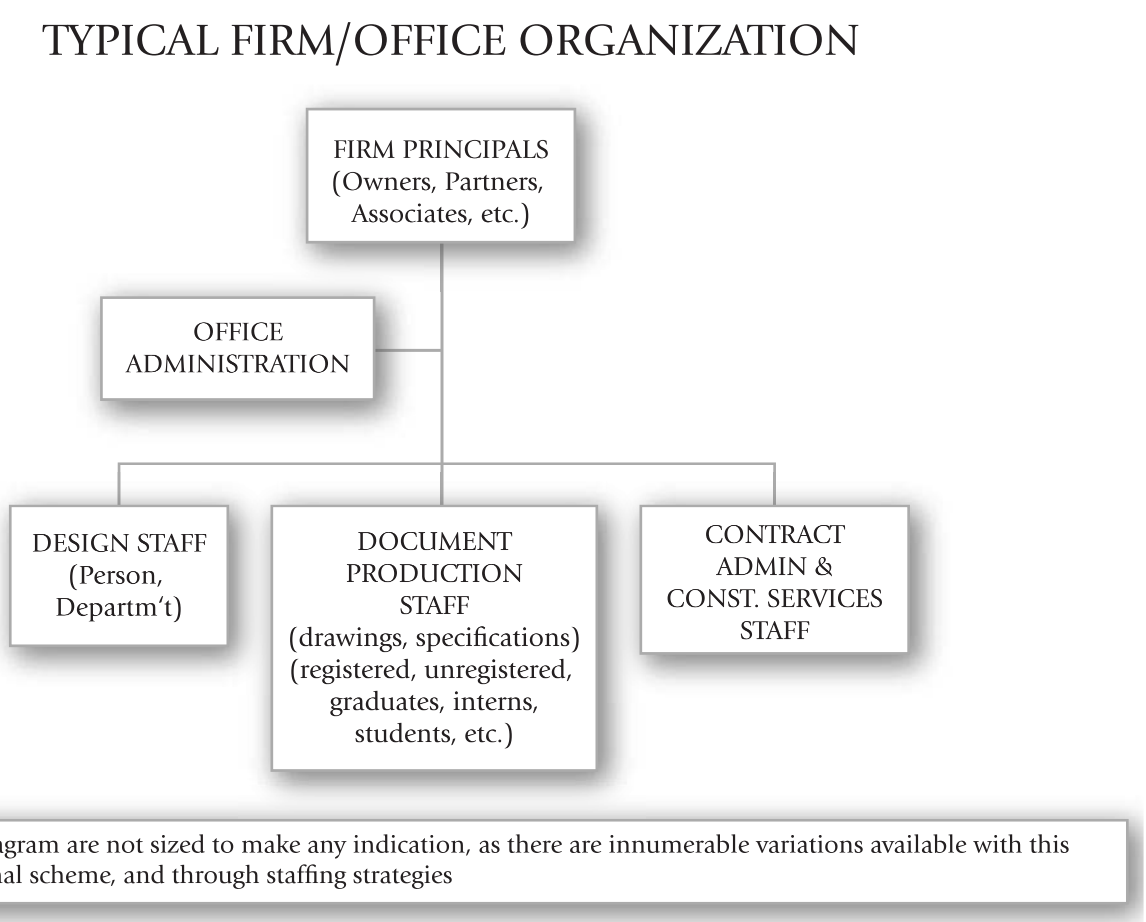


Fig. 6-5
Chart showing a fairly typical organizational chart for an architect's office. Number of staffers in each section is variable, as are the skills and tasks involved

volved and will function to the good and best interest of the client's operations, be it a school, store, office, plant, hospital, small addition, residence, etc.

This begins to define the whole of the profession!

The whole of the profession is embodied in each office. Some functions, tasks or even phases of work are adjusted to be minimal – others to be maximized, but most all are part of each office's operations. A good place to start to analyze this is with the list of comprehensive services that professional architects offer as basic services, and those they can be provided on an optional basis. The "array" of services the office selects directs the organization in part, and the overall direction and emphasis of the office. It might even direct the location of the office, and certainly influences the activities within the office.

As noted previously, the selection of these services does profile the office, as well as the individual in the office. Simply, if the office engages in a particular limited-scope service, or in a single special field of work [healthcare, for example] and you have deep interest in or choose to work in that area, then there could be a very good match. The more matches between the individual's concepts, philosophy and desires and the office profile, the better your prospective position, contribution, and influence in the office. Now if two offices provide the same "fit" for you, but one is located in Nebraska, and the other in Delaware, which will you choose? What if the salaries and benefits are the same or very close? What if a third firm makes an offer and they are located in New York City, with a branch in San Francisco? Also, what of daily travel/commute time, cost of living, community reputation, amount of available work, housing, school system, architectural atmosphere [lot of work "farmed out" to out of town firms?], hiring and lay-off policy and so forth. Your entire career does not necessarily rise and fall on simply your work and freedom to live/move as necessary. The more you become involved with family, the more judicious you must become in your career selections.

Over the course of a career – defined as that period between the decision to study architecture and retirement – each individual must make a number of choices; some by circumstances that force them and some by mere personal choice or opportunity presented. One cannot stand at the beginning and chart out with any reliability, the course of the career as it will develop. Over time, circumstances changes; mindsets change; interests change; and certainly, opportunities develop through choices made by others. The "career line" is NOT a straight line; rather it is more like a canoe trip down a small stream with many twists and turns; many changes in scenery; unknown hazards; blind corners; and other unpredictable occurrences [some good; some bad].

The constant in all of this is the interest and drive of the person, and what they see fit to do, and what they can do to reach whatever goal they are pursuing. Often circumstances

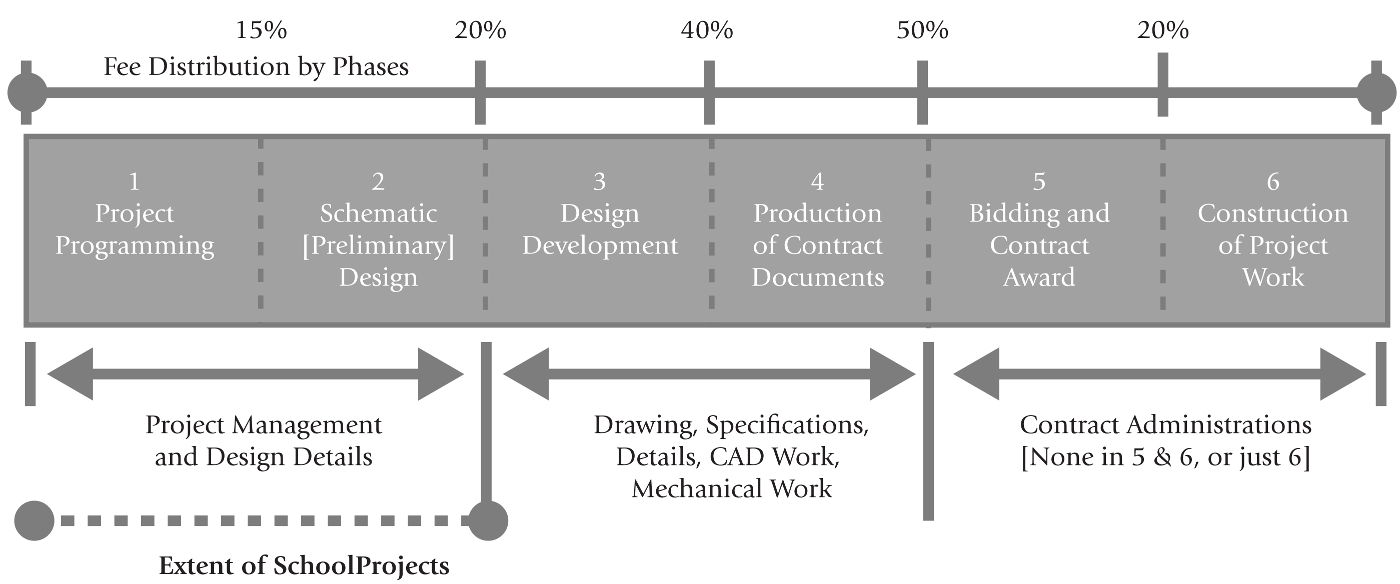


Fig. 6-6
Chart relating the percentage of professional fee received allocated to each phase of work. This is a rather traditional breakdown which is quite varied, now, in that computer operation can reduced time and fee required in Phases 3 and 4 which can the be re-allocated to other phases as required [or converted to increased profits]

or opportunities will arise that you never "dreamed about" [as the saying goes], but which really do happen, daily, to regular people. Often there is some risk in taking advantage of such opportunities, but many are simply too attractive to pass up. One must then be prepared to learn new skills or to expose oneself to the risks involved with trying something new – uncomfortable, but quite often most rewarding.

Also, in this, there is need to understand that very few, if any, architects are fully and equally astute, functional, or knowledgeable about each and every aspect of practice. Knowing a little about many or all of them does not equate to the omnipotent sound of the title "registered architect". The majority of the most renowned architects of the past and the "signature" architects of today, are attuned to certain, limited areas of practice. Many are excellent – brilliant – designers, but may be very poor business-people. Some take jobs at less than acceptable [profitable] fees just for the sake of gaining the publicity of doing the project. But PR and recognition does not "make payroll"!

The work of the profession is far too complex for one to know everything-there-is-to-know-about-it. It is this reality that causes each student, intern and registered/practicing architect to choose, openly or by mindset, that niche in which she or he can find satisfaction, comfort and skill in task, acquired expertise, productivity, and success. It is also the reason that continuing education has been implemented and is required by most states prior to periodic renewal of registration.

Things in the profession and indeed in the construction industry are moving so rapidly that one simply must make every attempt to keep pace, and to continue to learn throughout the career. It is not only new materials, new software and new concepts, but the continuum of changes which beset construction projects. Projects are becoming ever more complex in concept, in function and in design and construction. New regulations, and changed conditions within communities are increasingly imposing and challenging, to the point that it is almost a fulltime chore to merely keep abreast of them. And of course, another major factor that must be considered as it too evolves and fluctuates, is the owner-client-corporation-developer, etc. Businesses need construction to improve their capacities, but in that they will demand more and more a very careful process for achieving successful projects, wholly to their benefit – i.e., budget, time, complex and quality will be constant companions and constant parameters that need to be dealt with in flexible, innovative and positive manners, by the architect and other design professionals.

HISTORICALLY

A short glimpse of the past development of the profession, its practices and the relationship to working drawings [drafting overall] is quite revealing and worthwhile.

History repeated is bad enough. But history that regresses, or is dismissed as irrelevant, is far worse – most unfortunate if not tragic! History should teach and point to instances for improvement in at least one way. It should prevent "re-invention of the wheel", following faulty processes, and falling victim to the same hazardous situations. History lost is shameful, and only serves to leave lessons learned to be re-learned and mistakes repeated – it stymies progress! New and glitzy irrelevancies and aberrations tend to turn heads with flash, sparks, glitter and the unusual, but may divert, disguise or even obliterate good and valid from the past.

The passing of years encourages change by the mere fact that familiarity with the dynamics of new materials, techniques and technology combined with that already in hand, aid further development and refinement; better usage and innovative application. From that of those development attributes comes change in procedure, more flexibility, more understanding and a wider use of the basic items. In turn, production is aided and enhanced, and the end result is, hopefully, better products will be produced in a shorter amount of time.

Certainly the aircraft flying today are far removed from the first flight [1903] of the Wright Brothers; but still there are some residual principles, concepts, or even mechanisms that have survived, if only in different forms. What is available today is a compounding and evolution of what has been in the past, modified by new visionaries, inventors, designers, engineers and others, incorporating fresh, new and recent [and still evolving] concepts, materials, systems, techniques, and technology. There is no area of life that cannot be traced down such a trail.

What survives and moves to even more sophistication and development, are the "winnings" and "learnings" of many who battled through the excruciation of trial and error development, to find even a small particle of useful information or material. In each of these there is a value – a matter of what that particular item contributes or contributed to the development of today's machine, action, or principle. It is these "findings" that have allowed human kind to work forward and make better.

Even in the human realm there is still value in the knowledge, skill, understand and adaptability of the senior citizen. Some seniors continue to envision, explore and invent; some continue to contribute, mightily, using old skills, knowledge, techniques and experience in new formats, tempered with traditional values, and accomplishments. Industry has found that an older element in the work force tends to direct the newest of work in time-proven values, dedication and direction, which all are gradually being lost. The idea of formally "handing down" from generation to generation has lost its appeal, but still it is happening and really needs to be [through mentoring, word-of-mouth, similar experiences, advice, etc.]. There is growing recognition that some of the more "traditional work-related nuances" are still quite applicable, valid, and indeed, important to continued production of quality products. "Better-Faster-Cheaper", it appears, needs to be tastefully seasoned with older "home cookin'." And this applies to a wide range of work products, situations and venues.

Indeed, even to the professional offices of today where the computer is certainly the tool of choice. These places thrive on modern technology, but all too often find the answers they need in the older staffers, whose work has carried through several evolutions of change in knowledge and technique. Applying old standards and dedication, as well as skills and understanding into new formats and by using new equipment, brings the best of both to a focus that is hard to beat.

There is need to understand that "everything old, is NOT bad", simply by default!

The profession of architecture, today, functions overall very much as it has for centuries.

Of course, changed and added technologies, advanced production capacities, and personnel training have advanced the profession to meet both increased, changed and far more complex project needs. Having negotiated and evolved through some changed circumstances, the profession remains the primary influence on projects due to the intimate involvement in the processes of programming, design and documentation. The areas of the profession that have changed the most are during the documentation phase and during actual construction of the project. Here various factors have been brought to bear with direct impact on the architect.

From the instincts and total dominance of the ancient Master Builders and the early development of the profession, today's architect functions much like those of the past, but with slight mutations that have impacted it. Even today there is still deep concern and mystery about how the pyramids were built in ancient Egypt. Many theories have revealed questions of both skill and knowledge and even how they could possibly be executed, physically. Obviously there were factors in place and at work then that we have yet to expose and understand, while these may not portent to today's practice , many significant changes have occurred and influenced practice today – most of these occurred in the 20th century, both at the on-set and at approximately mid-century. The two primary influential events were the Second Industrial Revolution [1880+] and World War II [1941-1945]. Out of these major changes to the overall complexion of the United States, architecture came to new tasks, moved away from others, and repositioned itself as it is today.

Think of the span of architecture! Think, too, of the evolution of the practice and profession of architecture!

Architecture started from simple necessity, from well before the reach, insight and annals of 1st century BC Roman architect Marcus Vitruvius Polio [Vitruvius], who wrote "De architectura", known today as "The Ten Books on Architecture" and much later Sir Bannister Fletcher's " A History of Architecture" (12th Edition- 1996). History shows that "architecture" in its most primitive stage, started as far back as 2600BC with works by Imhotep and 1470BC with Senemut, nobles who built monumental works. These included such projects as stepped pyramids, towers, tombs, etc., using native material, and labor rich [often enslaved] civilizations, and testimony to pervasively deep religious devotion and unbelievably opulent wealth. And to build facilities for evolving and growing civilizations. Overall the efforts were a form of refinement as well as utilitarian in nature, providing the flexibility and variations required.

It was the continual quest to make better, more beautiful, bigger, more ornate and still respectful to easier and longer lasting; from wholly untrained minds who merely rationalized and pragmatically envisioned how things "could be done" without calculations or true understanding, in new and different forms, shapes, and techniques. From sheer mass in some logical shape for stability [pyramids] to the gross use of open space [Coliseum], to the splendor of Solomon's Temple; from aqueducts done out of necessity, to the desire for a new shape over a large volume [the dome]. So much done through tragic trial-and-error!

Through the evolution and added necessities of developing civilizations, new commerce, expanded travel, new experiences, changed conditions, uses, and demands; to expanding communities requiring more infrastructure, facilities and security; to on-going refinement and a transition to an art based attitude that embraced the decorative along with the utilitarian.

From, yes, the Golden Age of Pericles to reconstruction of the World Trade Center; from the crude, undocumented, trial-and-error pragmatics of ancient times to the expansive imagination of the "signature" architects of today- Graves, Koolhaas, Gehry, Eisemann, Meier, Mayne, etc.; and in between the genius, daring and insight of Wren, Wright, Sullivan, Richardson, Noyes, Breuer, van der Rohe, Kahn, Johnson.

From ziggurat, pyramid and minaret to skyscraper; open-air stadia to arenas with retractable roofs; from monument to monumental; from refined, quaint, sedate to the bizarre, quirky, outlandish and near grotesque.

The list may go on, but in the end they all lead to and illustrate the vast reach of architecture not only in history but in concept, design, construction, appearance and intent. Architecture, though, is a complex profession, not unlike medicine and law. the complexity reaches deep and often to draw forth the various forces, principles, and methodologies required to achieve the stated goal – The adequate provision for and protective enclosure of people, chattel. equipment and functions as required by the individual and the community. It has transitioned from a rough-cut, crudely conceived effort to solve problems, using masses of labor, without documentation per se [in ancient times] to the places where it has created richness and added convenience and character to society and civilization – the contribution still being made today, also remains an enigma to the general public. The statutory charge to architects [and other design professionals] is to "protect the health, welfare and safety" of the general public – literally to do for that group what it cannot do for itself.

In that statement is the beginning hint and innuendo of what has grown to be the very essence of what is required beyond the brilliance, excellence and startling efforts of design!

Indeed, the span of architecture is in the extreme and quite varied – from residential additions and renovations to inordinately complex and massive buildings and other structure. Careers migrate toward certain final configurations, selected by the individual from this plethora of possibilities, and opportunities. Technology exploded as more and more thinking and experimentation was done, and engineering principles began to develop and appear – and were put in place and use. Even today, with talk and efforts moving rapidly away from CAD toward Building Information Modeling [BIM] and its 3-dimentsional computer models for construction, there are thriving offices of professionals using manual drafting and succeeding in very limited but nonetheless important projects [meeting owner needs]. It is almost impossible to predict where one will finally settle and practice and what resources, skills, equipment and ingenuity will be required or utilized. Hence, preparation in a full, well-rounded and broad-based manner is advisable if not mandatory.

There is a need to remain pragmatic, realistic and open to see and understanding what may be in the offing for one's career. History distinctly documents the rapid change in skill and attitudes as architecture became more adventurous. What appears to be "cutting edge" efforts at this time may be either obsolete or so routine in the next short time period that one who is ill-prepared will be stretched to keep pace. In that, basic and fundamental principles need be "absorbed" and understood, so ingrained flexibility will serve to adjust one's efforts and skills toward whatever lies ahead in the profession – this cannot be a shortsighted, quick-fix process, but one of true understanding of the realistic basics principles and concepts involved. Things happen because they are made to happen, and not by pure happenstance, luck or divine intervention.

Poor construction in Rome and elsewhere brought about things like the implementation of Hammurabi's building code [part of his massive law for his people]. His action was to reduce the adverse impact of one element of civilization on others through use of substandard, and highly questionable method's Architecture suddenly was not unfettered, but a new challenge to meet, and at the same time a drive and demand to continue to be different, unique, and outstanding.

It was probably here where architecture began to be separated from technology or engineering/scientific aspects of construction. Mathematics was under development but not really to the point of everyday use. Things were still done by intuition and pragmatic beliefs. Even as late as the 11th and 12th centuries, the massive Gothic cathedrals [Notre Dame, Chartres, etc.] were executed under the direction of religious Bishops and not architects and engineers. Highly skilled artisans of course were an important asset to these ventures but overall scope and configuration, along with sizing, ornamentations, etc were parameters set forth and executed by the artisans with help from some animals. Too, "machinery" such as it was, and manpower was the sum choices of mobilization available and sheer strength, grit and power were essence to a successful outcome.

But an increasingly important theme came out of these efforts. As designs called for more complex and intricate construction almost sculpturesque in nature], technology was going to have to play a bigger and bigger role in the project. It was the designers themselves who "forced" this issue, literally mandating that some level of technology be made available to execute the design – if it did not then exist, it had to be invented or created. That scenario was not all bad for the construction industry. In fact, it was a major impetus for the tone of that industry, even today.

No adequate and appropriate technology – no architecture!

And with that, the rationale, relevance, motivation, impetus, need and substantiation for the "other" architecture.

To begin to know and understand where we are today, it is helpful to look back at times past for the historical view of developments in working drawings, detail drafting and office procedures. One excellent resource for this broader review is the book, "Drafting Culture: A Social History of Architectural Graphic Standards", by George Barnett Johnston; 2008, MIT Press. [This is recommended reading for readers of this book.]

"His [Johnston's] account (…) is especially welcome at a time when euphoria over digital technology threatens to induce historical amnesia and political complacency among practitioners."

- Casey Nelson Blake,
Professor of History
Director of American Studies
Columbia University

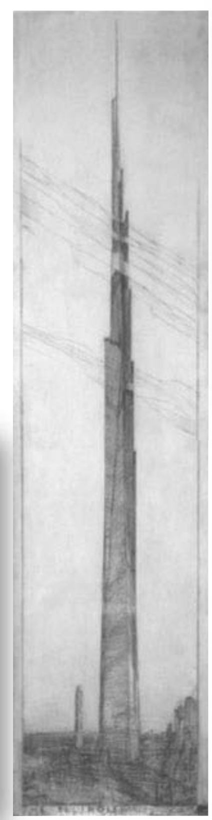
From about 1850 and most certainly with the Reconstruction after the Civil War, architecture and engineering drafting made great strides, were highly refined, and actually created as profession of "drafting" unto itself [distinct and different, even then, from designing]. Structures and buildings of all natures, forms, shapes and style were designed, documented, and built. From structures supporting the expanding maze of new railroads, to sophisticated inner city structures for business, merchandising and cultural uses were coming into play. Development was rampant on many fronts, and was a necessity to further expansion of every phase of life. Johnston's book traces the evolution of drafting and the added impact it had – as well as how it influence the profession of architecture. It during this period where architects became more and more dedicated to design, while the draftsmen carried the task of project documentation. [This is the harbinger of what we have today where the computer has now taken over from the draftsman, but creates a void around correct and flexible application and documentation of construction materials, systems, and detailed drawings]. Within the context of architecture, it has been since about 1875 that the construction of the more significant buildings has also been identified by its attribution to its designer. The more prominent projects created the “style” of each designer and their approach to their work. While not every project followed this course [much was done in obscurity] it was in this period when the more imposing and influence trend-setting architects appeared. This, of course, continues today in the form of the “signature” [big name, better known, well-publicized] architects or “starchitects”. These professionals usually have a continuum of high profile clients and projects that attract much attention and acclaim even if they are never built [the Mile High Illinois Building, of Frank Lloyd Wright in 1960 is a good example].

Early in the 20th century residences were split between those of creative builders using plan drawings, etc. from various sources, stick-built procedures [on-site fabrication], or pre-cut “kit” houses such as those produced by Sears and Roebuck Company, and those architect-designed for specific needs of some families. Of course, this all was broken down into the economic levels of the new home owners – the more affluent families building mansions of monumental proportions [and cost] on massive estates, while the working class “settled [and were satisfied] with a good house adequate to their needs and budget.

The separation between wealth and working class always existed from the beginning of the United States, once the pioneers started to cross the Appalachians living, initially, in log cabins and mud hut, while along the coast more substantial housing [even brick construction] was becoming more and more established. Architects were not in general use, but did work for some wealthy families along with the buildings for the new government and commercial ventures. This scenario remained up to and through the Civil War, but changed with

The building!
A blank space! Simply there is no building! Nothing was constructed and completed that brought the concept in the rendering to reality.

With the lack of support for the project, there never were any construction or contract documents created for this project. Hence, the sole information about the project is the rendering - the concept and idea for the project.



The rendering!
The drawing by the architect [sometimes in more layman terms called “the artist sketch”] of the preliminary concept and design for the proposed building.

Project depicted is the “Mile-high”, Illinois Tower designed by Frank Lloyd Wright in 1956. It was not constructed due to the complexity and the lack of support for it—still it serves as a good example in this context.

Fig. 7-1
This is precisely the scenario with any project! The schools of architecture, in their limited time, require the students to produce only a conceptual display of the project. The anticipated result is generally at the level of skill, knowledge, and construction expertise illustrated in the rendering - the vast majority of requisite detail is missing. While this is an important aspect of the architect’s project work, it is but a small part of the work required to produce a complete and usable building. This has produced and continuing to heighten the concern over inadequacies in the profession and the individuals - the fact that nowhere is the entire process of producing a project explained or portrayed in the academic sequence.

expansion, and certainly with the coming of the Second Industrial Revolution in the United States [approx.1880+]. When more people began to accumulate massive wealth and fortunes in giant industrial corporations, they tended to change their life-style and taste for "estate" housing on huge tracts of land, and opulence of all sorts to accompany their housing.

But, although confined to a rather small segment of the population, residential work was a major part of architectural practice. Case in point is the celebrated Frank Lloyd Wright, whose most admirable buildings are, in the main, his residences with several other commercial and institutional projects interspersed.

Into the 1920s such housing thrived, but came to a demise and jolting near-stop in the depressed '30s when very little moderate housing was built [some mansions of the surviving and opulent wealthy were constructed] as the housing industry dried up. At that time, houses were primarily of brick exterior finish on wood framing [using strictly on-site fabrication] or with masonry [cinder block] backup with plastered interior walls. It was a lengthy, time consuming process, stifled by weather, and left owners with white walls for a period of time so the plaster could thoroughly dry out [before being covered with wall paper, as interior wall painting was not readily done]. Some homes were finished with wood siding or shingles on the exterior as well as with asphalt shingle panels made to resemble brick with embossed imprints and granular facing.

Housing continued to suffer as did the architectural profession., The profession was buoyed up somewhat during the depression with Work Progress [later Projects] Administration [WPA] work, recording work [measuring and re-drawing of existing buildings] and conversion of most drafting skill into wartime production operations for military facilities, and production of vehicles, planes, etc., even weapons and munitions. In much of this the Civilian Conservation Corps [CCC] was quite active and productive. Members [unemployed men] were housed and supported in work camps near the various infrastructure and public facility projects. Many of these projects still exist and were the foundation for urbanization and later development. Then 1941 and the Second World War!

Many people "became" architects by acclamation [their own] and had their foundation in engineering. Others merely applied for initial registration when formal registration laws were enacted [part of the self-proclamation process]. One of the primary influences on American architecture was the Beaux Arts School of Architecture, active during the 1920s and 1930s. Here design was heavily stressed with little regard to other aspects of the profession, and its practice. It was such a major influence that even today its primary direction is still felt, and used as the hallmark of the entire profession. But here again, a high percentage of work by architects is carried out in far less obvious ways, with less celebrity but still successful and satisfying to the related client[s].

But more and more all of these projects became figments of documents, and not whim of Master Builders waving their arms and vocalizing their instructions to the builders. Designs of every sort, had to be converted to information that was of direct benefit and use to the contractors, suppliers and manufactures. Indeed, so much of the buildings were distinct, unique and customized [mass production was not that widely available for building elements] that their depiction was an unvarying absolute! Some projects [or at least some of the more important aspects of them] were produced at full size so the intricacies and nuances of the often sculpted details work could be shown. Cornices, pediments, column capitals, and similar building elements did not come by model number – they had to be fabricated, fashioned and tooled by hand!

World War II was, of course, the watershed event for many things that we have today – many very good, and many quite bad or negative. It was the genesis of change in how we thought about and how we did things. It brought new thinking to many aspects of American life and of course, since that time a great deal has further evolved, eroded, disappeared and appeared!

As the mass of troops came home they were in a mood to find a job, a spouse and start to raise a family. Crucial to most of this was housing. This created a strong impetus and rigorous market and industry as never seen before. Wartime production both in home factories and in the embattled fields created a method of production called "pre-fabrication". This was a process of creating, as applied to housing, portions of houses in a covered building or factory environment. It imitated war operations where new construction was essential in many forms, and weather could prove no inhibit to that need. Done primarily to keep production going in rapid order to meet the events and evolving needs of the war, the mentality and process was brought home, so to speak.

Pre-fabrication immediately became the new process for housing. This was coupled with a mentality that anything with four walls and roof could be called "home" – as opposed to a trench, bomb crater, tent, or foxhole. The market was large, and demanding. Rapid production facilities were set up, easily, in a production line system similar to Henry Fords' early-developed methodology for producing automobiles. As the portions of houses [individual walls, partitions, floor and roof panels, trusses, etc.] moved along the line, workers could add more pieces until the component was in a state that it

BEAUX ARTS

Beaux-Arts architecture denotes the academic neoclassical architectural style that was taught at the École des Beaux-Arts in Paris. The style “Beaux Arts” is above all the cumulative product of two and a half centuries of instruction which reached its zenith in the period of 1850-1870 and culminated in 1940.

The style of instruction that produced Beaux-Arts architecture continued without a major renovation until 1968. Beaux-Arts training emphasized the production of quick conceptual sketches, highly-finished perspective presentation drawings, close attention to the program, and knowledgeable decorative detailing. Site considerations tended towards social and urbane contexts. At the eve of World War I, the style began to find major competitors among the architects of Modernism and the nascent International Style [architecture].

“Beaux-Arts” found a second wind in compromising the new manner with the traditional training. All architects-in-training passed through the obligatory stages, studying antique models, constructing analos, analyses reproducing Greek or Roman models, “pocket” studies and other conventional steps in long competitions.

It is obvious that vestiges of Beaux-Arts instruction [if only its basic theme] still prevail today, in the almost universal quest solely for design excellence! And nothing has really changed, overall, as then as now, others carried on the work of ensuring proper construction documentation to support the presentation drawings.

Beaux-Arts in the United States:
The Beaux-Arts style heavily influenced US architecture in the period 1880–1920. The last major American building constructed in the Beaux-Arts style, the San Francisco War Memorial Opera House, was completed 1932.

The first American architect to attend the École des Beaux-Arts was Richard Morris Hunt, followed by Charles Follen McKim. They were followed by an entire generation. Henry Hobson Richardson absorbed Beaux-Arts lessons in massing and spatial planning, then applied them to Romanesque architectural models that were not characteristic of the Beaux-Arts repertory. His Beaux-Arts training taught him to transcend slavish copying and recreate in the essential, fully digested and idiomatic manner of his models. Richardson evolved a highly personal style [Richardsonian Romanesque] freed of historicism that was influential in early Modernism.[5]

The “White City” of the World's Columbian Exposition of 1893 in Chicago was a triumph of the movement and a major impetus for the short-lived City Beautiful movement in the United States. Beaux-Arts city planning, with its Baroque insistence on vistas punctuated by symmetry, eye-catching monuments, axial avenues, uniform cornice heights, a harmonious ″ensemble″ and a somewhat theatrical nobility and accessible charm, embraced ideals that the ensuing Modernist movement decried or just dismissed.[6]

The first American university to institute a Beaux-Arts curriculum was MIT in 1893, when the French architect, Constant-Désiré Despradelles was brought to MIT to teach. Subsequently the Beaux-Arts curriculum was begun at Columbia University, The University of Pennsylvania, and elsewhere.[7] From 1916, the Beaux-Arts Institute of Design in New York City schooled architects, painters, and sculptors to work as active collaborators.

The best known architectural firm specializing in Beaux-Arts style was McKim, Mead, and White.[8] Among universities designed in the Beaux-Arts style there are, most notably: Columbia University, [commissioned in 1896], designed by McKim, Mead, and White; the University of California, Berkeley [commissioned in 1898], designed by John Galen Howard; the campus of MIT [commissioned in 1913], designed by William W. Bosworth, Carnegie Mellon University [commissioned in 1904], designed by Henry Hornbostel, and the University of Texas [commissioned in 1931], designed by Paul Philippe Cret. Though Beaux-Arts architecture of the twentieth century might on its surface appear out of touch with the modern age, steel-frame construction and other modern innovations in engineering techniques and materials were often embraced, as in the 1914–1916 construction of the Carolands Chateau south of San

Francisco [which was built with a consciousness of the devastating 1906 earthquake]. The noted Spanish structural engineer, Rafael Guastavino [1842–1908], famous for his vaultings, known as Guastavino tile work, designed vaults in dozens of Beaux-Arts buildings in the Boston, New York and elsewhere.

Beaux-Arts architecture also brought a civic face to the railroad. [Chicago's Union Station and Detroit's Michigan Central Station are famous American examples of this style.] Two of the best American examples of the Beaux-Arts tradition stand within a few blocks of each other: Grand Central Terminal and the New York Public Library.

could be shipped to the job site for erection or installation. Entire houses could be loaded onto a single flat-bed trailer and moved to the job site.

Levittown, New York became the threshold development – massive; trend-setting; on-point, but in the end perhaps more disaster than benefit. Here land was laid bare of trees and other natural and man-made improvements, and a crazy twisted complex of roads and streets [and other infrastructure] was installed. The houses were "plopped" down, one next to each, row upon row. Stories came out where husbands walked into the wrong house because they all looked alike and unless the paint scheme differed they were readily mistaken! They were the hallmark of the era – four walls and a roof! But then life was still simple, naïve, and perhaps quite innocent compared with today.

But how did this scenario play out and impact the profession of architecture?

With end of war in 1945, the demand for housing burgeoned in major proportion. But innovative developers and lumber dealers saw the immediate value of pre-fabrication, whereby housing elements could be produced round the clock and in controlled environments not susceptible to weather [unlike the normal fairly lengthy construction process].

The United Sate became the gathering place for many European architects both just before and after the war. This was especially true of those from the German Bauhaus school. Walter Gropius, Mies Van der Rohe, Eliot Noyes, Richard Neutra, Philip Johnson, Marcel Breuer and others found some lucrative commissions in single-family housing, as well as in the commercial market. Their designs were of the International style, devoid of ornament; details openly visible and used as decoration; and sleek, open floor plans and oversized glass areas, opening the house to bring in the outdoors. Post and beam construction flourished with light framing methods and creating surprising warm feeling within rather austere designs. They were "mechanical" but minimized the use of materials, and provided a marketable array of striking custom designs.

Too many architects [and offices] were simply too expensive for the common person, and for more and more major owners. The architects' work was seen as superfluous and unnecessary – anybody could call in a contractor and get the project done, after a fashion, without the elitist glitz and "artistic" input of the architect. A truly sad state of affairs! And again never really countered, addressed aggressively or recovered.

Too there were the lingering threads of the Beaux Arts movement form the '30s. The time when architectural design was "the" thing – if it looked good, it was good! Again all too many architects held to this theory and had a very difficult time in coming to grips with the fact that all such projects designs had to be constructed!

And in that the correct application of building technology HAD to be employed. Schools of architecture, even today, still tussle with the "design is everything" [in regard to the total profession] over-emphasizing the theoretical and failing to even approach, much less address the technical end of architecture in a meaningful and commensurate manner. It is as if technology is not even there – a necessary evil easily ignored!

These efforts drove much of the residential end of practice. In the end though, architectural offices simply could not garner the fees from home owners that they needed to sustain their office. Unless the client was wealthy [relatively] and was seeking a conversation piece house, the works of the immigrant masters faltered and lost traction. Most residential work became the purview of the younger architects as "moonlight" projects done outside the confines of their "day-job" offices.

The second half of the 20th century has seen a drastic change in the practice of architecture. This change, overall, has been an extremely rapid, but still an evolutionary process, that involves several very pervasive factors, including;

- *Change in status of architects as project leaders; some by choice, others by virtual abdication, disinterest, and unprofitable fee levels*

- *Drastic changes in legal and liability exposures; changed insurance environment; incidence of litigation and adverse awards*
- *Owners' [and others] perception that architects are unnecessary, added-cost factors, who do not contribute commensurately to projects*
- *Introduction of computerized design and drafting service capacities*
- *Changes in project delivery systems; rise in popularity of construction management, and design/build programs*
- *Vacillating public perception of the value of the profession*
- *Lack of a strong, overall, grassroots effort on the part of the profession; also, between all organizations concerned with the profession*
- *Confused and uncoordinated professional educational and registration systems*

Before assessing and addressing the changes since the '50s on, let us briefly look at the professional situation at the beginning of the century. In the first half of the century there was also an evolution of the profession, but this was rather subtle, and more a moderate evolution of exposure. Just after the turn of the century, and as a continuation of the industrial revolution, architects occupied an elitist position. This was created in part by the professionals themselves, and in part by the public's perception.

In both aspects were the factors that few persons knew what architects did, and fewer still actually were exposed to, or used the services of the profession. Documentaries on television today show the work and influence of the architect during the first 30 years of the century. This was the time of industrial and commercial expansion, estates, excessively rich industrialists, publishers, and other industry leaders. Mansions of enormous size [for the times], overwhelming cost, and pure opulence abounded, most produced through the efforts of now renowned architects – Frank Lloyd Wright being perhaps the most commonly known of the group. Others included, Shepley- Bullfinch; McKim, Mead and White; Richardson; Sullivan; Gilbert.

In many aspects these professionals were each ahead of their times, inventive, visionary, and with clients who were willing to pay for unique and distinct presence and images; who were open to the design suggestions of their architects. Their buildings, be they factories or houses, were status symbols of their success. Surprisingly the mere fact that these owners were willing to engage the architects was further evidence of their success, and as a way of expressing their verbosity and import. Even in that day and age, one can imagine the ″strong discourse‶ between architect and client when costs began to run up, but the results were more excessive, and thus were accepted as a sort of dues one had to pay for obvious expression of wealth. Of course, the cultural aspects, and the developed tastes and opulence of the owners [based on their heritage and upbringing] were fully expressed in the projects. This is easily seen, today, in books and documentaries showing these architectural exploits, and noting what even today is an extreme in cost. It does seem, though, that the dollar spent then, bought far more than today; exotic wood species, handcrafting, ornamentation, mass, overall size, rare building materials, and huge facilities overall.

The Industrial Revolution of the late 1800's also provided fertile training grounds for architects. While many consider ″industrial architecture‶ as an ugly cousin, there were work opportunities, as well as openings for innovative thinking. Plant owners often were [and still are] so obsessed with their own business that they did not take time to evaluate how their buildings could be built to better serve their operation. In some aspects the architects brought forth new ideas and concepts which were both unique and unknown, but which also provide new concepts of building for high production, and for a new concept, employee comfort. The concepts of factory construction that Albert Kahn presented to Henry Ford are now legendary. They survive today with suitable refinements attuned to the changed times and techniques. For several decades, now, there have been very refined and attractive ″plants: constructed, so in the end they serve their industrial operations/ functions well, while at the same time offering very attractive forms and facades to the surrounding community. No longer is there a direct correlation between "industrial‶, and ″dark and dingy‶, and patently utilitarian ugly.

"Architecture is the finite blending of art and engineering, in such proper proportions as necessary to provide the expectant client with an aesthetically pleasing and functionally satisfactory building."

- Albert Kahn
Russian born, American Architect
1869-1942
Noted for innovative industrial buildings
[mainly in Detroit auto industry]

In this quote, Kahn makes a very profound, unique and correct distinction about architecture and its two elements. By noting art and engineering [the two elements] he further explains by innuendo that the art is represented by the "aesthetically pleasing" aspect of the project; the engineering element by the "functionally satisfactory" aspect. In essence, Kahn is showing *that the appearance of the project needs to be supported, reinforced and legitimized by the functionality [from both a well constructed building, but also one that serves the operations of the owner for required product production or other commercial or administrative work].*

And while Kahn did not specifically address it, the results of the two elements may change and vary greatly [by determination at the outset, or overt time as owner requirements change]. While always interrelated in some ways, one element is never solely dependent on the other. For example, the type of work performed within the building can be changed from production line manufacturing to high-tech research and development and administrative work, while the appearance of the building remains unchanged. And similarly other varied combinations can be utilized.

The expansion of railroads [starting in earnest in the last third of the 19th century, and continuing into the 1930s] provided an opportunity for many design and drafting personnel. Although rather restricted in style, the work did allow development of design approaches, and drafting techniques, as well as setting standards for many of the design and construction work. The railroads trained, employed, and instilled professional dedication in numerous professionals who went on to practice in various fields, often far removed from railroading. They maintained, though, the discipline of the drafting room and work, and for the architects, the exposure to the need for close and continuous cooperation and coordination.

Even the Great Depression presented some outlet for architects. The federal government developed programs where unemployed architects, and draftsman [drafting was almost exclusively a male occupation in those times] measured, drew and documented historic buildings, and developed new drafting standards and concepts that would come into use in later years. The documentation has proved eminently valuable in restoration work, and in merely creating a record of architecture and building in the United States. Also, there were outlets in the other Depression efforts, namely the Civil Construction Corps [CCC] program, and in the Work Production Administration [WPA], both of which enhanced and upgraded the civil works and infrastructure of the emerging country. These efforts both aided unemployed persons, but contributed to the necessary rapid expansion of the country's facilities when the Depression ended, and World War II began.

Of course, the tremendous building effort after World War II utilized and formed reputations for many, many architects, and even into ancillary fields such as master planning, etc. The innovations in construction developed during the war were put to domestic use – pre-fabrication, use of sheet materials such as gypsum wallboard, lighter construction, etc. The war, too, brought new techniques and thinking to the profession. Interchangeable parts, rapid mass production, use of materials that could be installed in quicker order along with new shapes and forms. The building boom was also an "architectural boom". With a society rejuvenating itself, and needing literally every type of facility, the need for architects and their work burgeoned – exploded! Additionally, more people began to use architects for their residences. While far less imposing than the mansions of patronage, many of these efforts were innovative, cutting edge, and really forged a new facet to architecture.

With ever evolving technology, new building techniques were available, which made construction lighter, stronger, and more open to new design concepts. Design rose higher, and spread wider; openness, glassy walls brought the exterior inside; simplicity came from themes of "less is more", and "form follows function". We approached the design of buildings in entirely new ways, quite removed from pre-war concepts and construction. There was an urgency, a faster life style that demanded quick production of facilities, as well as new outlooks, and images. In addition, the convulsion of Europe into open warfare brought a series of new architectural minds to the United States – van der Rohe, Breuer, Le Corbusier, Gropius, the Saarinens. The Bauhaus quickly added to and changed the Beaux Arts mentality and training styles. American architects joined these architects as they created and developed much of the styling that was utilized after World War II, as the country expanded in every aspect of life – plants, stores, schools, churches, mass housing, single-family housing, high-rise offices. Lighter, open, sleek, glassy, and modularized construction came to the fore.

Of course, the growth of American society continued through the 1960s until now. In the interim many different styles of architecture developed, and many "shining stars" came to the forefront. Their innovation, excellence, and cutting edge work draw raves of adulation from both public and clientele. The public viewed the work and admired the distinct sensitivity and blending of systems which produced new forms, new shapes, and the many different motifs, designs and solutions. Clients gloried in the images and mere status of an admired building.

But something else was happening, just as it happened since architects first began their professional efforts. For every published and openly-admired project, there were innumerable others produced, which satisfied their clientele, met the program requirements, and followed budget and schedules. These all were – and still are – little known beyond the confines of their locale, but serve as the massive and strong undergirding of the profession as a whole. Many large cities, for example, have vigorous construction industries but no renowned architects. Large international companies in their cities often [too often] ″import‶ their architects from even larger cities and seek those that have a penchant for publication and adulation. Certainly, the companies are seeking image making and prestige as a priority above substantial buildings. This is not to say that local architects cannot design and build good, well-designed projects, but merely that they do not catch the eye of large clients if they do not have a portfolio of ″recognized‶ projects.

Still the local firms produce ″architecture‶ – thoughtful, sensitive, well-designed, adapted to site, and propeller functional for their local clients. They are successes by definition although their practices are confined to relatively modest local or perhaps regional influence.

Yet such ″success‶, so prevalent in the profession is something never discussed in the schools. The innuendo, although unspoken, is that if you remain unpublished, or uninvited to the local Women's Club for discussion of your work, you are not a truly successful architect. Further, if you come up short in design skills you also are not really an ″architect‶. Thus the elitist attitude prevails, at least in the semi-public perception. The general public merely accepts what architects deliver in the way of facilities, and it is only the rather rare instance where they are personally engaged – for a residence for example.

In the mid- to late '50s master planning and urban planning began to arise as the new way of thinking. In lieu of a site-by-site development, thought was given over to those of greater vision and foresight, for larger developments. Architects, until now the ″captains‶ or lead professionals of the projects began to lose their status in major projects, and were finally relegated to the status of designers of single buildings within the context of the master developments. A real professional blow to the profession and one from which there had been no real rebound or recovery. Perhaps it was an abdication of sorts, but at any rate it was another slip down the slippery slope of lost professional "market share".

Coupled with the earlier [1960ish] reduction of interest on the part of the profession in residential work, there was also a shift of attitudes that moved many clients to take a broader view of their assets. Namely, in lieu of a site-by-site, single project mentality, many looked at long ranges prospects and began to demand "master planning". Starting with governmental entities, this type of action also spread throughout the industrial and commercial enterprises. The development grew to the proportion that full college degree programs in urban planning were developed, refined and exist in a healthy manner until today.

Gradually, the master planner took control of projects, and the architects' status has steadily declined. Despite this change, it did not eliminate the role of the architect – just elbowed it aside, while it remains eminently import and unique today, and a valuable asset to every project.

Previously first-hired, the architect automatically became "captain" or professional lead of the design/construct team. Architects now must work to gain or maintain credence, and retain only a proper and commensurate, if reduced influence and role on the project site. This is not a demotion, or loss of status, but is reflective of new owner demands and development of more narrow-scope skills performed by new types of professionals charged with differing responsibilities. The construction manager often now holds sway over the project, acting as intermediary between the design profession[s] and the contractors – often controlling the whole construction process. Contractors, via their own separate and direct contract with the owner, can portray all trouble spots as things caused by inadequate or improper professional effort, knowledge, documentation or pure "fantasy". The basic, unique, special and incisive role of the architect remains but with some tasks stripped away and assigned to others.

Realistically, there continues to be an increasing lack of understanding and respect for architects and their work and contributions to projects. This can be seen in the distrust that owners have in their selected project designers and their ability to produce as desired. Of course, contractors of all types have long regarded architects as generally "necessary evils" to be contended with and sort of tolerated, but in general to be all but ignored.

Technology and secondary education have also unfortunately added significant contributions to this situation. In the 1990s secondary and vocational school heavily "marketed" computerized drafting, with no regard for the substance or content f the rapidly produced drawings. Speed and ability to quickly replicate proved to be more imposing features than well conceived and executed documents with appropriate content. Literally, students were allowed to glamorize the use of the computer with virtually no instruction regarding "what" was to be included, developed, refined and applied specifically to projects. The instruction mainly terminated in isolated "school problems" and not in the context of overall project documentation – i.e., the concept of detailing of architectural work was not broached. Indeed, in some technical schools and institutions, even today, CAD is a multi-discipline course, covering architecture, civil, mechanical, tool design, piping, interior design and electronic work, with no distinct emphasis and little distinction for use. It is for other venues to provide specific discipline knowledge [like construction materials, etc], correct applications, proper techniques and related aspects within the office. Too often inadequate skills are relieved by such crutches as "standards details" in lieu of correctly assimilated drawings and thereby allow the creation of marginally adequate drawings, which the contractors could easily argue with and overcome [at the hidden expense to the owners].

Colleges, plagued by other more academic considerations and demands allowed technical instruction to "slip away" so that the ever clanging gong of "Design is everything" could survive and divert proper perspective to the profession. Simply, the faculties did not wish to defend a perfectly valid portion of architectural education or get their hands dirty with technical considerations, when they could get by requiring nothing more than idealized renderings of projects, which lacked any substance or wherewithal to become reality.

Hence we continue to produce "architectural graduates" [and now interns] devoid of the correct level of construction knowledge and know-how, and the flexibility of mind to adapt this to the project circumstances. More and more these young people flounder to find their way into and through the profession's rigors and to their professional niche where they feel they best perform.

Things were far different in the "drafting room" of the early to mid-20th century professional office of architects and engineers and bore little resemblance to the office landscape of today. There were no cubicles, no printers, no copy machines, no plotters, etc.

In some offices these rooms encompassed perhaps a full half, if not more of an entire floor of a building. They were outfitted with a variety of drafting boards and tables. Some were merely flat boards, or doors laid across wooden sawhorses; others were large, four-legged oak tables with an adjustable sloping top. Most were topped with "battleship linoleum", a pliable sheet material that allowed good pencil drafting by providing some forgiving surface [as opposed to a hard, or "dentable" wood surface that would be permanently scratched or grooved]. Much of the equipment depended on the financial viability of the firm, and the history of its existence. Some of those rooms were outfitted with equipment salvaged from the massive drafting rooms of the railroads, who in their hey-day, [pre-1900] produced thousands of drawings for construction of the companies' rail networks – track alignments, roadbed details, bridges, trestles, equipment, stations, depots and accessory buildings and structures, among numerous other items.

In some instances, the ceiling was merely open structure, with fluorescent lighting fixtures hung by chains – many still had drop-cord "shop lights" shaped like upside down funnels with incandescent bulbs. Others relied heavily on northern exposures for lighting into the rooms. In addition, many of the draftsmen [very few women were employed in drafting at this time] had individual, adjustable desk lamps mounted directly on their boards – some small fluorescent, some incandescent. This was of the very few individual items, since there was no room for desk equipment, pictures, books, etc. The drafting room was literally "a sea of large sheets of paper laying on and across the tables". Without air-conditioning, moisture problems were a constant problem.

At this time, there was a dismantling of the major drafting efforts expended for World War II. One can imagine the massive drafting efforts put forth for the construction of airplanes, tanks, various vehicles, ships, artillery weapons, and even down to the smallest parts, along with personal equipment, handguns, and demolitions. Drawings – thousands of drawings – were required for all of this work. But with war's end, the drafting effort was moderated. Both personnel and equipment was reduced in number; and much of this pool of resources was salvaged by newly established forms of various disciplines. A precursor of sorts for "re-cycling", just as done earlier in the century when the railroads divested themselves of major drafting needs.

At this time, there was another transition of sorts occurring, as

Fig. 7-2
We have come so far, and yet not really!
Much different now from this office photo circa 1891,
not in direction or dedication, but in surroundings, equipment,
styles, implements, etc. – there is always need for a placing to do
the work – both design and documentation!

"linen" was giving way to vellum and 100 % rag paper as the medium of choice. The linen was indeed the same fabric used in handkerchiefs, but coated with a starched finish, which would accept either ink or pencil as the drafting media. For decades, earlier in the century, linen was used for all drawings – usually with ruling pen and crow-quill and ink as the basic drafting implements.

Gradually the development of high quality drafting papers was introduced. At first, this was a heavy, opaque, maxilla-colored paper, which was not reproducible. Then came a form of 'tracing paper', a translucent media through which light would pass. By passing a strong light through the paper, and having the light blocked out by the ink [of the drawings] on the paper, a sensitized sheet placed under the tracing would become a "blueprint". Here the sensitized paper became a sort of negative, which when developed through a chemical process, would turn a medium blue in color – but where the light was blocked out by the ink lines, white lines appeared on the blue field. Hence the drawing on the tracing paper was literally transferred to the sensitized paper. And this permitted numerous reproductions of the same tracing.

Gradually the drafting room evolved into a series of cubicle-like "stalls" for each drafter [new title as more women took up the tasks]. Here there was some area left for reference material, supplies, etc. in addition to the basic drafting table. This began the movement to what is most common in "drafting rooms" today, save for the total absence of computers.

The drafting force was outfitted in collar and tie, with some sleeve garters; and dresses, hose and "heels" for the ladies. And in many instances in the early '50s, the work took place in spaces without air-conditioning [a real joy in summer]. In fact, there were even some other yesteryear implements like spittoons, green eye shades, "bunny bags", "shot bags" [to hole the paper down on the board before or in lieu of thumb tacks, drafting tape, or adhesive "dots"] – and the overwhelming persona of the Chief Draftsman! The Chief occupied a table at the head of the room, facing the drafting force, much as a teacher faces the class. The Chief was the "know-all", disciplinarian, master detailer, and keeper of the strict rules, standards, and values of the "room" – giving instructions, advice; making changes; critiquing work; and in many forms, "ruling the roost". Basically, the Chief was the person responsible for the overall quality of work produced, its appearance, correctness of construction and presentation, readability, and style.

All of this easily portrays a very hands-on approach to the production of drawings – both literally and figuratively! What has not changed, and will not change is the intent of the documents, and the content of them, and its importance to the construction process. What has been lost, in the main is the very personal and intimate knowledge of, and "feel" for the drawings itself. Is this a loss that is harmful, or is it something we need to revitalize and maintain.

Well, so long as we artificially produce the drawings, via computer imaging, is there a pervasive need to have the feel of the drawing? Sending instructions and direction to a machine for the actual creation and production of the drawing sheet, is the dispassionate approach we now use. In what has become a throw-away society, if the resulting drawing is not sufficient or correct, we merely discard it and send a new set of instructions to the machine – new drawing sheet quickly appears.

The lines on the computer are colored, but really have no particular significance as to their weight or value, their type, or other attributes. They can, and often are, all produced in the same line weight, on the plotted drawings. Anything lost? Some say, "no" – the information required has been transferred from the human mind to the plotted drawings. So long as the information is there, proper and complete; 'nough said! The matter or manner of presentation is superfluous!

True? Perhaps! Best the end-users be involved in answering since they have to contend with what the design professionals send them. Readability and clarity [especially in drawings with a maze of line work, rather indistinguishable one from the other] are crucial factors for ease of reading, understanding, assimilating, along with completeness and accuracy, with speed of production, program used and other ancillary considerations long forgotten!

This is an instance where the capabilities of the machine and software inappropriately drive the end result and can be an impediment to work progress. If time must be taken to "decipher" the drawings, the documents are improper and intrusive.

THE "OTHER ARCHITECTURE"?

This is merely a catch-phrase to call attention to the fact that design is not the sole factor in the creation of works of architecture. It is not to create primary and secondary; to be controversial; to denigrate or set apart. Simply, there are numerous other aspects, tasks and work involved, that in the main are not commonly known to even a small degree inside and most certainly outside the profession. It is, rather, to identify processes, and efforts not readily apparent in the design concept, nor in the finished buildings; and things never thought about or taken from granted!

The phrase is used to set down a distinct statement that architecture is an amalgamation of many tasks that lie beyond the conception and development of a valid design concept specific to the project requirements. All of these tasks require diverse expertise, depth and breadth of construction knowledge, flexibility and skill in application, and insight and efforts all too often totally overlooked or never realized. In truth it is the tasks of "the other architecture" that gives the design concept – the "architecture" its life and reality!

"Design Is Everything"!

This has been, and continues to be, the most highly proclaimed and widely accepted view of architecture. It is professed in the schools of architecture and has become the hallmark and guiding precept for architectural education – its ultimate goal, and pinnacle exercise! It is instilled in the students to the point that many accept it, totally, in spite of the restricted and askew direction. Most have no way of knowing differently or better! The unfortunate consequence of this, both in the schools and the profession at large, is the persuasive impact the slogan has had on the image of the profession and the various elements within the profession – staffs, offices, philosophies, directions, project production, etc. It is largely a mischaracterization of the profession's complete effort and the array of services it offers. No one denies or desires to impugn the wonderful, tremendous creativity, insight, innovation and skill in the designing of buildings, and building complexes, but there is need to present a properly balanced perspective of the complete professional effort involved, to each practicing or prospective architect. The dearth of full coverage information made available to students of architecture [including graduates and interns] is quite disturbing – stunning actually – and creates a less than a correct, equitable, and appropriate exposure to a full and comprehensive view, and depth of understanding, of the profession – in its totality! It is patently unfair to potential professionals and is more of breech than a mere oversight or necessary course of action. It ,too , is curious that none of the organizations in architectural education conduct an outreach program in this regard – a few do have website resources, etc,. but these are not all that apparent and obvious. [www.acsa-arch.org/students/education.aspx is a good example]

A "profession" involves a large block of the information, skills and expertise, and is truly defined by all of the elements in combination. The breadth of professional services, the ethics, professionalism, dedication, flexibility, intangibles and other personal aspects of the work are overlooked and never revealed. Simply, inadequate knowledge is extremely short-sighted and harmful to the development of an architect. There is far too much involved with the profession to merely gloss over or ignore much of it. To deal with but one element –- like design – is to deal with a single skill within the profession. Even though it is important, it is hardly the sole skill required in architects who are responsible for "whole and complete" projects.

By way of any introduction into the discussion, the following definition is first needed.

"A profession is a vocation founded upon specialized educational training, the purpose of which is to supply disinterested counsel and service to others, or a direct and definite compensation, wholly apart from expectation of other business gain".

- Sidney Webb, Esq.
English Attorney and Politician
1859-1912

Common knowledge holds that there are three Classic professions are: <u>Divinity</u>, <u>Medicine</u>, and <u>Law</u>.

The primary hallmarks that mark them as professions in lieu of occupations are:

1. It became a full-time occupation;
2. The first training school was established;
3. The first university school was established;
4. The first local association was established;
5. The first national association was established;
6. The codes of professional ethics were introduced;
7. State licensing laws were established.

The ranking of established professions in the United States based on the above milestones shows Surveying first [George Washington, Thomas Jefferson, and Abraham Lincoln were all land surveyors before entering politics], followed by Medicine, Law, Dentistry, Civil Engineering, Logistics, Architecture and Accounting. Law and Medicine) are both noted by many as requiring not just study to enter, but extensive study and accreditation above and beyond simply getting a university degree. Accordingly the more recently-formalized disciplines, such as Architecture, which now have equally-long periods of study associated with them. For centuries, architecture was carried out by Master Builders and self-proclaimed "architects" with little formal training, per se, and using basic common sense and some basic, but informal, engineering principles.

With the rise of technology and occupational specialization in the 19th century, other occupations began to claim professional status: Pharmacy, Logistics, Veterinary Medicine, Nursing, Teaching, Librarianship, Optometry and Social Work, all of which could claim to be professions by 1900 using these milestones.

Although professions enjoy a measure of high status and public prestige, all professionals are not necessarily held to equal or the same standards of performance, do not all earn the same high salaries, and do not have the same depth of understanding, respect and acceptance by the general public. And, in addition, there are hidden inequalities even within professions.

Anyone contemplating or entering an educational program, a new line of work or a profession – and especially young people looking toward choosing a new profession – should have ready access to [and should seek or be advised to seek] a complete and comprehensive review of their choices.

No one should blindly commit to anything so important, be it a purchase, or work place, much less a future career on pure whim or a romanticized guess about what may be included and involved. Of course, for a life's work one must be doubly cautious and caring, so their illusion of the prospect and its reality come in fairly close in alignment. To make a deep commitment, lasting, important and expensive choice of professions only to find out later that either one is not attuned to such work, or has no truly deep searching interest in it, is quite devastating and costly – and becoming more so with each passing year.

Students contemplating a career in the practice [profession] of architecture, deserve and need to have at least a glimpse of the full breadth of the profession. They need a true reality check to ensure that their interest and attraction is not based on a single aspect of the work, only to become quite disillusioned later when their aspirations are not fulfilled and their career path is forestalled or directed elsewhere.

Analogies abound in various other professions, where it is easily seen that one must be at least aware of the breadth of knowledge and skill required, the massive array of services offered to clients and all related facets of the work before choosing a specific and limited niche or role in the profession. There is no stigma in this since, in any profession, it is virtually impossible to be equally expert in every aspect of the work and the conducting of the deserve. So it is in architecture!

Hence, one needs to be made aware, early-on, of all aspects, prospects and reality, so the initial choice can be intelligently modified or directed toward that place where the person is best suited, deeply interested, and functionally astute. To "know about all" is not to have full, in-depth knowledge, but is to acknowledge the existence of the various ancillary elements and be able to understand their inter-functioning and their working relationships. Professional work is usually not a singular function, with narrow focus, but indeed, is a mosaic of work tasks, performed by persons well qualified in those tasks, flexible and adaptable, working in tandem and as a team to achieve the final product or deliverables to the concerned parties.

Professional education is compounded by the need for such a wide range of information and knowledge and the need to understand the adaptive use of that data for specific functions, results, and operation. Certainly, it is far removed from some educational efforts that concentrate on more isolated functions.

At first glance it may appear that architecture is a simple profession that centers its efforts of goo design and not much else. There is a good level of both lack of understanding and misunderstanding in the general public and many other groups about architects and their function – usually this is a very narrow view lacking in broad-based understanding.

But the profession and indeed each project produced by any of the thousands of professional offices is quite complex – of course some more than others. A good insight into the effort required in one, fairly modest project is shown by this quote:

" … Architects, as we all know, create unique structures and suitable environments for their clients, and have a tremendous amount of control and impact on what products are used to construct their designs. Historically speaking, architects are responsible for selecting 95 % of the products installed on an average-sized project.

A recent [2002] study designed to uncover how architects make product decisions yielded a particularly interesting fact: Architects, on average, must select 1,500 products and make over 17,000 decisions on what is best for the project and the owner. That's 17,000 answers to 17,000 important questions.

How big? How high? What color? What shape? What style? Moreover, what products will give the owner exactly what they have paid the architects to design? The list of questions about what products to incorporate in a project can be overwhelming for architect and their clients.

It is impossible for an architect to know every detail on all these products. By nature, they are generalists, but they carry a complexity of responsibilities. Architects are the design creators who desperately need trusted product information providers, someone they can rely on to provide objective answers and help them determine the right product for their project. An effective stone strategy, therefore, should not center on selling to architects. Instead, focus on influencing architects to incorporate stone products using the three E's: Education, Ease and Execution."

- "Selling Stone Products to Architects"
by Dan Ouellette,
STONE WORLD magazine,
May, 2003

Think of the span of architecture!

From simple necessity, from well beyond the reach and annals of Marcus Vitruvius Pollio's [Vitruvius] "De architectura, known today as The Ten Books on Architecture" and much later Sir Bannister Fletcher's "A History of Architecture". [Twentieth Edition - 1996]; to the use of native material, labor rich civilizations; to pervasively deep religious devotion and unbelievably opulent wealth.

From the continual quest to make better, more beautiful and respectful to easier and longer lasting; from untrained minds who merely rationalized how things could be done without calculations or true understanding in new and different ways. So much done through tragic trial-and-error! Through the evolution and added necessities of developing civilizations, new commerce, expanded travel, new experiences, changed conditions, uses, and demands; to expanding communities requiring more facilities and security; to on-going refinement and a transition to an art based attitude that embraced the decorative along with the utilitarian.

From, yes, the Golden Age of Pericles to reconstruction of the World Trade Center; from the crude, undocumented, trial-and-error pragmatics of ancient times to the expansive imagination of the "signature" architects of today – Graves, Koolhaas, Gehry, Eisemann, Meier, Mayne, etc.; and in between the genius, daring and insight of Wren, Wright, Sullivan, Richardson, Noyes, Breuer, van der Rohe, Kahn, Johnson.

From ziggurat and minaret to skyscraper; open-air stadia to arena with retractable roofs; from monument to monumental; from refined, quaint, sedate to the bizarre, quirky, and outlandish.

The lists may go on, but in the end they all lead to and illustrate the vast reach of architecture not only in history but in concept, design, construction, appearance and intent. Architecture, though, is a complex profession, not unlike medicine and law. the complexity reaches deep and often to draw forth the various forces, principles, and methodologies required to achieve the stated goal – The adequate provision for and protective enclosure of people, chattel. equipment and functions as required by the individual and the community. It has transitioned from a rough-cut, crudely conceived effort to solve problems, using masses of labor, without documentation per se [in ancient times] to the places where it has created richness and added convenience and character to society and civilization – the contribution still being made today, also remains an enigma to the general public. The statutory charge to architects [and other construction design professionals] is to "protect the health, welfare and safety" of the general public – literally to do for that group what it cannot do for itself. Or individually.

In that statement is the beginning hint and innuendo of what is required beyond the brilliance, excellence and startling efforts of design!

The architectural profession has but the one title and is generally considered to be a single, cohesive entity – one group of people known collectively as "architects". Reality also make it known that there are several varieties of architects all gathered under the collected title of the profession – still architects, per se, but in various roles, under function-oriented titles and actually a form of specialization or specialists within the profession [even though they are fully registered, practice as "architects"]. This is why you hear of so few of the 88,000+ members of the American Institute of Architects, and the other 30,000 + architects in the United States [and similarly world-wide] – it is only the design oriented professional who work at the cutting edge who gain the publicity. For each of them, there is a host of others who support their design efforts, and get them built.

This not an attempt to create "architect*" [with an asterisks] to denote a special niche, nor is it advocacy for title modifiers like, "M.D. – General Surgeon". Rather it is a direction to point out that architects! work in and are most active and influential in other aspects of projects than design, and those efforts are necessary to the proper documentation and construction of the projects. They are invaluable; necessary; and require the highest expertise for success in all of the work. Every student and young professional needs to know – and understand – this, and how they can or will choose to fit into the overall professional practice scheme.

This list, in itself, points up the breadth of the profession and the various narrow opportunities for architects. Each area is valid and has its prescribed direction that is well served by an architectural background and education. Yet these are not all exposed much less discussed in the schools of architecture, where heavy emphasis is placed on design and the design effort – and professional practice instruction is sparse if it exists at all. While there may be some validity to heightened exposure to design principles, it would seem not to rise to the level that valuable instruction on other ancillary aspects of practice are excluded.

In view of the fact that the same type of talent, knowledge and skill is required to produce the entire range of projects, architecture must be a process that is varied to the desires of the client and the results anticipated. This, in no way, demeans the direction and work of any individual architect.

Rather it speaks to the specific challenge of each and every project and the flexibility required to resolve the issues and produce a meaningful design for the client. It also indicates that project parameters vary and change, over a very wide range – and project goals are different but still need to please and satisfy the client. But there is one leveling process that all projects must negotiate – the process of construction.

At some point, no matter the type of project, the status and talent of the architect, or the drama of its design, every project must traverse the construction sequence. Here the project - design and all - is almost literally turned over to the constructors for their execution of the requisite hands-on work. The route to producing "architecture" of any style, type, or level of design accomplishment, is a collaboration of tasks, work items, application of varied skills some dangerous; some roughly hewn, back-breaking, and rudimentary; others dirty, greasy, oily, awkward; still others labor-intensive using human-power in place sophisticated machinery or technology. Projects cycle in stages where, at times, one wonders if the final project will ever match the original design concept: but most projects do.

Indeed, the span of architecture is in the extreme – from residential additions and renovations to inordinately complex and massive buildings and other structure. Careers migrate toward certain final configurations, selected by the individual from this plethora of possibilities, and opportunities. Even today, with talk and efforts moving rapidly away from CAD toward Building Information Modeling [BIM] and its 3-dimentsional computer models for construction, there are thriving office of professionals using manual drafting and succeeding in very limited but nonetheless important projects [meeting owner needs]. It is almost impossible to predict where one will finally settle and practice and what resources, skills, equipment and ingenuity will be required or utilized. Hence, preparation in a full, well-rounded and broad-based manner is advisable if not mandatory.

There is a need to be pragmatic, realistic and open to see and understanding what may be in the offing for one's career. What appear to be "cutting edge" efforts at this time may be either obsolete or so routine in the next short time period that one who is ill-prepared will be stretched to keep pace. In that, basic and fundamental principles need be "absorbed" and understood, so ingrained flexibility will serve to adjust one's efforts and skills toward whatever lies ahead in the profession – this cannot be a shortsighted, quick-fix process, but one of true understanding of the realistic basics principles and concepts involved. Things happen because they are made to happen, and not by pure happenstance, luck or divine intervention.

In the unfortunate but traditionally pervasive zeal to portray architects only as the project designers, no real effort is mounted to illustrate the complete picture of the work done on a project from inception in the office to completed project in the field. There is a lasting impression on the part of the more insightful student that something else happens, but there is little if any information about that process. There is, apparently a "second agenda" within the profession that is, for some reason, vague and rather hidden away.

Is there really an "other" architecture: a "second" profession of architecture; or is that more myth, legend, fiction, or pure untruth? Or is it unspoken reality? These questions are rarely, if ever asked in the academic preparation of architects, nor is the broader topic. Reality holds that the training and education of ALL architects entails certain limits but must always utilize high efforts in teaching theory and design. It is as if design is not only the pre-eminent issue, but the sole issue in training and developing architects. Indeed, can a person be considered or, indeed, be an architect and never design a building or other structure?

The answer is ″yes,″ and is upheld in the registration process, that basically licenses architects in the various states. Once the academic design sequence is complete, and one passes the design portion of the nationally-applied Architectural Registration Examination [ARE], the issue of design and design ability virtually disappears! They never have to exercise or re-visit it again, through a career!

This combination of highly misleading activities flies in the face of the true nature of and effort required of the profession and its members. There is a vast array of professional services offered to clients that are never exposed much less discussed. There are aspects of work available to clients that the student never is made to realize or understanding. And possibly the most unfortunate professional task that is ignored is the documentation required to bring the design concept to reality – i.e., a complete and finished project, fully satisfying to the client.

One must ask if the true, accurate, and complete reach of the profession is contained in the innovative, cutting edge, and revolutionary design concept of the current array of ″signature architects″ [″starchitects″] or not. They are relatively few in number, but most extraordinary in the impact they have; the coverage they receive from those addicted to only the far reaches of design; and the miniscule clientele that can afford their efforts.

Must you win design awards to be creditable and successfully as an architect? Is that the sole consideration when declaring a person to be "an architect"? [And that matter is most quirky and weird in itself, since some of the more widely known "architects" are not registered at all – they have NOT withstood the rigors of examination for overall knowledge – including the technical portions. What of the tens of thousands of other architects [″other″ once again, as in second class citizens; or derogatorily, those other masses of people]? Is their work, contribution, and influence of little or no consequence? Is it such that it need not even be mentioned?

We suggest the answer to all three questions is simply … NO!

Part 2 following, gives a very complete view and direct reason why that is the answer!

SETTING CONTEXT

The practice of architecture has been, is and will continue to be an evolutionary process!

Its evolution is largely a reflection of civilization, demand, and technology. But strangely enough, in the entire evolution since early times, it has been and remains an entity with two distinct, related and yet divergent elements – art and science [with variation in the proportions of these basic terms]. The overwhelming and lasting definition of "architecture" always seems to contain some combination of these words, or others closely related. They are linked together in a fashion that leads one to believe that they are, indeed functions inseparable in the overall context of the architect and the profession/practice of architecture. Rarely, are there statements or definitions which refer solely to the design of buildings.

In large measure this is also supported by the fact that many architects, up even until today, have basic engineering backgrounds and educations. Through the years some of the most widely recognized architects were "engineers" and in fact never were registered as architects [registration was adopted as law mainly in the 1930s, and often engineers of that era were able to become architects by acclamation – i.e., "grandfathering" and not formal training]. Of course, many engineers are fully capable of designing buildings and other structures, but usually these are of a more utilitarian nature, rather devoid of the "art" influence of the architect.

Are not architects a conflicted lot? Are not architects constantly in the dilemma of finding their own niche somewhere betwixt "art", and "engineering"? Are not laws regarding construction of structures, about safety and not aesthetics?

In view of all this, it seems that Professor Victoria Beach [p. 104, July, 2003 issue of ARCHITECTURE magazine] has described what is, and has long been a veiled "secret". An "other" or "second" architecture exists and is executed by persons other than qualified architects!

Is John Doe, Registered Architect, fully equal to the Eisemans, Graves, Koolhaases, Maynes, Johnsons, Wrights, Libeskinds, Le Corbusiers, Saarinens, Gropiuses, Mieses, etc. of the world? Is one a "real architect" only when widely acclaimed, rewarded, and published? Can a person with projects in mid-America be an architect in the same breath as a person whose work is encased in the pages of THE RECORD or ARCHITECT?

Whose clients are the more satisfied? Whose clients are the better? Whose money is better spent?

Professor Beach, herself a registered architect, has chosen to express a most dismissive and unfortunate mischaracterization of the situation, but one that is rampant among academics. It serves to cast some grossly unfair stigma on architects who perform, in her words, as "building engineers. Too bad! But what is lacking is the insight and understanding that good architecture is not confined, and does not start and end with projects ballyhooed and highly publicized – those by "signature" or "starachitects". Often these are not registered persons but no matter, any office employee can similarly be an unregistered "designers".

But design skill resides in the hands of any architect who has understanding and command of the design principles, and the knack for creating and fashioning attractive, yet functional projects – pleasing to the eye [even if revolutionary] and standing out from other buildings, in some way. This, though, need not be the quirky, weird, unusual, or other "cutting edge" projects that often seeming defy good sense for the sake of shock appearance [and the hidden "attribute" of excessive cost].

But let us consider that if the "building engineer" types did not exist, would architecture exist, or become reality? Does architecture exist only as renderings or doodles on paper or foam board, or does it exist when one can feel it, use it, and yes, experience it? Are "building engineers" any less of professionals simply because they approach architecture in an alternative way? Does the end result "architecture" require the intercession of someone to convert it from concept to reality?

It was mainly in the 1930s when registration laws were enacted to differentiate between architects, engineers and other allied professionals [today even landscape architects have separate regulations]. It may well be that this was done to legitimize the profession of architecture, as it was still strongly represented in the Beaux Arts system, but emerging and expanding into other venues. Registration became the terminal process, immediately following the acceptance of the academic thesis at the end f the curriculum in each school. It became the "goal" as such, of *prospective architect, since it was the threshold to a successful career, added community status and influence in many community activities. The profession, per se, came of age!*

The law for architects [note: not for "architecture"] was and still is intended to merely test, at least once, the root ability of the person to be, as that person chooses, architect, or "building engineer". The law wants to ensure safety for the citizenry, just as for safe application of medicine and therapy. The law does not require restoration of absolute 100 % health, but careful application of medicine, and skilled surgery. Not perfection! Not the epitome! But rather the minimally safe. The law tells no patient or client how much money to spend, or how to spend it – but it does indicate that those persons utilize expertise that will produce safe results/structures, "despite" what else they may be. The registration process set the standard for the profession as well as demonstrating minimal competency to the community – a "right of passage" so to speak!

So circumstances continue, and will eternally fuel the fire on controversy over what is architecture, and who "produces" it. Every architect, of every talent level, seeks to design every project to be a "piece" of architecture. Being so very, very subjective in its nature, design cannot be defined nor codified.

So architecture, much like Supreme Justice Potter Stewart's definition of pornography, is something indefinable, but fully recognized when seen. It, however, varies as widely as human nature, understanding, and appreciation. So what if it is designed by ARCHITECTS [real or otherwise], and brought to being by "building engineers". History shows all too well that we all can't do it all well – just some a little better than others.

The underlying presumption that one cannot be an architect unless they are a masterful and creative design is terribly misleading – as is Professor Beach's summary dismissal of the other as merely "building engineers". It is true that in the gradual liberalization of thinking through the last several decades when everything was questioned, architectural registration has not been spared. Understanding of the need and support of the process was eroded and compromised in many ways. Lack of academic support, diminution of status by the profession itself, increased rigor in the process and cost of the examination itself, have tended to disrupt the "normal flow" from entering perspective architect to fully registered architect! As trite as "we don't need just a piece of paper to be married", new architectural graduates claimed their professional title and dissed the means of gaining it [in the traditional manner].

But to be clear – this is worldwide process, so when an American "starchitect" produces a project, someone, in most jurisdictions, will emboss or seal [with rubber stamp] the documents intended to be used in the actual construction. If the designer is not registered, then a surrogate is required – BUT most jurisdictions require the declaration of the responsible party [i.e., the registered person] who will be held accountable for the correct and safety construction! Period!

Yet the law is clear and perhaps too highly "under-enforced". State laws in a move to provide adequate and safety construction for all constituents, has deemed that at least certain buildings [residences are usually exempted as is agricultural] must e designed by registered architects. This s a way of saying that the desire for safe and proper construction starts with those who have been educated, trained AND TESTED to show that they have the minimum professional capacity to design such buildings.

To disclaim or ignore this premise may have some credence and certainly there are some people fully capable of designing building projects correctly, but the fact remains that the state legislatures have created a format that involves the formal testing and examination of their practicing architects. This is, of course, a prudent effort and one aimed at eliminating substandard construction with no basic responsibility for their sophistication of their design. Citing Frank Lloyd Wright as a person who did works of wondrous architectural design without being registered is a fallacious scenario since the laws of his times did not require registration and Wright, without much doubt, was a brilliant although irrepressible designer. He cared less about registration than anything else – surely!

Many of the more publicized "architects" wish to be architects when it is to their benefit, but prefer to declare this by self-acclamation in lieu of the audacity imposed n them by having to ex tested and examined. Often these people are rather singe-dimensional, leaving the requisite documentation and execution of their "design efforts" to staff – of registered architects! Their designs may be fine for privately funded projects [individuals or private organizations] but seem most inappropriate to produce publicly funded projects with exaggerated costs and questionable premises where no one of the general public has any meaningful say in the project.

From the times when written words were sparse, there was an "architecture" of sand sketches, scribbling on a trestle board and verbal directions. These were used to convey to the mass of workers the ideas, direction, "design" [concept or thoughts] of the person in charge of the project.

This person, over time, came to be known as the "Master Builder", who knew not only the overall result desired but the individual materials, their installation, and how to incorporate and interrelate all this in the fashion that produced the expressed [in one form or another] design concept.

Obviously THE practice was not built upon or conceived by the definition, but over time the two distinct events each came to be recognized for their collective contribution, but also for the separate effort required in both. In trying to define what the practice was [is] various people used different terms which in essence mean the same things. As civilization evolved it had a direct and important impact on its architecture – and in turn on the people involved. Projects became more complex; structural integrity was required; styles and tastes changed as more sophisticated people were in high/ruling places; and more and more was learned in the areas of materials [native and developed] and technology [engineering; thoughtful processes that could be repeated but with varied results as required].

Also, the people involved changed and evolved with the two elements, as architect/designer, and constructor. contractor – each a specialty; each with its own developing expertise and skill. This serves to foster a broader distinction and a more defining relationship between the two elements. There now had to be a communication linkage between the factions so the desires and requirements of the design function are conveyed to the field workers with direction and instruction as to not only what to do, but how, and how much. This aspect has escalated even until today, where it has been and is still becoming more and more critical [because there are complications in both processes].

There is a need to remain pragmatic, realistic and open to see and understanding what may be in the offing for one's career. History distinctly documents the rapid change in skill and attitudes as architecture became more adventurous. What appears to be "cutting edge" efforts at this time may be either obsolete or so routine in the next short time period that one who is ill-prepared will be stretched to keep pace. In that, basic and fundamental principles need be "absorbed" and understood, so ingrained flexibility will serve to adjust one's efforts and skills toward whatever lies ahead in the profession – this cannot be a shortsighted, quick-fix process, but one of true understanding of the realistic basics principles and concepts involved. Things happen because they are made to happen, and not by pure happenstance, luck or divine intervention.

But an increasingly important theme came out of these efforts. As designs called for more complex and intricate construction, technology was going to have to play and bigger and bigger role in the project. It was the designers themselves who "forced" this issue, literally mandating that some level of technology be made available to execute the design – if it did not then exist, it had to be invented or created. That scenario was not all bad for the construction industry. In fact, it was a major impetus for the tone of that industry, even today.

No adequate and appropriate technology → no architecture!

And with that, the rationale, relevance, motivation, impetus, need and substantiation for the "other" architecture.

Is there really an "other" architecture: a "second" profession of architecture; or is that more myth, legend, fiction, or pure untruth? Or is it unspoken reality?

These questions are rarely, if ever asked in the academic preparation of architects, nor is the broader topic. Reality holds that the training and education of ALL architects entails certain limits but must always utilize high efforts in teaching theory and design. It is as if design is not only the pre-eminent issue, but the sole issue in training and developing architects. Indeed, can a person be considered or, indeed, be an architect and never design a building or other structure?

The answer is "yes," and is upheld in the registration process, that basically licenses architects in the various states. Once the academic design sequence is complete, and one passes the design portion of the nationally-applied Architectural Registration Examination [ARE], the issue of design and design ability virtually disappears! They never have to exercise or re-visit it again, through a career!

This combination of highly misleading activities flies in the face of the true nature of and effort required of the profession and its members. There is a vast array of professional services offered to clients that are never exposed much less discussed. There are aspects of work available to clients that the student never is made to realize or understanding. And possibly the most unfortunate professional task that is ignored is the documentation required to bring the design concept to reality – i.e., a complete and finished project, fully satisfying to the client. One must ask if the true, accurate, and complete reach of the profession is contained in the innovative, cutting edge, and revolutionary design concept of the current array of "signature architects" ["starachitects"] or not. They are relatively few in number, but most extraordinary in the impact they have; the coverage they receive from those addicted to only the far reaches of design; and the miniscule clientele that can afford their efforts. What of the tens of thousands of other architects ["other" once again, as in second class citizens; or derogatorily, those other masses of people]? Is their work of little or no consequence? Must you win design awards to be creditable and successfully?

All of these questions are not an attempt to create controversy, or denigrate any currently practicing or prospective professional but rather to identify and discuss the ″other″ aspects of the architectural profession that are not always that immediately obvious. It is the work of architects in the ″fee″ like configuration where only a small but impressive portion of the work is readily seen and discussed.

In the eyes of many, both inside the profession and in the more aware general population, architecture is indeed solely the visible images of the projects – i.e., what is really the visible tip of the project ″iceberg″ – the obvious; the recognizable; the published; the acclaimed with rhetoric of those in authority as the deciding factor; the unusual, the quirky, the startling different; in part, new configuration not yet understood but assumed to be proper, meaningful and as desired. All this is based purely on what is seen, overall, in the completed project, and noted in various comments and reviews. Fundamentally, it is the expressions of good [?] design that ″catch the eye″ and impress the mind. In that, it is the function of architectural design that appears to be the sole determiner. This effort is to expand the understanding about the profession of architecture beyond the concept of ″design-design-design″ [much in the same context as ″location-location-location″ is the foremost consideration in real estate]. It is not to discard or dispel design as a featured element of the profession, but to look beyond the myopic concept that ″design is the only thing″, in regard to architecture. Surely, as the new student/professional is promised a professional education, then the instruction should cover, in correct proportion, the whole of the various aspects of that profession! Unfortunately in all too many cases, currently, this is not the case!

Michael Sorkin, Director of urban Design Program at City College of New York, commented in the "Critic" column in the August 2009 ARCHITECTURAL RECORD, as follows [in regard to education of architects]:

> *″The ossified rigidities of architectural education are unable to come to grips with the real sate of the planet … to give each student entering a school of design a common grounding on which to build later specialization. This would include rigorous introductions to the environment and natural systems, deep immersion in the social and economic modes of production of the built world, and a vivid grounding in the global histories of physical responses to the question of habitation at every scale … Designers should be equipped with the knowledge of what makes a building sustainable, what drives construction workers to despair, what makes the city humane, what deepens our connection to the landscape, what gives us a sense of real connection to each other.″*

A recent quotation, from a very creditable source, that captures the essence of architectural practice and the correct, valid and important interface between design[er] and documentation used by the contractors.

Emphasizing design in proper proportion is one thing; but casting it as the sole or exclusive driver or consideration is both misleading and shortchanging to the student professional – Architecture involves more, and indeed, is more!

There is need, for the public and especially for the prospective and young professionals to come to understand the whole of the profession and the myriad tasks involved within a single project that are carried on beyond the PR, the rendering, and the initial public face of the project. Architecture is, of course, a very unique profession, highly misperceived even though it has a profound impact on daily life of every one in every community.

There is an unfortunate situation with the profession that perpetuates misunderstanding among the general public and with many more insightful people – including some within the profession itself. Too many do not know about architects at all, while many of those who do, see architecture solely as the unusual, odd, innovative, radical, and fascinating projects that catch the eye. Many do not relate architecture to everyday experiences in other buildings or structures. Neither do they relate to the underlying support and efforts that produce any architectural project.

First, it is quite striking that architecture is defined in terms of ″building″ and ″science″ [which includes engineering and technology]. This helps to define the relationship in that there is a dependency on construction as an integral part of producing architecture. Architecture needs construction, it appears, but not vice versa. But still there is a need to establish more about architecture, overall, and in that aspect that is not construction.

It could well be that failure to recognize this situation is the reason the profession of architecture remains perceived as elitist, remote, mysterious, and virtually unapproachable. In simple terms, architecture is not a popular or embraced profession!

The profession has but the one title and is generally considered to be a single, cohesive entity – one group of people known collectively as ″architects.″ Reality also makes it known that there are several varieties of architects all gathered under the collected title of the profession – still architects, per se, but in various roles, under function-oriented titles and actually a form of specialization or specialists within the profession [even though they are fully registered, practice as ″architects“]. The reach of the profession is so broad that it is impossible for one to be expert in every aspect of practice. It is extremely difficult, if not impossible, to be equally astute in every aspect of practice-design, business, administration, marketing, construction administration, etc. Some in small or single-person offices are forced to attempt the strenuous balancing act of ″being all things,“ but usually find a very complex and trying task – and usually with limited success in at least one area.

While not specialists by declaration, architects do tend to precipitate to certain niches by self-determination. Even the most astute and renowned architects were far short of complete professionals – 100 % expert in every portion of the practice. Most of the more noted architects are known for their design work, and in fact many of them shy away from detailing, documentation, contract administration, etc. and concentrate strictly on design concepts and images – how they are to be and get built lies in the hands and minds of others.

This is why you hear of so few of the individual 88,000+ members of the American Institute of Architects, and the other 30,000+ architects in the United States [and similar numbers world-wide] – it is only the design oriented professional [″starchitects“ or ″signature architects] who work at the cutting edge who gain the publicity. However, for each one of them, there is a host of others who support their design efforts, and get them built.

And too, those thousands of others who have viable, active, productive, and successful practices serving their clientele well with sound projects – well designed and executed. It is unfortunate that there is an impression both in the profession and with those who know something of the profession, that these ″others“ are somehow second-class citizens – perhaps not even worthy of the title architect.

Herein lies the ″other“ or ″second“ architecture – those professionals who serve in any of an array of tasks to bring the design concepts to reality. The ″other“ architecture is by no means subservient to architecture but rather is an integral part of it. As the chart shows, the total architectural profession can

Typically only one-tenth of the volume of an iceberg is above water. The shape and extent of the underwater portion is quite difficult to judge by looking at the portion above the surface. This has led to the expression ″tip of the iceberg“.

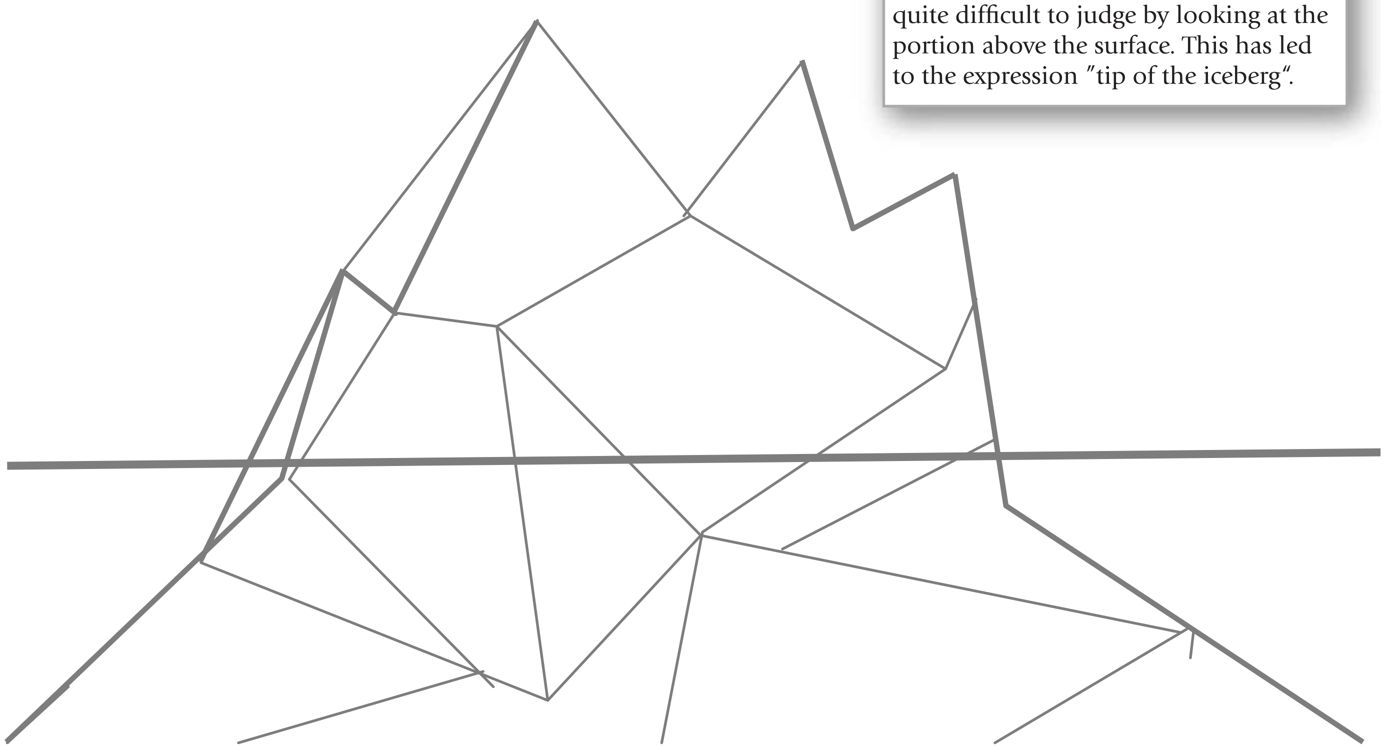


Fig. 9-1

The reality of the iceberg is very much the same as that of the architectural project- while the design and its representations are quite visible; there is an underlying array of information and knowledge that is crucial to proper completion of the project. But all that is the unseen 90 % of the project “iceberg”!

be broken down into two parts. These parts may vary in size and impact from office to office, but both are required for a successful practice.

ARCHITECTURE	
Design	"Other" Architecture

It can be seen that architecture really does not exist without both elements noted. The best of designs requires and is really beholden to the ″other″ architecture that brings forth the design concept, gives it full expression, and faithfully realizes it in the finished project. With no design, ″other″ architecture is merely the production of documents that provide something – perhaps something other than actual architecture.

This is not to malign engineering projects, but in the main, there is a far stronger utilitarian aspect to these than there is an appearance or architectural aspect. These projects are more for what they do or produce, and less about how they look. Oh, there have been and still are industrial projects that are designed in the highest of design principles and concepts, but these do not represent the majority of such work.

This configuration with design as the primary function is not unique to architecture. Indeed, it exists in most sequences where design is a major aspect. For example, in fashion, the designer is backed up with all sorts of support personnel to produce the garments. So too in the automobile industry, where the principal designer creates the overall concept, but its execution is established and performed by others. In addition, it is well known that in the military, for every person on the frontline there are 10-12 support personnel behind the scene. It is just that in architecture, the pre-eminence of design is so profound and extensive and so little regard given to any other ancillary function.

A refined and distinctive definition must be assigned to each of the following staff positions [a partial list] in or related to an architectural office [even though every title/position is not necessarily present in every office] where do think you fit now? What is your ultimate goal in this list? Also, realize that various combinations of these titles can be connected with anyone person. Some titles represent jobs, or positions under the umbrella term, ″architects″ [some fully registered; some trained but not registered] who work at jobs outside the professional office.

There is no intention in this discussion to create any controversy or establish the case for any semblance of ″second-class″ architects – for there is absolutely no such stigma of any kind involved when we work within the narrower parameters of one of the listed job titles. It is strictly a matter of doing the work involved, and each of us finding particular aspects of the work that we enjoy doing and become more expert in. The project [and its Owner] is the beneficiary of this, in that the best effort is offered by the best-positioned personnel who seek the pleasure of doing a good job to produce project success. Even the worst, most mundane tasks can be well-performed if the person is interested, dedicated, committed, and executed with a passion for doing the task well. No office is, and none can ever be devoid of, such persons!

Rather this all is an explanation showing that the profession of architecture is not fully revealed or defined by the confines of the pages of a few architectural magazines, or the news reports of new and startling projects. In fact, these are the minority of the professional projects. The unfortunate part is that it is these projects that have access to the publicity and the eye and mind of the general public who may or may not embrace the efforts.

These are examples of architecture, but not necessarily the representation of the profession. They are atypical, and in their wondrous ingenuity they are unique and eye-catching. But the fact is that the vast amount of architectural projects are not published; are not widely acclaimed; and are not necessarily cutting edge and revolutionary. So the ″other″ architecture is a project consideration as well as a personnel situation.

It is quite obvious that very well designed projects, in fairly remote locations, will see little recognition except at the local level. Some may rise to the level of an award for excellence at the state level [by the state AIA organization]. Most architects and firms are satisfied with this situation simply because there is so little hope of anything more. Unless one rides a rhetorical stream to ″talk″ a project into being [i.e., selling a client on a project and design] and one has access to media exposure, projects serve their clients well, weather and function well, but in relative obscurity. The majority of clients are interested in more modest projects in scope, design, and cost. The revolutionary projects take a very unusual clientele who build to a far different agenda than that of the majority owners. High-profile and more flamboyant clients are more amenable to radical design concepts. It is a very mysterious situation, though, where public entities hire ″starachitects″ for their buildings, funded by public funding. But these projects tend to run heavily over-budget, create continuing maintenance problems [leaks, failures, etc.] and give a questionable and off-beat complexion to the complex and the organization. Is, for example, a university building new buildings among older, more sedate structures bettered and enhanced by a quirky, off-beat and highly erratic new building?

Neither do the projects, overall, indicate nor determine the skill levels of the architects, or their educational backgrounds. Being first in one's class, in architecture, is no more guarantee of a highly published career than in any other profession. Every project has a design element to it, most not nearly as ″explosive" as in form. But in every case, the project work is defined and documented by others, including various professionals, in the offices, who find their reward and satisfaction in other aspects of practice [see list above].

The truest measure of successful architecture is the satisfaction of the owner/client. Many owners remain loyal to their architects despite continuing problems with the construction. Others hire specific architects simply for the eye-catching and innovative designs they produce. Some question whether public funded projects [using taxpayer funds and where the public really has no vote or voice] should be used for such projects – the critics seeing the money better spent in other ways. Too often the designs are problematic with almost prohibitive cost overruns, questionable aspects, missing completion dates, and problems with regulations and improperly conceived details of construction.

The final, completed project, no matter its function or location, is at its best when the owner is satisfied with virtually every aspect of the project – design, function, cost, timing, and improvement in image and operation. Much is made of ″architecture‶ as it is designed and built with avant-garde direction, by what are called ″signature architects‶ [or the new emerging term, ″starchitects‶]. The projects are new, wondrous, revolutionary, ″cutting edge‶ design concepts of the most fertile minds of a relatively small group of daring architects, worldwide, supported by a very limited number of clients. They are the results of a mindset to produce a new expression or ″statement‶ about design or structure; perhaps simply a new approach to a known type of building.

For example, look at the wide variety of high-rise office buildings, and while each functions well as office space, they look quite different. These projects receive a disproportionate amount of publicity, examination, discussion, analysis, rigorous comment pro and con – and often wide and lasting acclaim. They are topics of seeming endless rhetoric that tries to justify the whole project and each primary part. They are celebrated by the profession of architecture; analyzed, criticized, and held as examples in the schools of architecture; and are held in wonder, or high disregard, by the general public that knows only what it sees and not the nuances of good design and architecture.

Each of these projects is brought to fruition through the efforts of many who perform quite varied and ancillary services and tasks, both in design and in realization of the completed project. This is a sequence of tasks and events that creates and produces the finished project. It is, for sake of a better word, the ″grunt‶ work which transforms creative design concept into the final reality: it is the process of ″how it got that way‶! Architecture, then, is a ″result‶ or the product of several sequences and efforts; the combination of many talents, and skills; the real manifestation of a mental concept.

One point, though, that needs clarification, is this:

″Architecture is NOT exclusively equated to ONLY the cutting edge, innovative, eye-catching-unique projects – it exists, and is continually produced over a far more vast array of images, and configurations, in far-flung locations.‶

The overwhelming body of work is produced by talented and dedicated architects who please their clients in less imposing, and less publicized ways. Even the most visible signature architects have a good portion of their total body of work, far less ostentatious projects [which help pay the bills and fill the time of staff between ″big‶ projects]. It is not uncommon for a signature office to design warehouses concurrently with, or in the intervals between, the more glitzy and prestigious projects. World over, the profession of architecture is practiced with continual results that protect and enhance communities and make better the lives of the occupants and users of the projects. The vast majority of the time, the general population is totally unaware of the work done by the architect, and the daily impact it has on their lives, in so many ways and locations.

So, for the sake of discussion, let us set the premise that ″architecture is the complete array of buildings and structures that have been, are being, or will be built, for human occupancy, and use.‶ We, purposely avoid any dissertation about styles, concepts, values, appropriateness, good-or-bad evaluations, or marginalization of projects. Our task is to relate how each of the projects has progressed from inception to completion-simply, not what is built, or why, and not why certain designs, materials and systems were used, but how were they are produced from perceived needs to mental processes and images, to ″bricks and mortar‶ – i.e., standing building stock.

THE ″AXIOM‶:

Architecture is the manifestation of design, achieved through construction.

This is the fundamental and perhaps too simplistic [but true] axiom regarding the process that produces the world's architecture. This axiom holds in all climates, all cultures, all styles, all levels of expertise, and all levels of need. The intent is meant to address this very axiom and to provide explanation of the several parts, how they interact, and how they "feed" one another, until the project is completed, occupied, and used. The process moves from thought or idea, through the rationale of deciding what exactly to provide or construct, and then the efforts of any disciplines to produce the documentation for construction. Last, but certainly not least is the cooperative process of construction: contractor and designer working to produce the project that the owner is anticipating. As to architecture, construction, for the most part, is non-judgmental. Its task is the pragmatic conversion of a concept to a usable entity, whose design, style, and appearance are functions of others.

Note that the axiom does not analyze the work as good, bad, or indifferent architecture – it merely states the path followed to produce architecture, as satisfactory to the client, and to the profit of the contractor and the profit and reputation of the design professionals. No matter the type or style of the structure, it still produces these by-products and conveys these elements to the various parties. Every project follows this path and produces its own set of results for each party involved. The ideal situation is that in which all parties receive full measure of their needs from the finished project.

Some purists would strongly indicate their displeasure and disdain at any work being called architecture which falls short of their prescribed definition or perceptions. But the world is not so restrictive or simple. Architecture, worldwide, is a broad expressive panorama of varied talents, all directed toward the singular goal of providing a project that is consistent with the needs and desires of the clients. Certainly, some clients are more open to new ideas and images – to the more creative and imaginative and the fact that their project becomes more widely known for its image and status perhaps, than its function. But to the contrary, many other clients seek solutions, through an architectural effort that is quite different in intent – they seek problem solving, increased capacity, and other more practical results.

To be clear, the final design concept and physical appearance of a project is an expression of the mutual desire and intent of the client and the architect. While the architect is engaged to work as an agent of the Owner, this is not a matter of subservience. Rather the architect takes the programming [which was mutually produced by the parties] and interprets and adjusts it into a coherent design. Sometimes the client guides or even demands the direction of the design effort, but more times than not, allows the architect to create one or more concepts. This is the direct impetus for innovative design, and unique appearance, fashioning of materials, orientation, and distinctive image in each and every project – none replicating another [except where more mundane prototypical work is involved]. Owners choose the one design concept/solution that is to their liking, and the rest of the project work is directed toward producing the project, in real terms, as depicted on the approved concept [preliminary design] drawings.

In view of the fact that the same type of talent, knowledge, and skill is required to produce the entire range of projects, architecture must be a process that is varied to the desires of the client and the results anticipated. This, in no way, demeans the direction and work of any individual architect.

Rather it speaks to the specific challenge of each and every project and the flexibility required to resolve the issues and produce a meaningful design for the client. It also indicates that project parameters vary and change, over a very wide range – and project goals are different but still need to please and satisfy the client. But there is one leveling process that all projects must negotiate – the process of construction.

At some point, no matter the type of project, the status and talent of the architect, or the drama of its design, every project must traverse the construction sequence. Here the project – design and all – is almost literally turned over to the constructors for their execution of the requisite hands-on work.

The route to producing "architecture" of any style, type, or level of design accomplishment, is a collaboration of tasks, work items, application of varied skills, some dangerous; some roughly hewn, back-breaking, and rudimentary; others dirty, greasy, oily, awkward; still others labor-intensive using human-power in place sophisticated machinery or technology. Projects cycle in stages where, at times, one wonders if the final project will ever match the original design concept: but most projects do.

In this, the design professional is not relegated to the position of bystander, but there are various levels of participation. Therefore, it is necessary that the professionals know, understand, and fully appreciate the complete extent of the project and the process of construction. There is need to be flexible, decisive, strong, instructional, and educational, a good manager, and the correct interface between Owner/Client and Contractor.

So the next question is how does the design concept of the designer for a new piece of architecture transcend and "become" a reality?

One of the most telling occurrences was the number of architectural interns who participated in the essay contest, over the last few years, who expressed a high degree of confusion, mystery, and outright annoyance with their education, knowledge level, and situation. As graduates, their backgrounds are quite varied but their collective experience is all too telling – they are at a loss to understand where they are, what they should be doing or looking for, and what the future really holds for them. Much of this is based on their own perceptions that their education and training, to date, is such that they have no realistic grasp of the profession – and more particular their fit into it.

Certainly it is rather disturbing to learn that these budding professionals have been given, far too often, no instruction, information or discussion about their profession. Of course, some who chose to write essays are operating on different levels, and have found their niche, usually in the design functions of the profession, or in the more theoretical aspects. Practical project development and documentation work lies either unrevealed or so murky that no sense of need or directions at hand. Flatly, these interns are short of both construction information and knowledge and also short of pertinent, clear, and unbiased information about their own profession – as an entity!

It is both unfortunate and disconcerting that there is not a more cohesive method of educating and training architects. The three-tier education system – schools, IDP, and offices – still is not coordinated to the point that the student/graduate/intern really grapes the profession. The school faculties formulate their own versions of what the professional instruction shoulder. They tend to emphasize design and choose to relegate most technical and professional practice instruction from very little to none. NAAB supports this in their rather low-expectation credentials for accreditation. This reflects the attitudes of the state regulators [through NCARB] who choose to test aspects of practice [like codes and specifications] but do not support strong instruction in these areas. Incongruent at best! By the same token, if the states ″agree″ on the NAAB credentials, and on the ARE promulgated by NCARB, there is a distinct level established which reflects commonality of purpose. Certainly professional practice varies in a regional manner to meet the changed conditions that prevail – from climatic to legal and style. For some reason, this commonality of purpose – i.e., how professional practice is carried on in a legal and ethical manner [despite regional nuances] – does not carry over into the instruction and education provided.

Why not?

It seems reasonably obvious that a lack of discussion, the setting of isolated requirements, and the parochial approach to curricula development are some of the prime factors. Simply, there is not a cohesive universally accepted approach to professional practice education, and no manner in which such can be achieved. Responsibilities are fragmented and uncoordinated, for the most part, and certainly all of the involved entities do not ″buy into″ the process or program overall; too many are doing as they please, or as they alone see fit [for the varied circumstances they see].

The offices for the most part have not really bought into the idea that they are places of education. Hence, they tend to ″train″ new hires in their specific areas of need and offer little in the way of broad scope professional instruction [they want productive hires, not those in need of more than minimal and specific training].

This is not to advocate a mandatory professional curriculum, but rather to strongly suggest that there is need for collective discussion and adjustment of the expectations of the schools and the graduates they produce. This is not a matter of right and wrong, but one of what should be expected of every architectural graduate, upon graduation, without having to rely on a remotely conceived and portions of a rather unresponsive and inappropriate IDP sequence. Of course, the overriding issue is what is expected by the regulators and registration agencies when they issue the registration documents – what, in their technical knowledge, is an architect and what should their registrants know, and be capable of?

PART TWO

Working [Contract] Drawings

The primary tasking that those new to the profession of architecture [be they student working part-time, graduate, intern, new registrant. etc.] will encounter is the production of the working drawings for the actual construction process. The work is most valuable and unavoidable!

The success of any project is not in the process of design or in the mode of production, but in the value of the information that is developed and conveyed to the job site and/or construction entities.

There is a need for correct, clear, complete and prompt communication of the information in such a manner as to render it directly useable and assimilated by the construction personnel.

The basic content [application of construction knowledge language and depiction commensurate with the design concept] and communication value of that information are the overriding issues at hand. The following chapters contain information of direct and lasting value to the document production process, no matter the vehicle for development and transmission. These basic and fundamental issues are time–proven and will remain of value in the future to meet the needs of appropriate project construction.

FORETHOUGHTS

Prior to engaging in discussion of more technical matters contained in PART 2, it would seem some mention and thought should be given to a couple of items – not really "issues" but items within the work and purview of the profession of architecture that impact the operations and the results – and merit some comment and context.

First, it is clear that this is not a "design" book or manual – it was never intended to be. But a short reminder of basic design principles and axioms seems appropriate to addressing the later matters of document intent, content, development and production. Creation and finalizing the design concept is, of course, the primary "trigger" for moving the project forward – that which has been conceived as the "proper" and preferred [and owner approved] solution to resolve the owner's requirements.

PRINCIPLES OF DESIGN

Much of the design of a project is unseen and "hidden" as it involves intangibles and the subjective application of principles, concepts, and feelings. These are factors that act as guidance during the process of producing the overall scheme of the project, from program analysis to layout to physical appearance. Yet, as with some many activities and work the underlying principles are not readily apparent and obvious, but manifest in objects, shapes proportions and relationships. The documentation and construction of a building project take all this and convert them into hard facts ["nuts and bolts" so to speak], defined objects, materials, systems, devices, accessories, etc. and directed work; tangible "things" seen and understood, in lieu of intangibles that are present but unseen and not understood.

This is the fundamental difference between design/art and documentation/science aspects of architecture.

As a quick review the following are the generally recognized principles of design:

*Design is the **organized arrangement of one or more elements and principles** [eg. line color or texture] for a purpose.*

Awareness of the elements and principles in design is the first step in creating successful visual compositions. These principles, which may overlap, are used in all visual design fields, including graphic design, industrial design, architecture and fine art.

The principles of design are as varied as attitudes regarding modern design. They differ both between the schools of thought that influence design, and between individual practicing designers. The principles govern the relationships of the elements used and organize the composition as a whole. Successful design incorporates the use of the principles and elements to serve the designer's purpose and visual goals. There are no rules for their use. The designer's purpose and intent drives the decisions made to achieve appropriate scale and proportion, as well as the degree of harmony between the elements. Design principles are a technical and artificial method to attempt to produce home architectural and interior design beauty.

PRINCIPLES OF DESIGN

Unity: Unity refers to a sense that everything in the artwork belongs there, and makes a whole piece. It is achieved by the use of balance, repetition and/or design harmony. Two objects like a living room and a dining room can be unified by giving these similar features like a shared hardwood floor design. Unity helps the objects like furniture look like these belongs together.

Balance: Can be either symmetrical or asymmetrical depending on if the right or left side is identical or not. Also refers to a sense that dominant focal points are balanced and don't give a feeling of being pulled too much to any part of the artwork. Some people may have a tendency or urge to want to balance objects like furniture locations or flower arrangements. Balance can be balance by location of objects such as windows on a house, balance by volume or sizes of objects, balance by color [like desired brightness in a room]. Balance lighter colors with darker colors, balance natural colors and patterns with synthetic colors, balance bold colors with light neutral colors, colors with high contrast in a room may be more visually pleasing to younger people.

Harmony: Harmony is achieved through the sensitive balance of variety and unity. Color harmony may be achieved using complementary or analogous colors. Harmony in design is similarity of components or objects looking like these belong together. Harmony is when some or many of the components [usually three or four objects depending on size of project or room] such as a furniture, drapes in a room share a common trait or two.

A common trait could be: color[s], shape[s], texture, pattern[s], material, theme, style, size, or functionality. For example a drapery could share the same color that is on a pillow or wallpaper. This is called color coordination in wall paper design. Harmony and unity generally make designs more visually appealing, organized and interesting. It is a technical and artificial process for attempting to produce interior design beauty. Design harmony may be used to produce a hidden or difficulty to see order or organization. Design harmony or unity sometimes produce balance in: design, furniture and accessory selection, and organization of furniture placement in most cases.

Contrast: Contrast is the occurrence of contrasting elements, such as color, value, size, etc. It creates interest and pulls the attention toward the focal point. Color contrast or ″pop″ also helps people navigate easier in a dark room. Contrast or ″pop″ in home colors may be visually pleasing.

Repetition [rhythm, pattern]: The recurrence of elements within a piece: colors, lines, shapes, values, etc. Any element that occurs is generally echoed, often with some variation to keep interest. Rhythm in interior design also may be used to reduce randomness. For example, placing four plant pots in a row and evenly spaced apart on a floor produces an organized look. Natural patterns like pattern on polished solid granite countertops may add visual appeal or interest to a home design.

Variety [alternation]: The use of dissimilar elements, which creates interest and uniqueness. Variety like a painting or some reflective wood panels added on a plain wall may be used to reduce monotony. Helps infuse color to a house decor to attempt to increase design beauty. Decor interest as variety or more decor usually increases the visual appeal of architecture and interior design.

Emphasis [dominance, focal point or area in a room's decor]: Areas of interest. Guides the eye into through and out of the image through the use of sequence of various levels of focal points, primary focal point, secondary, tertiary, etc. Emphasis hierarchy may give direction and organization to a design, and avoid subconscious confusion to sometimes improve the design's [like a house] visual appeal and style. Emphasis hierarchy or focus is not giving each object [like a bed or curtain] in a project [like a bedroom decor] equal dominance. Emphasis or dominance of an object can be increased by making the object larger, more sophisticated, more ornate, by placing it in the foreground, or standout visually more than other objects in a project. The primary focus point or area receives the largest emphasis in a room. Emphasis hierarchy avoids style confusion.

Proportion [scale]: Proportion involves the relationship of size between objects. Proportion is also relative sizes of surface areas of different colors in a room. The proportion of color areas such as on a wall of a living room may be chosen to be visually pleasing. Proportion also depends on functionality of object. For example, for the best proportion between a room and furniture, the sizes of furniture depends on the size of the room. In interior design, proportions like the floor to ceiling height of 8.3 to 9 feet tall may be used to obtain good visual appeal, functionality and grandeur in home design.

Functionality: A design must have good functionality. For example a bedroom must function well as a place to sleep and store clothing as well as looking nice. Proper functionaly is simply the best possible design and best possible location of this design that the occupant[s] requires. The requirements may be medical services, medical supervision, professional assisted living, easy use of home and/or handicap access. Such a home design is clean, nearly sterile, tidy, brightly lit, warm, visually appealing, is relatively dry, has relatively clean and healthy breathing air, complies to high level health and safety standards, uses genuineness of function like a hospital.

Attraction and design styling: Attraction is how much an observer is attracted to a particular design such as a particular style of a house. May involve studying the psychology why certain people are attracted more to particular designs than other designs. Consider the psychological effects of color, shapes, design, design style in interior design that may occur sometimes on prospective home owner when designing a home. In architecture and interior design, styling the design is important; the designer should make a home style that the prospective owner will like. For example some people may perhaps prefer to buy an upgraded Victorian traditional style home while young people perhaps want a trendy new modern style home.

Artistic unity: Artistic unity is staying on the story [like a science fiction novel] topic or story line, telling only one story at a time, staying on the style of a home in interior design. Avoids distraction or subconscious confusion in house decor style. Helps strengthen the style of a house, gives a clear design style communication.

Genuineness in media, form and function: Genuineness in media and form in architecture and interior design is using real material for finishes rather than faux. The beauty of natural patterns of stone or wood, and real crystallized metals may be used to enhance the visual appeal of an interior design. Using real metal, glass or crystal instead of plastic or paint simulations, because these [real] are usually better aesthetically and functionally. Real style, prestige, glamour or luxury rather than pretense.

For example, some material used for counter tops cannot duplicate the mirror reflectivity, natural beauty and functionality of granite counters.. In some cases, furniture and cabinets made of real wood could look nicer than faux wood [photographic wood] like in ″top of the line″ casework design. Finishes like wood molding and trim without finishing errors like accidental paint smudges, gaps [holes], splinters, or crooked cuts, as high quality finishes usually looks better and more prestigious. Up-scale projects need real materials for finishes, not faux [phony stone or wood]. Genuineness of form is using a real structure in design rather than a facade.

For example, genuineness of form is using a real brick wall rather than thin-brick or manufactured "brick tiles" on drywall. A real structure like a real brick wall usually looks more prestigious or grander than a facade or faux wall. Genuineness of function includes using real materials that is best for its function. For example, using real metal accessories with high and lasting finishes instead of plastic for rest rooms may be better functionally and aesthetically and in long term cost. Genuineness of form means using real structure rather than simulations; for example using real solid stone wall rather than phony stone tiles on drywall.

Genuineness of form could also mean using realism rather than fantasy and pretense in home design. Genuineness of form is also when one object is not disguised as another; for example a artifical fireplace is not disguised as a real one.

Genuineness of function could mean using the correct construction material[s] for the function; for example a hospital structure is made from steel, concrete, real stone and/or brick that is strong and are fire resistant, noise resistant, germ resistant. Genuineness of function also is using the best possible construction for a structure like a hospital building; for another example a modern solid stone fence would be better than a rickety wooden fence, because the stone is stronger, more weather resistant, germ and mould resistant and probably will look better and more hygienic than a worn wooden fence.

Proximity: Proximity in decor is the placing of similar objects closer together physically, and unlike objects [decor] further apart. Helps to produce harmony by grouping like objects. For example, different furniture styles with different colors compressed in a small bedroom does not look as nice as the same furniture placed further apart in a very large living room.

Color theory: Color theory in interior design includes the color wheel. The color wheel are the colors of the rainbow arranged in a circular array. Color theory also involves the idea of how color affects human thought and emotions. Pastel colors are considered as soothing colors. Red on sports cars is considered a daring color, or may be used to bring emphasis to a part in a design. Colors that have red such as orange, reddish-brown and yellow are assumed to be warm colors because we associate these with sunlight. Woody browns are considered as cozy colors. Colors than have blue are cool colors because we associate blue will cool water and ice. Ice cream packages with white, blue and silver colors may be associated with cool so that buyers may be inclined to buy ice cream on a hot summer day. Color harmony is a pleasing combinations of colors and the amount of these colors in a design like a room decor. Color harmony could also be a visually pleasing color combination that enhances the style and character of a design like a home interior design. Color harmony is also using a limited number of colors in a color palette usually seven or less initially to help preserve design unity. A visually pleasing color combination may be chosen for the color palette of a room for a particular age group and gender. Light neutral colors as dominant colors in a room seem more visually pleasing for people over age 35, because perhaps it resembles the colors in natural stone or wood. Natural colors like white, woody browns easily found in nature may produce a sense of realism and is usually visually pleasing for people over age 35.

De-cluttering, organization and harmonization of accessories: Neatness, construction precision and organization in interior design, architecture and home appliances is important. Some belief that de-cluttering a house from too many redundant objects makes it look better. A neat, and tidy or organized room, and backyard usually looks better. Redundant objects or accessories like broken radios, broken appliances, broken vases, cardboard boxes are hidden in storage or recycled. Clothing can be stored in closets. During de-cluttering, the best looking objects and accessories are kept that are in design harmony with the room's design and accessories.

Lighting and light reflection: Lighting is important in home interior design. It allows the observer to clearly see the design. Home interior design decor and furniture usually looks better in brighter lighting. Use lighting to set mood and ambiance in interior design. Lighting may be needed also for comfort; children need bright bedrooms, and women perhaps usually prefer brighter living rooms. Finishing materials could be selected that reflect more light like a fresh coat of semi-gloss white paint on drywall, light colored real wood paneling as wall or brightly colored wallpaper. A mediocre basement with poor lighting can be made brighter and more visually appealing with more lighting like pots lights, with brighter colors and finishes [sparkle and sheen] that reflect more light.

Lighting coloration: Light coloration is important to setting the mood in a photograph or work of visual art. Use various types of lights to denote specific mood changes. For example, a red-light may be used to denote an alert of some sort in the form of a beacon. Differences in lighting hardware can affect the mood as well. Halogen lamps and fluorescents can give a cooler feel to visual design works. These can be replicated through psychological studies [citation needed]. In digital mediums, lighting can be applied through a variety of filters. For example, filtering out noise and changing hues in a subtle manner can give a simple but tolerable logo feel to a red-alert beacon.

ELEMENTS OF DESIGN

The Elements of design play an important role in the creation and success of a piece of art, whether it's for outdoor, indoor, digital or print medium. These elements are:

Space: Space is the area provided for a particular purpose. It may have two dimensions [length and width], such as a floor, or it may have three dimensions [length, width, and height]. Space includes the background, foreground and middle ground.

Line: Line is the mark made by a moving point, such as a pencil or brush. The edges of shapes and forms also create lines. It is the basic component of a shape drawn on paper. Lines and curves are the basic building blocks of two dimensional shapes like a house's plan. Experiment in design by adding or changing lines such as the lines of the floor plan of a house.

Color: Color is the most expressive element of art and is seen by the way light reflects off a surface. Color is used to create illusion of depth, as red colors seem to come forward while blue seems to recede into the distance. Color, and particularly contrasting is also used to draw the attention to a particular part of the image. On some cases of interior design, color can be added to increase visual appeal such as the natural colors of wood of a china cabinet. Color may add visual appeal to a home decor just as colored flowers can add beauty to a field on a prairie.

Shape: Shape is an area enclosed by lines or curves. It can be geometric or organic. Importantly, a shape automatically creates a around it. Shapes in house decor and interior design can be used to add interest, style, theme to a design like a door. Shape in interior design depends on the function of the object like a kitchen cabinet door. Natural shapes forming patterns on wood or stone may help increase visual appeal in interior design.

Texture: Texture is the feeling and visual feel of the fabrics, colors, and room accessories. There are two types of texture; Tactile, or visual texture, and texture which you can detect with your five senses. Texture like grass sheets on a wall, or white pebbles embedded in a concrete wall gives a three dimensional look to the wall and a few of shades of its colors. Texture is the roughness of the surface of a material. Surfaces with same or similar textures like fireplace marble tiles and drywall usually look more visually appealing. The quality of finishes of surfaces in home interior design and even on automobiles are important. Smoothening and polishing wood wall panelling neatly and uniformly usually improves its finish and so its appearance. A smooth and polished surface on a marble tile is also a texture, and smooth and uniform quality finishes can enhance the visual appeal of natural material finishes like marble tiles on a wall. Smooth mirror reflective finish on a marble bathroom countertop enhances its looks.

Form: Form may be created by the forming of two or more shapes. It may be enhanced by tone, texture and color. Form is considered three-dimensional showing height, width and depth. It can be illustrated or constructed.

Value: Value helps with Form. It gives objects depth and perception. Value is also referred to as tone. Basically shading.

Type: Type is the use of letterform to add a message that would be otherwise challenging to create through the other elements.

COMMENTS ON BIM

Building Information Modeling [BIM], despite its 10-year existence, is still an unsettled and unresolved situation. It is a new approach to the design, construction, and later the facility management of a project. The program uses digital representation of the process creating the building and facilitates the exchange and interoperability of information. BIM is beginning to have a major impact on the appearance of buildings, how they function, and the methods used in their design and construction. But it requires a major, almost cultural, change in professional firms that have it or are moving to it. Truly it is a matter of firm size, financial considerations, benefits to all effected parties, and not just another new software program.

It alos mustb enoted that BIM has up until now a rather spotty hsitory, in that its development has ccurred on a case-by-case, office-by-office seqeucne. There is not a "wave" or overwhelming movemtn, as the professional firms are continuing to review and consider the use of BIM in a format that best serfes etheir clientle and their own bestintesrts. While more heavily used in desing functions, where major interferences occur and in the adminsitration [estmating, cost management, project contro, etc.] of projects by contractros, the use of a production element is more limited.

BIM is NOT just another drafting method of a sophistication of CAD, used strictly in the documentation of a building project.

It is developing and remains both a concern now and for the future and a "disturbance" of sorts that appears to run counter to the realities of architectural practice. Best advice to readers is that you should not expect to run into BIM immediately upon your hire by a firm! It is NOT a automatic given about your employment and something without doubt – of its existence or its use. Where used, it is primarily a tool of design, and not production [do not be swayed by high profile or enthusiastic users who tend to portrayed BIM in excited tones and overstated capacity].

Architects continue to look over and consider BIM with something of a skeptical and hence restrained eye. They highly regard the idea of BIM and its capabilities, yet it unfortunately never equals [much less exceeds] the expectations of marketing machines. If software were capable of utilizing today's hardware – and not two or three generations from now – and if we understood that all software problems weren't going to be blown away in the next version coming out "soon," then they would be more intrigued.

If the software actually enhanced the architect's process, instead of adding layers of complexity to an already complex process, then they would much be interested. BIM was developed not as a means to solve stated problems, but to create a new, revolutionary program for design professionals. Problem was, the resultant software marketing provided the perennial "cure to all ills" complex. Everything wrong in the professional practice could be resolved – forever – with the combining of all project phases, work and information in one place, the BIM program! This was figment of the software industry and not the answer to a call from the professionals!

If architects [and engineers] thought their clientele had qualified staff on board to utilize the full building model with its "downstream benefits" for the future, AND that their own files were not going to become useless in 3-6 years because of new, better formats, then there would be a greater movement to getting involved. [Some do use the full building model, but many of them subsequently end up translating the data into other formats for their purposes.]

The most troubling aspect of BIM is that architects don't need to be saved; they need software developers to listen to what they do, and understand how to make that process easier. But BIM was developed in isolation and much like CAD where software companies think that their idea is the best solution, but it really is NOT without fundamental changes in the on-going, work-a-day, reality of the architects' world.

Does anyone ask why? No. Far too many think architects are lazy, and are slow and cheap to change. Slow and cheap really are due considerations before making major changed and investments; cheap is an on-going attribute predicated on static and notorious low fee available [pennies must be watched!] To make chances and provide training, while at the same time, continuing to produce work is delicate and fraught with danger of doing injustice to everything. Added the rapid production of new iterations of software is mind boggling, and allows for nothing to settle in, to be tested, and evaluated. And architects are anything but lazy! They are very good at constructive criticism, if anyone would listen.

This is not to say that a good number of firms have accepted and incorporated BIM in their operations. In the main, these would appear to be larger firms, and those engaged in very complex and involved project, with complex systems and high concentration of system material and appliances in place. To overview a model and find "interferences" [conflicts] in the design stage is highly advantageous, but in not necessarily present in every project, nor justification for the use of BIM by all firms in all circumstances. To have BIM in the office for spot usage is, of course, rather expensive, and not acceptable or prudent.

There is an inherently troubling issue with the whole BIM concept. Architects have for generations made drawings that are shorthand for construction of portions of the whole building. These are called ″working [construction] drawings″ or CDs. BIM is asking that the whole building be drawn, in a manipulable model format that results not only in just cutting out the shorthand drawings, but to portray the whole project up-front. Then portions can be extracted, pulled out and in some form detailed, much as one would use an appliqué method to "apply" features, elements and information to the "existing" design model.

Will the CD process change any time soon for estimating by contractors or getting approval from the variety of planning and building code departments across the country? It is doubtful and unlikely, but not inconceivable. After all, we never thought we would see the economic crisis we are in. If BIM is complex for architects, we certainly can't see building code departments jumping on, saying ″Sure! With this BIM model [instead of CDs on paper], we can review and assess your project much more easily and give you a permit quicker!″ This is asking architects to provide extra data for no apparent reason, which adds time and complexity to their operations, with no apparent need or financial gain. Does this seem like good business? What other profession provides an extra no-cost-to-them service as is being suggested?

Contractors more and more are turning to BIM for their cost estimating, tracking cost control work. With more information available in computerized form, they find a myriad uses for that information in assisting their operations, their production and of course, their bottom lines.

FOLLOW THE SKETCHUP APPROACH

BIM is being used now in the primary role of a design tool. Wheil some firms have expaned its production into working drawings, the vast majority are still relying on 2D working drawings for their project. Of course,this is also a matter of what the contreacots are capable of recevingin the field – i.e. if there is no receving apparatus for BIMwrking drawings,the needed information will not be trassnfered and will have to converted ot other formats for field use.

This again ins ot a draw back but rather a feature that while greatly marketed has not proven t be easily achieved in practice. The same holds true for construction specifications. the BIM marketing portrayed a massive database of omanufacturers' information that would be available to the moel, so the mere click owold bring in ALL the information required. Unpreened and monitored this information could prove to so cumbersome that it is vtiralull use less. Many knowdlegable experts are saying it wil be in the area of 15 years [2025] possible boefreo specifications MAY be BIM produced – and there is doubt now exact low that may be achieved or what formatting of iput and outpit this may present.

If the complexity of a 3D building model was somehow made easier and quicker to work with compared to typical 2D electronic drafting, then architects would invest quickly and adapt overnight. Please don't suggest more training. I have been working in 3D since 1987; I know how to make building models, but none of the current products are inherently intuitive to the casual observer.

Architects will always use a host of programs; there is no one product that will be the end-all answer. These BIM products can be enhanced to help with the most trivial issues [like sheet numbering and organization] to more complex issues, like energy calculations, water retention on a site, and daylighting studies. Helping architects early in the process of design with sustainable issues is one of many paths for development, not the current ″marketing junkie″ approach.

These major selling points with every vendor are old and tired concepts.

Collisions [Interferences]: Having models find collisions in building designs before construction suggests architects and engineers have been unable to figure these things out in the past; it is demeaning marketing, at best. We figure these things out in 2D or 3D because it is the business we are in daily. Many times, unsuspected problems on the site create collisions, such as drawings being misread. To resolve them, we come up with solutions as needed. I don't believe BIM models are going to change people misreading models and drawings, unless there are major advancements in the ease of use among the current products.

Cost Estimating: The process of cost estimating has become a very delicate issue. Many times these days, it is left to consultants, because of the liability involved on large projects –

thanks to our legal system. This marketing sales point is always less than valuable, because no one has developed a rock solid relationship with a reputable estimating company, like RS Means, who updates regional prices for materials and labor on a quarterly basis.

Without this information, no architect has the time, or trust in their junior-level help, to input data in any trusting/valuable way. Because of the liability issue, no CAD company develops this end of the product, other than to say, "It will do it" – if you, as the architect, put a lot of time and energy into tracking which objects are connected to what pricing. Would we like this to work easily? And be set up so that we can get very accurate cost estimating from the model? YES! We would embrace that overnight, if we thought it was ironclad accurate. Otherwise, it is simply another of the marketing ploys that marketing junkies put out there about a product that just really doesn't do anything other than double our efforts in getting projects completed.

Currently, it appears that there are other and different kinds of tipping points. Owners who originally required BIM are now realizing that billings by architects go up [not down] to implement BIM. And so owners are moving back to CDs being drawn electronically. Indeed, some architecture firms who bit on the BIM marketing concept, and are now cutting the BIM apron string to finish projects on schedule; they are bringing 2D drawings back in to play.

Readers are advised, here, that there is no firm, universal solution, or answer to the use of BIM. Time and circumstances will come to dictate what is, or is not done. There will be qwide variaitions,and readers can only be prepared for what may be given orver to, or required of them.

THE ROLE OF WORKING DRAWINGS

With few exceptions, every person embarking on a career in architecture will be faced with the task of participating in the production of documents [primarily, working drawings] for the actual construction. This task lies immediately beyond the creation and owner approval of the design concept, and the completion of the drawings and specifications that are ultimately approved, for construction, by the Owner. It involves the researching, gathering, collection, assimilation, application and translation of construction information, the development graphic and written information for use by the constructor – the premier means of direct communication between designer and contractor [and trade workers].

This is unvarnished fact! It is not meant to intimidate or demean any one, nor to disillusion. It may be some of the first reality for some readers, but a necessary exercise in any event. Additionally, it applies to those with a Bachelor's, a Master's, or even an Associates' degree; those from highly-ranked prestigious schools, and those from more modest programs; to those with interests in other aspects of the work and to those with varied expertise in computer operations. Employers, unless hiring for a specifically position of "Designer" are looking for newly hired employees to take on the work of the office as they deem necessary – that work that simply is necessary to success of their projects.

No matter what the new professional may perceive or choose to anticipate, employment in an architectural office will start with work in document production. In particular, this involves the working [construction] drawings, as the project specifications are usually produced by others in the office who are experienced in those documents and have a wide range of expertise, experience and construction insight. Hence, it is essential that there be a fundamental understanding of both the documents, their intent, their content, their interrelationship and their correct development. Even if the ultimate goal of the new professional is to specialize in – or restrict one's effort solely to – design, the need for understanding of the documentation process remains crucial to success – even when such goal is achieved!

The primary role, or function of working drawings [sometimes called "construction" or more correctly "contract" drawings], is to convert design data into construction information, facilitating timely conveyance of it and clearly communicating that information to the various contractors, sub-contractors, vendors, suppliers and manufacturers that have a part in the project construction. This is a pre-eminent obligation set on the design professional as the creator of the documents and the interface between the Owner's programmed requirements [in written form] and the actual material, systems and equipment required. The mere change in lexicon, format, vernacular and language is formidable and imposing so there is no question what is required and in terms the constructors fully understand.

They must provide and transmit a complete, faithful, and accurate graphic depiction of the project's design concept, drawn to scale and replete with specific and detailed drawings and information; a major portion of the construction information required to build the project. They are the instruments by which the design professional applies the technology to the project's design concept, and clearly conveys/communicates the same to the various personnel of the contractors and their on-site construction personnel, so they all know what is to be done, how, and what with. The crux of the working drawings is that they are the design professionals' interpretation and resolution [one of many possible solutions] of how

Fig. 11-1
Photograph of a complex area of construction that involves and resulted from clear, complete and in-depth graphic details, of the work required, depicted on the working drawings [and with some aspects contained in the project specifications].
Photo by J. Robert Welling, Architect

the project should be built to satisfy the client's program and approved design concept for the project. That satisfaction relates directly back to the very reason for the project, and the resolution of the client's problems, needs, and desires. Neither the architect designer nor the contractor is "cut loose" to free-lance the work as they see fit. Both are constrained – the designer to meet requirements including budgetary limits, and the contractor to build the project as approved by the owner.

Hence, the fundamental reason that the drawings must clearly and completely communicate the requisite information from designer to the field personnel. What is in the professionals' mind is necessarily important and vital to the field so faithful construction can occur. Hence, too, the design information must be converted to construction language for easy receipt, understanding, assimilation and direct use and application.

In this context, working drawings are not intended nor do they exist for the enhancement or gratification of the design professional. Their entire orientation [and the effort to produce them] should be as the documents used, most directly in the field, i.e., they will be taken to the actual work area/location [on the site] and used by the construction trade workers as they erect or install work. [The other contract documents – the Agreement and the Specifications – are used primarily as administrative, office, and legal instruments]. Because of their function, the drawings need to provide the necessary construction information, in such graphic form, that the workers can use, the information depicted, directly, in their effort to construct the project as designed. This is not to say that the specifications are any less important, but usually they explain or expand [complement and supplement] the graphic information used by the workers; they are more usable by Project Managers, Expediters, estimators, subcontractors, suppliers, manufacturers, and those others interested in ordering, providing, receiving and moving material as necessary for project progress.

The importance of working drawings is perhaps best reflected in the requirements of the Intern Development Program [IDP] of the National Council of Architectural Registration Boards [NCARB]. Here roughly 25 % of the total post-graduate professional experience required must be gained through working drawing work. This is more than 3 times the experience required in any other aspect of practice. The requirement of 135 training units equates to 1,080 actual clock hours, or 27 full-time workweeks devoted strictly to working drawings.

While substantial in time, there should be no illusion that one can be anywhere near fully oriented, trained, and knowledgeable about working drawings within this period. Development continues as project circumstances change, and more new products, materials and equipment come to the market. This IDP requirement reflects the lack of time devoted to working drawings in the academic environment. Many may say that working drawings are better "taught" in the office, but we submit that understanding of their intent and content, and some minimal skills development is an academic effort. True, refinement and wider experience through IDP and practice is both preferable and more easily achieved, but the schools certainly can make a good effort at providing some fundamental training. Isn't it reasonable for good drafting techniques, habits and skills to be developed during, and required in the production school projects??

Ancillary activities of the profession associated with working drawings include code research, materials research, specification writing, and document coordination and checking. All of these are also required experience factors in the IDP program. This gives increased credence to the value of and the need for quality understanding of and work in production of working drawings.

The individual professional is interested in, and tends to pigeon-hole herself or himself, by being much more interested and active in one aspect of practice than in the others [i.e., design, document production, contract administration, etc.]. However, whether or not a specialty concept exists [on either a personal or firm basis], there is a prevailing technological aspect to the architect's work. This technology encompasses one fundamental premise [understanding of, and respect for the design process and concept], and two basic forms [materials/systems, and documentation].

If the dictionary defines architecture as " … the art and science of designing and erecting buildings and other structures", can we not re-state it as,

The application of technology [science] in a manner and combination so as to bring a design concept [artistic idea] to functional realization.

In essence, without the application of the technology, the concept will remain just that – an idea, thought, and unrealized design. And where does that technology reside?

The two elements – design concept and technology – are not necessarily equals, but rather they are mutually supporting. Each needs the other to produce another example of architecture. Needless to say, the design [concept] is the more visible, and the element most celebrated [or maligned]. Awards honor, and celebrate good design but very few, if any, recognize good construction, good detailing, or excellence in physically achieving the concept. There is even a competition and appropriate awards for specification writing. However, the overwhelming number of plaques and citations on office walls mark excellence or achievement in design, but very few, if any, in drawing production.

The minds and hearts of architects vary, finding expression and satisfaction in different aspects of the professional's work, and the profession. While repugnant to some, the fact remains that a massive array of architectural/construction technology MUST be present and properly applied, IN EVERY PROJECT. It is a major and dangerous breach of professional understanding and direction if one embraces only the design, aesthetical, and overall concept of a project. No project proceeds, successfully, from concept to reality without the application of proper technology, in minute detail.

What is the technology of architecture?

It is generally recognized that the architect is a combination of artist and engineer; with the "art" ["design"] aspect emphasized. For the most part this is true since most architects have an initial and abiding concern about a project's aesthetic appeal, impact, and propriety. But this in the minds of most architects is not the entire story of the project. Architecture is, of course, a visual art and presents projects that remain and endure. They are not momentary glimpses of near-perfection such as in the dance. The basic charge to every architect, from the client, is to produce a pleasing and attractive structure [at least in the eyes of the client]. Most often the client is not completely sure of what she/he wants, or needs, and is unwittingly asking to be led to good form and pleasant presentations.

Appeal, of course, is quite profound in that it is the attribute of the project that is seen and assessed by the casual as well as the professional observer. It is the overall pleasing or striking impression of the project that is foremost since this is the expression of the project most readily apparent. It expresses the image and "message" of the client. The basic inner working and relationships of the project, and the actual construction still are present, but the observation of them is restricted to those who are looking into them. The clients, their staffs, tenants, and other users are more concerned, usually, with how the building functions for their operation[s], and their work environment. In addition, there is a measure of pride and prestige in working in a well-designed, beautiful, and impressive structure. The construction, though, is more than likely "forgotten" until something goes wrong, or becomes a problem. However, both function and construction of the project were integral parts of the program that produced the structure; they were "designed" just as much as the overall concept which added the aesthetic virtues to the project. It is virtually indisputable that working drawings have been transformed, in complexion, over the last 20-25 years. Their intent has remained exactly as it has been for decades, but growing utilization of new and better production techniques has contributed to the overall change. There also has been a change in the concept somewhat, but little that touches on the reason for the existence of the drawings. Most all of this is tied, directly, to the increasing use of CAD for the production of the drawings.

Part of the uniqueness of the design/documentation/construction process is the fact that the project starts with an overall vision, plan, or concept. It is envisioned in its final state [as evidenced by the preliminary drawings and renderings, which appear quite often in announcements of new projects]. The designer, with little regard, for minute detail fashions the idea into an overall scheme which encompasses, addresses, and resolves all factors regarding the project. This involves owners' needs and desires and, the public voice [codes and other regulations]. This is done in a manner of what must be done, or what is necessary to bring forth the basic idea of the project. Through design development, more and more details are added, but it is in document production where each small portion or piece is analyzed to see just exactly how it may be constructed, related to other parts, and brought to reality in the project. This is a pain-staking, careful, and vigorous effort, but time well spent where the project is successfully realized, and the design concept is correctly and distinctly revealed.

So the project process is not strictly evolutionary, but rather is one of taking an overall concept and dissecting, expanding, developing, and "constructing" it, on paper in written and graphic terms, item by item; transforming design concept into technical information which can be used by the contractors. This application of technology in the largest to the smallest work item, in turn facilitates the construction, which brings the concept to reality as the finished project. Perhaps facilitation is the better term to apply to the process.

Technology, then, is not something to be feared, or avoided, nor something that can be obviated or ignored; it is a "given", a necessity – its application an unavoidable task; a foregone conclusion. Architects and architectural students need to fully understand, appreciate, and respect this scenario, even though they may choose to concentrate their individual efforts on more conceptual or aesthetic premises.

For the technological aspects of the project to perform as required, there must be a fundamental and in-depth understanding of the process of design that has preceded the creation and development of the approved design concept. With this, there must be full and abiding respect for that concept and a firm resolves to bring it to full reality, faithfully and completely. Both of these values, understanding and respect are necessary for a successful project. They should be given to and instilled in the entire staff that has or will process the project in the various phases of the project work. Without this, detailing, specification writing and field observation will be virtually rudderless, without guidance or goal. While the design concept may exist only in schematic/presentation drawings, rendering[s], and/or a model, these provide guidance to the other work. At least, here, there is "something to shoot for"- a distinct goal. A great deal of time, talent, imagination, skill, knowledge and experience are required to bring the presentation instruments to fruition. There usually is not, and need not be a formal education process to get design information to the staff, but some effort is required to convey the perspective of the project, the quality to be achieved, and the process which will produce the project documents.

Staffers who have pursued a professional education [toward registration] may have some degree of the requisite understanding and respect. Part of their education may entail "practice instruction" which covers the various work phases, of the professional, for each project, and their interrelationships. Still some may need to be reminded of these aspects, and even prompted to fuller values. Remember, some persons may already have found or moved toward their own narrow professional niche which lies elsewhere, removed somewhat, from the technological aspects of the project.

Other staffers, including architectural technicians, may need to be made fully aware of the need for their understanding and respect. Their normal work position, in the professional office, usually is within the technology work [documentation to be precise]. Often their training will be so narrow so as to exclude any instruction, reference or allusion to the proper handling of a project, the work required in each phase, and the movement of the design concept to a finished project. However, this is so vital to the success of the project, that time is well spent in giving the required "training"- if necessary, in the office.

In this there should be no effort toward making design "the everything" of the project. Design will dominate, but it must be supported, enhanced and facilitated by the applied technology- it cannot stand alone! Well-designed projects which are not properly conceived functionally, and/or improperly

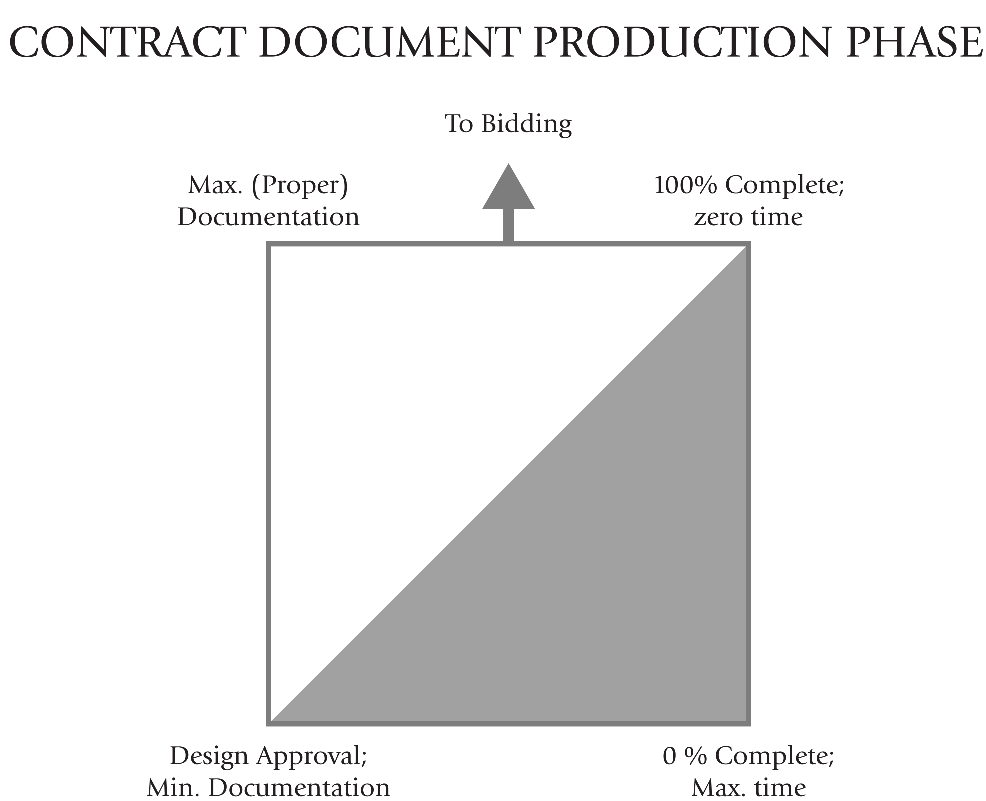


Fig. 11-2
Chart relating time expended to work completed in the documentation of a project

detailed, documented, or constructed will fail in a relatively short period of time; some which come to ill-serve their occupants, some because of failures in their systems, and some by mere deterioration. For example, many of Wright's houses had confounding leaky roofs, difficult to resolve once found; Michael Graves came under severe criticism for his choice of materials on his Portland [OR] building. There is a need for the professional to be extremely prudent in what choices are made, and how these function and interrelate within the total project.

In these and similar situations, it is quite evident that the technology must be present in its best form, but must retain its proper relationship and not overcome, or obviate the features necessary to convey the concept. While not a ticklish process, necessarily, the staff must be together on the issue. Moving then in lock-step toward their common goal- a successful [and profitable] project. It should NOT be perceived, though, that bad design can be "saved" by good technology. Bad technology, though, can ruin the best of designs!

To bring a design concept to reality, there must be a process of selecting the materials to be used for the project. These must be combined into systems, where possible, or distinct details which gather and utilize them to formulate "pieces" of construction. Professional offices and individual architects tend to re-use materials/systems that they have used previously. In many cases, this is acceptable practice. However, in almost every project there are nuances and requirements that necessitate new materials, details, systems, and applications/installations; or new ways of utilizing "old" materials. There should never be any hesitation, on the part of the designer, to seek and investigate new materials.

Most offices will retain some sort of library [formal or otherwise] in which they store product information. This along with the normal array of manufacturer sources, sales/technical representatives, etc., provides a wide range of data which can be accessed. Frequently the specification writer in the organization will be the repository of product availability, and the technical information in connection with their use [Eero Saarinen, however, retained a full-time staffer to do nothing but research materials]. Where needed, however, additional information must be sought out, evaluated, discussed and then, only, incorporated into the design scheme.

Being an integral part of the project's technology, searching for a material may fall to the architectural technician. The Project Architect could, for instance, ask the Technician to find a number of possibilities for analysis and deeper consideration. Of course, the Project Architect, or other architect/staffers could perform this work as well. The main point, though, is that incorporation of new materials and systems is not an off-handed process, done without regard to prudent assessment.

Fundamental to this entire process is a working knowledge of construction materials. This should include some information as to basic raw materials, production, fabrication, processing, testing, availability, costs, and so forth. No one person may have all of this data at hand for every product, but an office organization should use its entire technical staff as a resource. Experiences on other projects or with other firms can prove to be of great value in the material selection process. Obviously, there will be times where some "experimentation" or risk-taking is required. Every effort should be expended to try to find out everything possible about the material under consideration. At least a comfortable level of confidence must be in place before the use is approved. Lenient selection, shoddy incorporation, and lack of professional attention can lead to drastic consequences; claims, disputes, recurring problems, failures, and the like, up to and including litigation. The John Hancock Tower, built in Boston, is an outstanding example of a project gone wrong because of many factors that contributed to the overall concept.

The sequence, in the field at the job site, entails the crew leader ascertaining, from the working drawings, what work is to be performed, and what materials and equipment are required for the work. By this time, most of the materials should be on-site, but the specifications must be checked to ensure that the correct material is placed as required. For example, there may be several types and thicknesses of plywood on site. The crew leader must then determine what type and the specific thickness that is needed in the work the crew is to perform. Where there are two types and two thicknesses required, the drawings should distinguish the type, thickness, size, and shape of the sheets or pieces in their correct locations and relationships. From this example it can be seen that the specifications provide valuable information [regarding the types, sizes, thicknesses, and other features of the plywood], but it is the working drawings which provides the specific direction, size[s] and shape[s] required, to the workers.

As noted elsewhere, the professionals producing the working drawings and specifications must be very careful in what information goes on which document. It is wholly inappropriate to list too much information about a product on the drawings, which does not affect the work or installation, or note how and what is to be accomplished. Likewise, it is improper to try to verbally depict the work or project by a lengthy written dissertation in the specifications. The professionals must learn, early-on that some things are better drawn, while others are best described in words. In general, the specifications will elaborate on the attributes of the material or system [sizes, thickness, finish, type, etc.]. The role of the drawings is to show the specific installation[s] as to exact size [shown to scale], configuration, attachment, relationship to other parts/ pieces and material, etc.

There is a strong and prevailing need for clarity and directness in the drawings, to the point that they are self-evident, or self-explanatory. Techniques and medium may vary, but clarity, directness, and ease of readability are paramount. This is not the place for the design professional to be "cute", divisive, unique, or innovative; nothing should be used or incorporated which disrupts clear communication – nothing that causes pause or question.

Design professionals, in today's construction climate, can ill-afford to create documents that confuse or confound the erectors. There have been several different formats or systems developed for the production of working drawings. Few have really "caught-on", since they served more to undo traditional communication lines and formats, than to enhance or better them. Not only is there a need to separate information into written and graphic forms, but there is a need to understand how the information will be used – by whom, in what environment, and for what reason. This all needs to be considered and thought through, very carefully.

Naturally, there is some crossover, as absolute and strict lines between the information cannot be drawn. However, experience, and exposure to experienced people will bring a good feeling and understanding of how the data can be separated and properly placed. A portion of the role of the drawings is to cross-reference information both between drawings, and between drawings and specifications. Left undone, or inadequately done, this aspect of the working drawings can prove detrimental to good work progress and proper construction.

Oddly enough, the role of the working drawings is to dissect the design concept for the project, and examine, determine and portray every portion of the work required. The designer of the project will create an overall scheme, but will not deal in the details of how the scheme is to be achieved [constructed]. In the main, projects require a "set" of drawings. In a few small projects the complete project work may be confined to one sheet. However, it is not at all unusual for a project to require upwards of fifty [50] sheets just for the architectural work; and projects requiring hundreds of sheets are not out of the ordinary. Beyond these drawings are those for the other disciplines – HVAC [heating, ventilating, air conditioning], plumbing, electrical, fire protection, site/civil engineering, utilities, landscaping, furnishings, etc. The proper documentation of architectural projects involves not only the concept of "set", but also the requisite interrelationships and coordination. Understanding this is crucial to successfully producing project documents that result in successful projects.

There are many things that we call, or use as "sets"- dishes, golf clubs, tires, tennis games, etc. The word itself alludes to a group of closely related, but different items, combined to form an entity, interrelated, and interworking. So it is with architectural working [contract] drawings.

In some "sets", the individual items can be used at random, or for very specific circumstances. The interrelationship with other parts of the set is put aside. However, due to the necessary tight interrelationship of information within architectural projects, things change. From early in the production of the documents, it is absolutely necessary to proceed in a very close, careful, thoughtful, prioritized, meticulous and fully coordinated manner. This may seem like an extraordinary path but there is so much information, necessitating close coordination insuring that no other path works. Axioms that apply to other types of work also apply here – "the specific rules the general"; "proceed at your own risk", etc.

Hence, a set of working drawings is best produced through a series of small incremental steps; "shuffling" if you will. Progress is governed by what information is available to be portrayed on an individual sheet. The lack of information indicates that the sheet cannot now be started, or that the sheet cannot be finished completely, at this time. This situation directly shows the importance of gathering information, and then developing it.

All design and drafting personnel, including junior drafters and students, need to understand the PRIORITY of their work, as well as the "fit" or interrelationship with the work of others. Rarely is work on working drawings done in isolation. Obviously, there are a lot of drawings required in any set of architectural or construction drawings, and a lot of information. However, by setting and understanding the personal priorities based on those set by the Project Architect, one can approach the work of getting all of this work done, in proper sequence, and in good, well-coordinated order.

For example, consider three PRIMARY aspects of a set of project documents; configuration/size, height, and construction. Immediately, these translate into FLOOR PLAN[S] which deals with the shape [configuration] and size in the form of length and width, and the intricacies of the room layout. EXTERIOR ELEVATIONS add the element and relationship of height, and give the third dimension to the project. WALL SECTIONS which cut through the exterior walls [primarily] reveal the construction of the project, or just "how" the building/project is to be built, interrelated, and so forth.

Without all three of these aspects of the project, the documents are INCOMPLETE, INADEQUATE, and UNACCEPTABLE/USELESS!! There is no sense issuing such documents to contractors, for bidding or construction, when they do not contain all of the information that is required. If that information is not available, the contractor[s] will either be forced to ask numerous questions [which is confusing and time consuming], or will attempt to fill-in the data, on their own. That usually will prove to be a detriment to the project, since the contractor[s] do not know the thinking, reasoning, and rationale behind the design and documentation of the project.

Further, these three categories of drawings form the base of information for the other drawings in the set, and contribute heavily to the success of those other drawings. Everything after these basic drawings enhance, expands, or adds to these drawings; they clarify, amplify, detail, dissect, reveal, coordinate, enlarge, or complete the basic drawings. They are like the smaller pieces in a jig-saw puzzle – they are needed to complete the entire "picture', even though they are smaller [in size/scope], and perhaps in the amount of information they project [a single colored, border piece of a puzzle, for example].

Also, it needs to be said, that these priorities SHOULD NOT be avoided or ignored in favor of other, less important drawings, simply because the others can be more easily, or more rapidly produced on CAD systems; neither should they be produced just for the sake of using the computer. A set of several tens of drawings may appear impressive. It may indicate a "tremendous work effort". However, they can prove to be quite improper, inadequate, or even useless where they do not provide the required information; one cannot install a "beautifully" depicted elevator shaft in a "building" which has no walls [none shown on the drawings]!!

The mere fact that one "likes", is intrigued by, or is drawn to particular materials, systems, or areas of the project, is irrelevant to this process. Projects are NOT produced to meet the

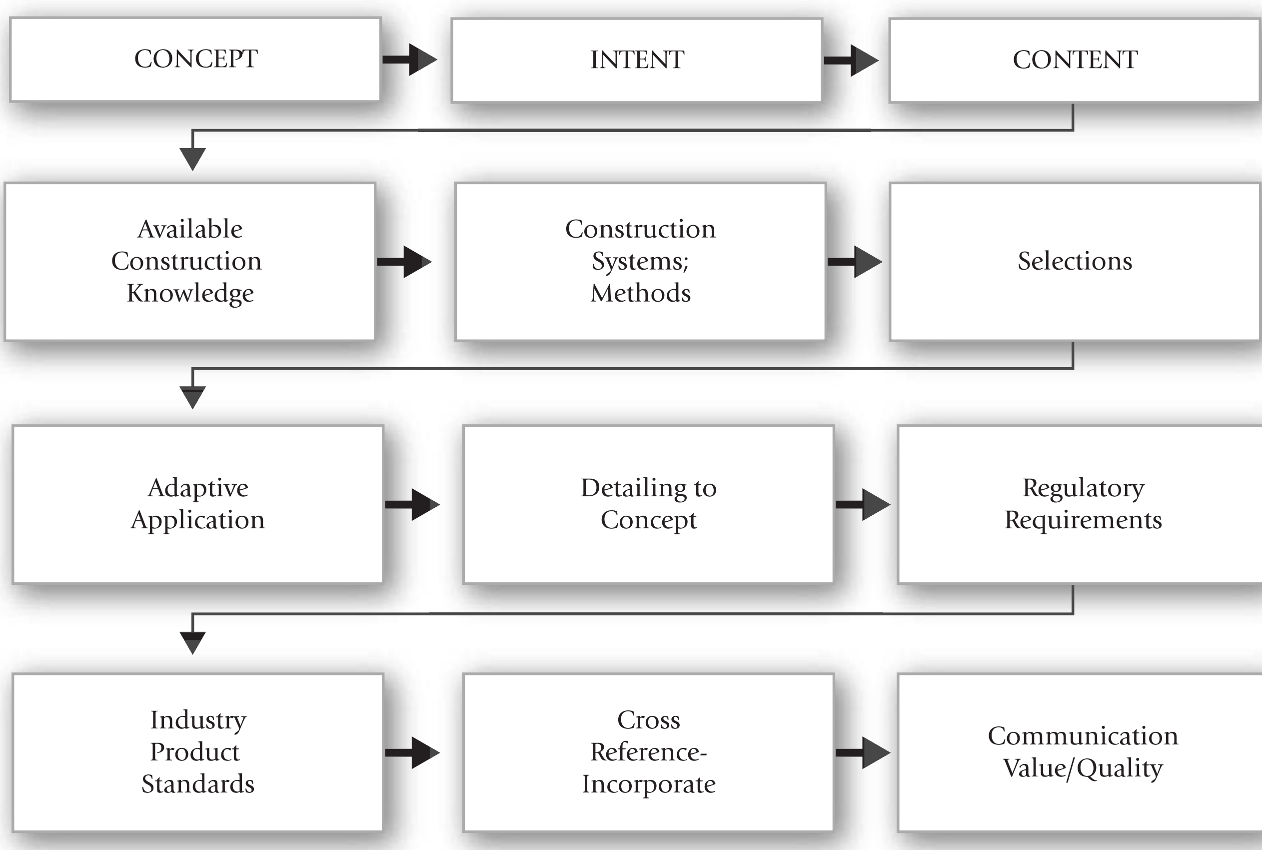


Fig. 11-3
Chart showing progression of drawing and document development indicating tasks, skills and work required between acceptance of the design concept and communication of that concept [converted to construction language and graphics] to the contractors in the field – providing working drawings [and specifications]

whims of staff, but rather to carefully delineate the work required BY THE PROGRAM to produce the CLIENT'S project! Obviously, the major systems of the project will initially dominate the work; general schemes and concepts will be brought forward to transform client programming into working documents. Details will dominate the work in the finishing phases, as truly "the specific" rules. General ideas, concepts, and terms, etc., MUST be converted to usable construction information, in a very specific manner. This directly follows the premise, but does so in a developmental setting, in sequence, and with priorities set, followed, and met.

Of course, it is possible to find minute detail of fairly obscure portions of the project immediately, but this DOES NOT mean that they are then IMMEDIATELY incorporated into the project documents. Too many things change, too often, in the course of production to install firm, final determinations, information, or details right-off or early in the process. Proper priorities must be given each piece of data. To do less than this is too often require that "finished work" be abandon, deleted, worked over, or radically revised to meet new project requirements- this is professional disaster!

It is neither prudent nor wise to allow obscure, minor, "cosmetic" or utilitarian details drive the project. The process is to DEVELOP [as in evolve] the general schemes INTO the detailed explanations; not vice versa. Every project has a basic and fundamental set of pieces and systems that are vital to a successful, proper functioning, and safe project/structure. To these an endless variety of cosmetic finishes, and utilitarian items are added. So to make decisions early-on about remote or superficial aspects of the finished building[s] and have them drive or force decisions about structural, mechanical, and other general matters, including aesthetics and conceptual considerations are fundamentally WRONG! and quite counterproductive.

No item of clothing is designed around a button selected first-off; no automobile is designed about a selected spark plug, or new oil! Details and finishes should be conceived, and considered as enhancements and explanations of the design concept, and its overall scheme and systems; the "execution" of the concept! Finishing touches mean just that; relatively minor additions/revisions and fine-tuning of the project's major considerations.

The production of a set of working drawings can be most intimidating. At some point, one realizes the terrifying reality that several, if not all of the drawings are "in progress"- NONE [!!] finished, and all requiring massive amounts of additional work. To this, in the office, one must add the inevitable time limit at which point the project MUST be finished [??] and biddable!

Yet, in spite of all this, the movement toward completion is done in the same shuffling fashion; moving ahead as information is received, modified, and developed specifically for the project. It is good to perceive this process as an inverted pyramid. [See chart below]. In this mode, the work of documentation starts literally at a point- that being approval of the design concept [scheme] and completion of the Design Development phase of work. Progress is made from the initial point AS INFORMATION BECOMES AVAILABLE; each layer adding to the BREADTH of the project.

While completion of information gathering and incorporation can be seen as a "wide field", the time and percent of "incompleteness" becomes narrower and narrower until they reach a POINT, also – that point being "out-the-door-for-bidding" [Let's get paid!]

In all of this, the documentation has moved from the conceptual to the very general, to a controlled general, to the specific. This is in direct proportion to the importance of the information, or the construction detail/system to the project. Of course, the complete package or "SET" of drawings is the final product being pursued. Its completeness, appropriateness, and its accuracy are derived directly from the process that produced the set of documents; i.e., "the end not only justifies the means – THE END REFLECTS THE MEANS!!"

The end will be adversely affected by OVER-DETAILING. This means, simply, that showing too much is as great an error as showing too little. In addition, sacrificing initial research, study, review, design, and modification of systems, in favor of detailing small, mundane, or relatively unimportant pieces of the project, will usually result in faulty documentation. Emphasis will occur in the wrong places; other, more crucial items will be inadequately covered, or worst, not covered at all. Specific information will be in place, but will have no frame of reference, i.e., will not be tied back into a greater or more general scheme. The information, then, is useless! Where these items are requirements, systems, or concepts of some significance, the project will suffer in numerous ways- cost elevation, safety compromise, disputes, complaints, claims, dissatisfied client[s], and the degrading of the professional[s]' reputation.

While detail is important, and necessary to the project OVERALL [as it defines and refines the project's features], it is NOT the driving force. It must be applied to the other MAJOR aspects of the project, IN PROPER SEQUENCE, and in PROPORTION TO THE SUPPORT IT LENDS THE PROJECT.

One of the more important aspects of working drawing production that has been lost in most offices because of time and money constraints is the objective review of the drawings.

This usually would occur at or near the end of the production process, immediately before the drawings were issued for bidding and construction use. This process involved a most objective, comprehensive review of all the drawings by a highly experienced person [most likely am Associate, or Project Lead] in the office, who was not part of the production team or development of the project.

Here the view through "new eyes" unfamiliar with the project come to expose the many gaps, glitches, and or miscellaneous errors that are inherent to drawings [drawings need not be "perfect" unless required to be by contract – court rulings]. The review – often called "red-lining" in tribute to the use of a red pen/pencil to note the problem situations – would take often times, 2 weeks of intensive reading of the documents and the many interrelationships and coordination requirements. It would expose errant detailing, misspelling, bad construction, and most any type of error or wrongdoing. The goal was to get the drawings completed – on time – but also in a correct manner that reduces questions and mistakes in all subsequent work including the actual construction.

A PERSPECTIVE ON WORKING DRAWINGS

> *"A new consumer protection group is being led to find ways to reduce fire-related deaths. The first action of the new group will be the formulation handbook for the filing of lawsuits, against design professionals, for fire-related death".*

- Newspaper report, 1987

News items such as this greatly elevated [or should have] the awareness and concern of every design professional; they have not done so over the last 10 to 15 years. In addition, a series of disasters again have served to show the fragility and vulnerability of the various design and construction professions; none has gone unscathed. In some cases, professionals saw careers completely destroyed because of the way in which they chose to practice. Moreover, is in the liability insurance industry added to the malaise and struck fear in the professions. Premiums rose, inordinately, yet fees coming to professionals remained unchanged, or in of buying power, actually declined.

Clearly, professionals were under siege on many fronts and were literally forced, in the main, to seek new configurations in which to carry on their affairs and practices. However, even then, due to the strong mitigative trend, professionals were, and still are, finding themselves involved in more and more court cases, often on most tenuous grounds. One study forecasted, on the average, a suit every 3 years against a design professional. This alarming reality of practice must and can be dealt with in every phase of the work.

It seems, then, more than appropriate, to set out this new perspective. Even within the relatively short span time conditions have changed dramatically. Overall, professional practice is far different now than in the late 1970's – and this includes production of working drawings.

In the construction industry, there is a propensity to be myopic – to be almost mindless beyond one's current purview. Obviously, there is much beyond a design concept before it can become a "perfect," prize-winning project. The award plaque on the wall and the new copy in the company brochure are most prestigious, but the "wearing" of the project is also a worthwhile consideration, and perhaps a truer measure of the success of the building. Thus, the mere welding of two structural members, the installation of glass, the use of proper fire ratings for finish materials or assemblies, and such other intricate details should not be perceived, executed, or dismissed lightly.

The architect's purview, on every project, must be to realize that only faithful execution of the design concept, both in documentation and in the actual working, will result in the project's being satisfactory to the client and a contender for awards.

Every principal, associate, project architect, or job captain in charge of production must be constantly vigilant to ensure that the contract documents are not perceived or produced in an offhand, mindless, disjointed, or seemingly disparate fashion, without direct relevance to the project. Staff education, involvement, and motivation are necessary.

Should any of those negative characteristics be carried over into practice, they will eventually have a devastating effect. Therefore, the professional's staff should be made aware of and instructed about their status as "agents" of the professional. The legal concept of agency is crucial in that the professional is being contractually bound by virtue of the actions of others. Few professionals observe, monitor, oversee, perform, or review every line and sentence that staffers include in the contract documents. However, the work of the staffers becomes direct contract obligations of the professional [and others].

Any failure, error, misrepresentation, illegality, or other malady in the documents becomes a potential problem for the professional. Some of these may be caught early and problems avoided. Some may be minor and easily remedied; others could become major impositions or threats. A few could be so serious as to result in litigation.

Confidence and trust in staff and loyalty to employer become hallmarks and key issues of successful practice. Both deserve full airing in the office and complete understanding by all. Even good-intentioned or unwitting gaffs can become problems. Assumptions are deadly. Questions by staff should be openly encouraged, with unqualified assurance of no stigma, and fully resolved. Indeed, it is essential to make every effort to create an open, communicative, harmonious, strongly directional production atmosphere.

Architectural practice, it must be remembered, is carried on within a vast and complex legal framework; from personal registration, to code compliance, to business affairs, the law requires distinct paths and hallmarks of legality and compliance. There is an impressive litany of case law that deals with professional practice, and much of it with architectural practice. Court cases are not new, although the incidence of cases has increased. In most of the cases reviewed for this effort, a common thread is found as the basis for suit. Wherever some uncommon, rather irrational, non-prudent, or "cloudy" procedure is used, suit will follow. The cases are rather telling in that straightforward, clearly defined, and well-executed contracts and projects will usually give little cause for litigation. Apparently, most practitioners recognize this fact and attempt, even through exaggerated means, to provide the correct scenario for the project. The professional should neither attempt to perform "above and beyond" [the contract] nor allow the owner to extract services or documents for which no provision[s] has been made. This is not to shirk the duty of the contract, but rather to perform in full accord with an appropriately drawn contract, fair to all, and apropos to the project. In reality, this is part of the "quality" built into each project.

The "Who cares?" attitude has led directly to massive expenditures for insurance and litigation. The professional seeking protection is caught in a vicious circle. To remain competitive, the fees charged must be low. To maintain low fees, there is a great tendency to shortcut work, including document production. Something has to give. Realizing this, the professional sees the need to protect the practice by purchasing "errors and omissions" [malpractice] insurance. This coverage, however, has become inordinately expensive, with some premiums being increased as much as 1,000 % in just one year's time. This is due to excessive awards in some court cases and to the high frequency of claims and suits.

Yet almost every owner will seek to reduce professional fees to a minimum while retaining the requirement for a "perfect" [and profitable] project. The owner must realize that impossibly low fees will result, more frequently, in suspect projects. It is easier [all too easy] though, to squeeze fees and litigate any [and all] shortcomings. Not realizing or understanding that excellence in the production of working drawings lies in complete and coordinated documents, an owner may think that professional fees can [and should] be reduced. Too often the owner sees the professional as a "necessary evil." This misdirected and myopic view neglects the fact that the professional is the owner's agent, acts for and it half of the client/owner, and is the entity who translates the owner's project concepts into the hard reality called construction information. Obviously, the owner, in reducing the professional fee is acting counter to his or her own best interest.

With reduced fees, time and money are not to the professional for producing fully comprehensive documents, complete and coordinated in every way. Contractors [as seen in Chapter 4] finding less than adequate documents, have no choice but to seek changes or directions from the owner [with whom they have a contract] who usually will rely on the professional for that "gap-filling" information. If the professional has arranged protective cover by noting the inadequate time and money to produce correct documents, the cost is billed to the owner over and above the contractual price.

Therefore, in exercising their option in the areas of cost and scope [see the discussion in Chapter 14], owners always need to be reminded that quality, in both their project and the documentation required to produce it, is a factor whether in the initial professional fee or later in unforeseen added costs. The issue of fee versus quality of documentation is one that they should address when discussing the fee initially and throughout the project as other land changes occur. It is far better to address matters than to allow slippage in quality and client confidence/ relationships, which can cause to the professional that may take years, if not decades, to repair.

The situation, in part, is not without help in the industry. In early 1989 the provincial government of British Columbia [Canada] investigated the requirement that, by statute, 6 % of a total project cost must be allocated to structural design. This occurred when a roof on a major business building collapsed and it was found that only 2 % of the cost had been used for the structural design fee. While well intentioned to enhance public safety, this solution falls short of the best answer. Rather, only after there has been a satisfactory determination as to the qualifications and abilities of the professional should a fee be set; preferably a negotiated fee that assures the professional adequate time for exploration, design, production, checking, and a decent profit level, all in full accord with the requirements of the project.

Several other recent disasters have been caused by the failure of systems or combinations of materials that were mishandled or mis-designed. Given that some were due to faulty contractual arrangements, it is questionable whether more time would have prevented the problems. To some degree then, professionals have contributed directly to their own increased liability exposure by ignoring their legal responsibilities or by "adjusting" their methods of practice in regard to transferring responsibility and establishing accountability. Professionals must be ready to accept their multiple responsibilities. It is when one begins to "unload," or transfer one's responsibility to others, that crises occur. Clearly, it is important to understand what responsibility is transferred and what is retained. Often, it is impossible to completely divest oneself of responsibility without adjustments in the contract. These situations are taken up in the Manual of Professional Practice: Quality in the Constructed Project, published by the American Society of Civil Engineers [ASCE]. Although not all professional groups endorsed the whole of this book, it is, at a minimum, a good checklist for design professionals, be their projects large or small. Responsibility does not vary in direct proportion to the size of a project; it is foolhardy to think otherwise.

Lawsuits are filed over a broad range of issues, not least among them contract documents [including working drawings]. Issues such as cost overruns, payment for extra work that is not properly documented, field instructions left unverified, delays resulting from slow approval, refusals to approve or issue change orders, and unclear plans and specifications are commonplace.

Although most lawsuits involve contractual and procedural matters, technical issues are involved in the vast majority of disputes and claims. Fortunately, not all claims result in suits, but, like disputes, they still require excessive amounts of time, money, and effort to resolve. However, some technical issues are litigated. Very little litigation is rooted in the design or design development phases of work. Rather, most technical suits [which begin as disputes and claims] are rooted in the contract documents and matters contained in the working drawings. In the main, these issues are money oriented, with lawsuits almost certain in cases that result in casualty: injury or death to a project worker or another person. So things in the office that appear to be mundane, routine, or inconsequential, really can impact a project [and a professional practice] quite adversely.

In a year's time, approximately 40 % of insured design professional firms are encumbered in law suits. Although the majority of the suits prove to be relatively groundless, it is still costly to the professionals to simply answer, and address the action, and defend themselves. Where situations can be resolved through issuance of a change, there is still a cost [perhaps in hundreds of dollars] to the firm for the processing of the order. Similarly, where major lapses, omissions, conflicts, or contradictions occur, the design firm's cost of resolution can rise, very quickly, to several thousand, or tens of thousands, of dollars. And even with professional liability insurance, the deductibles are extremely high, merely to reduce the overwhelming premium costs.

This underscores the need for well conceived and executed drawings and faithful construction – and in reality, full contract administration; moreover, as-built drawings are very valuable in establishing this scenario. Thus, if there are changes made subsequent to the completion of the final construction, and these lead to an incident or disaster, the responsibility falls to someone other than the design professional. Of course, where failures can be traced to the contract documents, there will be direct and quick reflection on the professional.

Thus, working drawings and the drafting staff are directly involved in risk management – i.e., the avoidance of problems, disputes, and litigation. *Every drafter – indeed, every staff member – should be fully aware of this on a continual basis, not as intimidation but as a factual aspect of his or her work.*

Literally every line drawn has an impact on the project; nothing is frivolous. All too often some drafting personnel are left without definitive direction or perspective of how, and to what extent their "grunt" work contributes to a project. This can lead to "mindlessness" in the very sequence where decisions for the project are made, and documented. Any part of this process can be the flaw that will unravel the project in the future. Oddly enough, though, it is this production phase of the work that is often compromised, financially, to reduce the disproportionate amount of the fee that must be allocated to it.

And there is an added threat when the work engages the tremendous new technology, both in new construction materials and methods, and tools such as computer-aided drafting [CAD], used in document production. Some recent reports show that computers in the hands of principals tend to move decisions from the documentation phase forward to earlier work phases. By "locking in" features very early in the process, later phases will be somewhat inhibited by the lack of flexibility. This could produce adverse results, in the long run, for the project. Although this may be a good device for acquiring more of the fee earlier, it may not be best for overall quality in the project. Simply, the practice must be fully attuned to its liability exposure in every phase of the work, or its chances for intrusive problems are greatly enhanced.

All of these indications show that the professional is more than well advised to practice in a straightforward and extremely careful manner. However, this all falls short of requiring a "perfect" performance by the professional. In the legal case of *Seiler v. Ostarly, 525 SO.W 1207* [La.App. 1988], the court held that the architect need not, and does not guarantee a "perfect" plan, nor even a satisfactory result, where the owner/architect contract does not state or require the same. From this we can conclude that if the professional acts with care and reason, and adheres to a prevailing standard of care, fewer problems will be encountered.

Usually professional efforts are measured, by a court, against a standard, called varyingly, Standard of Care, Standard of Practice, or Standard of Professional Practice. This standard varies from locale to locale, but reflects the level and direction of "normal," prudent practice among like professionals under the same or similar circumstances [as those at issue]. Although the standard is unwritten, professionals within a given region create the standard by the very approaches, methods, and procedures they employ as routine/normal/standard in their work. Every architect practices within the parameters of such a standard of "reasonable care" [also known as "practice standard"]. Basically, the standard evaluates how each of a given group of prudent professionals would act, given similar or the same circumstances.

It is difficult to precisely define this standard, but a process of thought may help to do so. By asking the following questions, the professional [or staffer] can run a self-analysis of his or her performance/action against the standard;

- Is this the right thing to do?
- Is it the best for the circumstances, as I know them?
- Is my reasoning explainable to others?
- Can I defend this decision/position?
- Have I apportioned the risk properly?
- Have I taken, unnecessarily, too much risk for myself?
- Am I genuinely comfortable with this decision?
- Will the outcome be favorable?

Every professional – budding, new, and old – must embrace, accept and mentally engrain this process, early on [in college, actually] so it becomes automatic, second nature, continuous, and although not pervasive, it becomes a strong guide in every aspect of the work.

To illustrate the risk of working outside the standard, one has only to look to two court cases. In *Huang v. Garner*, 157 Cal. App. 3D 404 [1984], and its quote from *Burran v. Dambold*, 422 F. 2D 133 [10th Cir. 1970], the professional is found guilty of "negligence per se," where the building was not designed in compliance with the building code. Further, this professional breech was so compelling that no evidence was required in regard to the standard of care. Simply, designs by professionals must be in compliance with the prevailing building code, period – no further evidence or debate required.

This very scenario is addressed by several states, which require design professionals to make several "visits" to the construction site to ensure that the work is proceeding in accord with the approved drawings and, hence, with the prevailing code [s]. At least one other state requires via a "seal law" [where building designs by registered professionals are mandatory] that the professionals engage in ongoing code education, file standardized permit application forms [with code analysis], file statements of design responsibility, and, in addition, perform the verification "visits" required by the other states. Although some may see this as a nuisance to the practice, it directly involves the design professionals with the code professionals in a cooperative effort to "protect public health, safety, and welfare" – the statutory charge to both professions.

Although construction has become more complex, and so necessarily the documents to produce it, fundamentally the basis of the drawings remains much the same. Without a good working knowledge of these fundamentals one can never hope to produce the very intricate details, complex drawings, and complete documentation so very necessary to a successful project. It is obvious that our buildings are no longer festooned with custom-designed, artisan-made, individualized ornament and other such distinctive features produced only through pain-staking drawing of full-sized details. Much of today's work can be, and is, ordered by model number; but transpose two digits in that number and see the havoc!

This is not to suggest that modern-day working drawings require less effort. In fact, they require more, mainly because of the overall complexity of projects, the construction and the hectic atmosphere in which we must practice. Yet with the current necessity for speed comes a commensurate, if not elevated, increase in the risk of error, simply because speed requires faster processes, allowing less and less time for finite design and careful thought; and precious little time for coordination and objective checking of the documents.

Contending with the requisite speed can entice a professional into divesting him- or herself of as much responsibility [and work] as possible, mainly by delegating more aspects of the project to other professionals or to third parties. This practice carries high risk. Hence, it has been very easy for professionals to move to extensive use of exculpatory clauses in their contract documents. These clauses are basically "disclaimers," which are set forth to disavow, repudiate, or deny responsibility, guilt, blame, or even connection with certain conditions or situations. Here, in lieu of complete and in-depth staff review, the professional seeks to lay responsibility on others and attempts to invoke other codes, standards, regulations, and the like, hoping that where any of these are violated the exculpatory clause will be applicable and protective [to the professional]. Often these clauses are too broad and intangible in trying to mitigate errors or omissions in the contract documents. They will almost always fail where they are unduly vague, uncertain, or risky. Contractors are not to be made to "exercise clairvoyance" in noting and resolving ambiguities in the documents [*Blount v. United States* 346 F 2D 962]. Yet even the 1997 edition of AIA Document A-201, "General Conditions of the Construction Contract", approaches this very scenario [see Articles 3.2.1, and 3.2.2].

"One-Liners": Thoughts, Theories, and Concepts

[Worthy of review, pondering, discussion, and understanding]

- Simple buildings require only simple documents [not always so].
- CAD or hand-drawn drawings that look good are correct and well coordinated; sloppy drawings, produced either way cannot be complete and well coordinated [both statements are wrong].
- If every item and decision is thought out correctly, no errors will result [except that time and complexity do not allow such thought all the time, - and who decides what is "correct"?].
- Errors and conflicts are unavoidable, but they can be minimized [true].
- Errors, even though undesirable, are not really important, because they will all be worked out in the field [bad concept; not good practice; if attempted, the professional loses control of the project].
- Drawings are really necessary only for getting a building permit [that is but one purpose; another, among many, is giving a firm and exact description of what the owner wants built].
- Errors on drawings are irrelevant inasmuch as the owner and the contractors will change everything anyway [and will all more than likely be dissatisfied, engaged in disputes, regulation violations, claims, and possibly litigation].
- Preplanning the documentation, using checklists throughout the process, using meaningful checks and back-checks, and coordinating between documents are continuous hard work, but usually produce better projects [true].
- The size of the documents [number of sheets] and amount of detail on the drawings are direct indications of the project cost; i.e., the bigger and more detailed, the greater the cost [not so!].
- Diligence, striving for excellence, and doing the right thing are major virtues of professionalism [absolutely].
- Makes no difference who makes the errors; it is the effort to find and correct them that is of utmost importance [true].
- Architects tend to have a more global or overall view and concept of a project; many consultants become totally engaged in their narrow realms of work, without thinking of others [unfortunately, true].
- The degree of project success is elevated, directly, by the number of errors found and resolved [true].
- There are errors of omission [forgetting/not doing things] and errors of miscoordination [things done, but isolated from one another and not properly interrelated].
- For architects committed to excellence, checking for and finding errors are an emotional, not an intellectual, experience [true].
- The best reviewer for the final check before issuing the documents is an experienced and knowledgeable [about construction] professional who has not been related to the project [new, fresh eyes find things more quickly and more reliably].
- Working drawings [and specifications] will never be perfect [but as in a game of horseshoes, the closer the better].

Contractors will usually assume that if their work is performed in accord with the plans and specifications, it will meet not only their contractual obligations, but also all codes, standards, and other regulatory requirements. No broadly worded clause will change this reaction. Although, the design professional's concern is somewhat understandable, broadly based documents and exculpatory clauses are not the best methods for resolving ambiguities besetting the contractor. Courts usually will find against the drafters of the documents, and for the contractor[s] where the contract or documents create conflicts or ambiguities [*Mac Knight Flintic Stone Co. v. The Mayor*,l60 N.Y. 72; Green v. City of New York, 283 App. Div. 485].

The concept and use of exculpatory clauses have a direct impact on working drawings. It has been shown that the professional need not produce a "perfect: plan but at the same time must produce a proper and adequate plan that will allow construction of the project. If errors are rampant in those plans, the cost of the project may escalate, putting the professional in danger of suit by the owner. Yet it is shown that total reliance on the clauses may very well not provide the protection sought by the professional. The best direction then has to lie in producing the "best" documents possible, using a standard of care as the measure throughout, and incorporating the exculpatory clauses in a very judicious manner.

In addition, one must be aware that the courts have ruled that the professional cannot shift the basic responsibility for the proper preparation of the plans [contract documents] to the owner, a building inspector, or any other person to whom the professional has delegated all or a portion of the preparation [see, respectively, cases of *Simpson Bros. Corp. v. Merrimac Chemical Co.*, 248 Mass. 346, 142 N.E. 922; *Johnson u Salem Title Co.*,246, 425 p.2D 519 [1967] – *Johnson v. Salem Title* at 409, 425 P. 2D at 519. Neither can the professional evade the basic responsibility even where the contractor fails to check the plans, or discover the defects in them [(*Chiavernin u Vail*, 61 R.I. 117, 200A.) 462 (1938); *Covil v. Robert & Co.*, 112 Ga. App. 163, 144S.E. 2D450 (1965)].

Nevertheless, several courts have taken a very enlightened view of the design professional. Those courts have noted that professionals are different from contractors by virtue of "... education, training, experience, licensing, and professional stature," to such a degree that "... limitation on their tort liability would not reduce the care with which they performed their tasks ..." [*Zapata v. Burns*, 542 A. 2D 700 [Sup. Ct. Conn. 1988]. In essence, the court is saying that the professional will act as a professional, and can be held under a shorter term of legal limitations.

Working drawings have been part of professionals' responsibilities, in some form, even from the most ancient of times. There has always been a need for communication on every construction project, in every era, no matter how primitive. From scratchings in the sand made with a stick, to the chalk drawings on the trestle boards of the Master Builders [architects] for King Solomon's temple, to the Greeks in the Golden Age, to Rome in its grandeur and demise, there were at least "temporary" instructions, drawings, or other visual communications. Consider, further, the cutting plans used long-term through the centuries required to build magnificent Gothic cathedrals. The forms and terms may have changed, but never the intent: clear, concise, complete, decisive, proper, *professional* instructions/ communications.

Where time and speed [i.e., economic issues] begin to impinge on any of these attributes, the professionals and their staff members had better include yet another consideration – *care*.

Thus, the documents become:

> Clear: at the cost of almost anything [show and tell what you mean, and mean what you show and tell],
>
> Concise: brief, but not to the point of ambiguity, evasiveness, or "gaposis" [provide all that needs to be there – nothing more],
>
> Complete: a most worthy goal, but subject to normal human foibles [each item within itself, and in relation to other things]; and
>
> Care: sensitivity to what is needed; a stride toward a "job well done" [realization that the final project is worth a dedicated, directed extra effort, early on, and throughout]; a personal feeling of involvement, and pride in what is being done and what will result.

Therefore, neither principal nor junior drafter should perceive working drawings [or specifications] to be "busy" or "throw-away," time-filling work, relegated to the most junior staff. They are not relegated, but rather should be delegated to staff who are the best available for that work. Only with a careful studied, enlightened, monitored, and fully coordinated staff effort, well motivated, will the risk of problems of all kinds be reduced and responsibilities met.

GENERAL OVERVIEW OF WORKING DRAWINGS

The work of the architect is not confined to the design of the project – as noted in the expert quotations in Chapter 2.

While it important that the architect properly program the project [to ascertain the necessities and parameters] to develop an appropriate design concept, it is equally important that all of the relevant information regarding the subsequently approved concept be conveyed to the constructors in the field. Between the activities of designing the project, and communicating complete and pertinent information, lies a vast amount and sequence of work, all of which is part of the architect's charge. This entails the conversion and documentation of the design concept into usable construction information. Here materials and systems must be selected, construction details developed to show exactly how various portions of the project are to be built, and specifications and drawings executed to convey the necessary information into a form which is readily usable in the field. Working drawings are a part of this entire work and communications sequence – but a very important part.

Computer-aided drafting [CAD] has revolutionized the production of architectural working drawings. While late in coming to this area of professional work, CAD has now evolved into the standard in most offices, for at least most, if not all functions in the production of working drawings. In its early stages, CAD was perceived, by architects, as a design tool that provided the electronic depiction of a concept – a new project that was not yet reality. Quickly, through electronic manipulations, the project could be changed; expanded, rotated, reoriented, etc.. Eventually, with the continual development of new software, one could literally walk through a project – electronically, that is – while the structure [in concept form] unfolded, and changed around you as you progress along a path. This was a tremendous process for the designers, who no longer had to produce a series of study perspective sketches to present new or differing views of a project. Of course, this electronic process was readily embraced, by the profession, in this context.

Working drawing production, though, was slower to evolve. As late as the early 1980s, there was still college level instruction in hard-line [manual] drafting. This was still the predominate method for producing the drawings used for the actual construction work. There were, only naturally, many professionals who took hold of the CAD concept, early-on, and through their fascination and growing expertise in computers, incorporated it into their entire professional operation – working drawings and all. This was the ″cutting edge″. Similarly, since word processing was one of the first, and most impressive computer functions, architectural specification writing also was a very early use of the computer, and it marvelous, rapid manipulative powers. In other fields closely related to architecture, any requirement for calculation [such as structural analysis] was almost immediately computerized. This was done mainly because of the set routine or method for such calculation – it was an unchanging methodology, which varied its results with varied input to it. Architectural working drawings were not of that demeanor.

Overall, beyond the architectural profession, computerization was exploding in many directions, and coming by new software functions almost daily. What had been novel and intriguing in the 1970s, now was commonplace, readily available, and continually changing adding new features and functions; much of this very specific to products, processes, and operations. This, of course, found a strong and instantaneous reaction in the educational system. It was quite obvious that computers were, indeed, "the wave of the future". Schools of all types immediately began to buy the equipment, and convert their curricula to offer more computer operations; this included drawing with the computer – i.e. CAD.

Since drawing is not confined just to the architectural profession, the schools sought to meet the demand for CAD operators, no matter what type of drawing they were to produce – tool design, machine design, civil engineering, structural engineering, mechanical engineering, or many others including architectural. CAD training, particularly at the secondary, and vocational educational levels became a hot bed for this generic CAD instruction. It was felt that if you could operate the computer, you could learn and be productive utilizing any of the still expanding array of software, and the mind-boggling myriad of new functions and capabilities.

In some technical and community college curricula [leading to 2-year, associate degrees] the CAD instruction was structured in a manner that a new discipline was addressed in each term or semester. This instruction had to be skimpy and minimal if it addressed anything more than the particular functions required in that new discipline. In essence, CAD was being taught in the same context as typing, i.e., once you learned the operation of the machine, you could adjust and work in any work environment. But things were not, and still are not that simple!

Educational institutions that teach CAD as an entity unto itself leave the student without a framework in which to utilize that system. For example, one can manipulate the machine and software very well, but without a meaningful and in-depth knowledge of architecture and construction, the application of the manipulations can be marginal to useless. Often secondary, vocational schools, and technical/ community colleges provide this type of CAD training. It matches the level of instruction assigned to, or established in such institutions. Collegiate level professional programs which include CAD instruction, in the main, provide the fundamental background of construction methods and materials, their architectural application, etc., which then can be applied, developed and displayed utilizing CAD. This major change in emphasis and context is the primary difference in any discussion of the use and/or success of a CAD program.

A good deal of post-secondary academic training tends to direct CAD efforts toward enhancement of the design process, and not toward the development and processing of construction drawings. Some major schools of architecture even refuse to incorporate CAD instruction in their curricula. Even then, the students use the program in their work. But overall things have been changing in some ways. One issue, though, needs to be specifically addressed in the use of the CAD process; that is refinement. With so many software programs, options, "bells and whistles", and the tremendous capabilities of any CAD system, it is a real shame that top quality documents are NOT always produced. This is not a shortcoming of the CAD machinery, but rather of the users; the operators.

There is a tremendous level of fascination in "computerdom". It revolves around what the latest software can do; how much faster; how much better, etc. However, in the production of architectural working drawings, this enthusiasm must be tempered, if not tethered, to the end product, it content, format, clarity, etc. Operators and users are developing more slowly than the software capabilities. While these folks has changed somewhat, they still are charged to meet and serve the needs of very traditional trades workers.

The ultimate goal of CAD in an architectural office lies beyond the mere operation of a computer. It lies in crafting a skill that allows one to facilitate that skill through use of a computer, AND achieving the goal – accurate, legible, well-executed, helpful, communicative working drawings. It may be well, for just a moment, to look at a more generalized, but studious and considered opinions/philosophy of computerization and CAD. This surely will put a different perspective on the discussion, and may help to bring focus and greater understanding to our task.

Malcolm McCullough, Associate Professor of Architecture at the Harvard Graduate School of Design, has written a book titled, ABSTRACTING CRAFT. This is a study not precisely of CAD, etc., but rather of skill and craft within a computerized setting. He speaks to the application of mental capacity with technical skills. For example, McCullough notes the following random thoughts;

"… view computer-mediated design like … traditional crafts like pottery making or weaving."

"Our use of computers ought not to be so much for automating tasks as for abstracting craft."

"…view a skilled CAD user as much more than a technically sophisticated mouseclicker."

"… now looks to the day when praise will go to those who control computers much like the architects of latter day 'who could make a pencil sing' …!"

McCullough goes to some length to tie craft with artisanship, artistry, industry and skill. He also notes specifically that,

"Ultimately the use of the computer is the combining of the skillful hand with the reasoning mind."

To relate directly to CAD, isn't this indeed what our mind set should be? To manipulate without direction or regard for the final product is a hollow, non-productive waste of time, in regard to working drawings.

Further, McCullough looks at the word "craft" as it is now used as a verb. We now craft memos, for example, meaning that we adjust, fine-tune, and hone the final product. To develop a skill into a craft, there is a need to couple physical activity with mental astuteness. Mindless machines can be highly productive by merely turning out the same object time and time again. But this generally is not an aspect of architecture and construction. Granted there are proto-type buildings, and standardized materials and systems, but in most every case there is a need to re-combine these in different ways to produce yet another project; i.e., every project is different, even if we start with the same resources.

Can we not agree that the skillful use of CAD is a wonderful attribute, in and of itself? The real essence of CAD, though, is allowing the crafting of the display of information in an appropriate form. To manipulate the commuter programming to find the best route or format for the display at hand, is purely and solely an exercise of the developed computer skill. But it is when one is able to then add correct and pertinent architectural and construction information and knowledge, that one utilizes the entire array of CAD-driven abilities. [illustration- CAD redefined] Remember it is the person [operator, user, technician, architect, engineer, drafter, designer, etc.] who is the repository of the knowledge, know-how, and ability to craft information; the computer contains only that knowledge given it previously, and cannot evaluate, or retrieve it on its own, or develop any new version or revision.

Comprehensive Applied Definitively: Another way of defining CAD and showing the intent of the method.

This all may seem to be another version of "CAD is just another drafting tool"! This, though, is a true, middle-of-the-road comment, and certainly not derogatory. Without such ''tools'' much of the information and knowledge [not to speak of creative works, including architecture] may find an extremely difficult route to expression. For example, the quill pen in Jefferson's hand allowed him to craft the language of the Declaration of Independence. Wouldn't the same wonderful document have been produced if Jefferson had had access to a computer? But just through the use of a different skill, medium and equipment.

The same holds true for CAD. Knowledge and know-how, applied through the skilled use of the medium of computerized drafting can be crafted, changed, expanded, reduced, rotated, and whatever else, until the proper end result – fully developed and fully usable – can be produced.

CAD, we must always remember, is "command-driven". It is incapable of producing anything on its initiative. Also, it can produce anything, when directed, from the very good to the very bad- but that production is the outgrowth of what the operator tells the machine to do. Therefore, it is obvious that it is the operators' skills and knowledge we must concerned ourselves with; not the machine, nor the software, nor the latest fad of cutting edge developments of the production systems.

You cannot endow the best of machines with initiative – the jolliest of steamrollers will not plant flowers.

– Walter Lippman
American teacher, editor and journalist

The hardware and software are both manipulated by the operator who has total control over what is, and what is not done. Any failing in the final product is over 95 % of the time, operator-error; the other times it is confusion in commands whereby the computer produces what it "thinks" is correct, or another purely mechanical failure.

We are now in a situation where new students and professionals who are coming into the architectural profession, are lacking almost all knowledge of the values and techniques used in manual drafting. And with this is coupled the lack of technical, field-oriented know-how, and a fundamental understanding of what architectural working drawings are all about. Their expertise lies in the CAD operations, many of which do not even address architecturally oriented software. This places the profession in a position of having to re-trained, or upgrade new personnel to ensure that their contributions to project work is direct, usable, and valuable.

Granted this, now, is a function of the transition from full manual drafting to 100 % CAD operations, but there is a need to understand what is happening and what is being lost in this process. It is not an attempt to stop time, or to try to negate CAD and re-legitimize manual work. In the very near-future, the older professionals who were schooled and experienced in manual drafting and basic working drawing rationale, will be gone. Their replacements will be those who were educated in the CAD context, only. This is a harbinger of deterioration in both the process of producing working drawings, and in the final results. To establish our context let us, for a moment, look at the manual system.

Instructors teaching manual drafting used a grading system that covered not only the accuracy of the drawing, but the success with which the drafting work was executed. In other words, not only did the drawing have to be an accurate representation, but it also had to use expressive and appropriate lines, employed with varying techniques, weights, widths, etc. Overall the accuracy of the work had to be in a fully legible, readable style which easily and properly conveyed the message of the drawing. Now with CAD, accuracy is almost automatic, and lines can be produced ″in a flash″, based solely on the command of the operator. But herein lies the problem. If the operator is unaware of the need and has no ″feel″ for line work variants, and does not understand what different line weights can represent, etc. the drawing produced will be bland, perhaps illegible [if too many layers of information are overlaid], and not easily read by field personnel. In this, the drawing not only becomes a problem to the instructor [what now is the basis for grading? – hopefully not just how quickly it was done!], but the work is not of much value to the project because it may confuse, confound, or cause too many questions.

There is no doubt that the development and use of computer-aided drafting [CAD] has had a major impact on the production of architectural working drawings. However, even with all of the successful uses of CAD, it appears that there needs to be a tempering of the use. This involves consideration of a more mature, judicious, controlled, and refined use of CAD. This is particularly true for new and emerging professionals [students] who do not have knowledge of, or a background grounding in the traditional, manual methods of drawings. In addition they lack the understanding of what those methods, techniques and values established and imposed; and more specifically, what good they can contribute to the CAD process.

The controversy is long gone – CAD is not only here but it is performing extremely well, and there is a tremendous potential that the software of the future will continual to enhance the capabilities of the system. The use of the system is increasing, and broadening into more offices, and more functions. There can be no quarrel in this. There are residual issues around CAD, however. These involve, for the most part, operator, use, and conceptual considerations. For examples, the following are fairly typical ″issues″;

– emphasizing speed at the cost of readability
– simply not taking time to refine and utilize features of CAD that will produce better drawing products
– relying on color coded displays to evaluate final [plotted] drawings, when this is patently mis-leading; the lack of a ″feel″ for what the final product could and should be
– misleading orientation and education on the use of CAD, in its best format [usually a fault of secondary education]

CAD has had an influence on the concept and standards [values] associated with working drawings. Much of the movement to and utilization of CAD is attributed to the speed with which drawings can be produced. Perhaps more importantly, CAD drawings can be revised, relocated, expanded or reduced [in scope] in mere seconds. This lends an air of expedience to the process, and certainly is an attribute that cannot be denied. Every manager is seeking time saving measures in order to meet tight [or unreasonable] budget and time restraints. But strictly relying on the expeditious use of CAD really short-changes it capabilities, and belies much of it good.

To take and use only what the CAD system can produce, and to limit our output to what the software offers is to limit the quality of the products we produce. While the computer programmer and software engineer can include marvelous abilities, they cannot include a decision-making device that replaces the human mind, and the determination it can make. It is not Pollyannaish to state that the human capability is required to make a ″good thing″ [CAD], better.

In the evolution toward CAD, many have either overlooked or for some reason, discarded the values, standards and techniques of the past manual drafting system. But we suggest that there is no direct correlation between these and what CAD offers. The manual drafting attributes were developed, refined and used for different reasons, but their basic concept is sound, today, as it was in the past. Manual drafting was successful in large measure to the amount of graphite put on the paper – i.e., sharp, dark lines produce the same in the reproduction process; lighter lines reproduced their kind. In this process, it came to be known that drawings were enhanced, clarified and made more readable by calling attention to some lines, while allowing others to act as support or reference lines. This modulation of line weights introduced a ″sparkle″ into the final prints [reproductions of the original tracings], such that even the most untrained eye was drawn to important information, and guided away from other data, simply by the weight or intensity of the lines. It is much like a center of focus in a painting or photograph.

This technique was so widely and commonly used that it became a well-recognized standard within the construction industry. Some lines came to represent certain features, all the time. Line weights came to identify certain objects or materials, as opposed to others. Some types of drawings [sections, for example] used lines to define small, thin materials which were closely related, and difficult to discern if not clearly shown. All this still survives and is needed today. However, CAD does not have the decision-making power of the human to use certain in certain places at certain times; it cannot evaluate the need for more clarity, more separation, and more differentiation. This, then, falls to the CAD operator who CAN make these decisions, and can then command the CAD system to produce the required result.

The overriding, and important key, here, is that an ″old″ standard/technique is still valid, and still able to make good, better. Also, a secondary aspect is that this is NOT an inherent function of CAD but rather of a knowledgeable human who is in control of the CAD format and capabilities, and who can best decide what is best used for the best result!

In manual drafting the ″feel″ for the drawing was always there. Since the drafter was producing the drawing, directly, i.e., what was put on the tracing was the drawing, there was an immediate sense of whether or not the line was appropriate to its task. Of course, they were scaled as accurately as can be done by eye, but the weight, width, and type of line was of equal importance. The bottom line criteria for a successful line, was whether or not it would survive, as required for its task, when reproduced. Reproduction was accomplished by exposing the line to a strong light.

The graphite that made up the line was intended to stop the light, to some degree, so the sensitized paper below would not be fully exposed to the light. That paper was literally a negative – where the full light struck it, the sensitive chemical was ″burned off″; where the light was interrupted by the line, a line would appear on the paper. Where the drawn line was too timid or light, it would not create a line on the paper; simply it was not heavy enough to stop the penetration of the light.

In CAD, the operator is not given this direct cause and effect ″feel″ for the production of the drawing. Unless there is a conscious understanding about each line, they could all be produced merely as the machine is programmed. If the operator gives no change of command, the line becomes default function – whatever is set out in the machine's formatting will be done, automatically. Therein lies the problem. Also, the operator can be deluded into thinking that the lines are distinct, and separated one from the other because they are colored differently on the monitor. Again, this is faulty, as the coloring on the monitor has no effect on the type or value [intensity] of the line produced.

Several concepts immediately need addressing;

- the operator must understand what is to be produced;
- the operator must command the machine to produced what the operator deems to be correct;
- there must be flexibility in thinking to allow for changes in pen setting, and other commands required to give the desired result.

It is very important that these considerations be given attention and thought – that they be resolved as company policy, and as individual attributes. The end need for architectural working drawings has NOT changed. Despite the new information systems, production systems, software capabilities, and other sophistications, the workers in the field require all of the information required to construct the project – in a clear, complete, well-coordinated, and easily read and assimilated form. This constitutes a direct and formidable challenge, not to computerization or CAD, but to those who utilize those means to communicate their desires, and anticipate a final project as they envision it. Architectural drawings have always been different from other engineering disciplines. This is true for design and presentation documents, as well as for working drawings. So, too the techniques used to produce the drawings. This has all evolved into what are now called ″traditional″ standards. Really, these were developed by and through the process of manual drafting. One might ascribe all this to the art orientation of architecture. However, there is a good deal of sound rationale including the standards that still survive. Most of this entails, line work – the use of different types of lines, varied line weights [intensities and/or widths], their intersections, their meaning, that which they define and indicate, and so forth. It is self-defeating [disastrous] to perceive, think or assert that architectural drafting [in whatever mode or form], and the production of working drawings, as merely the recording of information, i.e. ″so long as it appears on the drawings, no matter the form, format, style, readability, or cross-reference″. Rather the working drawings need to be prepared in the same manner as the work is done on the job – closely fitted, scribe to match, cleanly cut, neat, true, well-crafted, and of highest quality workmanship, in full accord with contract obligations!

Literally, the lines often speak for themselves merely by what type of line is used and how pronounced and light it may be. This technique tends to add modulation, emphasis, expression, and readability to the drawing. The lines can actually sharply identify the work, at a glance. By being long-standing standards, much of the construction industry is quite aware of, and attuned to the linework of architectural working drawings. The general construction trades are trained in reading the prints [drawings], and have the variations pointed out to them. Print reading, for the other trades, is directed toward the specific type of drawings they can expect to encounter for their work. Also, there is at least minimal training in reading architectural drawings, since the trade work must be fitted into the overall architectural project scheme. None of this makes one type of drawing better than another; it is strictly a matter of the intended use and the tradition, repeated use, and established standards used for production. Only a few textbooks utilize actual working drawings [as does this book] which distinctly show the differing techniques, and how they aid reading and use. Most texts are published using printed lines for drawings which tend to give student drafters a false impression – every line is not ″perfect″, of even width, and constant value or intensity.

Part of the charge to this book is to act as an instrument that interfaces with several concepts. Unlike training manuals for CAD, or for other texts addressing working drawings, this effort supports no fixed system or program. Rather we are trying to provide a common ground between traditional manual drafting standards, the current CAD system. In making changes CAD has also imparted, created, or fostered a new outlook for drafting personnel. While not, of course, patently ″bad″ or misleading, this outlook is somewhat amiss. We seek not to stop time, or to impose outmoded standards. We seek only to add moderation, incorporation of helpful and appropriate standards [some which are long standing], and to inform the readers as to what architectural working drawings are all about, why they exist, what they are intended to do, how their content influence project work, progress, and cost.

It is unfortunate that the simple attraction of manipulating a computer has come to overwhelm the reason why a document is being made, what its content should be, and how BEST to portray the work. All this, in conjunction with the correct technology needs to be understood as the correct and valuable use of the CAD process. The full array of features and capabilities in computer software may be naught, in many cases, when there is no implementation of correctness, and/or properly conceived and depicted materials, systems, assemblies, etc. Only a drafter/operator trained in architecture, engineering and construction methods, materials, and allied technology can achieve suitable documentation.

The simple fact that the outline of an area can be ″clicked″ and suddenly filled with a material symbol, does not necessarily mean that the drawing is a success. In fact, this could make the drawing marginally effective, confusing, or mis-directed. While this type of task is easily done [and quickly] they may not have added information, or clarity to the drawing; if not, they are ill advised. Think for a minute – is a verbal message, quickly but indistinctly given, good in the final analysis? By the same token, is a drawing done quickly, but in need of later explanation or clarification, a good product?

The true value of a drawing [even the smallest of details] is not in the fact that it was quickly produced. Rather it is in the quickness with which it contributes directly to the project; easily read; complete; easily understood; easily assimilated; easily utilize in the actual work. Expedience puts a new twinkle in the eye of every person concerned with budgets, production hours, etc. But expedience should not be the driving force in the production of working drawings. Speed is admirable when combined with excellence in the communicative value of the drawing. Here is where traditional values come into play, and where understanding of drawing intent and content must be present. Expedience should be the force to produce a ″good, correct, readable, helpful, and complete″ document, IN THE SHORTEST AMOUNT OF TIME. Where that time can be shortened by utilizing CAD, all the better – but this does not mean minimizing or marginalizing time without regard for the product produced. However, the ″charm″ of expedience has led to several rather negative nuances. First, is a rigidity of mind that tends to force everything into one method of operation. Basically, what the CAD machine is set up to do is what gets done, without regard for other standards. From this comes the conclusion that CAD can be ″all-things-to-all- people″, which simply is not true if one takes due consideration of the products developed by each of the professional disciplines. This shows up in the lack of varying pen sets in plotters that allow the use of different arrays of lines for differing disciplines. Also, it is rigid and much easier to declare that all work can [and should?] be accomplished in the same manner, format, context, scheme, and/or technique. Lastly, is the matter that drawings – architectural drawings in particular – are being required, in many cases, to be done in the same fashion as those from other professions. Here the intent and content of the drawings differs, drastically, as does the direction they take, and the standard [traditional?] manner in which the work is done.

There is no discussion that CAD is bad or improper [or unprofessional]. Rather the discussion is that CAD is frequently viewed as the end result – the epitome of professional expertise and relevance. Some people speak of CAD in somewhat derogatory terms, noting it as ″nothing more than another pencil″. Certainly this ignores the tremendous value and capability that CAD brings to the project documentation. But true reality says that, indeed, CAD is the vehicle or method by which the required information is portrayed, just like the drafting pencil [perhaps we should consider CAD as ″today's tool of choice″]. The problem may be that we do not, as yet, consider CAD as commonplace as the pencil – something that is merely taken for granted. Nor do all professionals recognize and utilize the flexibility available in CAD – just as it exists in the pencil; for example, can one not produce a large array of different types, and weights of lines, from the same ″pencil″?

The time is fast approaching when want-ads will no longer address CAD in terms such as, ″... CAD skills desirable [helpful] …″ Rather there will an assumption that anyone seeking a drafter's position in an architect's office WILL KNOW CAD, as a foregone conclusion. Certainly, in the time of manual drafting, no ads appeared that said, "… drafting [drawing] skills desirable …" The assumption was if one wanted to be a drafter, one could draw!

Even now the ads are mainly used to identify what software is used in the office, so those who do not know that program need not apply [the innuendo being that the office does not want to train new personnel on their software system]. This, indeed, shows a very distressing matter. With the rapid and continual proliferation of new software, one is very hard put to stay abreast of it, and to be skilled in all such programs. Offices, today, change software when there is a new need, or where the new attributes provide better and faster production methods, along with new capabilities. One would think this will all settle out, eventually – but this is not likely as the research and development in the computer industry thrives on, and is aggressively producing new and better hard- and software at an almost alarming rate. The professional offices that seek to adjust and accept new programs will eventually have to "accept" the fact that training goes hand-in-glove with the new programming. The schools simply do not have the time or resources to teach every program available. This fact presents a tremendous challenge to educators who present CAD instruction. While basic operations are one track, specific software is now, and will become more imposing. The graduate simply must be aligned with some basic architectural software program, or will be relegated to entry level employment, at the best. Where one is CAD trained, but only in basics, and has no orientation toward any specific software, that person, if hired, is a liability requiring training while not being productive for a period of time. Many offices do not, or cannot accept this entire financial burden, particularly when they can hire other persons who have the necessary specific skill.

Perhaps this is all best illustrated in a comment from the Resources Manager of a major engineering company;

"I would want to see a portfolio. I would expect to see, from a technical school, knowledge of detailing different types of buildings and materials, some knowledge of building codes, NFPA, NEC, etc. I would also expect them to have strong CAD skills in AutoCAD, and Micro Station. Although I would not necessarily expect this from a technical school, a student who showed strong promise in use of Adobe Photo Shop, and knew all the right equipment to have for photographic quality "Photomontages" would be a plus. A desire to either become the "best" architectural detailer in town, or to become a licensed architect."

- Victoria Kahle, RA
Resources Manager
Fluor Daniel, Cincinnati

Working drawings simply must talk the talk of the construction project!

Together with the specifications, the drawings should speak directly to the work required, and how that work is to be accomplished. These two contract documents [the Agreement between owner and contractor being the third contract document], combined with information from other sources [see illustration] show and describe the exact requirements of the project, as do no other instruments or documents. In this situation, there is a very distinct and demanding onus placed on the document production sequence, and that is to produce the very best documents possible. This is tied to legal and administrative matters, as well as to the technical construction information.

Too often professionals forget that the technology of the construction project is really the work that makes the project "fly". No one disputes the thought that good architecture involves only pleasing and handsome buildings; ugliness is never rewarded! But to bring the well-conceived design concept to the point of being a usable structure, technology is the vehicle. This involves the conversion of many concepts [within the overall predominate "design" concept] into hard construction "facts", which are interrelated, combined, and presented. Correctly done this will enable the actual construction in the correct and proper manner. Without this effort, in the working drawings and specifications, the project would find a hard route to reality; in fact, it more than likely would never be built.

Graphic delineation of architectural/construction projects is a legal as well as a functional necessity. By being part of the contract documents, the drawings are legal instruments. They show what must be done to fulfill the contract in place between owner and contractor. Their relationship, legally, starts with the work being accomplished, "in accordance with the drawings and specifications". The owner is legally responsible to turn over fully adequate and complete drawings [and specifications] to the contractor for execution; the contractor is legally bound to produce the work displayed and described.

Doubtless, one could describe all of the necessary project requirements, and construction, in written form, but the resulting documents would be so voluminous, cumbersome, and complex, that they would be virtually impossible to use. The proverbial, "A picture is worth a thousand words", is never more apropos than in the instance of construction documents. Most legal concepts and aspects, though, defy "depiction". Drawings then become truly co-equal with their associated specifications, since they both rely on the other to complete the array of information [written and drawn] necessary to fully explain a portion of the work, or the project itself. Either type of documentarian is usable, but not in full without the other. The best criterion is that some things are best shown by graphic representation [drawings]; others are best described in words.

In the creation of these documents, and the drawings in particular, some marvelous opportunities are now available to the young and budding architectural professionals. What they do in contributing to the production of the drawings has a direct and important impact on the actual work and project.

The increased use and development of computer-aided-drafting [CAD] has opened many new directions, and has changed the face of project documentation. This has led to working drawings being changed drastically in complexion over some 20 years. Some dispute still exists as to whether or not the new drawings are better than those that were produced in the past. It is, clear, though, that not all changes have added to the betterment of the drawings. Many professionals are of the opinion that something has been lost along the path of transition. There are some deep, disturbing, and quite troubling concerns, most of which are seated in but a few items;

- lack of construction knowledge on the part of those now producing the drawings; field experience is also wanting;
- lack of knowledge of, and regard for traditional [past] standards, techniques, values, and criteria for drawing production; and for drawing intent and content;
- education, starting in high school and voc-ed which overly emphasizes the use of computer-aided-drafting by teaching only the manipulations of the machines;
- Utter disregard, and almost distain on the part of students and far too many faculty, about producing quality documents, with valid information correctly shown;
- the lack of a will or impetus to correct these items by incorporating the capabilities of CAD with refined production methods, and proper construction methods, materials, and details.

This opinion, held by many practicing professionals, was well-stated in a 1997 survey [and holds true today], noted in CONSULTING-SPECIFYING ENGINEER magazine, where the following comments [also applicable to architects] were included;

"From my experience, most [engineering] professors do not have the clear knowledge or the know-how of dealing with actual conditions in practice; … hence, engineers today have very little or no drafting knowledge. How can they design if they have no concept of details"?

The growing utilization of CAD has contributed to this change, but also to major changes in the concept and perhaps even in the intent of those documents. Most all of this, though, is tied directly to the increasing use of CAD, the skill level of CAD operators, the differential in educational goals, and the proliferation of software programs for use in the production of the drawings. Some is tied to acceptance of differing values, available levels of skill and knowledge, and the transition from traditional to modern methods. Other aspects of this are related to the ease with which drawings can be produced. Time-consuming tasks of the past are now achieved in seconds – but are they equal in quality? It appears that the values applied today too often are more directed by how easily a task is done, than by how properly it is done. While this creates a division of opinion in the profession, it is a key issue to the success of every project.

In many professional offices, the tremendous capability and speed of CAD has made expedience the primary if not the sole criteria for the production of drawings. With the inherent ease of performing CAD tasks, drawings can be created, in mere seconds, but unfortunately also in an almost mindless manner. This has the great potential for creating construction problems. One can be fully satisfied with the drawing, and the time it took in production, and still have a sub-standard, inadequate, or wholly inappropriate piece of communication. The

In his book, CONSTRUCTION FAILURES, 2D ED., civil engineer Jacob Field pointed out, early on, that failure in construction is not confined to instances of collapse, be it partial or complete. Rather, Field defines failure as "behavior not in agreement with expected conditions of stability, or as lacking freedom from necessary repair, or as noncompliance with the desired use and occupancy of the completed structure".

This necessitates, Field continues, "much more emphasis in technical education to teach what not to do, and when to say, 'no', rather than to give the impression to the untutored and inexperienced mind, that blind compliance with minimal code provisions and reports of committees, signed by all members after several years of disagreement, but with ultimate consent to the strongest willed majority, is a guarantee of sufficiency."

Failures, as Field defines them, "occur in all types of structures."

value of the drawing is NOT in the short time for production, or the utilization of several innovative features of CAD, but in the content, instruction and inherent value of the information to the field personnel. Because of this, there is a greater onus on the drafters [and unknown to many] to understand and meet the responsibilities they have to both their clients and the contractors involved – production of readable and accurate drawings. Construction workers remain unmoved and unimpressed when given CAD drawings to work with. How the information was developed and placed on the drawings is completely irrelevant to these workers – unless there are problems on the drawings. What the workers are seeking is the information they need to erect the structure, in the clearest, most complete terms – and in a quickly read format. They have no time to differentiate between lines that appear in the same way, but mean different things. They have no time to try to extract information from a maze of lines and symbols, so overlaid, confusing, or unintelligible that the drawing is virtually unreadable. Few job superintendents will take the time that one did several years ago. This ″super″ literally took colored pencils, and color-coded related/corresponding lines on a drawing, so he could begin to read and understand what all the drawing portrayed. The linework was marginal and similar in tone, weight and type, but attempted to show some 7 different surfaces and profiles, one superimposed on the one below.

The drawing in this example was manually drafted, but the lesson in it is most poignant to CAD. First, the intent was ill conceived [it was trying to show too much]. Second, the content was marginalized by the confusion created by all of the similar lines. The simple use of different line weights, better understanding of what needed to be shown, and a critical review of this drawing would have resolved much of its difficulty. These same issues could have been applied had the drawing been done via CAD.

If, indeed, we expect the workers to produce the project work in this manner, shouldn't we, as professionals, prepare the documents they use in like manner? If we are sloppy, disorganized, indistinct, ambiguous, and inadequate in communication, and outside our contract, won't the same be excused or allowed on the job-site?

The basic responsibility lies in the value of the drawing to the contractors; this, in turn, affects the client. Where a drawing is murky, indistinct, incomplete, unreadable, or otherwise marginal, the contractor will be challenged to execute the work. This can directly influence cost of the project [the impact on the owner]. In the bidding process or other early project work, the contractors will easily see the problems inherent in the documents, and will reflect that in their pricing. Also, inappropriate documents can lead to claims for added time of construction, and/or additional compensation.

This shows the need for the professional to be able not only to produce appropriate documents, but also to recognize what is, or is not appropriate, what should be included/excluded, and how best to display the information. However, it must be realized and understood that the training of new architects [similar to the comments about engineering education, above] is not carried on in an even-handed manner. While the project sequence [see pie chart illustration] breaks the work down into several phases, the greatest educational/training effort is not put forth toward the largest segment [in time, effort, and fee expenditure] of the sequence. Almost every school of architecture places heavy emphasis on design, and design theory. There is no denying that this is the fundamental direction of the profession, but the academic problem is that the other segments of practice are subjugated – others virtually ignored; some totally. This is most unfortunate since the student is short-changed by not having the opportunity to become familiar with the entire range of professional activities, their interrelationships, and their impact on the project, and the client's perception. Similarly, they may not come to grasp the totality of a project, and what must occur for the design concept to become reality. Understandably, time for professional training is extremely limited such that the schools simply cannot teach ″everything-there-is-to-know″ about architecture. Due to the inordinate emphasis placed on design, in many cases the inclination to teach a fully rounded, generalist curriculum is not present. It would be extremely helpful, though, if there could be some uniform accommodation for at least an orientation, minimal as it may be, in every phase of professional work. The student could then begin to appreciate what all is expected and involved in the profession, and could better understand the process of bringing design concept to fruition.

″… [the prevailing] perception of technology as an annoying, minor boundary condition.....technical subjects have always been the stepchild of architectural education and have been largely neglected....[creating] crisis in architectural education with the NAAB and practitioners demanding quick changes and schools often slow to react″.

- T.F. Peters in
JOURNAL OF ARCHITECTURAL EDUCATION,
1986

Many professionals still find working drawings tedious, a chore, ″fee-eating″, risky, and some even, unnecessary. It is not quite clear, though, how one portrays or communicates an entire construction project without the help [at least] of some drawings. There appears to be no flaw in the time-tested use of a combination of words [specifications], and pictures [drawings] to convey all of the required information to the contractors, suppliers, workers, and even to the client[s]. The methods may have changed, but certainly not the need for proper technical information; that need has increased tremendously.

The process of documentation usually is both intensive and extensive. It is imposing in that only the best of documents can clearly, adequately/fully, and properly explain the concept of the project, and the construction required to be performed. It is wide-ranging in that even relatively small, or restricted areas of the concept/project can entail numerous and complex details. Often what appears or seems simple in the end, is difficult to convey in the documentation. This is reflected in the complexity of the detail[s] and the need for careful and expert depiction/description. Then, too, the process is further complicated by the imposition of one system upon another, or yet another. The interface, and interplay of these systems must work in the final analysis [and project], but getting them built or installed is intricate and difficult even with decent documentation.

> *Design professionals should ensure all details are carefully and clearly documented on the plans and in the specifications.*
>
> *Details and loose ends should not be left to contractors, nor essential performance and reliability features to code authorities to assure compliance.*
>
> **- Consulting-Specifying Engineer magazine, May, 1997**

Obviously, the better the documentation the better the chance for accurate, proper, and more-than-satisfactory construction in the finished project. This goes directly to the minimizing of potential problems; the first noted premise!

However, by combining and utilizing traditional values and techniques with CAD, the documents can be refined adding clarity, giving proper emphasis, increasing understanding, ease of reading assimilation and application, and increased production in the actual work. This is matter of using knowledge of what needs to be done and incorporated, why, and how that can best be accomplished. Then using CAD to execute this, the best possible product [document] can result. Notice that all this is NOT machine oriented, but rather is a function of a knowledgeable, capable, and well prepared human operators!

One thing, though, has not [and will not be] changed – that is the need, on every project, for clear, concise, accurate, and complete documentation of the project work for easy assimilation and use by the workers. Perhaps the chore now is to use this aspect as the lasting goal, and adapting the methods and techniques to this goal. Also, we may have to overcome our prejudices, our peeves, our quirks, our inflexibility, and ourselves. With more and more professional offices practicing architecture only to the extent of ″plans and specs“ [and no construction oversight services] it becomes more incumbent that the documents be closer to perfect- all inclusive, errorless, well-coordinated and referenced, and a clear, exact, and thorough depiction of what is intended. Since the documents are the only [and limited] involvement of the professional, there is no opportunity to interpret, revise, or correct them, during construction. Even the best of these efforts will leave some matters either unresolved, or to be resolved by others [more than likely to the detriment of the project]. In the event of unclear, ambiguous, confusing, contradictory, incomplete, or inaccurate documents, the professional can become the target of claims or litigation. So the mere fact that the professional chooses to reduce liability [by not providing construction services], does not excuse, or eliminate liability for poor products. While the new professionals may not be fully attuned to all this, their tasks remain to produce sets of coherent documents, well executed, well coordinated, accurate, and true to the design concept approved by the client. Two issues immediately come forth – how does one BEST do this? and how does one know what to do? Perhaps one concise statement will suffice.

> The understanding of the content [what to show and say] of the documents is crux of the quandary; how [media, technique, format, etc.] you transmit this information contributes little to the information, and hence is really almost irrelevant.

To explain. It is necessary that only ″correct information“ be conveyed. ″Correct information“ is the technical data, and the form in which it is shaped [words or various forms of drawings]. That information can be successfully transmitted in any of several methods, but its fundamental relevance and accuracy is essential; its clarity, brevity, and completeness [words/drawings] quintessential.

We need to take a little time to ponder;

- What do I have to communicate?
- How can I best transmit it- words only?
- drawings only?
- drawing[s]/some words?
- mostly words/some drawings?
  [Of course, everything is a combination of words and pictures, since the normal technique is to show work, and describe it- see illustration]
- What type of drawing will best convey the message[s]?
- What should I cover via drawing notes?
- what via specification?
- What production system is being used- manual drafting, composite drafting, CAD, etc.? Is it appropriate for this instance?

As is so often the case, there is an old saw that covers this situation;

IT IS NOT SO MUCH THE MESSENGER,
AS THE MESSAGE WHICH IS IMPORTANT.

In architectural working drawings, this is EXACTLY the case; nothing transcends the information that must be transmitted to enable the successful completion of the project. Within this, is the necessity to understand WHAT is required [content], and HOW best to present it [choice of media, view, projection, etc.].

For the technological aspects of the project to perform as required, there must be a fundamental and in-depth understanding of the process of design that has preceded the creation and development of the approved design concept. With this, there must be full respect for that concept, and a resolve to bring it to full reality, faithfully and completely. Both of these values, understanding and respect are necessary for a successful project. They should be given to and instilled in the entire staff that has or will process the project in the various phases of the project work. Without this, detailing, specification writing and field observation will be virtually rudderless, without guidance or goal. While the design concept may exist only in schematic/presentation drawings, rendering[s], and/or a model, these provide guidance to the other work. At least, here, there is ″something to shoot for″ - a goal. A great deal of time, talent, imagination, skill, knowledge and experience are required to bring the presentation instruments to fruition. There usually is not, and need not be a formal education process to get design information to the staff, but some effort is required to convey the perspective of the project, the quality to be achieved, and the process which will produce the project documents.

As part of the process of bringing a design concept to reality, there must be a method for selecting the materials to be used for the project. The design concept tells what is to be produced, in the final project. Material and system selection tells what is to be used to produce the actual construction of the concept. Fundamental to this entire process is a working knowledge of construction materials. This should include some information as to basic raw materials, production, fabrication, processing, testing, availability, costs, and so forth. No one person may have all of this data at hand for every product, but an office organization should use its entire technical staff as a resource. Experiences on other projects, or with other firms can prove to be of great value in the material selection process. These must be combined into systems, where possible, or distinct details which gather and utilize them to formulate ″pieces″ of construction.

At this point there needs to be a focus centered on ″how the best result can be provided.″ Selection of materials may now lie in the rough conceptual drawings, manufacturer's literature, or perhaps just in the mind of the Project Architect and others. The focus must be aimed at determining both what to show [how materials and systems are located and combined for the construction], and how this information can be conveyed to the workers in the most direct, clear, and complete manner. This sequence for CAD directly parallels the hand-drafting process, and really the criteria is the very same; only the process changes. With time [and money] such an imposing factor in the production of any project, now, the tendency is to use the CAD capabilities quickly, and far too indiscriminately. The use of CAD must be controlled, and directed. It is simply too easy to produce a drawing which adds nothing to the project knowledge [and may even add confusion]. Needless line work, covering entire areas with non-productive portrayals of material symbols, drab/expressionless line work where no line weight variation is used can lead to ″monotone″ drawings where readability may be impaired, impact is non-descript, and confusion/murkiness is pervasive. Simply said- the product will be better [and more rapidly done] only where the operator incorporates manual drafting concepts and techniques, and where full understanding of the needs, intent and content of the final product are known to, and met, by the architect/technician/ operator.

There is no longer a need to concern oneself with dropping ink on the drawing, smearing graphite over the sheet [while working over other work], or otherwise marring the drawing/

product. But there is still a capability to produce an unclear, confusing, unreadable drawing, using CAD. Additionally, the drawing can still be ill conceived, poorly delineated, and of quite limited value. Why? Here an early axiom about computers still holds true- ″garbage in, garbage out‟. The benign computer produces ONLY as it is commanded –note that word-commanded! It MUST BE TOLD what to do, and HOW!

Therefore, they who tell the machines what to do, MUST know, well, what is to be produced or delineated. They must engage and utilize the best techniques available to produce a good result. As repugnant as this may be to some mavens of the computer, it is still absolutely true that old-fashioned, manual drafting standards and techniques still are perfectly valid, and are used. CAD, in the final analysis, when used skillfully and judiciously, is really another, but marvelous drafting tool [by far exceeding any pencil or pen]. It is another way to produce the drawings- the very same drawings required throughout the years, but produced by hand. In this is no stigma. Times change and technology evolves, mostly for the better. But we should not be so engrossed in the machine that we lose sight of the need to fully utilize its abilities within the context of existing and traditional standards and requirements.

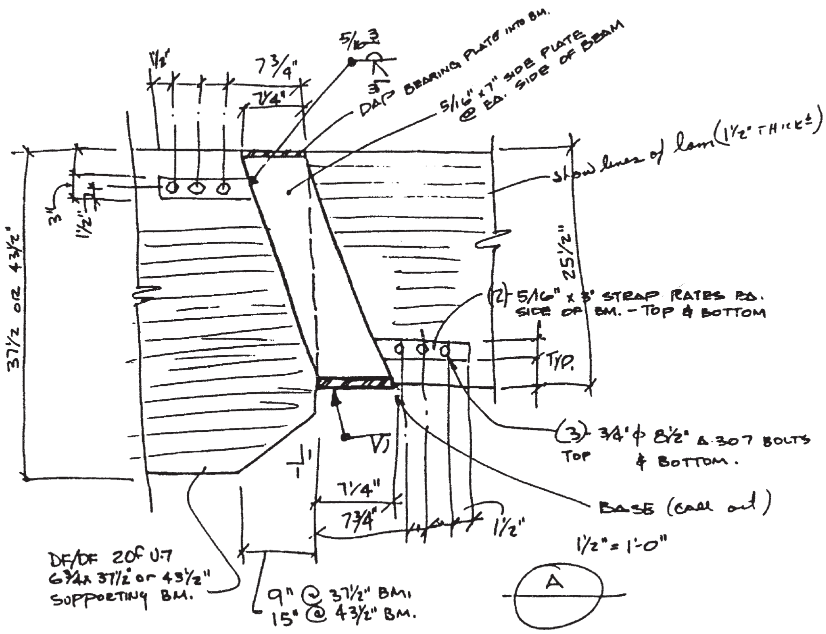
Let us propose the following scenario;

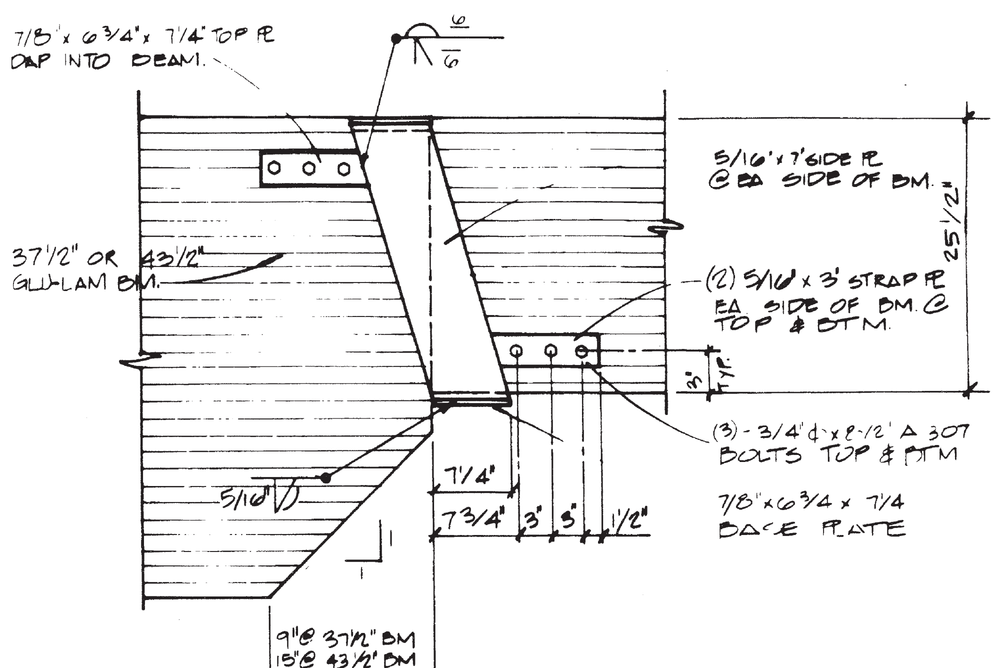
- learn the basics of construction materials
- learn the basics of construction systems
- learn what resources are available for added information
- understanding the principles of ″sectioning‟ and ″detailing‟
- learn from each project how materials can be combined, fitted, and made to work together
- learn CAD operations, and the capabilities of the more widely used software programs
- seek out and learn old, traditional, [but still valid] manual drafting standards and techniques; understanding the reasoning behind them
- learn and exercise a strict discipline over your use of CAD; consistent with the traditional standards/techniques; exercise control and restraint; produce results which you want [and which differ from mere ″wide--open‟ implementation of CAD features]
- learn and understand the intent of each drawing type; understand the function of each drawing and what it should contain to perform its function
- combine all this into a personal scheme for knowing what should be done, why, and how you can best achieve the needed result; understand how that result will be used and what function it lends to the field personnel, and the actual construction.

> Professionalism is a personal attribute that one acquires
>
> - it cannot be inherited
> - it cannot be bequeathed.
>
> Only they, having made the acquisition, who put to usethat knowledge, that skill and with all of their ability and complex dedication of purpose, can be truly called a “professional”.
>
> - R.E. Onstad

Professionalism is a most intangible virtue, and a very, very personal one. One is NOT a professional by mere acclamation!; nor by what machines she/he uses. Professionalism in architecture is seated in an attitude – an uncompromising, disciplined approach to correctness, and excellence in work performed [and in every phase of the project]. It is also related to dedication, and sincere, innate caring about one's work. Measured, legally, by a professional Standard of Care, it is eminently obvious that the true professional brings and interjects a new tone, vision, or element into every project. Part of that project is its documentation – and professionalism is manifest in the quality of the documentation. The professional will always seek to present the best design, the best information, the best detailing in the BEST format of fully coordinated, clear, and well-executed documents – including working drawings!

Part of the charge of this book is to relate and impart the concept of a professional approach to working drawings. It is hoped that we can aid each reader in establishing an understanding of this, and at least respect for these documents, whether one works actively in document production or not. A true professional working in this context, can achieve the proper and desired results through correct and astute manipulation of any medium – red pencil, yellow wood pencil, drafting lead holder, special lead, ink, composite [cut and paste] drafting, photographic drafting, and yes, using CAD. Combine the wise, informed, professional manipulation with the marvelous capabilities of the CAD system, and EVERY set of project documents should find their best presentation [excellence in the design concept, also, certainly adds further enhancement and credence to the project scheme]. There is also a pervasive need for human sensitivity to refinement of the process. In this, there is a need to recognize that the end result- a legible, complete, descriptive drawing- is the pre-eminent issue; not merely exercising the computer's capabilities, nor the





A typical office assignment, the hand sketch [top] must be converted into a proper working drawing detail, as done via the formal drafting operation.

spectrum of techniques. Project documents can suffer from the selection of media, where understanding, skill, restraint, sensitivity, and full operative flexibility, are not present. The traditional principles of architectural drawing remain- line weight variation, good lettering [adjusted to proper size to fit the associated drawing], clarity and readability via uncluttered drawings, adjusting scale to fit the work being depicted, etc. It is no knock against CAD to say that simply because the equipment is capable of performing a function does NOT mean you must use it, or use it to its fullest extent. Every brick need not be shown, on elevations, simply because you can block out the area, click on the ″brick symbol″ icon, and the area is immediately ″filled″ with brick. What have you contributed to the project? Basically nothing- you gain nothing by full rendering of working drawings, in a manner similar to presentation drawings. No one [hopefully] is going to count the brick and estimate from that count. Simply the process is unnecessary, even though time expended is minuscule. Also, the result can be a muddy, murky, or confused drawing; too many lines for no productive reason. Small areas of proper material symbology are helpful, and recommended to aid readability and understanding. However, don't allow yourself to be taken in by CAD's abilities and library figures- you control the content, and you can manipulate what CAD does [it ain't got brains yet!!!]. There is absolutely no reason for not having the same ″drafting refinements″ and techniques in CAD or composite drafting, as are present in good manual drafting; the drawings and the project will be the better.

Some may quarrel with this statement. Their only concern is that the information be there- damn the style, technique, readability, clarity, etc. Better, though, to approach any job situation in a fully professional manner, prepared to exercise the best of drafting skills and abilities, than to attempt quality work with less than quality techniques.

Before beginning the documentation of a project, there is a need to determine the process and format of that work. Usually the Project Architect will assemble his/her production team and go over the standards involved and the type of documents to be produced. This can include everything from sheet media, to sheet size, title block layout and data, to use of office standards, to the particular standards that the client might request/demand. All preliminary to the drawing of the first line. However, this pre-planning is necessary to form a context for the work. Obviously every drafter is not free to ″explore″ or produce drawings as she or he sees fit; nor in the style or format that person may deem appropriate.

Each drafter though must take an active part in the preparation for the work. There is a need to resolve the sequence of the drawings [in the set], the content of the drawings, the scale[s] to be utilized, the layout of sheets [depending on the size of the project; us of match lines, etc.], the relationship of drawings one to the other and their cross-referencing, and the fundamental ″how-to″ of the drawings, individually. Basically, this is setting a course for producing the ″BEST″ presentation of the information to all parties- particularly the contractors.

The process of producing working drawings requires some sophistication, and in need of some forethought. In fact, there are three distinct levels of involvement [knowledge/understanding; expertise; skill] required. While these need not be formalized into a formal list [being rather mental exercises], it may be a good idea to list them out here;

Level 1 – Knowledge/Understanding;

- What needs to be shown?
- Why is this necessary?
- What problem[s] needs to be resolved?
- What are the correct material selection[s]?
- What shapes, sizes, and interfaces need to be created?
- What fastening devices will be required?
- How many, what kind [legal; technical, etc.] of restrictions may apply?

Level 2 – Expertise;

- How large of an area of work should be included? [should more than one drawing be used?]
- What scale is appropriate for the amount of detail required?
- What type of drawing projection would be best?
- Can a standardized [previously used; banked] drawing be retrieved and re-used, and/or modified?
- Can it be anticipated that the new drawing will qualify as a standardized drawing for future use? [change format, if yes]
- What line weights should be used?
- Where are notes and dimensions best placed?
- How will this drawing fit on the sheet?
- Should it be located, and/or combined with related drawings? If so, in what combination?
- What cross-referencing will be required [to and from the new drawing]

Level 3 – Skill; with forethought and planning,

- Is CAD the best technique to use to make this drawing?
- What CAD operations/manipulations will be required?
- Can library figures be used, or adapted?
- What size lettering is appropriate for the size of the drawing?

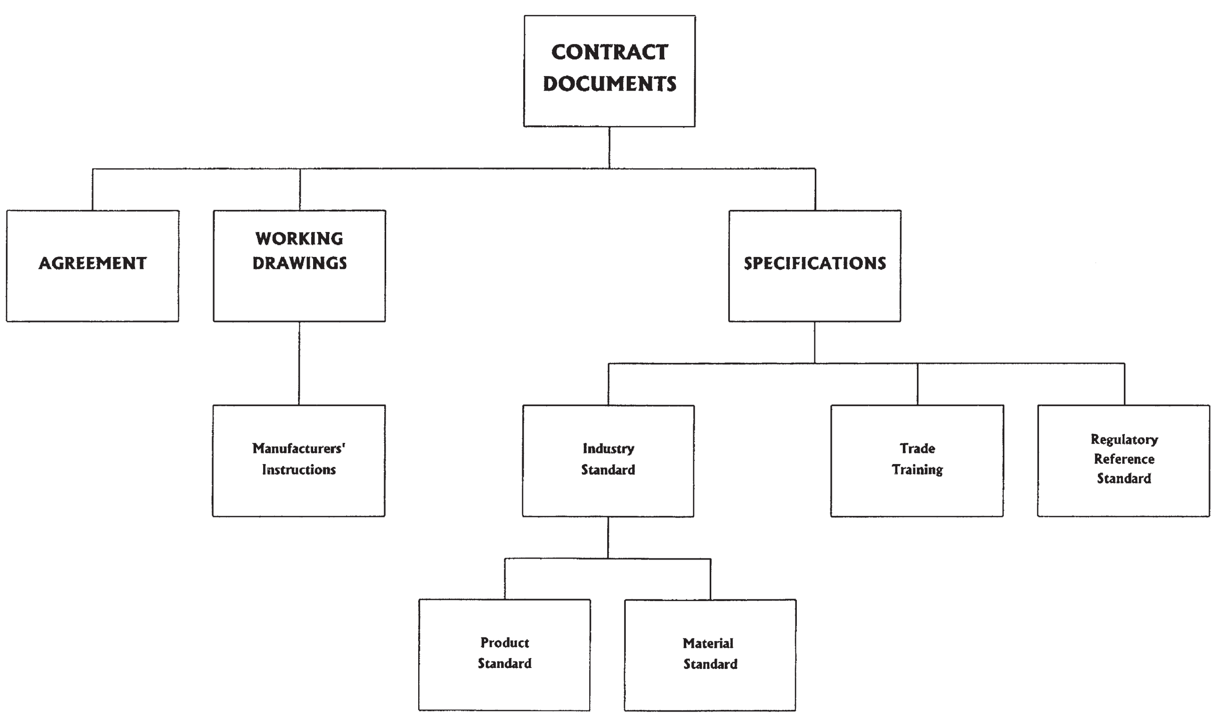
- Which of CAD's greatest assets can be utilized –
  - ability to copy;
    - entire drawings
    - individual views
    - portions of larger work [for details, etc.]
  - ability to edit;
    - a piece of work, or any portion thereof
    - add, subtract or manipulation entire layers
    - layers of information [even creating new or
    - additional drawings by so doing]
    - combining disparate pieces of information, without regard to scale, into a drawing
  - retain and retrieve work [details, drawings]
  - quickly change line weights, other attributes
  - move drawings/views from place to place in set
  - automatically update related work when changes are made on one drawing

As noted earlier, there is a need for the production staff to be made an integral part of the design/production team. While this is more of a management function, there is also a need for each drafter to ″pick up″ the responsibilities delegated to her/him. Envision this as a relay race, if you wish, but here the ″baton″ is one of responsibility. The final goal is the same as in the foot race- finishing in a timely, ″winning″, manner- sometimes you set records, sometimes you merely finish- best to do it in good style.

The following is a brief list and commentary regarding work on working drawings. It really is a process which each drafter should run through, continually, and certainly at the start of each project, and indeed, each new drawing for a project. This program revolves around nine [9] basic thoughts or rules;

- plan every step of each drawing, detail and sheet
- set out some way of checking your work
- know/understand what decisions you will have to make

Sources of Construction Project Requirements



This chart notes the sources that are readily available for use in the formulation of contract documents. Note the number of sources from industry besides those from professional sources.

- find out the applicable standards for your work
- draft from the reader/users' point of view
- cooperate/communicate and work with others
- assume nothing; find your main and secondary duties and responsibilities
- think for yourself; be resourceful; ask questions but try to have a possible solution at hand for suggestion or verification; be helpful to the process and all involved
- with each task, concentrate on improving one aspect of your skills.

The facts are undeniable – computerized production of contract documents, particularly working drawings, will continue to increase, and will become more and more refined. This refinement will bring added sophistication to the process, and will provide more and more options and capabilities to the operator/designer/ drafter.

The case we intend to make, is that all of the jiggle-like nomenclature of the capabilities of the computer system are meaningless, and productively useless where there is not an understanding, knowledgeable, construction-astute head on the other side of the keyboard and mouse from the monitor.

Rotation, electronic space walking, color graphics, and speed aside, if there is not an understanding of what material/system to use, how to connect or interface it with others, and how and what to communicate for construction of said system, the computer becomes superfluous. The wonder of the machine must be as directed toward its assigned task as the laser scalpel in brain surgery

> ASSUME NOTHING!
> Assumption leads to wrong conclusions
> misjudgments, miscalculations, errors,
> misinformation, wrong guesses, procrastination,
> contract deviations and numerous other
> assorted, but usually, adverse maladies
> regarding the work progress, interrelationships,
> or the projects as a whole.

Again, in addition to the professional nuances, the matter of personal caring about the work comes into play. Regardless of your current station in life [graduate, degreed- bachelor, associate, master; registered professional; co-op student; designer/operator], the success of the project you are working on depends, DIRECTLY on how much YOU care!!

Caring has a direct impact on the project and the cost. For example, if you show a detail requiring work that is not normally done or is not normally done as you show it, the cost of the project will go up. Simply because there is a question as to what will be required – if you insist on ″your″ way, the added cost is justified to your client's detriment.

> *TO CRAFT IS TO CARE!*
> **- Malcolm McCullough**
> **Associate Professor of Architecture**
> **Harvard Graduate School of Design**

It is true, though, that a junior drafter, CAD operator, co-op student, or graduate architect can [and does] has a direct, imposing bearing on a project. This is achieved through the work of that single person – linework; notations, correctness; dimensioning, readability of drawing; proper and complete cross-referencing, etc. Actually there is as much need to control and ″supervise″ the preparation of the documents, as there is the actual construction work. There is as much need to control and properly use CAD, as there is to install the work in the field!

You have to care about each line- what it does and does not do, and more importantly what it is SUPPOSED to do. So, too with each note, word, dimension, indication, symbol. Be aware and sensitive to conditions- does the door open into a brick wall; why is a door opening ″cross-hatched″?; misspellings; do your dimensions add up to overalls?; do things look neat, controlled, and orderly?

Each drafter/operator needs to instill a personal sense of dedication and drive to produce quality documents. This can be done through understanding of the control one has over the CAD process, how this can be utilized to produce proper, careful, thorough, and readable documents. In understanding content, intent, and methods to produce quality, professionals need only to care enough to exercise the equipment and processes at hand. Indeed, do the drawings look as if a responsible, knowledgeable PROFESSIONAL produced them? In all this, there is blatantly a challenge!

It is unfortunate that the attraction of working on a computer has come to overwhelm the reason why a document is being made, what its content should be, and how BEST to portray the work. All this, in conjunction with the correct technology needs to be understood as the correct and valuable use of the CAD process. All ″the bells and whistles“ of computer software is for naught, in many cases, when there is no implementation of correctness, and/or properly conceived and depicted materials, systems, assemblies, etc. Only a technician trained in architecture, engineering and construction methods, materials, and allied technology can achieve suitable documentation.

Education in CAD systems and programs include the basic fundamentals of terminology, formatting procedure, and the correct keying to perform the required task[s]. From this base of information and skill, the budding CAD operator needs to proceed to more specific information [in some cases, course study terminates with merely achieving skill in basic operations]. There is no ″CAD industry“, per se, which is the direct counterpart to the tool design/making industry, or the architectural and engineering professions. Rather like typing, the generic CAD function can be adapted and used in other work and functions. In some of this, additional skills and knowledge must be developed to address the specific task or work to be done.

In the past, prior to computerization, most professional offices had staff members who were geared toward document production, entirely. These were young people, who started, perhaps, as office runners, and gradually sought, and were given added instruction and the opportunity to become part of the drafting staff. Others were architectural and engineering graduates who, for one reason or another, never felt the need to become registered. All of these people became ″professional drafters“. However, by being trained, on the job, they were able to add technical knowledge to their drafting skills, to the point that many such offices had Senior, or Chief Drafters who were not ever registered, but who became a major factor and influence in the production of documents. Their knowledge was office gained, based on problems, and solutions resolved in various projects.

There is still a need for staffers who can function in much this same way; not necessarily as Chief Drafter, but who can bring architectural and construction knowledge to a project, solve problems and contribute to the production of quality and proper documentation. A budding professional or a technician who exercises technology instruction and knowledge, presented through enlightened use of CAD, will become a more valuable, and integral part of any project team. A person with such combined skills should not confine their efforts to one aspect or the other. While this may be something that needs to be talked through with one's employer, the employee is more productive, per hour/dollar paid [and billed], and will rise to more status and position, than one who remains as a more passive CAD operator.

The joy of this work is in actively contributing, and being a valued part of the effort, not just a machine operator!

> *The most precious asset any professional controls is knowledge of the disciplines and the skill to apply it effectively. Over the long run it is more important to maintain the value of this asset than the office. the furniture, the computer hardware or even the bank account.*
>
> **- Robert Gutman. PhD**
> **Author, Architectural Practice: A Critical View;**
> **Lecturer, Social/Behavioral factors in design,**
> **Princeton University**

THE PRODUCTION OF WORKING DRAWINGS

While the role of the entire drawing set is to depict the project work in total, each drawing sheet and/or each individual drawing has its own sub-role which entails showing various sized portions of the project work. To achieve this, subsequent chapters contain a general discussion of the various drawing/sheet types, and their roles. Additionally a checklist is included which lists what information/drawings usually appear of the type of sheet being discussed. Usually, though, for both convenience, and for saving of space, each single sheet, in the set, will contain more than one type of drawing. Some drawings, such as floor plans, are so expansive as to utilize all available drawing space on a single sheet; at times, for very large projects, floor plans may require a series of sheets to depict just one single level.

The method for producing working drawings is the setting of a series of procedures for accomplishing various portions of the work. Techniques, specifically selected from the many available, must be applied whereby each element of the procedures is done. In this scenario, refinement of information and work is a necessary and valued aspect, whereby precision, subtlety, and polished characteristics are established. It is this process which makes project documentation clear, creditable, coordinated, accurate and easily used.

The intent of this chapter is to provide a general outline and set of basic guidelines as "Working Drawing" standards. These aimed at assisting the young professional and drafter in correctly arranging and depicting information pertaining to the drawing documents. [NOTE: This list is NOT all-inclusive; see subsequent chapters for specific checklists of items to be included on drawings].

1. The theory of working drawings: An art of communicating; the method, used by the design professionals*, to convey graphic information to the contractor[s] regarding construction project; in particular, materials, methods of assembly, quantity, location, extent, configuration, and design intent [concept] information to construct the building project. The drawings are part of the contract documents**; hence they are legal, and binding documents.

2. A building project = Building + Structural System + All Building Services [mechanical] Systems and Utilities + Site Modifications.

3. Working drawings are a combination of "words" and "pictures" which convey different types of information to the contractor[s].

These documents are drawn to scale [a small unit of measure is used to represent one foot [12 inches]], and are usually two-dimensional, and drawn to the correct size, and in correct relationships [no distortion, nor foreshortening as in perspective drawing].

They do NOT, however, contain all of the information required to build the project; a set of written "specifications" is required. These add more, but new information, and really SUPPLEMENT and COMPLEMENT the drawings.

Only by using BOTH of these documents can the contractor[s] truly review, see, and understand all the work they are to perform.

4. On the working drawings, there are several different types of notes;

a. Demolition notes- used for removal of trees, vegetation, fences, existing structures, earth, etc., necessary to permit completion of the new project.

b. Construction, or Plan Notes- used to "call out" [indicate; designate; show; name] materials, methods of assembly, quality, or design intent [concept] information needed to define a particular item or situation found on the sheet on which the note occurs. Be very specific with the information each of these notes give to the contractor.

c. Landscape Notes- used only for extensive vegetation, plantings, and earth [contour] modifications. Call out both existing and new vegetation [size and quantity when applicable] and as necessary, planting information, or modifications to existing work.

* Design Professional is a registered Architect or Engineer who is engaged in the design and construction of building projects

** Contract Documents are the contract agreement, the working drawings, AND the specifications, in concert with one another.

d. General Notes- used to transfer information that is held common to either the sheet, discipline, or project on which it is found; usually refers, in general terms, to numerous items, etc. shown in other types of notes.

5. Sheet numbers- It is necessary that all sheets be given a distinctive number; it permits easy identification and access, reference and coordination between information and persons utilizing the drawings [for example, persons talking on the telephone can easily refer to a specific sheet merely by citing its number].

Numerous systems are in use, and each professional office has a standard of some sort that it uses. For example, on fairly large projects [more than 10 drawing sheets] sheets could be numbered as follows;

"A" Series- Architectural Drawings; defining dimensional, aesthetics, materials, and methods of the project.

"S" Series- Structural Drawings; defining everything to do with the structural features of the project [footings, foundations, columns, beams, joists, etc.].

"C" Series- Civil Drawings; show and define work of a "civil engineering nature", such as grading [contour modifications], drainage, roads/drives/walks. Used only on extensive, more complicated projects, or when breaking civil work out [defining it] on the site improvement plan to improve and simplify communication.

"L" Series- Landscape Drawings; define landscape work and vegetation modifications. Used only on more extensively landscaped projects, or where such work is to be specifically call out on the Site Improvement Plan, to simplify communication.

"P" Series- Plumbing Drawings; used to show and define the materials, methods, locations, equipment, fixtures, piping and intent of the Plumbing system [including storm drainage] for the project. May be combined with HVAC [heating, ventilating, and air conditioning] information where work is limited in extent [scope].

"M" Series- Mechanical Drawings; used to show and define the materials, methods, locations, systems, equipment, and intent of the HVAC [heating, air-conditioning and ventilation] work on the project. On small projects, the plumbing work may be included, provided that work is modest in scope.

"E" Series- Electrical Drawings; used to show and define the materials, fixtures, methods, locations, equipment, and intent of the Electrical system for the project.

6. The more extensive and complete the detailing of the drawings and specifications, the greater the amount of CONTROL the designer has over the aesthetics, quality & durability of a building project;

The less extensive and complete the detailing of the drawings and specifications, the lower the amount of CONTROL the designer has [and the more control by the contractor[s], who's main concern is money in the form of less cost and more profit]

[This is an EXTREMELY IMPORTANT point, since the design professional is an agent for the owner (acting in his/her behalf), and control is the key to a fully successful project (meeting all requirement of the owner)]. Control CANNOT, and SHOULD NOT be released, given-over-to, or abdicated to anyone else, particularly the contractor[s].

It is also an important aspect of the work of any drafter working for a design professional, in any capacity; it is fundamental, and needs to be understood and followed]

7. A Cover Sheet is used on most projects, and is quite helpful in many cases. This may be a separate sheet, or may be simply a portion of a sheet, which has some construction work shown on it. Basically, the cover sheet contains;

a. Vicinity or location map clearly showing the project site; can be a state map [where necessary], and/or a portion of a local street map.

b. Complete name of the project and any pertinent information such as project number, phase of work, etc.

c. Full address [street and number, etc.] of the job site.

d. Name of Design Professionals and Consultants

e. Name of Owner [Board of directors, Pastor, Company President, Mayor, City Council, Department members as they may they may apply to the project]

f. Registration seal of the design professionals of record [i.e., those who worked on or supervised work on the project; this is required [in several states] by law, on ALL sheets of all projects except residences].

g. Date project is issued and goes out for bidding; also occurs on EACH sheet.

h. Index of ALL drawings contained within the set; show sheets titles and sheet numbers.

i. On some projects [as an option] a rendering of the project is included on the cover sheet.

8. Drawing Sequence- Though not a sacred ordering, the following listing can be modified, added to, or deleted from, as deemed necessary [order may be varied from project to project. The following is but one example of sheet numbering [use of a decimal system allows for inserting of other sheets at later date], and possible content [varied as the project requires]. Working drawings numbering as noted in 5. above is not magical; with less than approximately ten sheets, numbering should be simply consecutive.

INDIVIDUAL DRAWING REQUIREMENTS

THE SITE IMPROVEMENT [SITE, PLOT] PLAN

1. Using a drawing containing actual survey information [by a registered land surveyor] show all property lines with a heavy line [long dash, two short dashes, long dash], and the bearing [meets and bounds] for each line [for example, N85symbol 176 \f "Symbol" \s 1232'41"E, 158.94']; this denotes the direction of the property line, and it's length.

At property corners [the point where property lines change direction], indicate the intersection of the property lines with a small dot, or a hollow circle. Show Bench Marks [point which show grade elevations as used by the surveyor] with a solid circle or target bull's-eye, and a note.

2. Show and call out all concrete paving, aprons, curbs, curb cuts, stoops, sidewalks, etc. Thoroughly dimension as appropriate; width, height, etc. Indicate as appropriate by plan note, all finishes, control and expansion joints, etc.

3. Show and call out all items, trees, structures [of all types], fences, etc. that exist; note specifically, or show in dotted line, those to be removed for the new construction.

4. Locate NEW building with dimension to two [2] property lines [one to side or building, and one to front or rear]. This should indicate the foundation wall locations.

Indicate the building in 1 of 2 ways;

a. as a "foot print", using a heavy, bold line around the perimeter, showing exterior columns [if any]

b. as a Roof Plan ["bird's eye" view] indicating slopes of roof, drains, parapet [top of wall] caps, etc. Also, dash in the building foot print where it sets inside the roof line [this shows any roof overhangs]; dimension to "foot print", NOT to roofline.

5. Show North Arrow- if there is a wide difference, note both "magnetic" [true] North, and "building [or Plan] north" which aligns with the walls of the building plan.

6. Show grade elevation of all contour lines [contour lines connect point of like elevation above a Bench Mark, or sea level]. Show existing contours in a medium weight, dashed lines- new or modified contour routes and locations in a heavy, dark solid lines. Note the numerical value of each contour line, in at least two places.

Indicate the grade elevation of the first floor [or "grade level"] of the building, within the building foot print; crosshatch the entire footprint of the building in a medium tone.

7. Show the locations and sizes of ALL existing utility lines, on the property, and in the adjoining street; show new utility lines into building from existing source; be sure to note the type of line [water, sanitary sewer, storm sewer, gas, etc.] Also, show utility meter, and shutoff valve locations if outside building.

[For some projects, it is advantageous to include a separate site plan devoted entirely to the utilities and the mechanical and electrical trade work]

Where appropriate show the Siamese "Y" valve location for the fire sprinkler system. This must be accessible to all fire apparatus on a paved surface, with back-up area, turn around, or continued access around building.

[In some jurisdictions, the fire service requires a fire protection plan. This is a modified site plan showing locations of exits, fire protection equipment, sprinkler connections, enunciators, fire pumps, utility shut-offs, building exits, driveways, radii, fire hydrants, fire mains; location of tress, high tension wires, and other items that may impede or effect fire fighting, access or other emergency services].

8. Indicate and call out site drainage system; piping, area wells, dry wells, culverts [inc. diameter and material], surface drainage swales, retention/detention basins, under-walk drains; roof drains and collection drains should be taken to "daylight" or tied into a storm drain age system- call out and so indicate; many residences use splash blocks beneath downspouts- call out where used.

9. Show, indicate and call out in detail all new site improvements; drives, walks, parking areas, handicapped ramps, fences, decorative features [pillars, light posts, archways, entrance features, other structures, etc.] bridges, fountains, etc.]; detail these features and locate properly.

In particular, dimension parking areas in relationship to the building proper- call out and show wheel blocks, paving materials, striping, planting areas; dimension the parking bays, and aisles in a string dimension and call out the total number of parking stalls in each bay. Note and locate parking area lighting standards, and all signage, both painted and erected.

10. Call out and note all new landscaping materials by legend or plan note; indicate type and quantities, spacing [if required] for each plant type. Note all sodded, seeded, or hydromulched areas- show extent.

THE FLOOR PLAN[S]

1. If information is available, layout the structural grid [column centerlines] for the building; then carefully, and as accurately as possible, scale out and draw in the walls, and partitions for the building; establish and show/indicate door and window, and other wall openings. Designate column grid centerlines with 1/2″ or 3/8″ diameter circles on the ends of the centerlines, OUTSIDE of the building's dimensions [these can be widely spaced away from interference with the drawing information. Assign numbers to one set of column lines, and letters to those perpendicular to the first. Draw in all columns- proper material, cover, etc.

2. By single string dimensions [as much as possible] locate and align all interior wall dimensions from face of studding to face of studding; call out wall finish materials, and show thickness by Plan note or by General note, with Plan notes at the exceptions [to the General].

3. Indicate fire walls, fire separation walls, and other special walls/partition types; change in hatching for change in detail or construction; call out locations [dimension], methods and materials.

All walls and partitions in 2. and 3. above, should have a distinctive hatching applied, via hand drafting, CAD drafting or by application of reproducible adhering tapes, to distinguish one type from another, and make plan reading easier.

3. Envision four [4] distinct lines of dimensions around the exterior of the building;

a. out-to-out [overall] of the extremes of the building walls;
b. the next line [moving into toward the building wall] would dimension between column centerline [grid] lines, and to edge of wall corners [indicate to what location dimension is taken]; this line may not be required on every project
c. next closest to the building would dimension the "wings", offsets, "jogs", angled walls, and major portions of the building;
d. closest to the building is the dimension line that locates door and window and other wall openings in relation to each other, and to the corners of the building masses.

Indicate rough opening [R.O.] or "masonry opening" [M.O.] [use dimensions to the centerline of openings in WOOD FRAME walls, ONLY]. Where bands of windows or glass are used these should be dimensioned to the center of the mullions [vertical members between glass panels]; call out type of system, glass type, and thickness, etc. [note should be made of panels, etc. which are TYPICAL, i.e., used repetitively around the building].

5. Indicate ALL rooms and spaces with an area name, and/or a room number. Most professional offices will have a standard regarding room/area/space indications. In the main, though, assign room numbers in clockwise order, in adjacent fashion, beginning at the main entrance, and working around the building perimeter, then toward the interior. In many instances, it is helpful to use a number which indicates the floor or level on which the room is located [example- Room 112= 1st FLOOR, ROOM 12]. Ensure in any event that EVERY space is numbered, without duplication; rooms added after numbering can be designated as 112A, 112B, etching relation to the numbered room nearby.

6. Indicate and call out fire extinguisher cabinets, drinking fountains, counter and work tops, [including in rest rooms], fixtures, built-in cabinetry, shelving, closet shelves and rods, electric panel locations, phone panels, utility entrances, telephone booths, and all other features to be built or supplied under the contract.

If the above occur in an area which is to be enlarged, in plan [larger scale], show the feature on the larger plan, ONLY.

7. Call out and indicate [heavy dashed line] portions of the floor plan that are to be enlarged for detailing and clarification purposes, in another location within the working drawing set [example; rest rooms, kitchens, specially equipped rooms].

8. Provide distinctive door and window symbol/designator, for EACH opening. In residential work, the window and door sizes and hardware information may be located at the opening.

In larger and commercial projects, designator should be used, and the complete associated information listed in a window, and a door schedule. Many different systems are in use, but it is not wise to use any system that COUNTS the number of units [this should be left to the contractor(s)].

9. Locate, indicate and call out with heavy, distinctive designators, building sections [cross- and longitudinal] cut through the entire building.

Also, use other distinctive designators for identifying details in the construction.

10. Ensure proper title and scale indication for EACH floor plan.

In some cases the complete plan of a building will not fit on the sheet. Here, MATCH LINES, can be used to severe the building into several portions, one of which is shown on a sheet; a "key plan" at small scale showing the entire building is required, with indication of what portion of the building is shown on the sheet. Match lines require heavy distinctive designators, also.

11. Call out, if and where appropriate, radical changes in ceiling height[s], floor levels, critical beam locations [bulk head] if no reflected ceiling plan is planned/used; exposed features, beams, etc., should be located and called out. All work in this paragraph shall be shown with dashed lines, and dimensioned as necessary.

12. In the chapter on floor plans there is a checklist of specific items relating to floor plans, and which should be depicted, where used, or required.

THE EXTERIOR ELEVATIONS

1. Exterior elevations are orthographic views of the outside faces of the building [two-dimensional]: they are ALWAYS projected at 90 degrees to the surface being viewed. The required number of elevations varies, with the layout [shape] of the building.

Where walls are angled, they should NOT be shown in the angled or foreshortened manner; an additional elevation view is required at the 90-degree projection to the angled wall. Curved walls should be drawn as if they were "pulled out flat", i.e. show the true [arched length of the wall]. Elevations should be drawn at the proper scale, with vertical "verticals", and horizontal "horizontals" [nothing should be optically correct as in perspective, and nothing should be distorted or foreshortened.

2. Call out critical vertical dimensions at BOTH sides of EACH elevation as appropriate; ensure that dimensions extend to an actual point or established level, top of masonry, joist bearing, etc. Vertical items needing location are;

a. bottom and top of footing [indicate depth below grade]
b. top of foundation wall
c. top of sill plate; top of double top plate [wood]
d. top of wall, masonry, parapet
e. bearing level of roof joists

Use a distinctive designator at each grade/elevation note [a "target" ⌖ , for example].

3. Indicate roof pitch [slope triangle or slope per foot] for sloping and pitched roofs; DO NOT indicate top of ridge as an elevation on pitched roofs.

4. Properly locate and call out wall section designators, where they apply; run designator down into the wall, but NOT through the entire wall height. Indicate detail cuts, or other locations.

5. Show configuration of NEW, FINISHED grade line, as it is to appear at completion of the project [uneven, sloped, graded, raised, lowered, etc.]; this is the heaviest line on the sheet [and is NOT a flat drafted line], and should extend well beyond the ends of the building, in its proper location. Existing grade is often shown in a dashed line, somewhat lighter, but also in its proper configuration.

6. Indicate all spread footings, foundation walls, column pads, pilasters, stepped footings, and other features which would appear ON THE OUTER FACE of the building; do not shown interior features. All work below the finished grade line shall be dashed.

7. Show and call out special vertical locations as necessary for clarity- window sill and head heights [indicate ROB, or MOB as appropriate], center line of circular windows, arches; vents, louvers, MAJOR items of mechanical equipment on the surface of the building.

8. Poche' [cross-hatch; use standard symbols for materials in elevation [not in section]] ONLY on selected and confined portions of the elevations [NOT over the entire drawing, un-

less this is office standard]; help to define design intent, and call out location of all exposed materials, joints, etc. Be specific, BUT DO NOT use specification language, or extensive notes [specifications writer will usually assign proper terms to be used].

BUILDING [Cross and Longitudinal] SECTIONS

1. Building Sections involve cutting the building across the short dimension [the "cross section"], or lengthwise [longitudinal section], to reveal both construction and relationships of construction systems and areas. The principle of "sectioning" is much like slicing a sandwich, which then reveals all the details of the "interior construction".

2. Show, usually at the scale of the exterior elevations, the overall mass section[s] of the building at the point of the cut; the section [cut] line may be offset to go through a variety of spaces- offsets MUST be taken ONLY at right angles to the cutting plane.

3. Show and indicate major structural features, using minimal detail [slabs, walls, floors, trusses, roofs, beams, girders, foundation walls, footings, etc. [Think of the section as an index to the construction!]

4. Indicate each space cut by the section by its name and room number. In these spaces show interior elevation[s] of walls beyond [those you would see looking in the direction of the cutting plane] ONLY IF there is new, or critical information resulting, and not revealed elsewhere in the working drawing set.

5. Indicate and call-out, by a heavy, dashed line [or a solid line] those portions of the building section which are "blown up" [increased in scale] into details.

6. Indicate and call out with designators [targets, bull's eye] all critical, vertical dimensions similar to elevations; extensive dimensioning IS NOT required.

WALL SECTIONS and DETAILS

1. The concept of wall sections is to section [cut] the building, vertically, from the bottom of the footing through the roof or parapet construction.

To reduce the extent of the drawing, portions of the wall construction which are similar, redundant, repetitive, etc., can be deleted by inserting a PAIR of break lines [usually this occurs about mid-way between floor assemblies].

2. There is a relationship between the scale of wall sections, and the use and scale of "blown-up" details; the smaller the scale of the wall section, the GREATER the need for associated "blown-up" details- obviously where work is shown at a small size, there is need for more, better, clearer, and larger-scaled information.

This relationship, and the scales and drawings involved are usually the subject of description in the office standards manual.

Scales of 1-1/2", 1", 3/4", or even 1/2"= 1'-0" can be used, as deemed proper.

3. There is no fixed number of wall sections; this varies with eh complexity of the construction, and the number of different wall types and detailing involved. Wherever wall construction changes [even in fairly minor ways, another wall section is advisable, if not required. This does not mean that every note, etc. must be reproduced, but the NEW information must be shown, and proper references to other information can be made.

4. Identify materials by both call-out note, and by material symbol; use proper line weight variations to distinguish between materials, especially thin materials; do this an adequate number of times to eliminate any doubt as to if-and-where a material is used.

A new method [if the office allows it] for call outs on wall section is to use a numbered designator for each item, device, material, situation, with one set of notes applied or types on the sheet. This greatly reduces the amount of lettering required, and offers a "cleaner", more-easily-read sheet.

5. Provide, call out and designate pertinent vertical dimensions in a manner like those on the exterior elevations.

6. Provide, call out all pertinent horizontal dimensions, aligning identical levels, in the various sections, across the sheet.

7. There should be NO reluctance to creating another detail; REMEMBER, we are trying to communicate a lot of information without speaking directly to the other person[s]. We must be clear, complete! We need to define intent [what we want] so we can maintain control of the project.

Locations of details can be identified by heavy dashed or solid lines [around the area in question] or by note.

8. Some parts of details DIRECT work ["provide masonry wall ties @ 24" o.c., each way"], or REQUIRE some work ["Flashing"] through their notes, and by leader lines that literally point to, AND TOUCH, the particular item.

In general, details show and indicate, 1) items required, 2) work required, 3) methods of placement, 4) attachment required, 5) a better view of the work involved, and 6] other aspects of the design professional's INTENT.

THE FOUNDATION PLAN

[Can be combined with the basement plan in some projects]

1. The foundation plan is really a form of floor plan, in that it is a horizontal section which looks DOWN on the foundation and footing system. The scale is usually the same as other floor plans; in fact, there must be a direct relationship between floor plan and foundation plan [match lines similar, etc.]. Often, instead of laying out the entire plan, again, one can overlay the floor plan and use it as the base for the foundation plan; this ensures coordination and correlation between these plans.

2. In many instances the footing/foundation layout and information can be overlaid [superimposed] on the basement floor plan. Where this becomes too involved and complex, separate plans should be utilized.

3. Show foundation walls, with pilasters [where used, and other extraordinary features, in a solid line; indicate cut-outs, slots, beam pockets [wall recesses for steel beams], masonry and slab ledges, and other features that must be formed into the concrete foundation all.

4. Indicate all bearing walls, column piers, columns, etc. which provide support for the floor above.

5. Show all spread, isolated, continuous, and other footings in their proper location, size and configuration, in a dashed line.

6. Indicate slabs-on-grade; note slab thickness, reinforcing, materials, penetrations, moisture protection, subsurface treatment, perimeter expansion joints, other concrete joints, etc.

7. Completely dimension plan; interior string dimension to locate all walls, wall thickness, openings, etc.; exterior dimensions same as the floor plan. Locate and dimension steps in footings, joints, and openings.

8. Identify and detail and dimension crawl space areas, and unexcavated areas [for slab-on-grade].

9. Add the proper material symbols in several, but isolated areas; at sides of openings, changes in materials, corners, etc.

10. Show detail and section cuts; draw associated drawings as necessary to define foundation systems. Show and call out location and types/number of reinforcing used.

Call out and indicate beam, CMU lintel locations, and similar related items and construction.

THE FRAMING PLAN[S]- Floor[s] and Roof[s]

1. Show the foot print of the building, with all bearing walls, and columns [which support the framing] in medium weight, solid lines; call out all members with proper industry designators; provide overall dimensions as indicated on the plan. [If all interior walls and partitions, bearing and non-bearing are shown, DO NOT show door openings, etc.]

2. Indicate with heavier lines, the centerlines of beams [wood, steel, composite], with proper call out notes.

Over the beam system, draw in heavy line, the centerlines of a portion of the floor/roof joist layout [every joist need NOT be shown]; dimension as and where required, otherwise indicate repetitive spacing of members; call out manufacturer, specification number, industry designator, etc. [a proper note would be, 2″x10″ joists @ 2′0″ o.c. = 88′0″] Indicate by an arrow with two 1/2 arrow heads, the SPAN of the joists [need NOT touch each bearing] in each bay.

3. Define completely the system, and all associated items and construction; bridging, decking, sheathing, accessories, anchors, trim [eave, ridge, edge closure boards] to provide a complete structural system.

4. Indicate applicable details, building and wall sections; show additional detail to clarify installation.

5. Framing systems, other than joists [glue-laminated beams and arches, steel bar joists, light steel framing, composite beams, trusses for floors and roofs, etc.] are depicted in essentially the same manner.

SCHEDULES [General]

There is a tremendous amount of information that must be incorporated, and shown on a set of working drawings. This is made more complex where the project in total, or the construction, in itself, is very involved, complex, intricate, and crucial. Often drawings become overburdened with both written and graphic material, to the point that the documents become almost unreadable. This will adversely affect the work, and perhaps the project as a whole. The use of schedules allows for the display, in a very orderly fashion, much of that information. In fact, one should always be looking for opportunities to combine data into a chart [schedule] form, always seeking to aid in clarifying the information and making it more readily readable and useable.

Examples of schedules would be room finishes, doors, windows, openings, louvers, lintels, beams, columns, reinforcing, equipment, hardware, footings, piers, caissons, test borings, light fixtures, electric panels [several types], partitions, fixture, symbols, etc. Most professional offices will have standard formats that they use.

ROOM FINISH SCHEDULE

1. Room finishes can be displayed in either legend or schedule form. In legend form, the information is placed within the space in question, and appears as a note, perhaps utilizing abbreviations to reduce the size of the note.

2. In some formats, the Room Finish Schedule is part of an entire sheet[s] devoted entirely to various schedules. Where this is true, it aids use of the schedule and relating it to various spaces, if it is placed at the extreme right size of the sheet; here the set pages can be folded back to reveal the schedule and with only slight manipulation, the space being reviewed. In some projects the Room Finish Schedule is typed, and bound into the Project Manual.

3. This schedule can be either a bar or matrix type [examples will be offered in the classroom]. The form used usually will reflect a concern for minimal time for preparation, and ease of use.

4. Layout the schedule, from left to right as follows;

- Room Number [from the floor plan]
- Room Name
- Floor Covering [structure can be left exposed]
- Base[board]
- Wainscot [if applicable for partial wall coverage]
- Walls; subdivide into 4 columns for N, S, W, and E walls
- Ceiling; subdivide into “material” and “height” columns
- Remarks; a sizable column for notes, details, specifics, modifiers, references

5. General Notes can be used which refer to the Room Finish Schedule, but they MUST NOT contain specification text or information [do not, for example, note the name and color of the carpeting]. Usually these notes will be few in number and will address specific/unique conditions, or will apply general principles in the form of a reminder.

DOOR AND WINDOW SCHEDULES

1. Show and call out doors and windows in BOTH written and graphic form, i.e., show elevations of EACH type of unit, and use a written, column format for associated information [size, material, manufacturer, model number, etc.]; cross-reference the two formats.

2. Choose scale for graphic portion of each schedule that adequately depicts the units in detail.

3. Show head, jamb, and sill details for both types of units; show vertical and horizontal dimensions, and specific features [louvers, glass lights in doors; special hardware or glazing in the windows].

4. Examples will be presented in class, but the Door Schedule is best formatted as follows [columinzed left to right];

- Door Number or Mark [designator used on plan]
- Number of doors in opening- single, pair
- Size; width, height, thickness, [in this order] and in feet/inches as applicable
- Material; face mats, and core construction [solid, hollow, insulated, lead lined or other special construction required]
- Glazing; explain any glass panels in door
- Finish; painted, aluminum, plastic laminate, pre-finished
- Type or style, taken from the elevations
- Frame; material and type; special features
- Details; list separately the title of the head, jamb and sill detail for each door
- Fire Rating [of opening]; applies to BOTH door and frame
- Hardware Set; list set number as described in specifications for Finish Hardware
- Remarks/Comments; list special conditions/exceptions/refurbishing/ replacements, etc.

5. Also include all special doors and frames [roll-up window closure over service counters, etc.]; show elevation[s] and assign make proper entries in the door schedule itself. Call out thickness, width, height, material, and other pertinent dimension.

NOTE: Care should be taken to observe standard conditions; for example, in a CMU wall, the frame height is best set at 7’-4” since this corresponds with block coursing.

6. The window schedule is also set up in a grid pattern, with columns, left to right, as follows;

- window number [and mark or designator used on plans]

- manufacturer [coordinate with specifications]
- size; rough, or masonry openings; usually width by height
- material; as specified
- glazing; type as specified
- Details; usually in three columns- head, jamb and sill

NOTE: where several detail condition applies to the same window unit, use a different symbol on the plans

- finish; as specified
- remarks or comments; ample space to list unusual conditions, requirements

7. Window wall and storefront glazing systems are NOT included in the schedules. Use notes, elevations, etc on the plans themselves. Require field verification of opening sizes.

8. In simple [smaller] projects these schedules can be modified and reduced to simple elevations, with proper detail references, at the head, jamb, and sill.

No drawing, no matter how it is produced should

- Create more questions than it answers
- Leave only a mere hint of what it depicts, where it is applied or what is to be done
- Leave the drafter or user scratching his or her head in confusion
- Let the drafting style/technique get in the way of the message being sent
- Mislead or give any wrong impression or direction
- Try to do or show too much
- Sacrifice readability for any other feature or attribute
- Be so badly executed that it is an artistic masterpiece but a technical failure – the presentation must fully support the information

COORDINATION OF WORKING DRAWINGS AND SPECIFICATIONS

Today, the word "coordinate" has become a buzzword, which is almost thrown away. Its real impact is too often lost, as many people merely nod toward that function without really addressing what is involved. In the production of architectural working drawings, though, coordination is essential, major, and pervasive activity that simply cannot be sloughed off, ignored, or nodded to. Coordination, in fact, is an activity that ensures that the correct information is depicted/described, applied in the correct format, and in the correct location both on the documents and within the project work. It is part of the design professional's responsibility, just as applying and administering the correct medication is part of the physician's responsibility.

The correct coordination of working drawings and specifications is as simple as it is complex!

In its simplest form, the overriding general principle is that the drawings and specifications are inseparable companions – partners, if you like. They should not be separated or used in isolation, one from the other. Note there is no claim of equality in this, each of the documents having its proper influence on the project, but only in the presence of the other. No project can be built using just the specifications – or just the drawings!

Some legal aspects apply in this. First, a contract [and the drawings and specifications ARE legal contract documents!] should be read "as a whole". That is to say that no conclusion or determination should be based on a single isolated portion of either drawing or specification. Second, they are generally considered to be complementary and supplementary, meaning that they support each other, and one requires the input or information contained in the other. Thirdly, it is general held, and accepted that, "what is shown/described in one [of the documents], is as binding, contractually, as if shown/described in both". This further reinforces the proposition of inseparability.

Attorneys and judges in particular love to try to separate out the specifications, since those people have a strong penchant to "work words". Few words have a strict absolute single meaning – a good attorney can make any word into something else, usually to his/her best interest, by changing attitude, perspective, or approach of the word in question. Of course, there is no inclination on the part of architects and engineers to engage in such "word-smiting". Rather they seek to be explicit, direct, and accurate; and as clear as possible. Some owners, for varying reason, also seek to set a "pecking order" for the docu-

SUPPLEMENTARY CONDITIONS

The following provisions supplement and modify the General Conditions of the Contract for Construction, American Institute of Architects Document A-201, 16th Edition, 2007. Portions of the General Conditions which are not modified by these Supplementary Conditions, shall remain in effect, as written.

1.2 EXECUTION, CORRELATION AND INTENT
1.2.6 In the event of conflicts or discrepancies among the Contract Documents, interpretations will be based on the following prioritized order;

1. Change Orders
2. Field Instructions [both 1. and 2. in reverse chronological order starting with last issued]
3. The Agreement
4. Addenda, in reverse chronological order starting with last issued
5. The Supplementary Conditions
6. The General Conditions
7. Drawings and Specifications. Full-size or large-scale details or drawings shall govern small-scale drawings, which they are intended to amplify. Details or conditions indicated for a portion of the Work but that are not repeated fully for other portions shall apply throughout to all similar portions except as otherwise specifically noted. In the case of an inconsistency between Drawings and Specifications or within either Document not clarified by addendum, the better quality or greater quantity of Work shall be provided in accordance with the Architect's interpretation.

[This list of documents has also been advocated by the Construction Specifications Institute (CSI)].

ments, but they should be dissuaded from trying to do this. Flatly, setting one of the documents as superior to the other is a dangerous practice. By separating information that is fully intended to be read, and used together, sets an ambiguous scenario, which is difficult to resolve, and often is the crux of disputes and even litigation.

Now comes the hard[er] part! Ideally, the drawings and specifications are developed concurrently. As information is added to one, it should [must!] be commensurately added to the other. Granted there are many administrative items that are contained wholly within the specifications, but technical items tend to be contained in two parts – written, and illustrated. When the information is incorporated into the project documents as they are produced, there is far less chance for errors, or for leaving vital items out. Gaps are difficult to find, later, often more difficult to resolve, without disrupting other work. Unresolved gaps lead to extra costs, disputes, and other needless aggravation.

Information changes many times over throughout the production of a project's documents, and the actual construction. This all needs to be reflected in the documents. Of course, it would be a needless effort, and quite costly to continually issue full sets of new drawings and specifications. However, this is done on a reduced scale. Bulletin drawings, addenda, change orders and field instructions are issued, as required, in different stages of the project. These all need to be made part of the contract documentation, as they augment, revise, or otherwise modify the originally distributed drawings and specifications.

To reflect these changes, some professionals add a provision in the Supplementary Conditions of the Contract [making changes to the General Conditions of the Contract, which are usually pre-printed, standard forms published by professional organizations like the AIA].

Here the professional, in consultation with the client, can list the chronological order in which documents will be held. This does not, however, indicate or establish precedence of one over the others, nor does it set a distinct pecking order for all of the documents. It merely reflects status of the document by virtue of when it was issued, and how that issuance influences the contract documents [which include the Agreement or contract, the drawings and the specifications].

Special note must be taken that this modified provision in no way creates, or is intended to create a new legal precedence, or status for the various documents. It is, rather, merely a statement indicating how the professional will use the most current information, in making any interpretations, as the work progresses. [The primary legal and working relationship is that the drawings and specifications for a project are *supplementary* and *complementary*, and *must be utilized in conjunction with each other in an inseparable manner – neither document contains ALL of the information required to construct the project*!]

Completed drawings and specifications are first issued for bidding. They may be modified during the bidding process, by issuance of addenda. These changes basically update the documents to new or correct information, revise project information, and answer questions from bidders. Addenda though are fully binding when the contract is signed. Usually the contract will make note and list provisions that all drawings, specifications, AND issued addenda are integral parts of the contract [Agreement], including them in the legal context of the project contract.

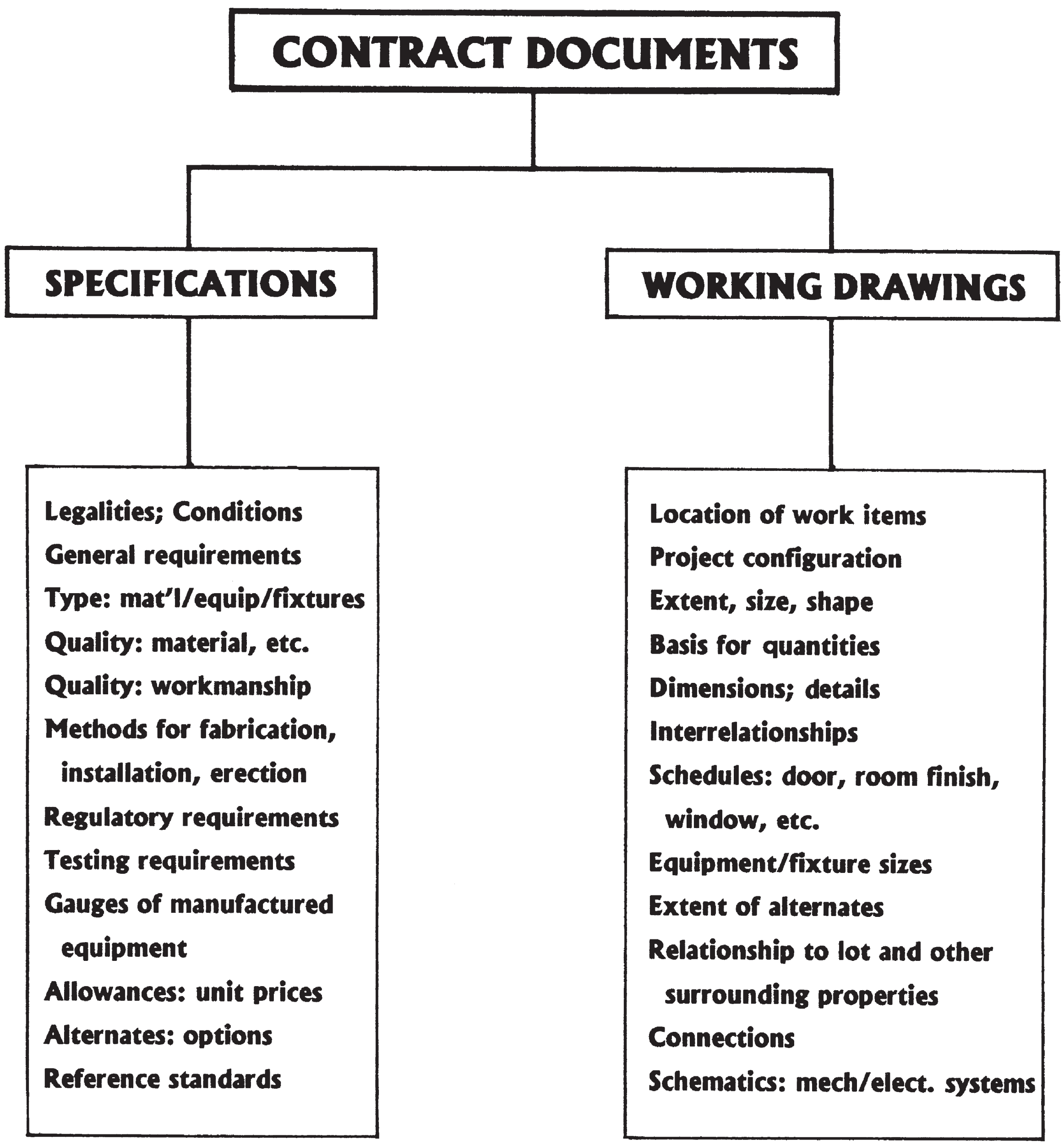
As work progresses [moving toward fulfilling the contract] other changes will be required. Some are items within the documents, which are unclear, inadequate, or perhaps even incorrect. Other changes come from differing field conditions [than those expected], unavailability of material or systems, changes desired by the owner, etc. These can be merely Field Instructions [formalized in writing, not by word of mouth] making changes which have no impact on either contract cost, or contract time [period noted in the contract, for construction to be completed]. Where such changes involve either cost and/or time, a formal, fully executed Change Order is required. In either case, however, this is another form of updating of the basic contract, and is considered as "later information" which modifies the project contract.

To properly relate all of these updating documents, many times a provision such as **seen in the illustration**, will be used. Note that the language alludes to how the documents will be considered, NOT to how they rank, or take precedence one over the other[s]. This distinction is pre-eminent, and needs to be fully understood by all involved.

In this, the first order of business is to set out, as best we can, what information goes where **[see chart illustration]**. While the information is not as cleanly segregated as shown on this chart, it closely follows this outline. There will be some overlap, and redundancy – best there be no gaps. Some decisions about location of data may be required, but they should be coordinated with minimal redundancy.

In frankly simple terms, some information is better shown by drawing; other information requires and is better described in words. For example, it is difficult to describe relationships of materials to each other – angles, fasteners, varied thicknesses, etc. Likewise, it is difficult [if not impossible] to depict an attribute, capability, or inherent ingredient of a material or system.

One learns early, that voluminous notes on drawings take up too much space which could be used for other drawings, and often are not as accurate as the "written word". Also, there is the aspect that inaccuracies are too easily included, and are less likely to be discovered [as objective review of drawings is not a widely used activity these days]. Specifications are usually proofread at least once before they are printed, bound, and issued. It cannot be stressed enough, that many dollars can be involved where two numbers are merely transposed, in a model number, listed in a note. Sounds simple, and inconsequential, but it is not so. First, the item matching the incorrect number may be totally wrong for the project, if it is not wrong in color, performance, size, etc. Either way there is need for remedial action, both administratively and physically [both



The chart shows one of the most important aspects of creating working drawings and other contract documents — the proper location of information! Note that items listed under the specifications are more readily written than drawn, and vice versa for those under working drawings. In addition, these locations are fairly traditional and widely accepted as being the first place personnel look for specific information.

expensive] to change-out and make the correction[s].

It must be understood that every piece of project information has several relationships, all of which must be observed and resolved. These relationships are;

- To the complete array of project documents [the "set" of contract documents]
- To other associated drawing sheets [to make references, to draw information from, or to expand/complete those items]
- To the specifications [by providing the visual aspect of the information]
- To other ancillary drawings [which when combined provide complete information]

The following illustrations are examples of the coordination of project information. One example shows how various systems relate to the same floor plan layout and area. The other notes how information is applied to the project, by reference, and although the complete "package" of information is contained in various drawings located on different sheets. The proper documentation of architectural projects involves not only the concept of "set", but also the requisite interrelationships and coordination. Understanding this is crucial to successfully producing project documents that result in successful projects.

There are many things that we call, or use as "sets"- dishes, golf clubs, tires, tennis games, etc. The word itself alludes to a group of closely related, but different items, combined to form an entity, interrelated, and interworking. So it is with architectural working [contract] drawings. The best simile that can be applied here is to golf clubs. Each club in the set is unique in shape, angle, and use. Combined they provide the player with a full array of "tools" that allow for every condition or challenge the golf course presents. Misuse of a club can result in a bad result, which impairs a good hole, game, or completion. Some clubs may be used very little, but they are still available [in the bag] should a condition arise that requires their unique capacity [the sand wedge, for example]. This is a direct parallel to the various drawings, types of views, and other presentations within a set of working drawings. One must have them at the ready, for use when appropriate, and helpful, and certainly when they add, contribute or clarify project information; and where they facilitate a "good" and complete game [the project].

In some "sets", the individual items can be used at random, or for very specific circumstances. The interrelationship with other parts of the set is put aside. However, due to the necessary tight interrelationship of information within architectural projects, things change. From early in the production of the documents, it is absolutely necessary to proceed in a very close, careful, thoughtful, prioritized, meticulous and fully coordinated manner. This may seem like an extraordinary path but there is so much information, necessitating close coordination insuring that no other path works. Axioms that apply to other types of work also apply here – "the specific rules the general"; "proceed at your own risk", etc.

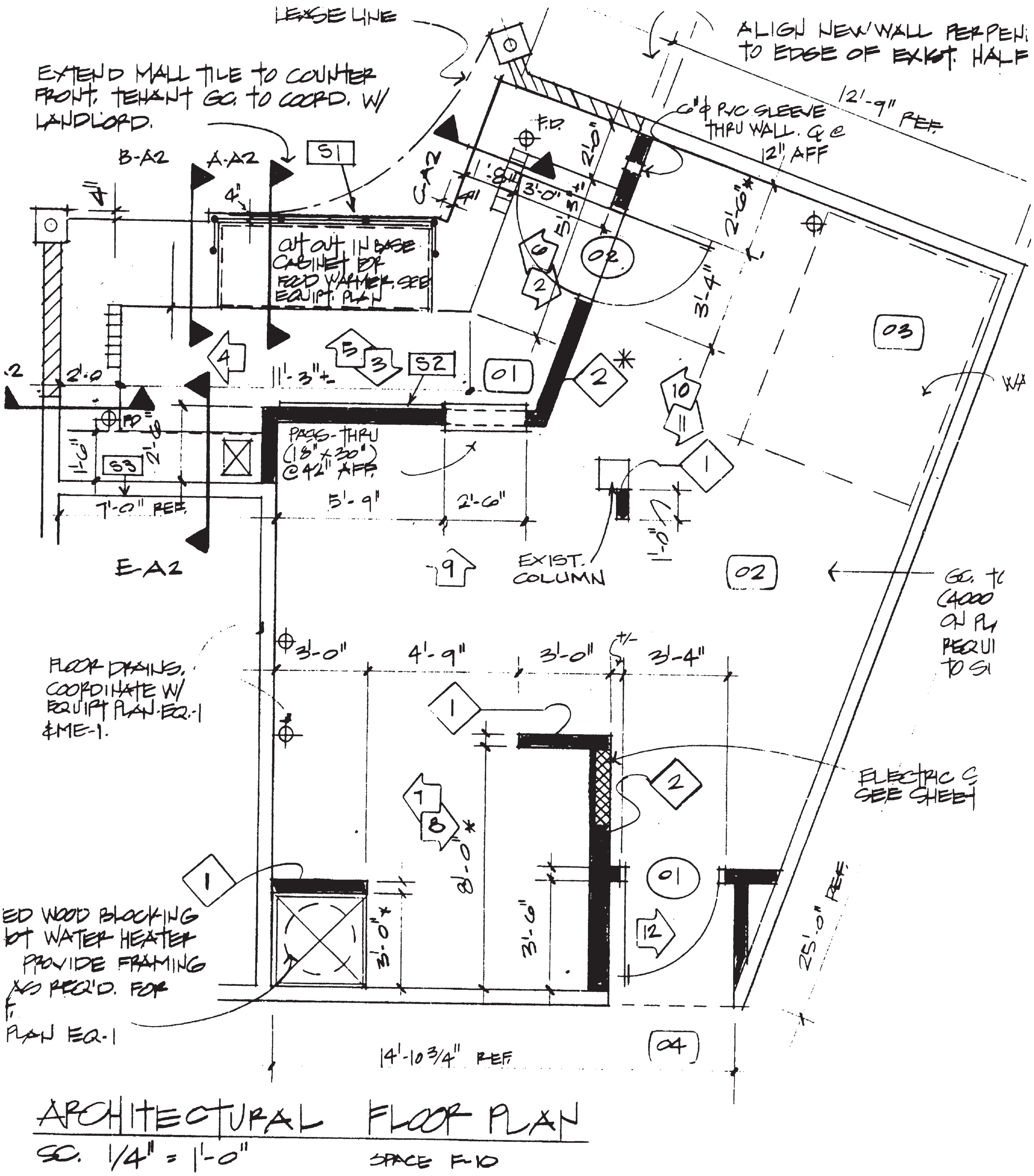
Hence, a set of working drawings is best produced through a series of small incremental steps; "shuffling" if you will. Progress is governed by what information is available to be portrayed on an individual sheet. The lack of information indicates that the sheet cannot now be started, or that the sheet cannot be finished completely, at this time. This situation directly shows the importance of gathering information, and then developing it.

All design and drafting personnel, including junior drafters and students, need to understand the PRIORITY of their work, as well as the "fit" or interrelationship with the work of others. Rarely is work on working drawings done in isolation. Obviously, there are a lot of drawings required in any set of architectural or construction drawings, and a lot of information. However, by setting and understanding the personal priorities based on those set by the Project Architect, one can approach the work of getting all of this work done, in proper sequence, and in good, well-coordinated order.

For example, consider three PRIMARY aspects of a set of project documents; <u>configuration/size, height, and construction</u>. Immediately, these translate into FLOOR PLAN[S] which deal with the shape [configuration] and size in the form of length and width, and the intricacies of the room layout. EXTERIOR ELEVATIONS add the element and relationship of height, and give the third dimension to the project. WALL SECTIONS which cut through the exterior walls [primarily] reveal the construction of the project, or just "how" the building/project is to be built, interrelated, and so forth.

Without all three of these aspects of the project, the documents are INCOMPLETE, INADEQUATE, and UNACCEPTABLE/USELESS!! There is no sense issuing such documents to contractors, for bidding or construction, when they do not contain all of the information that is required.

If that information is not available, the contractor[s] will either be forced to ask numerous questions [which is confusing and time consuming], or will attempt to fill-in the data, on their own. That usually will prove to be a detriment to the project, since the contractor[s] do not know the thinking, reasoning, and rationale behind the design and documentation of the project.



The following is a series of drawings, each depicting one aspect of the required work.
Note the coordination between them and the ease of reading how the work all fits together.
In general, the drawings are broken down into the work of the skilled trades required to execute the work.

Further, these three categories of drawings form the base of information for the other drawings in the set, and contribute heavily to the success of those other drawings. Everything after these basic drawings enhance, expands, or adds to these drawings; they clarify, amplify, detail, dissect, reveal, coordinate, enlarge, or complete the basic drawings. They are like the smaller pieces in a jig-saw puzzle – they are needed to complete the entire "picture', even though they are smaller [in size/scope], and perhaps in the amount of information they project [a single colored, border piece of a puzzle, for example]. Very few items of work on a construction project are depicted and installed alone. Everything seems to be tied to other work or at least to other drawings, which expand on, or use the information to explain, more fully the work they show. Even a flagpole, for example. While standing along, literally in the middle of nowhere, the flagpole needs a foundation detail [to illustrate its anchorage to the ground]. In addition it will appear on the Site Plan, which show the correct location, associated walks, curbing, benches, etc. It could possibly appear on the landscape plan if there is a complex of plantings near or around it. In some cases, the pole may also appear on the exterior elevations [where it has some impact on the building elevation].

On the other side of this, some items are repeated several times over in the same project but drawn just once. Proper reference and coordination is required to place this item in its several locations. Scale also plays a major role in the documentation, and coordination effort. As the need to be more and more specific, in showing the work, the scale must increase; sometimes very small items are drawn at full size [their exact size]. Not adjusting scale to the level of detail required, can either cause illegible drawings, or work that is poorly or inadequately shown.

There is a direct correlation between a drawing, its scale, its contribution, and the type of information it provides. The following is a brief chart of explanation;

> The more specific the drawing [a detail for example] –
> The smaller the area of work shown –
> The larger the scale –
> The more the drawing "informs" without reference to other drawings –
> The more it depicts an end-result, final configuration –

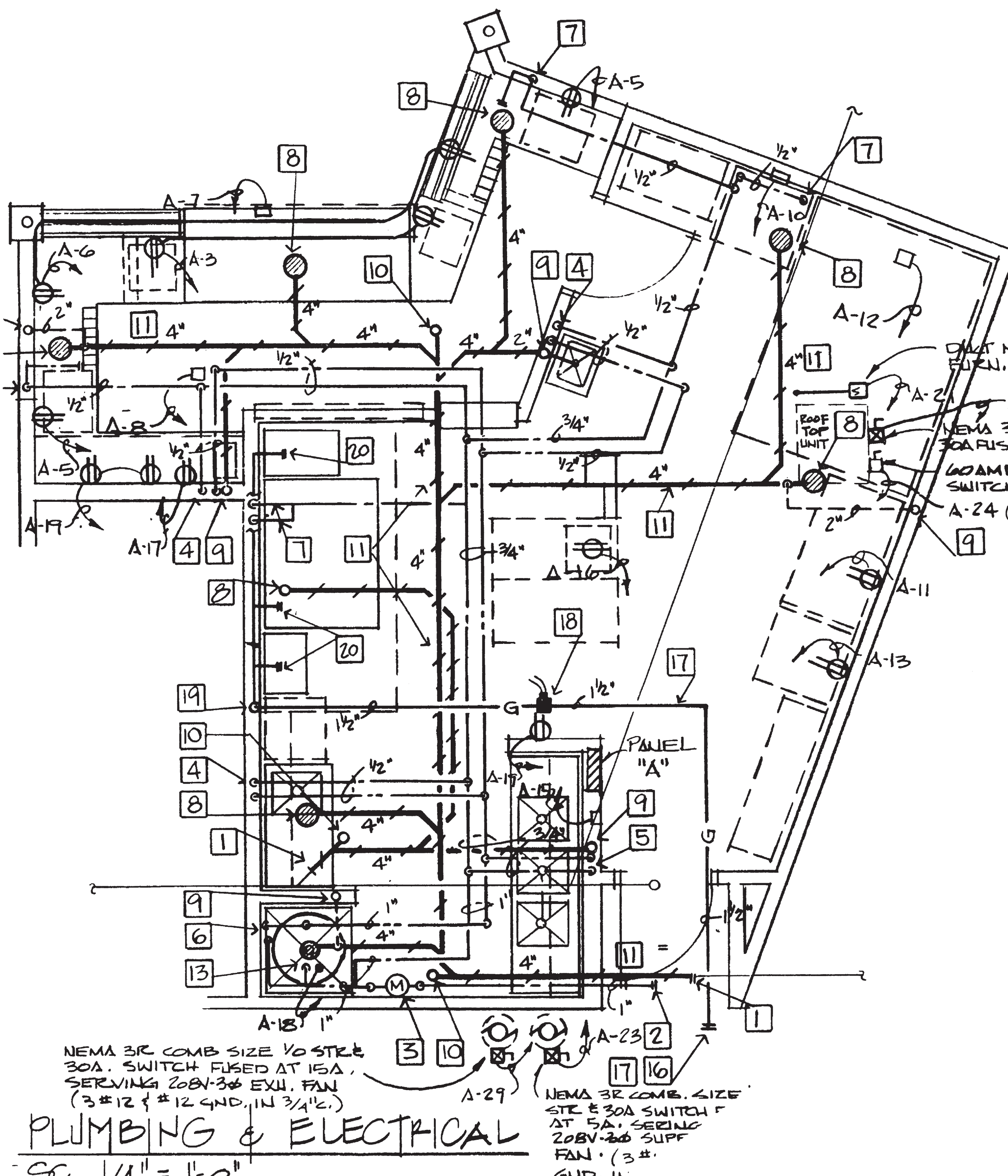
In the reverse, if the drawing is general or overall in scope [an exterior elevation of one entire side of the building, the area involved is larger; the scale must be smaller [to show the entire drawing on one sheet]. The more the drawing will reference other [more specific drawings- details/sections, etc.]; and it tends to depict a concept or overall view, but not the specifics of how the construction is created.

Also, it needs to be said, that these priorities SHOULD NOT be avoided or ignored in favor of other, less important drawings, simply because the others can be more easily, or more rapidly produced on CAD systems; neither should they be produced just for the sake of using the computer. A set of several tens of drawings may appear impressive. It may indicate a "tremendous work effort". However, they can prove to be quite improper, inadequate, or even useless where they do not provide the required information; one cannot install a "beautifully" depicted elevator shaft in a "building" which has no walls [none shown on the drawings]!!

The mere fact that one "likes", is intrigued by, or is attracted to particular materials, systems, or areas of the project, is irrelevant to this process. Projects are NOT produced to meet the whims of staff, but rather to carefully delineate the work required BY THE PROGRAM to produce the CLIENT'S project! Obviously, the major systems of the project will initially dominate the work; general schemes and concepts will be brought forward to transform client programming into working documents. Details will dominate the work in the finishing phases, as truly "the specific" rules. General ideas, concepts, and terms, etc. MUST be converted to usable construction information, in a very specific manner. This directly follows the premise, but does so in a developmental setting, in sequence, and with priorities set, followed, and met.

Of course, it is possible to find minute detail of fairly obscure portions of the project immediately, but this DOES NOT mean that they are then IMMEDIATELY incorporated into the project documents. Too many things change, too often, in the course of production to install firm, final determinations, information, or details right-off or early in the process. Proper priorities must be given each piece of data. To do less than this is to often require that "finished work" be abandon, deleted, worked over, or radically revised to meet new project requirements – this is professional disaster!

It is neither prudent nor wise to allow obscure, minor, "cosmetic" or utilitarian details drive the project. The process is to DEVELOP [as in evolve] the general schemes INTO the detailed explanations; not vice versa. Every project has a basic and fundamental set of pieces and systems that are vital to a successful, proper functioning and safe project/structure. To these an endless variety of cosmetic finishes, and utilitarian


PANEL "A"
ROOF TOP UNIT
60 AMP SWITCH
NEMA 3R COMB SIZE 1/0 STR & 30A. SWITCH FUSED AT 15A, SERVING 208V-3Ø EXH. FAN (3 #12 & #12 GND, IN 3/4"C.)
NEMA 3R COMB. SIZE STR & 30A SWITCH F AT 5A, SERING 208V-3Ø SUPF FAN. (3 #. GND. I
PLUMBING & ELECTRICAL
SC. 1/4" = 1'-0"

items are added. So to make decisions early-on about remote or superficial aspects of the finished building[s] and have them drive or force decisions about structural, mechanical, and other general matters, including aesthetics and conceptual considerations is fundamentally WRONG! – and quite counterproductive.

No item of clothing is designed around a button selected first off; no automobile is designed around a selected spark plug, or new oil! Use of a manufacturer's detail simply because it is attractive [in the catalog, or appears to be quite innovative] is ill-advised, especially where it has no immediate relevance to the project at hand. Details and finishes should be conceived, and considered as enhancements and explanations of the project's design concept, its needs, and its overall scheme and systems; the "execution" of the concept! Finishing touches mean just that; relatively minor additions/revisions and fine-tuning of the project's major considerations.

The production of a set of working drawings can be most intimidating. At some point, one realizes the terrifying reality that several, if not all of the drawings are "in progress" - NONE [!!] finished, and all requiring massive amounts of additional work. To this, in the office, one must add the inevitable time limit at which point the project MUST be finished [??] and biddable!

The start of the detailing process requires the drafter to assess the relative importance of the various items, the need for their appearance [if used at all], and then in turn their proper line weights in the presentation. This review needs to be a very objective process, remembering that showing "everything" is NOT necessarily the correct thing to do. In fact, it can be patently wrong, particularly if doing that in any way confuses reading and understanding the detail, or contributes to making it "too liney" and needlessly complex.

The illustration is a good example of several maladies noted above;

- line weights poorly conceived
- drawing too "liney"
- information shown needlessly
- detail overly complex for no good reason

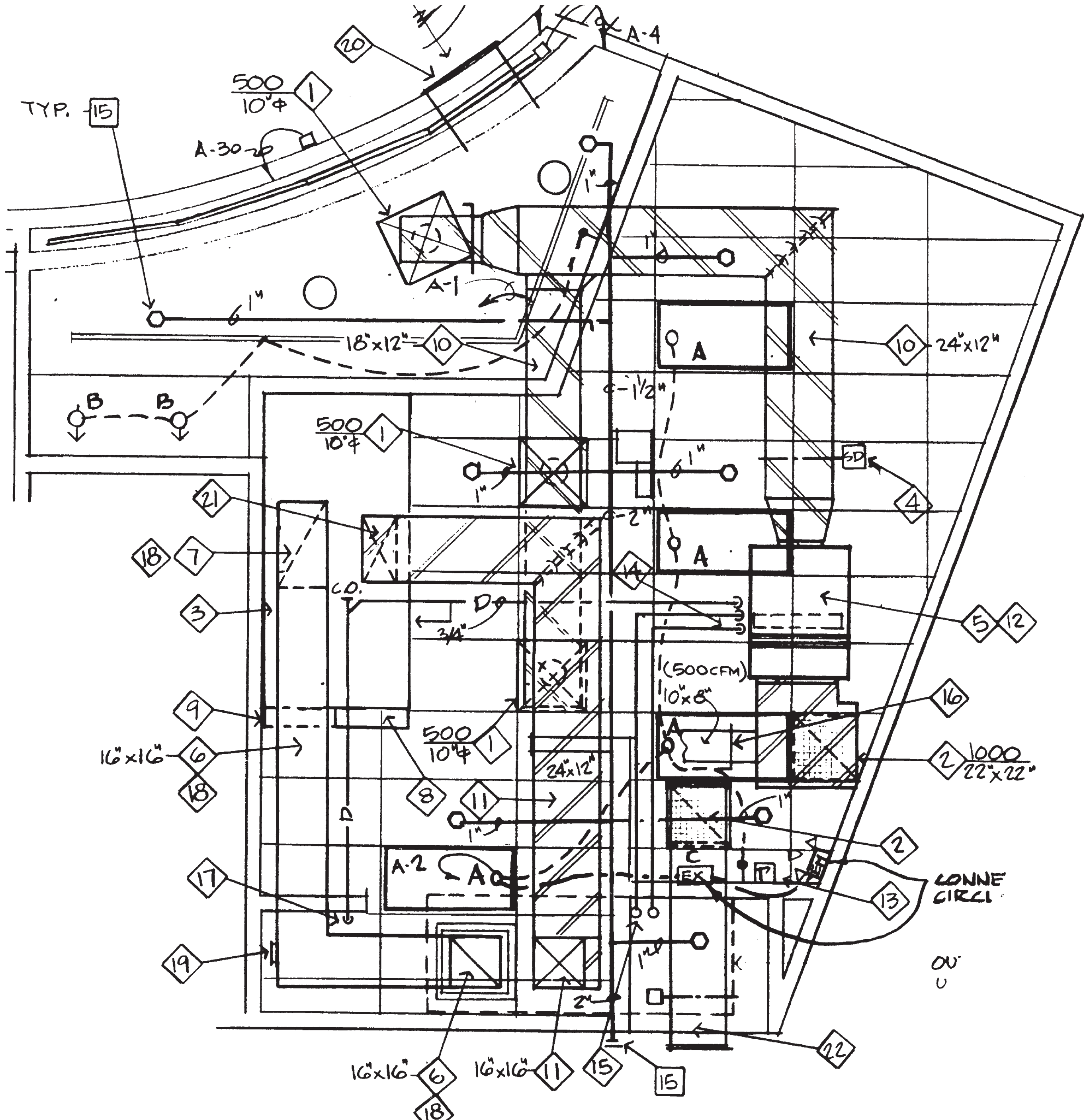
The assessment process starts with establishing what is to be shown; then adding the other items to be incorporated, which will further explain the construction of, or around the primary item. For example, structural steel columns, in the project frame, are to be surrounded by CMU enclosures. These vary from column to column to meet differing conditions. Thus, the assessment is, 1] we need to show the columns, and 2] how each is enclosed with CMU. The priorities are obvious [the column and the surround CMU are the primary features].

To this must be added dimensions, profiles [bullnose, etc.], proper relationships, anchors, etc. HOWEVER, there is no need to show the horizontal masonry wall reinforcing! This would add a number of lines and really add nothing that cannot be noted [on drawing and/or in the specifications]. Again, the illustration shows the latter, and in makes the drawing too liney, too complex, and places line weight emphasis in the wrong place. The detail has been degraded, and readability compromised. In the normal sequence of a project, the production of contract [working] drawings or documents is not a process that must start from a dead stop. Rather, the schematic [preliminary] design documents will have been further developed, and have had at least minimal detail begun; thus, the Design Development phase of the work.

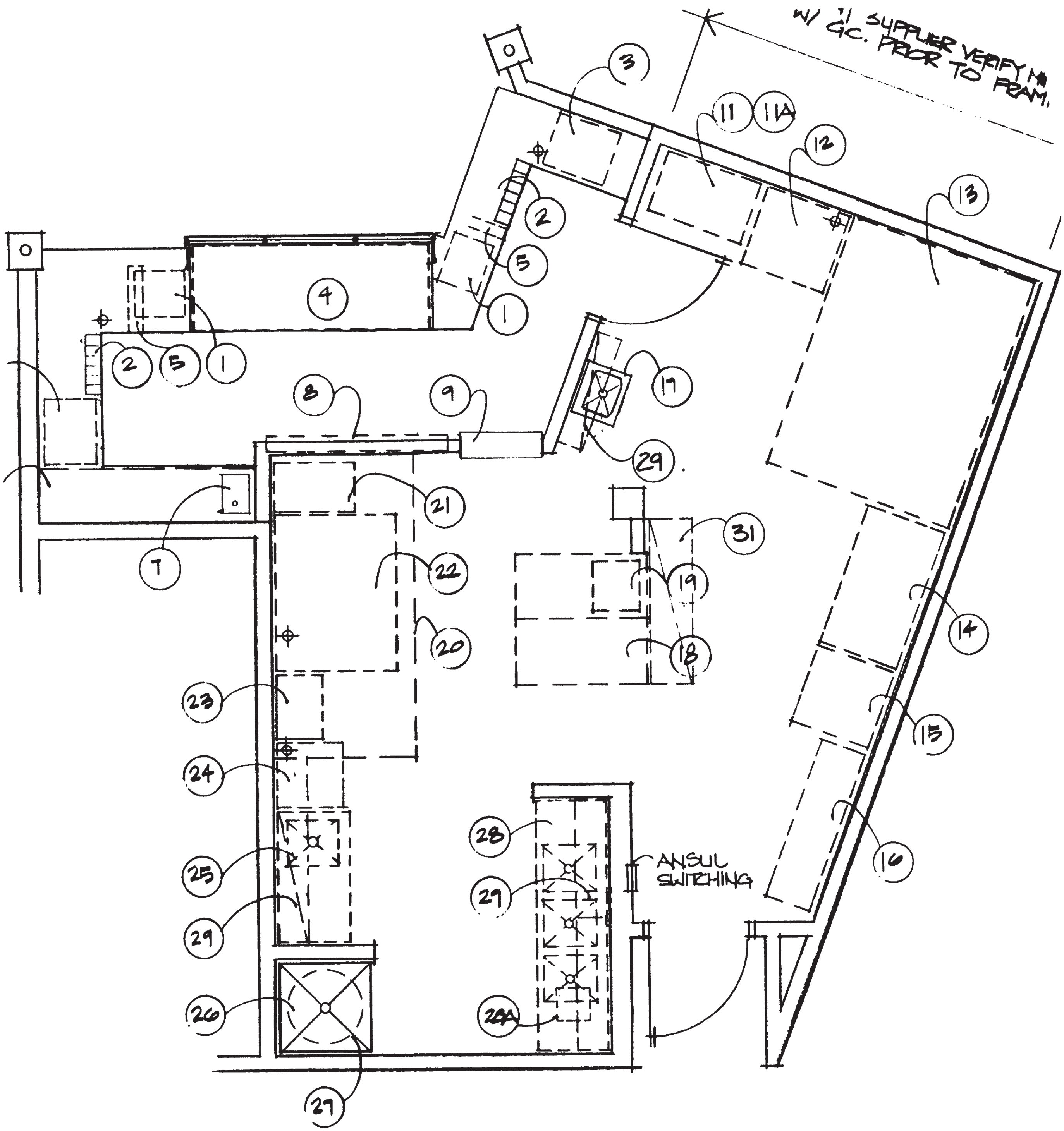
The working drawings start with those documents, and augment and further detail them into the full, finished set of working drawings. In reality three things need to come together at this stage –

- the design development drawings and decisions
- the programming documents
- a checklist of project tasks that must be performed, including a list of materials, systems, drawings, details, and the like that appear, in some form, in every project.

The first two items refer to, discuss, and note the uniqueness of the project, while the last relates the common, mundane, and "usual" items that are necessary for a complete project. Now these may be upgraded or enhanced to be more in keeping with the uniqueness of the project, but they nonetheless need identification, and a decision as to whether or not they are required, and in what form.

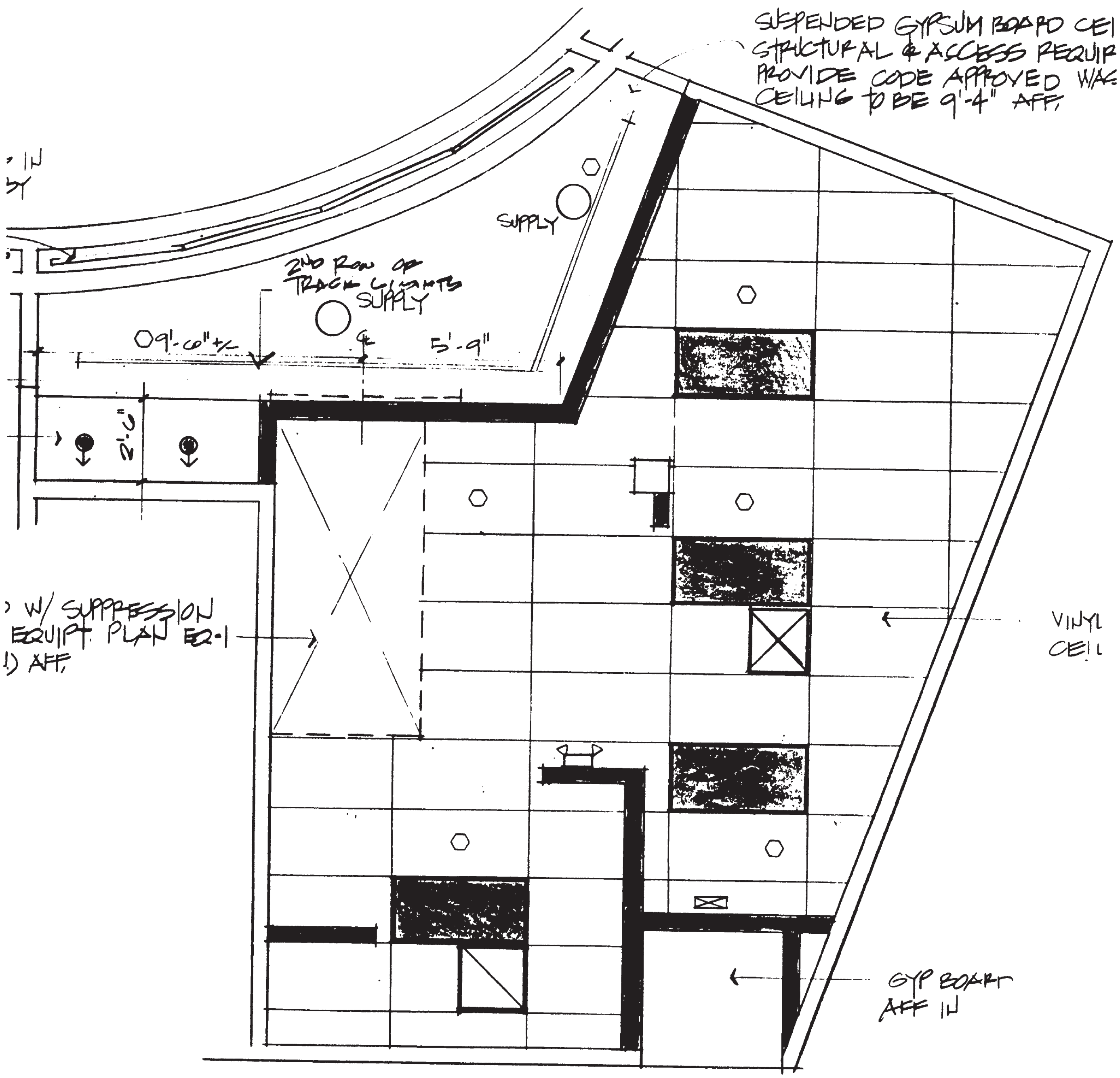


HVAC, LIGHTING, & FIRE SUPPRESSION
SC 1/4" = 1'-0"



EQUIPMENT PLAN

SC. 1/4" = 1'-0"



REFLECTED CEILING PLAN
SC. 1/4" = 1'-0"

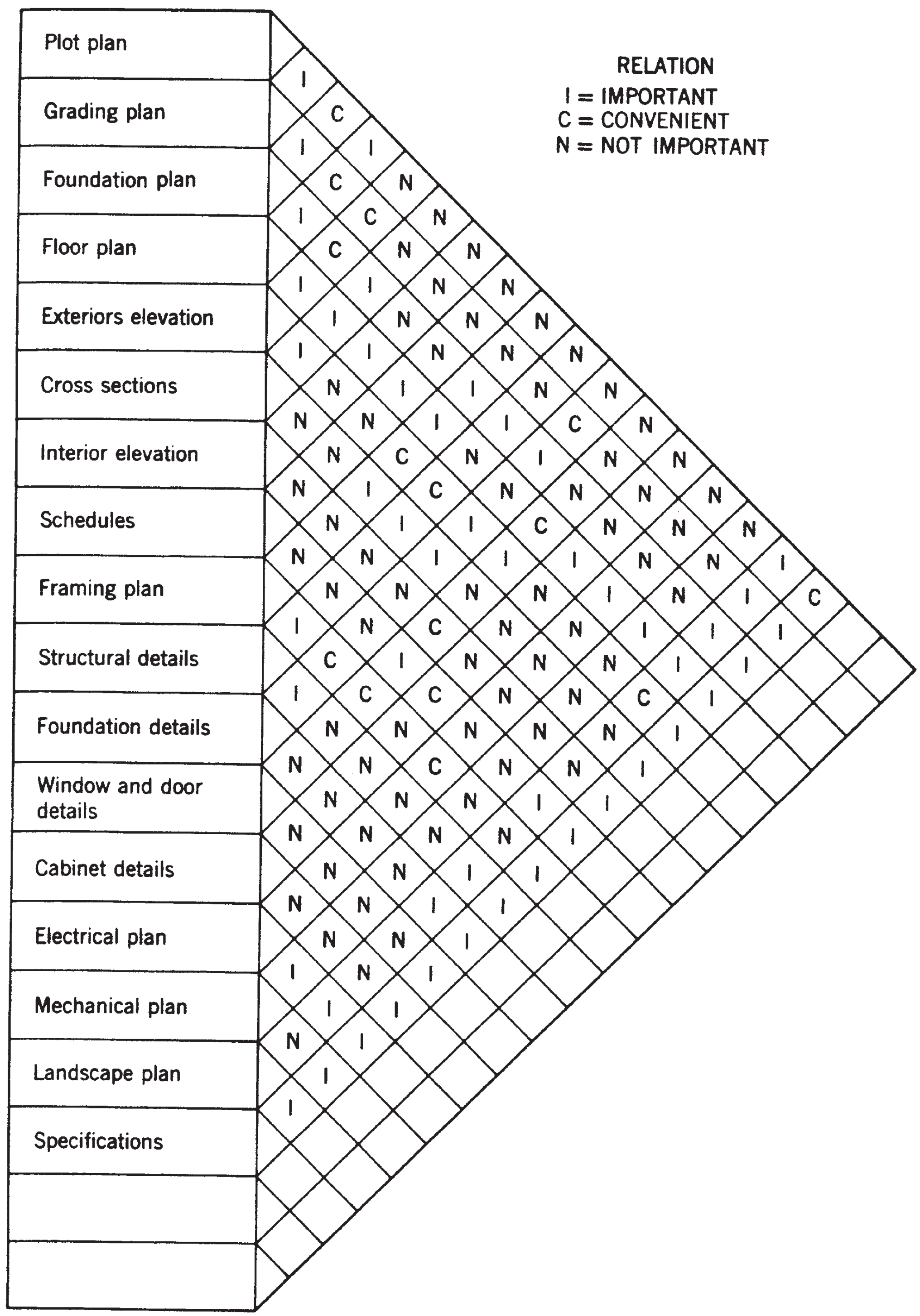
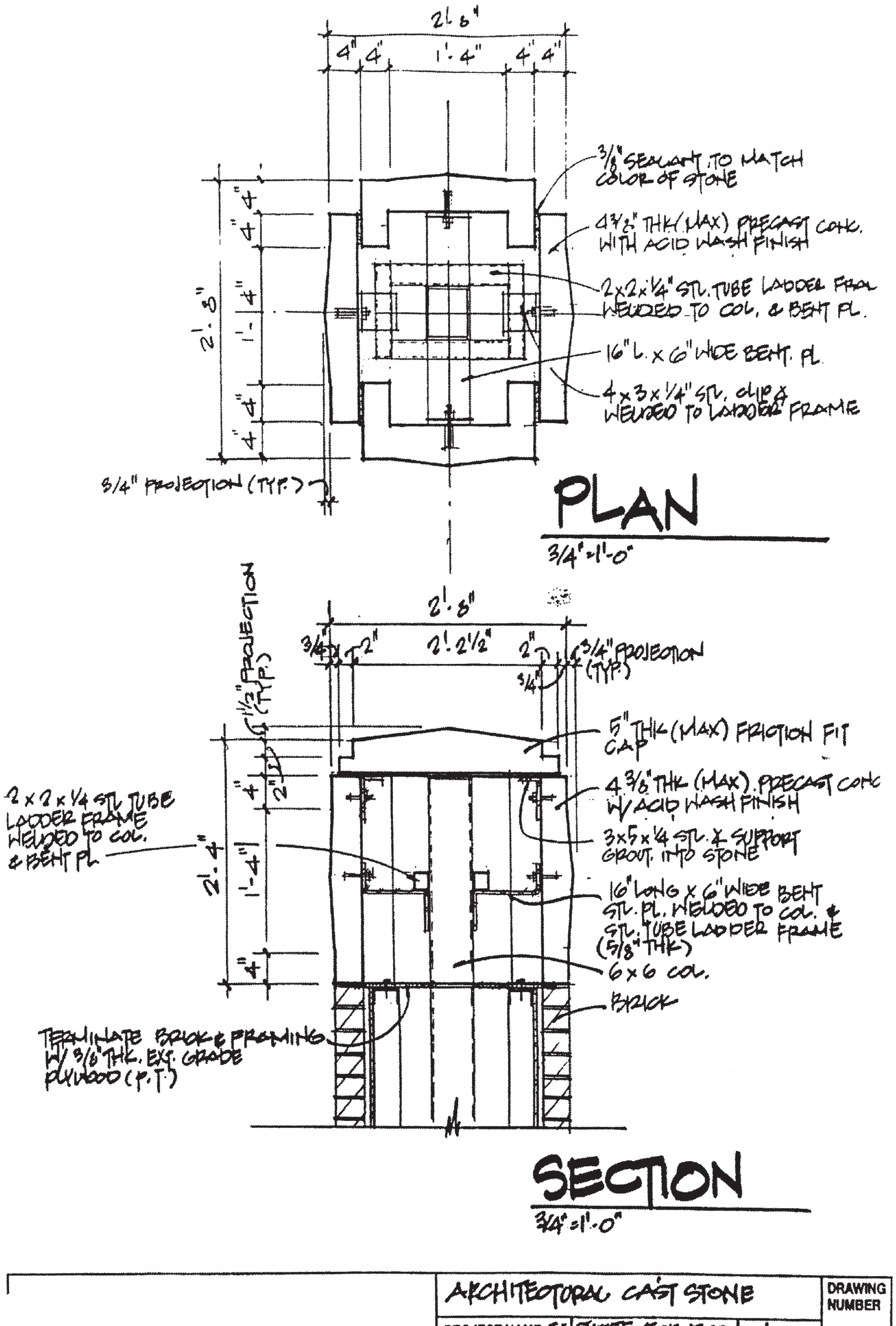
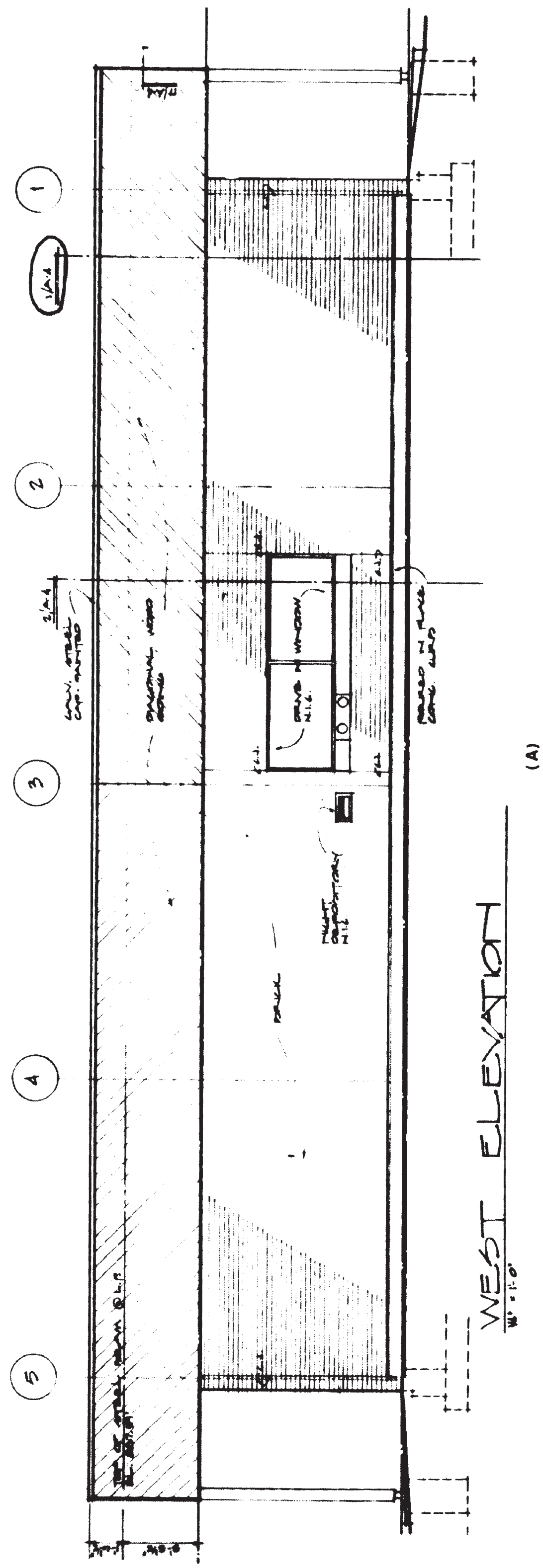


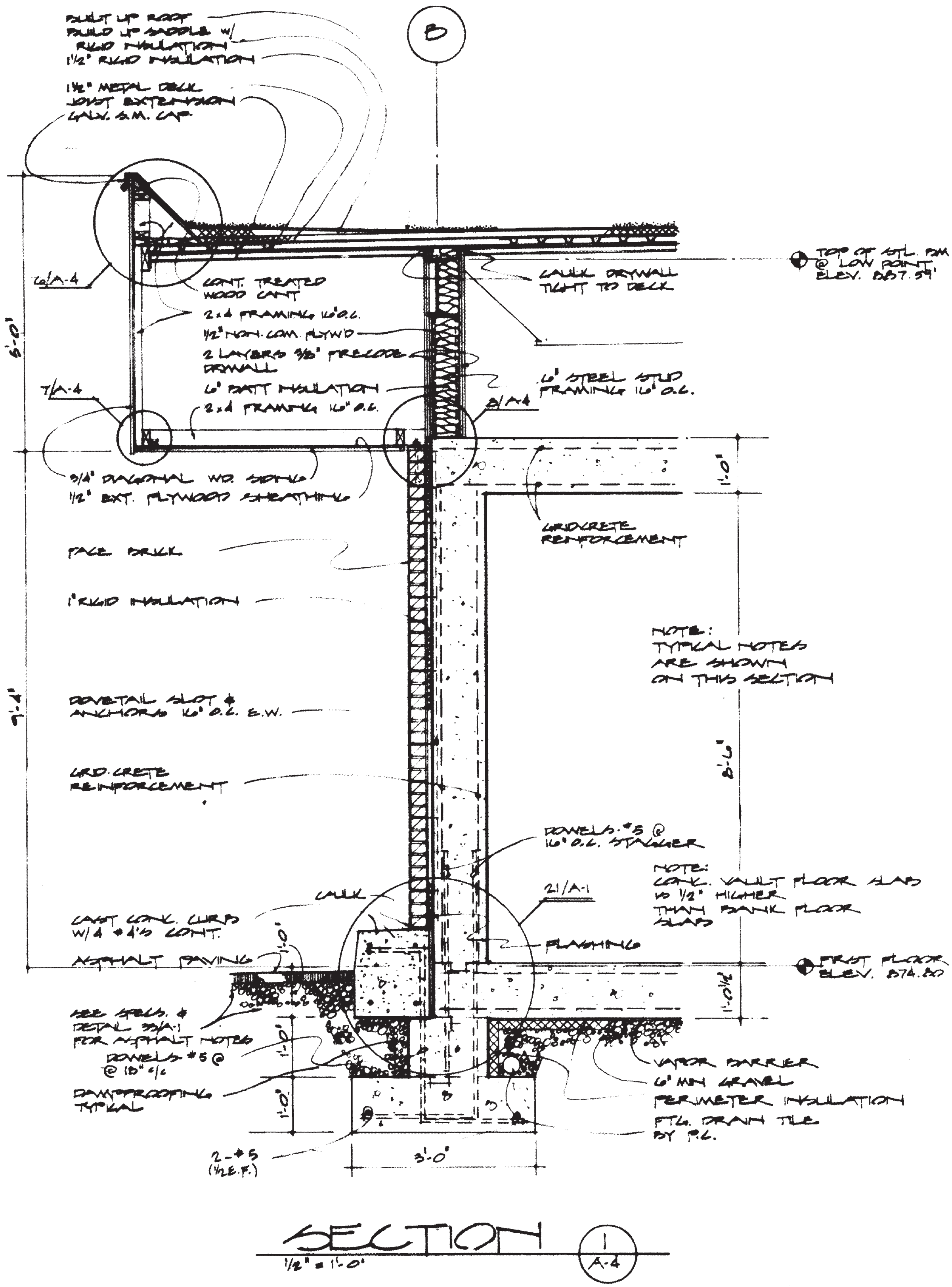
Chart showing the relative interrelation of various drawings, one to another. "I" indicates and important relationship; "C" indicates a convenient relationship; "N" denotes a relatively unimportant, but helpful, relationship.



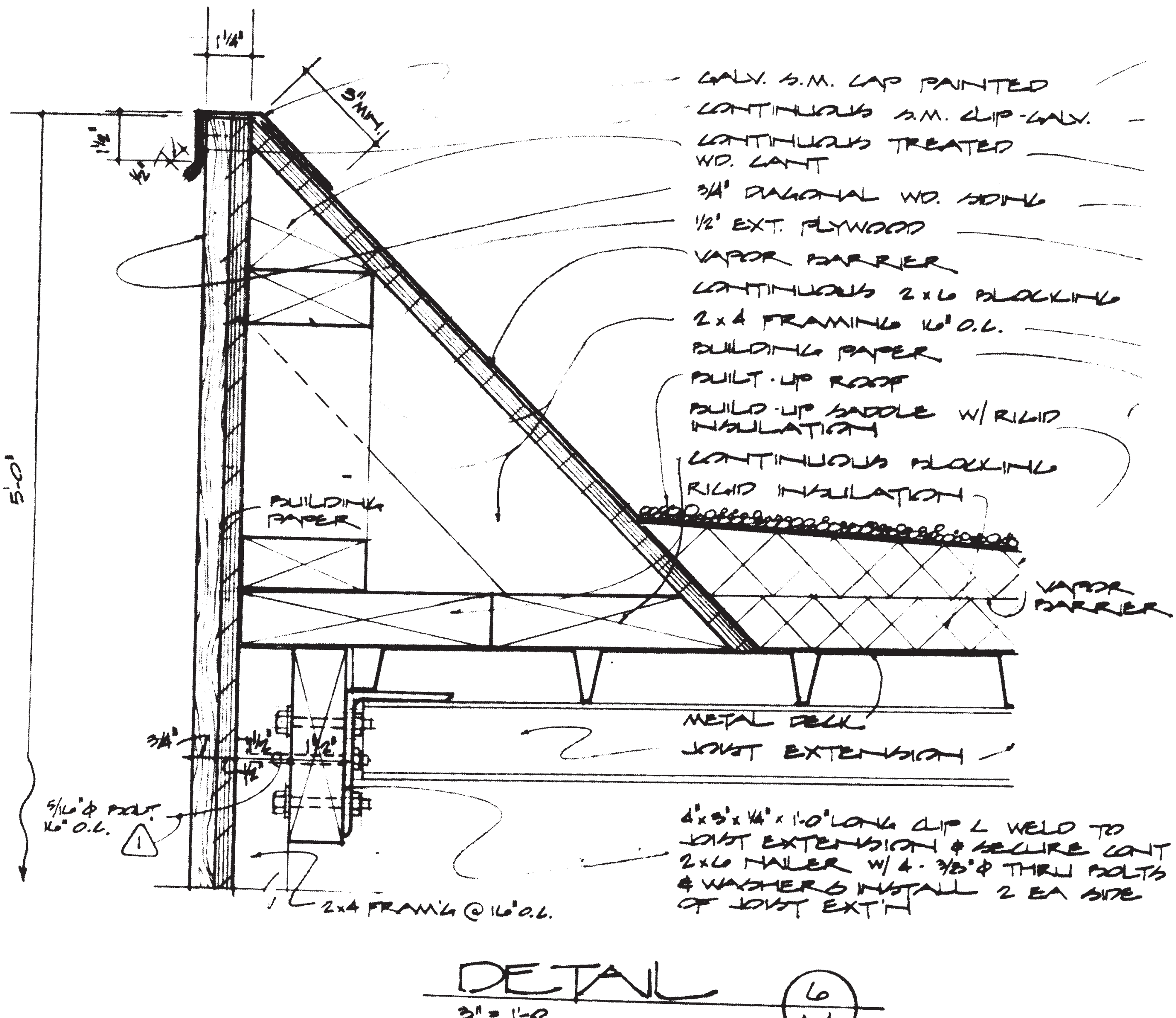
Details on one single element of a project; a decorative masonry pier for an entrance; the location[s] would be shown on the floor plan; also may appear on the site plan.



A series of drawings that show how a reference on one shows on another but in greater detail, to explain the context and construction of the work. Displays a very common practice used.


B
BUILT UP ROOF
BUILD UP SADDLE W/ RIGID INSULATION
1½" RIGID INSULATION
1½" METAL DECK
JOIST EXTENSION
GALV. S.M. CAP
6/A-4
CONT. TREATED WOOD CANT
2x4 FRAMING 16" O.C.
½" NON-COM. PLYW'D
2 LAYERS 5/8" FIRECODE DRYWALL
6" BATT INSULATION
2x4 FRAMING 16" O.C.
7/A-4
CAULK DRYWALL TIGHT TO DECK
TOP OF STL. BM @ LOW POINT ELEV. 887.59'
6" STEEL STUD FRAMING 16" O.C.
3/A-4
5'-0"
3/4" DIAGONAL WD. SIDING
½" EXT. PLYWOOD SHEATHING
1'-0"
GROUCRETE REINFORCEMENT
FACE BRICK
1" RIGID INSULATION
NOTE: TYPICAL NOTES ARE SHOWN ON THIS SECTION
9'-4"
DOVETAIL SLOT & ANCHORS 16" O.C. E.W.
8'-6"
GRID-CRETE REINFORCEMENT
DOWELS #5 @ 16" O.C. STAGGER
NOTE: CONC. VAULT FLOOR SLAB ½" HIGHER THAN BANK FLOOR SLAB
CAULK
21/A-1
CAST CONC. CURB W/ 4 #4's CONT.
1'-0"
FLASHING
ASPHALT PAVING
FIRST FLOOR ELEV. 874.50
1'-0½"
SEE SPECS. & DETAIL 33/A-1 FOR ASPHALT NOTES
1'-0"
DOWELS #5 @ 18" o/c
VAPOR BARRIER
6" MIN GRAVEL
PERIMETER INSULATION
DAMPPROOFING TYPICAL
1'-0"
FTG. DRAIN TILE BY P.C.
2-#5 (½ E.F.)
3'-0"
SECTION
½" = 1'-0"
1
A-4

(B)


GALV. S.M. CAP PAINTED
CONTINUOUS S.M. CLIP-GALV.
CONTINUOUS TREATED WD. CANT
3/4" DIAGONAL WD. SIDING
1/2" EXT. PLYWOOD
VAPOR BARRIER
CONTINUOUS 2x6 BLOCKING
2x4 FRAMING 16" O.C.
BUILDING PAPER
BUILT-UP ROOF
BUILD-UP SADDLE W/ RIGID INSULATION
CONTINUOUS BLOCKING
RIGID INSULATION
VAPOR BARRIER
METAL DECK
JOIST EXTENSION
4"x3"x1/4"x1'-0" LONG CLIP L WELD TO JOIST EXTENSION & SECURE CONT 2x6 NAILER W/ 4-3/8"Φ THRU BOLTS & WASHERS INSTALL 2 EA SIDE OF JOIST EXT'N
BUILDING PAPER
5/16"Φ BOLT 16" O.C.
2x4 FRAM'G @ 16" O.C.
5'-0"
DETAIL
3" = 1'-0
6
A-4

(C)

LINES AND DRAFTING EXPRESSION

The two areas of work in producing working drawings that have been impacted the most dramatically, most recently, are the line work, and drafting expression!

By converting the production of these areas to a mechanized motif, the drafter no longer has a personal "feel" for the drawing. Rather there is a detracted and remote relationship that does not always serve the drafter or the work well.

In manual drafting [used here for comparison of techniques and not for a call to status quo] the drafter has direct control over the drafting instrument – pencil, pen, marker, etc. There is a direct relationship in that the drafter knows that applying certain levels of force will produce differing level of line intensity, perhaps line width. There is a direct "feel" that the drafter can control for minute variations in the line work as appropriate to work being done. Of course with CAD, that relationship has disappeared – no manipulation of the leys will produce line variations since the production of all lines is now an "on or off" situation. In addition, the use of colored lines in the CAD programming gives no indication of the line weight, the type of line, or its comparison to other lines. A most misleading circumstance, and one that has led most CAD operators to simply dismiss "what the line is", and allude to them as simple lines, with no other context. The pen set is established and it alone determines what the lines will be and provides them. Where pen sets are limited, the variation in line widths, and weight are minimal and unfortunately this has a direct bearing on the readability of the drawings [particularly complex drawings with a "maze" of lines].

It would seem fair to say that this type of detachment and the loss of the relationship has played heavily in the portion of CAD use that hasn't been all hat successful. While CAD is widely sued, there is more and more information that indicates that the program is misused and removes some of the discipline the drafter needs to produce quality drawings. It is evident that this discipline is necessary and while it may have to be re-directed it is essential to drafter, employer, client and project. This and adequate and functional construction knowledge lead to successful working drawings.

Increased complexity in both project scope and construction has contributed to the need for more line work to define the work. The tendency, however, has been more toward cramming more lines onto to each drawing than to maintaining good, varied-weight lines with separation by use of differing scales – i.e., the perceived solution is merely to "record" the work without regard to retaining readability and understanding t the benefit of the end users. This new approach is counterproductive in that more time is required to correctly read and interpret the drawings, and there is greater tendency for more errors in construction. This is particularly true where a number of thin materials are incorporated, side-by-side or in close relationship. These need to be separated and made easily distinguishable by differentiating one from the other without extraordinary effort on the parts of the users [who sometimes must resort to color-coding to trace or identify materials, or to making copies at an enlarged size, etc.].

Often, too, selection of drawing scale contributes to the problem. It is not a good policy [office or personal] to pre-determine that all work will executed to a fix scale no matter the circumstances of the work. This fallacy plus the ill-advised approach to line work runs counter to the "faster-better-cheaper" percept so common today. Sloppily "throwing" line onto the sheet may be "faster" but plays havoc with "better", most certainly, and the resulting impaired use or the need to re-work the drawing[s] doesn't meet the "cheaper" requirement.

This is not a matter of trying to retain an unwarranted "artistic" appearance [or re-imposed the drafting standards when hand-drafting was in vogue and were exacting and demanding in the early to mid-20th century] on the drawings. Rather this effort is needed to facilitate reading, assimilation and use of the drawings in the field. Where drawings become a thoughtless, undisciplined " spaghetti of lines", they become merely non-productive clutter. Their message is garbled; their direct use impaired. Confusion too easily occurs and either further impairs quick analysis or proves to become a plethora of questions that should be answered.

To overlook this aspect under the guise of producing "better" drawings via the latest release of CAD or the newest version of BIM, is fallacious. "Better", here, means in quality of information presented, of communication transmitted, and direct facilitation of project work. The is a significant example of the need to know both the intent and content of the drawings – what are they supposed to and what do they need to contain to achieve that goal.

Projects have at times produced thousands of Requests for Information [RFIs], all too many of which were attributable to lack of clarity in the drawings. [It is easier for contractors to ask for information, via the RFI than to try to decipher the drawings]. An abundance of RFIs is a strong indicator that the documentation of the design concept was not well conceived, prepared or implemented – information may be missed or missing and communication of valuable information was absent. Actually, readability should be part of every office policy and standard as to quality of drawings and instruments of construction [i.e., direct contributions to the effort]. Certainly, in any event, it is a valid and professional attribute on a personal basis.

The simple straight line is the first firm element in the documentation of the design concept – it is the defining edge or limit of some portion of the concept. It may well be a "real" thing that eventually can be seen in full size and touched. Or it can be a unseen guide necessary to the construction – a column line common to several structural columns. Though never "real" or felt, this invisible line directs the layout of the work, and provides distinct locations for the columns and eventually to other elements.

It is most important in drafting architectural working drawings that the information be conveyed correctly, simply, and clearly. Expression in the drawings is mainly concerned wit the technique employed. Working drawings are an important part of the total architectural service in that we must first communicate with tradespeople, estimators and contractors – indeed, everyone concerned with construction of the project. These people rely totally on the architectural working drawings for technical information they need to build the building. A definite effort should be made to make the drawings expressive and at the same time give way to local convention. In the final analysis we must produce accurately scaled drawings that properly illustrate all the parts.

It can be a great help the final product if the drafter has enough knowledge to put him- or herself in the place of the trade worker, the carpenter, or the contractor. In this way the drafter can determine how easily the drawings can be read or whether the information required s readily available without searching through the entire set. When the information is found, it should transmit the drafter's ideas [really conversion of the designer's ideas in the design concept] with a minimum effort consistent with a minimum of misinterpretation.

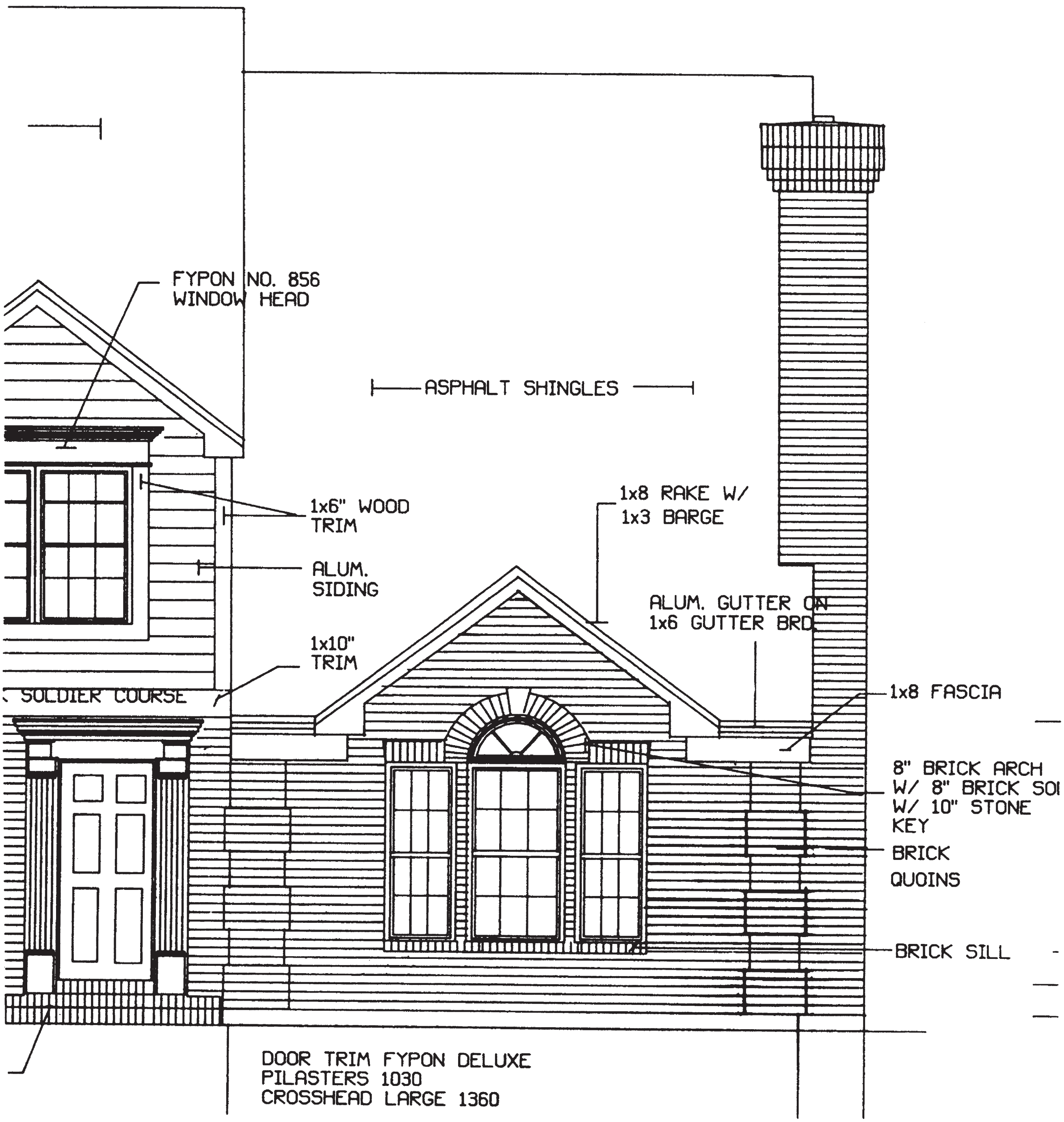
Lines are one of the most expressive aspects of working drawings. Every line drawn should have significance or there really is no reason for its existence. This significance, of course, can vary quite a bit and can be directly conveyed to the user by virtue of the weight or width of the line. Example: If a line has little importance, it should be light; on the other hand, if a line makes an important contribution to the drawing, it should be heavy and perhaps broad. Each line must be evaluated before it is drawn, and this comes only with practice. If we become too shy and produce a very light line much of the line work will be nearly unreadable if not distorted or lost entirely in the production process. Here, we must consider the lecturer and the monotone delivery that puts the audience to sleep. Just as in the lettering "monotone" drafting has no place in the architectural working drawings. Line variations or contrast of lines contributes directly to the success of the drawings!

The principle should also be exercised in using computer-aided drafting just as in manual drafting. Too often operators resort to or are restricted to one line weight for all of the lines in the drawing or rely on the preset "default" settings that are artificially set by the software program. Both of these practices basically give up control of the process by the drafter and allowing someone else [who produced the software] determined what will be used without knowing the circumstances of the specific project at hand. Although neither of these is a problem with the technical aspect of the project, it is a tremendous aid to end user readability when line weights are properly varied using several line weights – on a consistent basis. This aids, significantly the ease of reading the drawings in marginal and sub-standard light and other where through more distinctive differentiation between various materials and elements of the construction.

This may sound like a simplistic situation and a "no-brainer", but care must be taken that the varied-colored lines used by CAD programs usually have no relationship whatever to the type of line involved, nor to its weight/thickness. The CAD operator needs to be fully aware of the type line required for the immediate situation, and the weight that will give it its best presentation [or meets the standard set by the office]. This can be a major distraction to newer drafters in that a mental "dictionary" of lines is required to be expressed via artificial depiction on the CAD screen. In this, this text is a litany of lines, in quite varied situations all of which are viable, possible and pertinent to current office practice and drawings.

This not to set up a hierarchy of lines by importance but to communicate information in the best and most readable form. It is to state that lines need to be coordinated and varied, so the drawing properly reads as a whole, and is not dominated by one or more lines in such a way as to distract from the more valued information.

All CAD programs have the capacity for changing line weights as the operator desires. Some forethought is required on the



Example of CAD drawing that utilizes varied lie weighs.
This technique adds not only "sparkle" to the drawing but enhances the overall readability of it.

part of the operator. In older systems there may be a need to change plotter pens, and in newer systems alternative commands may have to be injected into the program to ensure that line weight variation is produced. The extra effort is clearly worthwhile.

Care must also be taken that there is no undue reliance on, or misconception about, the various colors used for lines on the CAD visual display. The colors are used solely to differentiate between various surfaces or materials, but they do not indicate the density, width, or intensity of the line work. Colors are used to separate information on the operator's screen, but do not translate to the finished product. Often the eye will register the colored lines as a valid and satisfactory presentation, but the plotted result will be imperfect, if not wholly improper. This is one of the major differences between CAD and manual operations. With CAD a line can appear to be one thing, when in fact it is something quite different as to value and weight [in manual work, the drafter sees, immediately, what the line is and whether its weight is correct]. If this CAD "hazard" is not kept firmly in mind constantly, the best of drawings, technically, may prove to be most inadequate when plotted. This is a major checkpoint for the validity of the CAD work and is an integral part of the operator's level of care in the production of the drawing[s]. CAD can and should be manipulated/modified in this instance-always-to ensure the most readable document possible.

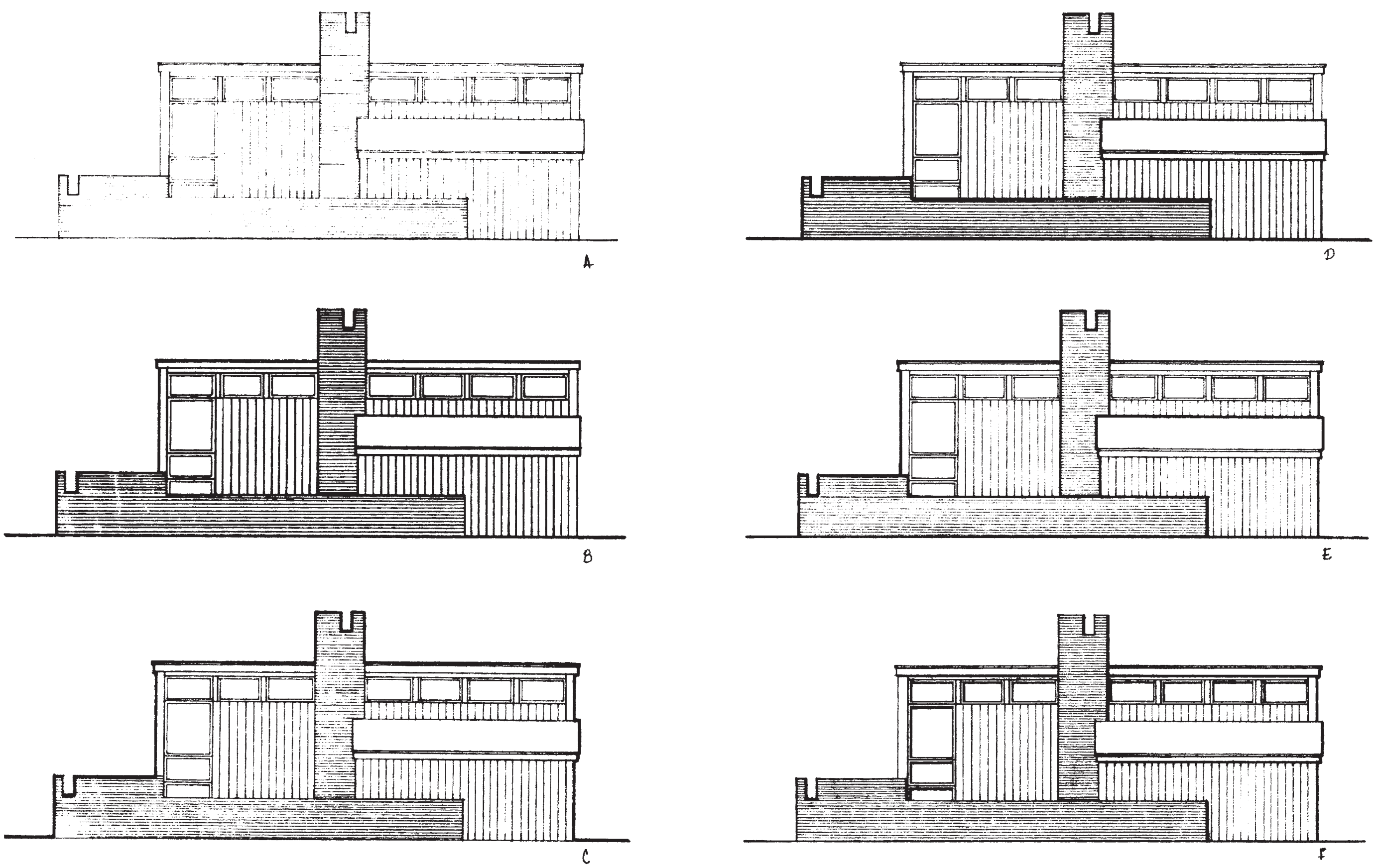
In addition, at a minimum the concept of three line weights [one for total object outline, one for planes within the object, and one for circumstances/conditions occurring on the planes] must be followed as in other architectural presentations. The configuration of the entire construction depicted in the detail is the "object." The architectural material symbols are the various "planes." The other circumstances are such things as the reinforcing, ties, strap, leader lines, and so forth, which are vital but need not be depicted meticulously [inasmuch as they are, mainly, described in the specifications and are of such small size that trying to show them to scale is doomed to failure]. It would be well to study examples of good line work to learn where to place emphasis and, of course, where to restrain it. In reality, the heavy line is used more and is more effective in most situations. Examples in this chapter show how a plan or elevation can be improved with a heavy outline that actually silhouettes the object. This silhouetting also applies, for example, to the cut portions of materials in a section. It is also generally accepted that the grade line or roof overhang will be shown in a heavy line to make an immediate impression on the user. A number of techniques are illustrated here for the use of lines, but it can easily be seen from the examples that line variation must be a part of our drafting technique.

While varying the lines, there must be care and concern about consistency in the line work. Architectural drawing differs from other types of drafting [even with CAD production] in that the line work is more distinctive and pleasing if there are slight extensions, or crosses, at intersections, rather than a sharp point. [It must be kept in mind, that there still are offices who use manual drafting without computer operations.] This technique is actually simpler, because in laying out the drawing we are extending its lines beyond their permanent dimensions and are reducing our effort by allowing this slight deviation. This is not done in a haphazard way with giant intersections, but by recognizing the crossing point with only slight emphasis.

Every kind of line should be taken into account in drafting expression. Many types of broken or dashed lines are used on a drawing and, again, should be done carefully and with added expression. If a dashed line appears in the drawing, it has importance and should be treated in direct proportion to its value. Hidden objects, hidden surfaces, or alternate positions of various features are often shown by dashed lines and should be given emphasis by adding slight pressure at their ends. The dashes should not be too widely spaced; at the same time, variety can be added to the intervals-for example, a line of long dashes and rather short intervals. It is most important, however, when showing a broken line, that the same motif be retained for its entire length; that is to say, the intervals and the dashes should be uniform. This uniformity should be carried out throughout the drawing in that the same character of line work should describe like objects. A drawing can become excessively complicated when one object overrides another, and extreme care must be taken in the execution of broken lines.

Object lines [around the outer perimeter of buildings or parts thereof in details], of course, should carry the most impact, because here we are describing the parameters of the object-the outline. The range of line weights varies between this object line and the extension lines [for the dimensions], which are drawn in a much lighter line weight.

Another set of lines is of concerned and requires discussion. These are the leaders, or leader lines, which are drawn from a note or a dimension to the point of application on the drawing. The leaders can be straight, drafted, curved, [or even freehand in manual work]. It is good practice to include an arrowhead or dot on the object end of the leader. Although various techniques have been devised, the most effective leaders are those that can be immediately identified and are in no way confused with the object lines or other parts of the drawing. They should appear as connectors between the notes and objects and should never be open to misinterpretation. This is



Drawings can be approached in a number of ways. The width of the lines and line weight are important in every drawing … In [A] all lines are the same tone and the drawing looks washed out. In [B] too much compensation has been made; the lines lack variation and are too heavy. The profile method used is in [C]; a dark line traces and defines the profile of the building. This is better a drawing because of its variation. In [D] the lines are toned to show depth – the closer the object to the viewer, the darker the line [E] is perhaps the best drawing – the profile lines and lines of the various planes of the building are dark; lighter lines characterize the work appearing “on” the planes. The shadow principle is applied in [F] where a direction of light is set and the lines are varied to show shadows on the faces of the building [used almost exclusively for presentation drawings and not working drawings].

the purpose of the more angular leader or some type of offset curve. Usually, the leaders are added after the notation has been entered. It is important that these connectors be prevented from forming a "spaghetti overlay" of intertwined lines, difficult to follow and read. Instead, they should be drawn neatly, without crossing one another, in a direct route to the points to which they apply. A leader should start at the beginning or end of a note, but never at some midpoint. There are times when a circle or balloon may be employed for more effective identification of parts; for example, in structural drawings to call out reinforcing bars. Offices often have standards relating to the type, application and location of these lines.

Leaders are often used to show angles in geometric shapes; circles may be shown, perhaps, by radii or diameter, and other dimensioning is not necessary.

BREAK LINES: Fine lines with offsets to show a break in or the termination of a partial view. Used to eliminate repetitive or relatively unimportant portions of detail.

CENTER LINES: Fine lines made with alternate dots and long dashes to indicate symmetry about an axis and to locate centers of window and door symbols. Lines should be extended beyond the outline of the objector view.

CUT LINES: Prominent broken lines consisting commonly of two dots and a dash motif to indicate the plane of a section. Arrowheads on either end show direction of view. A circular detail designator may be incorporated at either end as well.

DIMENSION LINES: Fine lines with arrowheads at either end to show length, width, thickness, and depth of a given dimension. Numerical dimensions are placed above and centered along the line.

EXTENSION LINES: Fine lines that relate and show points of application of dimension lines to the item being dimensioned [sized]. Should not touch object or feature; extend beyond dimension line.

HIDDEN LINES: Medium-weight broken lines composed of uniform dashes indicate hidden surfaces or intersections; in sections they show features occurring beyond our view. Also used to show old construction.

LEADERS: Fine lines with an arrow or dot at the point to which they apply. Drawn at an angle from note to point of application; leader lines never cross other leader lines! They may be drawn freehand.

OUTLINES: Prominent lines representing surface edges or the intersection of two surfaces. As the heaviest lines in a drawing, they separate the object, or material, from the surrounding space.

POCHÉ [i.e., cross-hatching and application of material symbols, etc.]: Fine line work, usually vertical, horizontal, or angular; gives the surface the appearance of a halftone. Line work made with conventional symbols of the materials, used in elevations and sections.

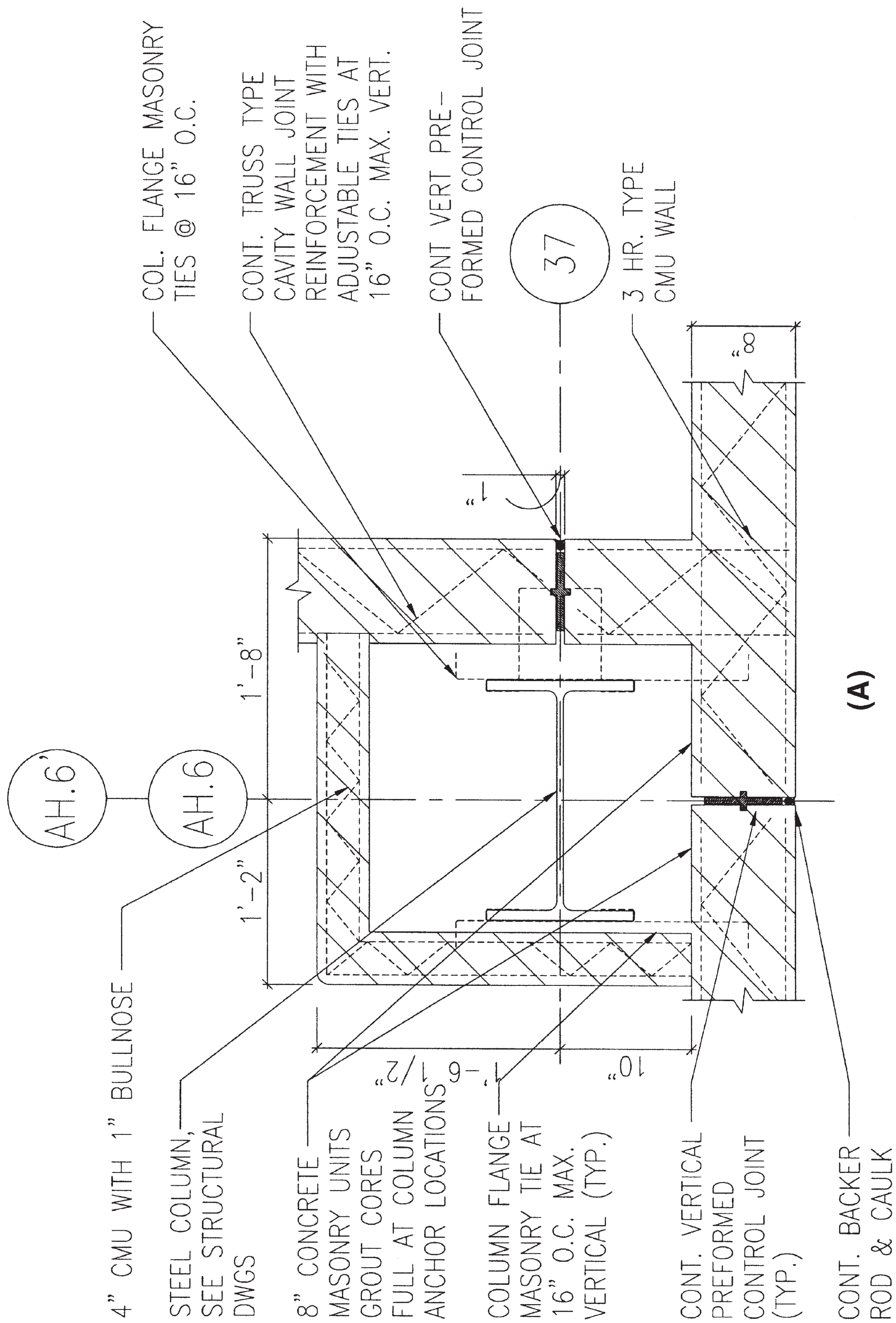
It often happens that projects are of such size or extent that their floor plans and other views will not fit, in their entirety, on one drawing sheet. Although the scale of the drawings can be adjusted, there may still be inadequate space on the sheets.

In this instance, the use of "match lines" is both advised and used. This is a drafting process whereby the project is divided into portions that will fit onto the standard drawing sheets. This divisioning should occur at logical locations on the plans that is, at offsets in the building, at the faces of major walls, or at column lines. This can be done vertically and/or horizon tally, resulting in several portions being created if necessary. The lines can be offset slightly along their route to align with walls, for instance, so as to prevent adverse effects such as dividing particular areas or creating confusion with the layout. Because there is no set rule or standard involved, the

The illustration, opposite, shows match line locations at [1], [2], and [3]. The [1] location is valid and usable, but the drawing remains crowded on the sheet, with too little space for other work. The [2] location is better; more workable and beneficial to the documentation process. The [3] location is a logical break point, but similar points may be used, if more advantageous. In fact, any layout or number of match lines can be used.

Because the use of these lines is a drafting procedure, the lines are invisible and cannot be established in the field in the same way property lines and building corners are located. Therefore, no dimensions should end at match lines. Dimension through or across these lines to actual points on the new building; do this on both of the adjacent sheets, so as to cross-reference the dimensions.

Match lines should be displayed on all appropriate floor plans. They should appear as very heavy and distinctive lines, fitted with unique designators and notes identifying them; for example, MATCH LINE "Q." These lines must appear in pairs; one on each of the drawings, which, in theory, could be cut on the match lines and placed together to make up the complete plan. It is necessary that the match lines be used, consistently, on all appropriate drawings that are associated with



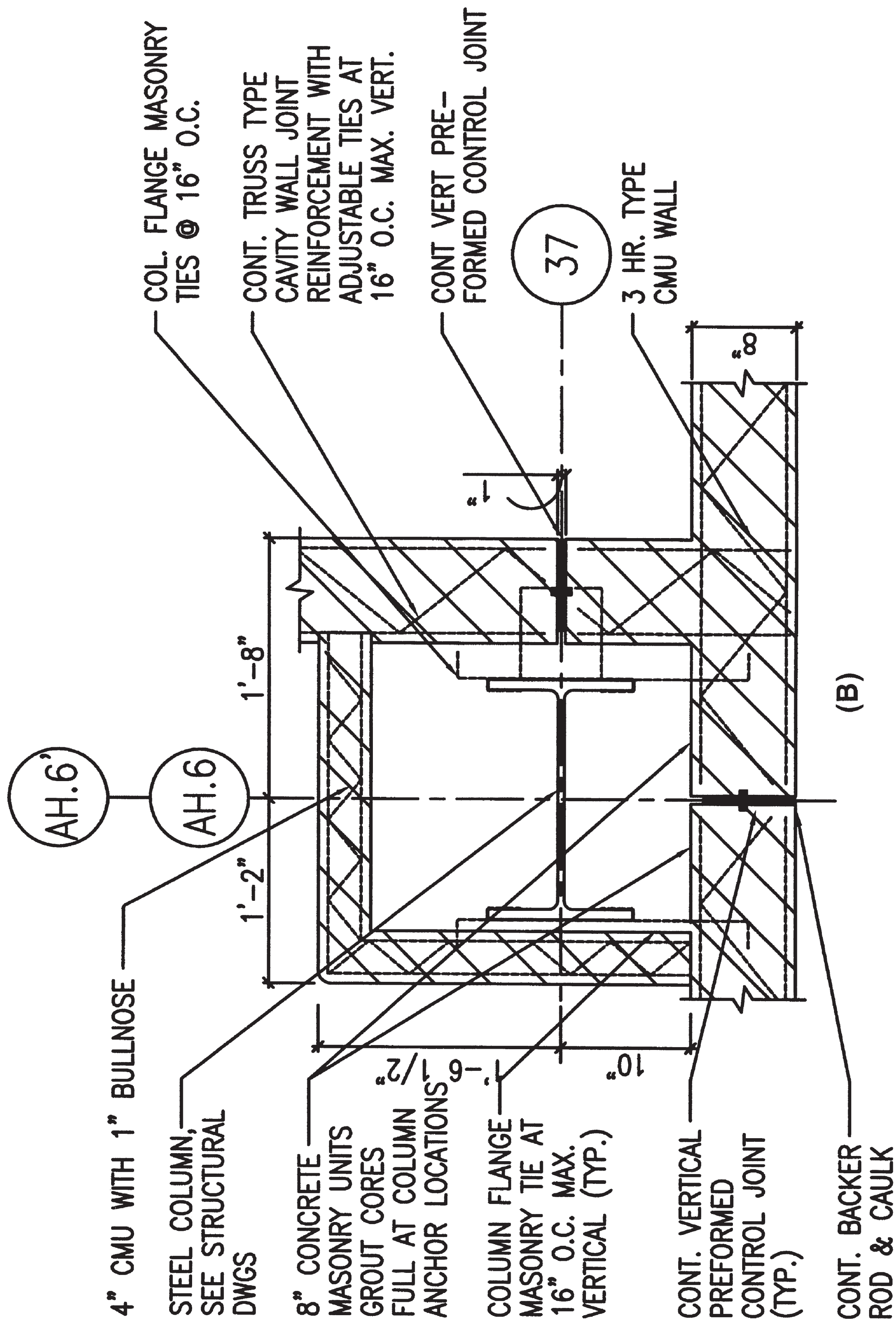
(A)

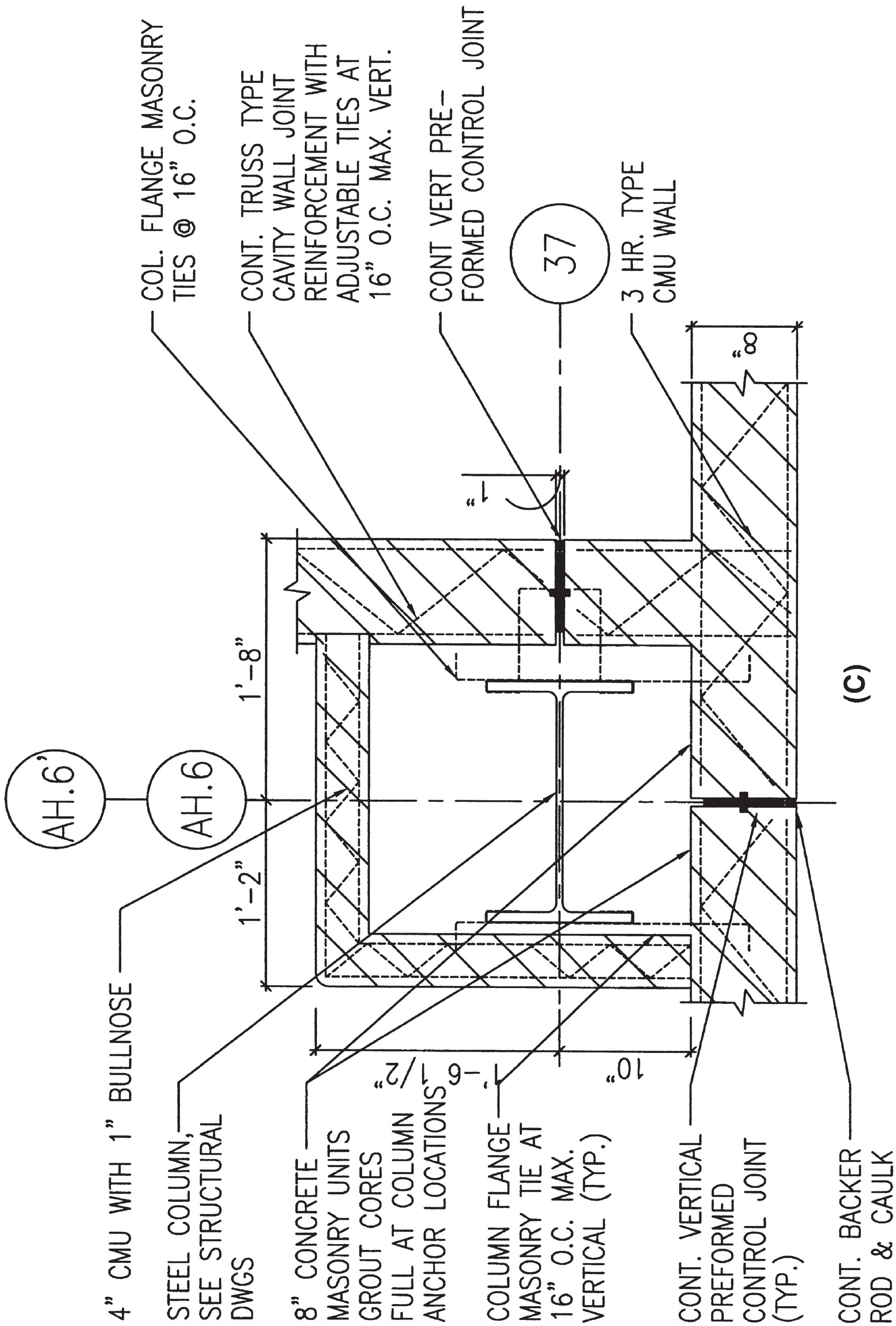
A series of drawings of the same detail in which all one light line weight is used [A]; all dark lines are used [B]; all medium weight lines are used; and one [D] in which a variety of line weights were used. The last is preferred in regard to the ability to read the information and discern the various materials, edges, and symbols.

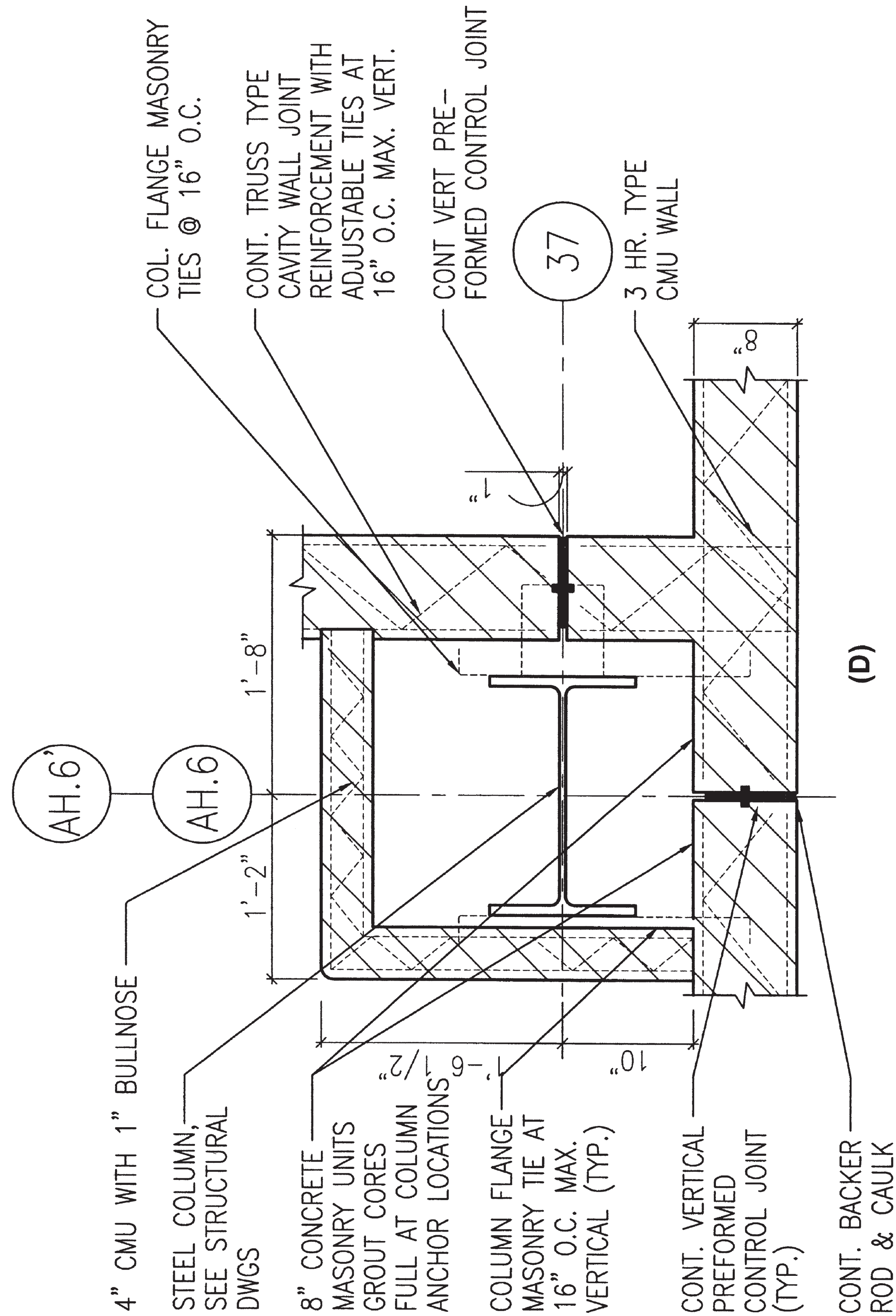
the floor plan[s], exterior elevations, major sections, interior elevations, and so on. Take care that they always occur in the same location[s] as those on the floor plan[s].

It is also helpful in the coordination of the adjacent sheets to show some of the walls or partitions that lie close to the match line. On the sheet showing most of the plan, add appropriate notes and hatching to the walls near the match line[s]. Where walls and other features occur on the smaller portion of the plan that extends just beyond the match line[s], just draw them in, lightly, in their correct locations and connected to the other plan where they are continuous.

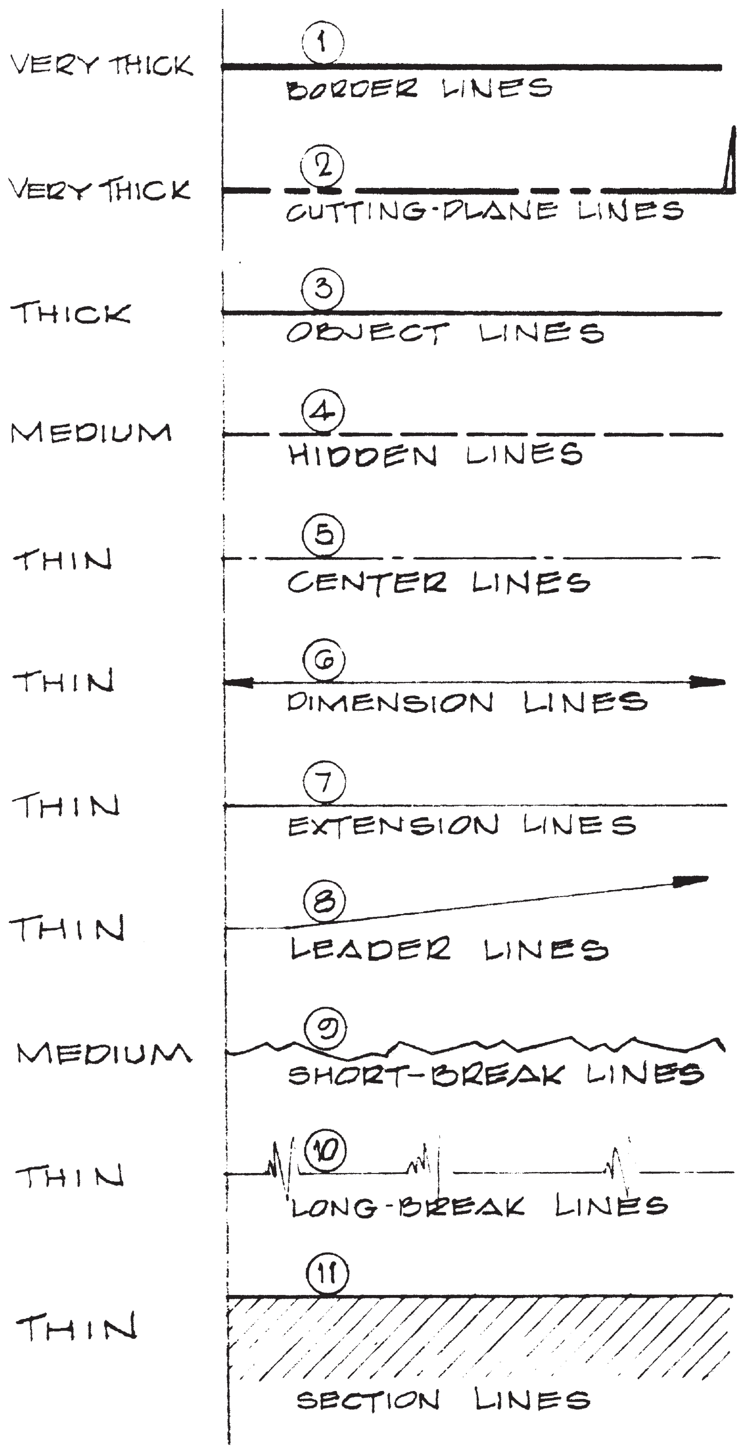
There is one added requirement in using match lines. This is the use of a Key Plan, similar to that used for exterior elevations. A small drawing [need not be to scale] of the entire floor plan should be shown in the lower right of the drafting area on the sheet. On this plan, the approximate location[s] of all the match line[s] should be noted. Then the area of the plan that is shown on the sheet should be noted or, preferably, crosshatched. The other areas not shown on the sheet should be left blank [they are hatched on the sheet on which they are displayed]. This plan acts as an index and is important because it orients the reader/user and prevents misunderstandings.


COL. FLANGE MASONRY TIES @ 16" O.C.
CONT. TRUSS TYPE CAVITY WALL JOINT REINFORCEMENT WITH ADJUSTABLE TIES AT 16" O.C. MAX. VERT.
CONT VERT PRE– FORMED CONTROL JOINT
37
3 HR. TYPE CMU WALL
8"
1"
1'–8"
1'–2"
AH.6'
AH.6
(B)
4" CMU WITH 1" BULLNOSE
STEEL COLUMN, SEE STRUCTURAL DWGS
8" CONCRETE MASONRY UNITS GROUT CORES FULL AT COLUMN ANCHOR LOCATIONS
1'–6 1/2"
COLUMN FLANGE MASONRY TIE AT 16" O.C. MAX. VERTICAL (TYP.)
10"
CONT. VERTICAL PREFORMED CONTROL JOINT (TYP.)
CONT. BACKER ROD & CAULK

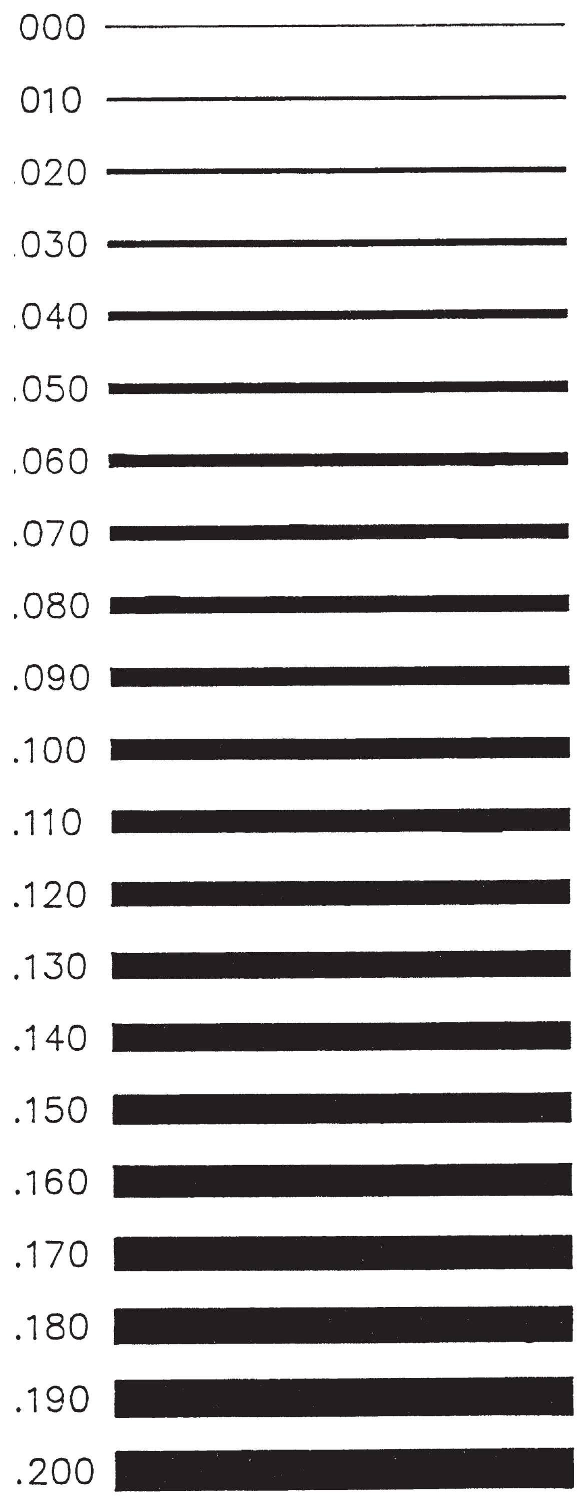

COL. FLANGE MASONRY
TIES @ 16" O.C.
CONT. TRUSS TYPE
CAVITY WALL JOINT
REINFORCEMENT WITH
ADJUSTABLE TIES AT
16" O.C. MAX. VERT.
CONT VERT PRE–
FORMED CONTROL JOINT
37
3 HR. TYPE
CMU WALL
8"
1"
1'–8"
1'–2"
AH.6'
AH.6
(C)
4" CMU WITH 1" BULLNOSE
STEEL COLUMN,
SEE STRUCTURAL
DWGS
8" CONCRETE
MASONRY UNITS
GROUT CORES
FULL AT COLUMN
ANCHOR LOCATIONS
1'–6 1/2"
10"
COLUMN FLANGE
MASONRY TIE AT
16" O.C. MAX.
VERTICAL (TYP.)
CONT. VERTICAL
PREFORMED
CONTROL JOINT
(TYP.)
CONT. BACKER
ROD & CAULK


COL. FLANGE MASONRY TIES @ 16" O.C.
CONT. TRUSS TYPE CAVITY WALL JOINT REINFORCEMENT WITH ADJUSTABLE TIES AT 16" O.C. MAX. VERT.
CONT VERT PRE– FORMED CONTROL JOINT
37
3 HR. TYPE CMU WALL
8"
1"
AH.6'
AH.6
1'-2"
1'-8"
1'-6 1/2"
10"
4" CMU WITH 1" BULLNOSE
STEEL COLUMN, SEE STRUCTURAL DWGS
8" CONCRETE MASONRY UNITS GROUT CORES FULL AT COLUMN ANCHOR LOCATIONS
COLUMN FLANGE MASONRY TIE AT 16" O.C. MAX. VERTICAL (TYP.)
CONT. VERTICAL PREFORMED CONTROL JOINT (TYP.)
CONT. BACKER ROD & CAULK

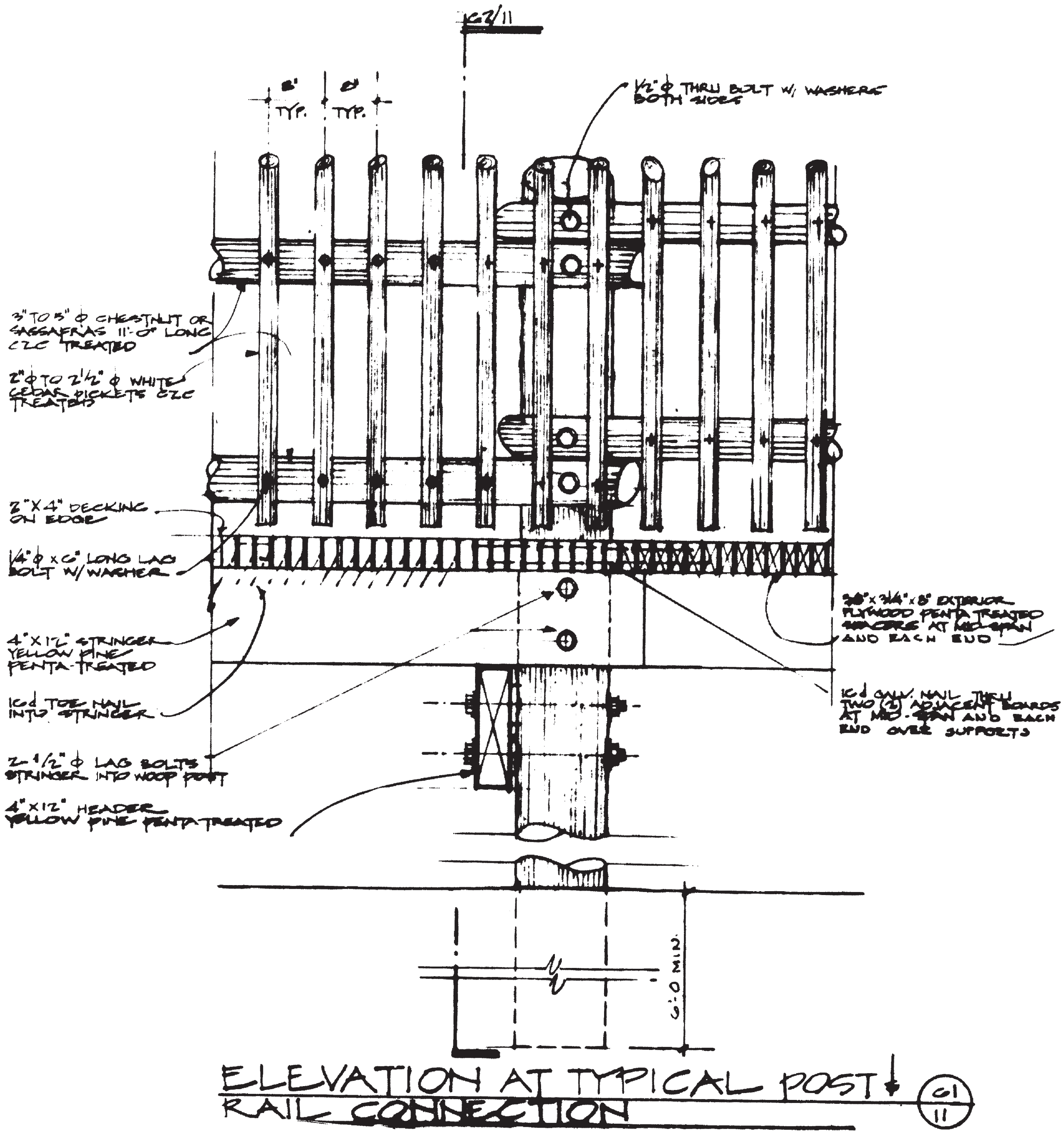
(D)



Examples of manually drafted lines with different meanings and different line weights. The same lines are valid for use in CAD production.



Examples of variations possible in such computer programs as AutoCAD; note decimal designations.



This drawing is saved by the use of curved leader lines [except to very long reaches]; the arcs do not compete with or distract from the drafted line work. Note that they do not cross and that they complete their function without obscuring the drawing.

SYMBOLS AND CONVENTIONS

As mentioned in Chapter 8, on lettering, we often rely on abbreviations to convey items of information. These abbreviations, of course, must be commonly accepted throughout the industry or defined in legends on the drawings. They can take the form of symbols, which are patterns of lines, or be incorporated directly into the lines themselves. This is done because all structures are combinations of many different materials, and methods of showing them graphically must be simplified.

It is important to understand that the use of symbols is preferred in architectural drawing. Here a small, simple designation is used to represent a larger or more complex item. One must understand that the symbol itself must be simple, direct, easily read, and devoid of detail [for the most part]; better to conceive this as showing a principle, rather than an actual object.

In addition, the symbol must be adjusted in size and complexity in relationship to the scale of the drawing. Obviously, a 1/16-inch scale drawing requires much less from the symbol than does a 1/4-inch drawing; yet in both cases a symbol is still appropriate and should be used. Accuracy in architectural working drawings is not carried to the extreme of showing every possible minute detail of an item or portion of work. Larger-scale details are for that; the symbols must adjust to the situation.

A note of caution is necessary in regard to computer-aided drafting [CAD] production. There is no value in trying to show every brick or concrete block, although this is very easy to accomplish. Modify the total area of the symbols to properly show the work, but do not overwhelm the drawing needlessly. Discussed here is a system of conventional architectural symbols which is new in that some universality has been attempted. The American Institute of Architects [AIA] recently commissioned a task force to produce these symbols, and it is generally agreed that a good draftsman will commit to memory those that are most widely used; for example, the symbols for brick, concrete, earth, rough and finished wood, concrete blocks, insulation, glass, doors, and frames. It must be remembered, however, that the symbols shown in a plan or section are not necessarily the same as those shown on an elevation. Therefore, we must take into account all the meanings of a particular symbol. Whenever there is one that is less well known, it must be shown on the drawings in legend form to give the viewer a frame of reference. Basically, all symbols are indicative of the materials they represent; if we invent our own, we must be sure that the information they convey is not misleading. Material symbols, or, in other words, hatching, crosshatching, and poché, need not be indicated by extra-heavy lines. Symbols are required primarily in sectional drawings, wall sections, and floor plans, in which the most important lines are those that represent the actual object. A symbol is shown among them to clarify the construction of a particular item. When a symbol must apply to a rather extensive area, a more contemporary approach is to enter it over only a small portion of that area or to produce a fade-out near the center that would give the impression of a highlight on the surface. This, of course, will emphasize the edges of the object.

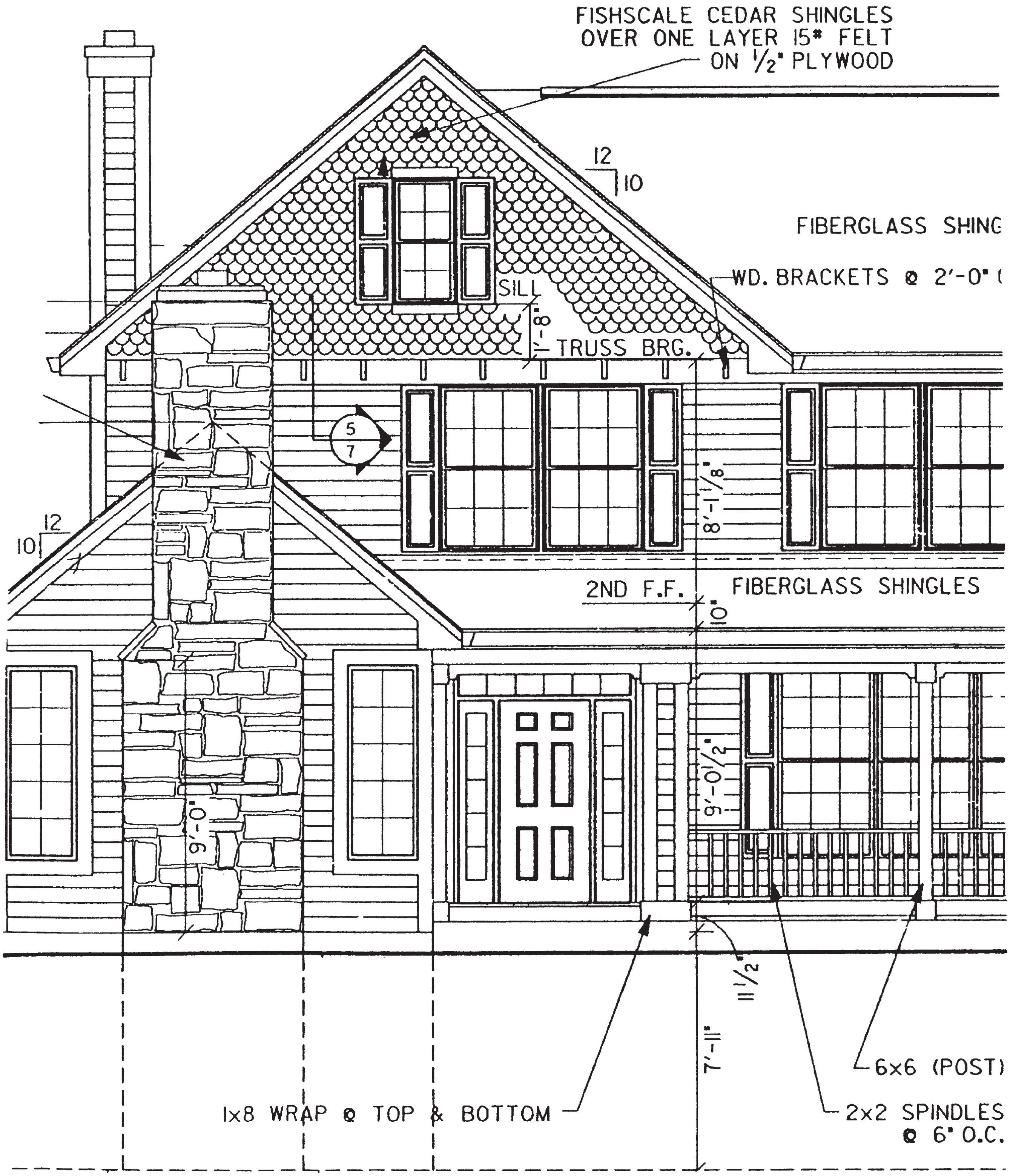
Contrast of the various materials is most important, particularly in sectional views; it is always good practice to crosshatch adjacent materials in opposite directions. It is also a good idea to make a distinction between the crosshatching intervals.

If notes or dimensions are to be entered in a hatched area, some of the symbols should be deleted to allow for their insertion. This is important to the readability of the drawing. It is also important when using drawings from other sections of the country to remember that regional variation in symbols can lead to confusion and should be kept in mind. Unnecessary repetition of hatching should also be avoided. Useful devices include a center line to divide a hatched area from a nonhatched area or a light diagonal line that does not conflict with any of the building lines to limit the hatching to one portion of the drawing. Often the symbols are backed up by some sort of clarifying note to which a dimension such as depth or overall size may be added. If there are repetitive items, a symbol may be applied to only one feature, a duplicate note to the others. Again, some consideration must be given to avoiding the time-consuming labor of hatching every item on a drawing.

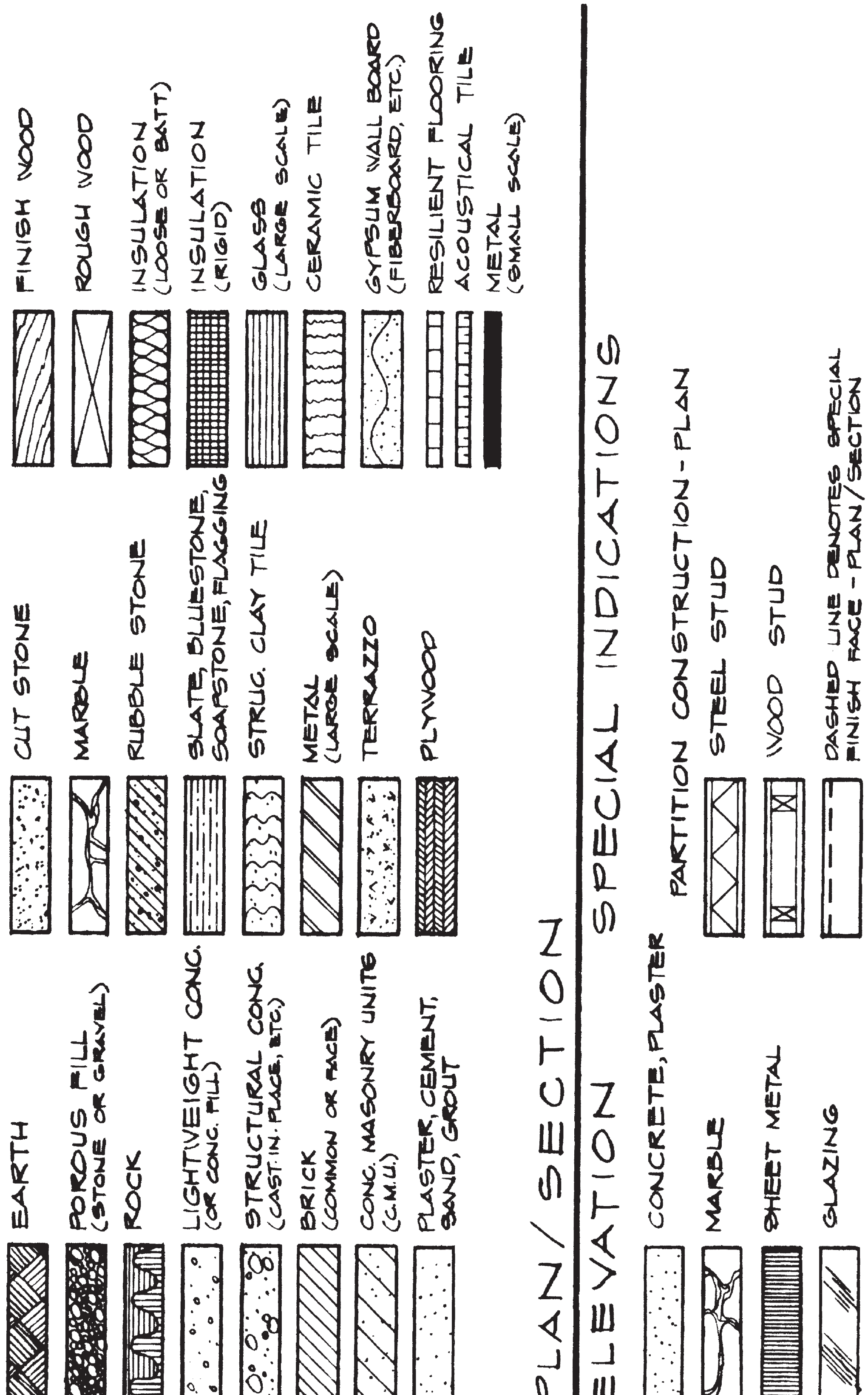
Some symbols are really outlines or silhouettes of the objects to be illustrated. Templates in the shape of plumbing fixtures, electrical outlets, kitchen equipment, circles, and many irregular forms that may be required in the drawings for one reason or another, are available to facilitate their reproduction. This must be done with as much care as any other drafting procedure, but, again, it is a quick, shortcut method that precludes the need to draw or dimension extremely small objects or to take the time to do more than outline them.

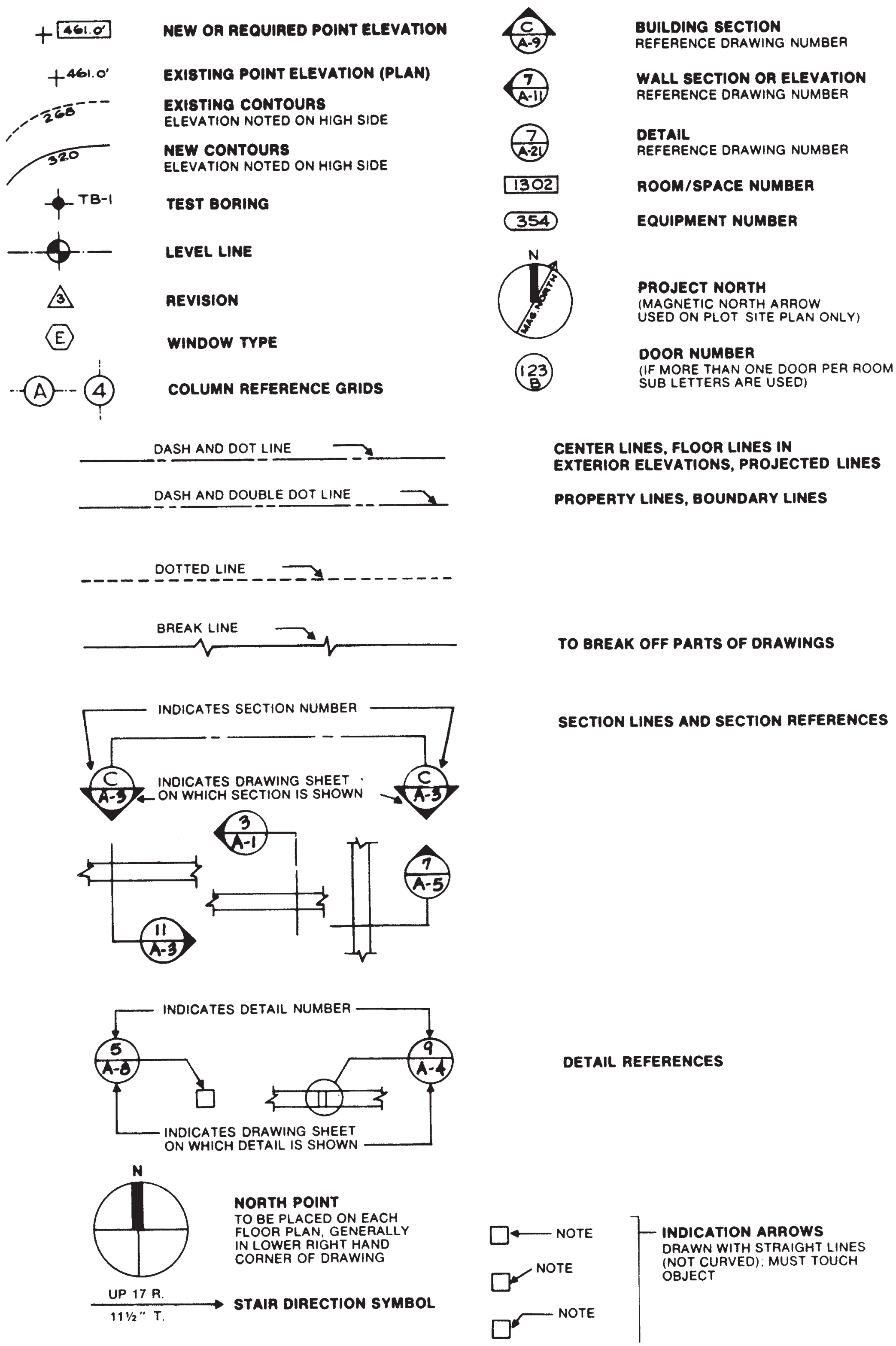
In many instances, particularly in the mechanical trades, symbols take the form of lines; for example, in piping or duct work. A gas line can be indicated by a long dash, a "G,": and another long dash; similarly, a hot water line can be designated "HW," cold water, "CW." Each line can be distinctive in describing its own function. When a complex industrial job is laid out on the working drawings, there could conceivably be myriad lines in every direction: gas, water, steam, compressed air, various liquids for processing, and so on. Piping is most often combined in racks, and even on the drawings the lines would be in proximity. Rather than a notational system and leaders, symbology allows us to show the functions of the various elements with a minimum of effort.

Each of the mechanical trades, of course, has its own graphic symbols.



This CAD-produced drawing simply tries to do too much. Not every line, shingle and spindle need be shown. This problem is easily created with CAD if one does not evaluate how complex or murky the drawing has become.


PLAN/SECTION
EARTH
POROUS FILL (STONE OR GRAVEL)
ROCK
LIGHTWEIGHT CONC. (OR CONC. FILL)
STRUCTURAL CONC. (CAST IN PLACE, ETC.)
BRICK (COMMON OR FACE)
CONC. MASONRY UNITS (C.M.U.)
PLASTER, CEMENT, SAND, GROUT
CUT STONE
MARBLE
RUBBLE STONE
SLATE, BLUESTONE, SOAPSTONE, FLAGGING
STRUC. CLAY TILE
METAL (LARGE SCALE)
TERRAZZO
PLYWOOD
FINISH WOOD
ROUGH WOOD
INSULATION (LOOSE OR BATT)
INSULATION (RIGID)
GLASS (LARGE SCALE)
CERAMIC TILE
GYPSUM WALL BOARD (FIBERBOARD, ETC.)
RESILIENT FLOORING
ACOUSTICAL TILE
METAL (SMALL SCALE)
ELEVATION
CONCRETE, PLASTER
MARBLE
SHEET METAL
GLAZING
SPECIAL INDICATIONS
PARTITION CONSTRUCTION - PLAN
STEEL STUD
WOOD STUD
DASHED LINE DENOTES SPECIAL FINISH FACE - PLAN/SECTION



This CAD-produced drawing simply tries to do too much. Not every line, shingle and spindle need be shown. This problem is easily created with CAD if one does not evaluate how complex or murky the drawing has become.

DIMENSIONS, NOTES AND TITLES

Before dimensions, notes, and titles can be applied to a drawing some overall sheet planning is necessary. Sheet composition must be considered because the three elements to be added contribute a great deal to the complexity of any given drawing. These elements play as great a part in the legibility of the total sheet as any other line or mass of lettering.

Notes and dimensions should not be placed in a helter-skelter manner merely to fill gaps; they must be done in a methodical way with due thought given to their placement and extent.

A draftsman needs only basic knowledge of dimensioning to do a good job. Sometimes, however, it will appear to be complex and the draftsman may have to struggle to meet unfamiliar situations. This is no time for guesswork or for wading through with a minimum of effort. The major controlling elements have frequently already been set, and it is the draftsman's responsibility merely to complete the job. Therefore, the only requirements are the basic reason for the dimensions and a certain arithmetic skill.

The purpose of dimensioning is to define size and location of the various materials and components. The most effective way to show these data is directly on the drawings; the specifications will list the methods and materials to be employed. The amount of measuring, cutting, and fitting that must be done on the job is based on basic dimensioning. As a general rule intermediate drawings of a similar nature are produced for use in the shops of the various suppliers. Overall readability, conciseness, completeness, and accuracy must be foremost in any dimensional system. Perhaps the easiest way to break down the requirements is in a series of brief notes on a particular phase.

1. Dimensions should be read across the sheet and are usually placed at the bottom; vertical dimensions must be readable from the righthand edge.

2. Dimension lines should be set apart from the object lines by spacing and line weight so that the chance of their being mistaken becomes minimal; extension lines are taken perpendicularly from the building lines out to the dimension lines. Extension and dimension lines should be kept light in value but should have enough density to reproduce in their entirety.

3. All dimensions are written in above the dimension lines and should always be given in feet and inches; the exception to this rule applies to dimensions of less than 12 inches. The drafter must decide whether to use 12″ or 1′-0″. Although this is the accepted break point, when referring to particular items we may sometimes speak, for example, of a 12-inch wall, a designation that may be more easily read than the shorter symbols. It is a hard and fast and widely accepted rule, however, that anything larger than 12 inches be referred to in feet and inches; even 1′-01/2″ [use the zero when the fractional dimension is less than 1 full inch.

4. However, all dimensions less than 12″ should be shown in inches only; use 9″, and not 0′-9″, for example.

5. Fractions should be shown with a diagonal slash by which the numbers are separated for greater clarity. Too much space is taken vertically by the horizontal bar and the chance of misinterpretation by deleting it altogether is too great.

6. In surveys, site plans, or other engineering-oriented drawings dimensions may be shown in feet and decimal parts of a foot, usually carried to two places; for example, 1 foot and 7 inches should appear as one point five eight feet [1′-7″ = 1.58′]. The draftsman should be fully prepared to make these conversions.

7. Basically, there are three dimension lines: the line closest to the building should describe its small elements – for example, piers, door widths, and window openings; the second lines should carry some of the small dimensions and reflect major features such as a wing, section, or offset; the third line [farthest from the building line] should be an overall dimension that will show the total distance from outside face to outside face of the building.

   It must be remembered that various types of construction, as shown in the example, will demand slight changes in dimensioning; for instance, wood frame dimensioned from face of stud to face of stud. This also applies to brick veneer walls, although dimensions are usually given from face of stud to the outside face of the veneer.

8. Dimension lines should be defined by an arrowhead or some other device, as noted in the example. There are many systems, but the only one in which the designator has significance is the modular dimensioning system used in some architects' offices. The arrowhead or other designator should point to an exact extension line, neither overrunning it nor pulling up short of it. Dimensions are definite measurements from one point to another, and showing them in a positive way can forestall the contractor's questions.

9. Currently, two methods of dimensioning are employed: one calls for lines to be continuous; the other more modern method shows only those dimensions that are vital to the placement of the various elements. Both systems are acceptable, although the current office procedures must be kept in mind. The more modern, or streamlined, version has one disadvantage in that in showing only key dimensions the draftsman may be forcing the contractor to build in a certain sequence. This sequence may not be acceptable, and the contractor may then ask a number of questions that may be difficult to answer.

10. Similar dimensions or, indeed, the same dimensions may be required several times on different drawings. It is important that these entries b checked and coordinated. Similar dimensions, however, should never be duplicated on the same drawing. Although continuity is desired, needless repetition should be avoided.

11. The clarity of the drawing can be improved if extension and dimension lines do not cross. In some instances, crossed lines cannot be prevented, but placement should be made with the greatest care possible to avoid confusion.

12. Dimensioning of architectural drawings involves actual sizes, regardless of the scale employed. A note may contradict the dimensions given; for example, a 2 x 4 stud may show a measurement of three and five-eighths inches [3 5/8″].

13. Obvious dimensions may sometimes be eliminated. A door placed in a narrow hallway does not necessarily have to be dimensioned, the inference being that the door will be centered.

14. To avoid needless dimensions or crowding, door and window sizes are often eliminated by the use of marks and a scheduling system; the contractor can then apply the correct size to any given opening.

15. Beams and columns are located by their center lines. A column, for instance, would have a center line running in both directions.

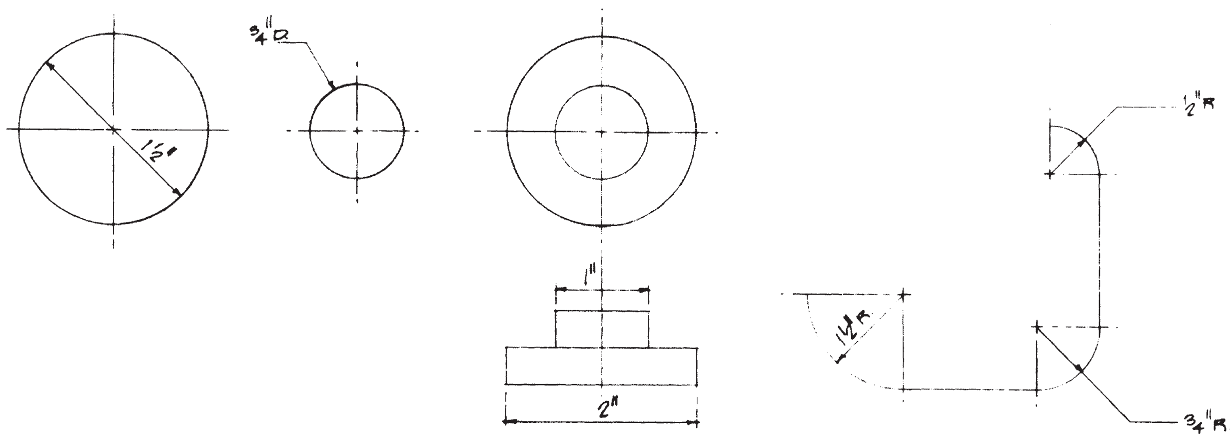
16. Overall dimensions should never be crowded and no fussy or fancy work should accompany them. They must be legible to the casual as well as the highly interested viewer and stand out without being obtrusive.

17. To increase legibility, identical units, spaces, or solids should be dimensioned at one element of the series and, by a note in a specific area, should be shown as repetitive. This will eliminate the need to repeat each unit from start to finish of the series. Items that are repetitive, meaning that they are all the same, may be noted as typical characters and not dimensioned in each of the scattered sections in which they may occur. The limits of any series should be marked by showing their extension and dimension lines and arrowhead designators.

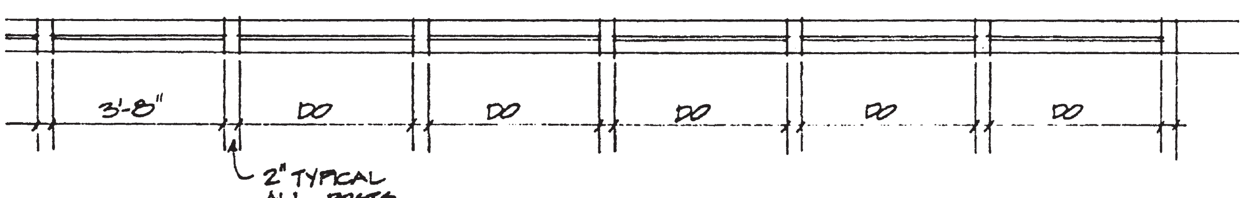
18. The dimensional system cannot be left hanging in limbo; it must be tied to tangible, usable items apparent in the construction. The building line, or perimeter of the structure, can be used for this purpose. Items are often referenced one to another. Therefore, it is important to see the item being referenced; the item being used as a reference should be installed before the item being referenced to it. This is especially true in using imaginary lines such as centerlines or in using joints in floor slabs and similar items. Construction can sometimes be held up because of a question about the reference point.

19. Overall dimensioning can clutter a drawing with too much detail, which can lead only to difficulty. It takes experience to determine how to use dimensions to the best advantage and where to place them for the best results.

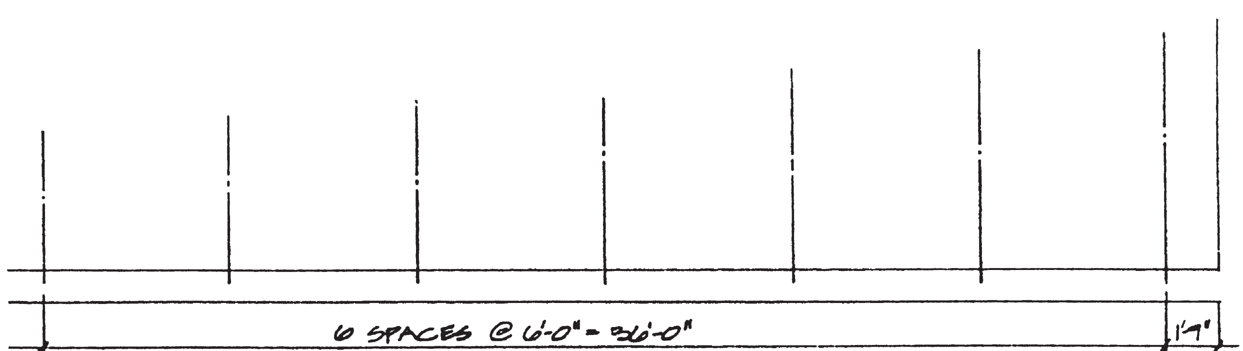
Many office standards address the dimensioning that is to be used. In most cases, dimensions are not required to be carried to very small increments. Particular attention must be paid when dimensioning is being accomplished via computer-aided drafting [CAD] operations. One must be watchful to see that the program does not produce dimensions that are inappropriate for construction work. For example, the automatic dimensioning in CAD may yield dimensions like 7′5 13/16″. Rarely does architectural work utilize such "tight' or finite dimensioning; most construction work does not have to meet such fine tolerances. Here, it is necessary to apply human determination to avoid impropriety in dimensions. This should be done by inserting proper dimensions that are consistent with what is expected of the work. In addition, this allows for variations in the dimensions as well as in the actual construction. Often, one or more dimensions in a line of di-



DIMENSIONS ON CIRCLES, CYLINDERS, & ARCS



(A)



(B)

mensions can be noted with a "±" [for example, 1′-4 1/″±] to indicate that a slight variance is permitted, either less or more the number shown. For the most part, this will not adversely affect the project, as the variations are virtually undetectable in the overall project work. However, if close dimensioning is necessary, use it; for crucial dimensions, mark the dimension "HOLD." This indicates to the workers that the dimension must be exact and true; if something must vary, it should be something other than the item with a "hold" dimension.

There is no hard and fast rule that decides whether notes should follow dimensions or vice versa. The two must be planned together so that one will not obscure or interfere with the other. Long leader lines between notes and their points of application should be avoided. Notes are properly located inside the dimension lines, that is, between the dimensions and the object drawn. Extension lines that regulate the distance from the object can be adjusted as required without any detrimental effect.

Notational systems include a number of items: room names, identification of materials, reference marks for scheduling, and titles for complete drawings and their parts. Notes that stand by themselves must be given some kind of label or explanation. They may also show specific locations or references. Some notes are used in direct connection with other designators such as material symbols. It is this combination of words and lines that must be carefully planned so that the legibility of the drawings is not impaired.

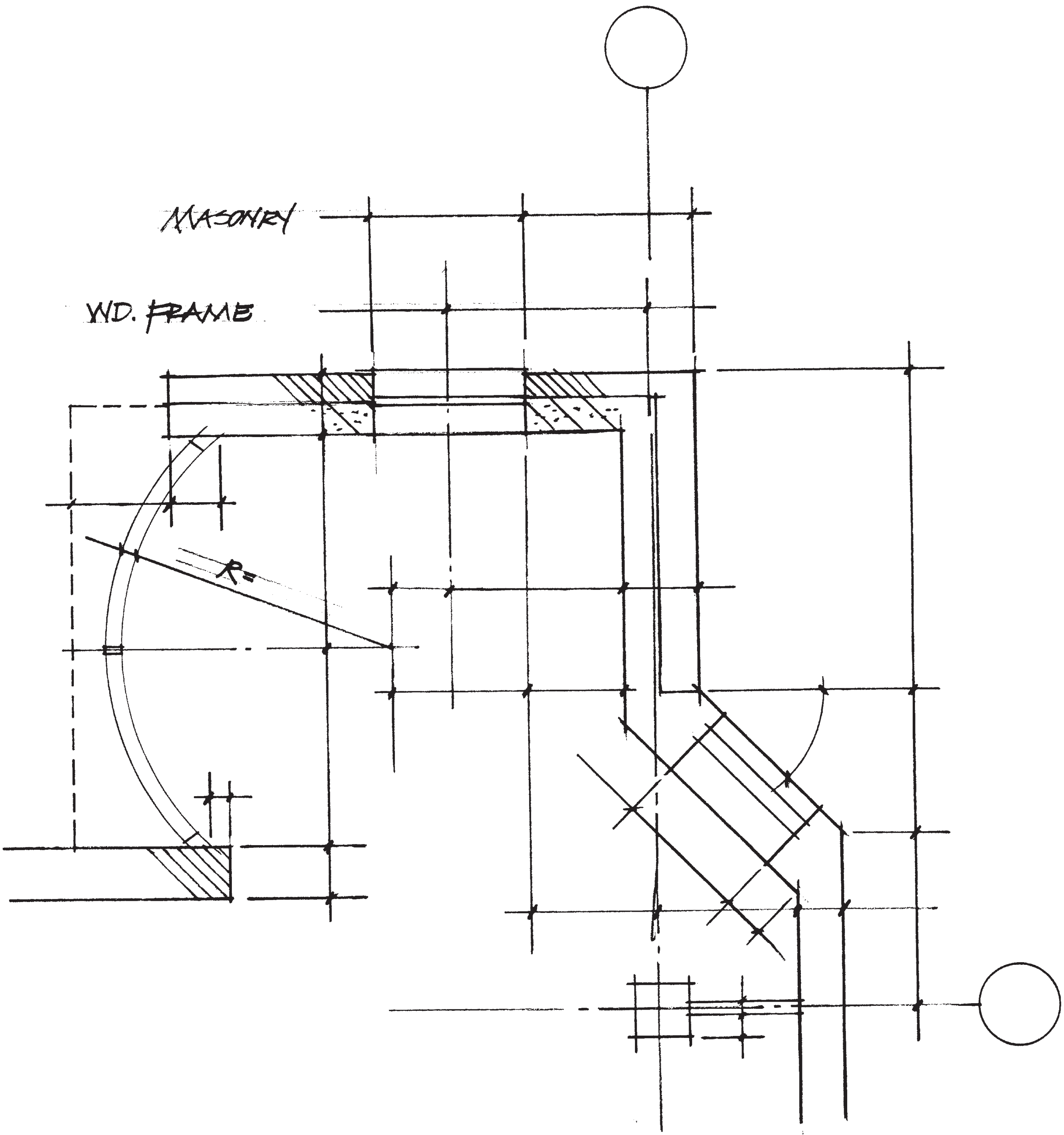
Notes in general should be organized and never left to chance. It is good practice to group those that apply around the construction to which they refer. This can be illustrated best in a wall section: all notes that have reference to the floor slab should be placed in one general area close to that section; notes that apply to the wall construction above the slab should be grouped elsewhere to avoid being mistaken or interchanged. Notes can sometimes be placed close together. The spacing between the notes must be greater than the spacing between the individual lines. The minimum should be a full line height or half the height of the lettering. However, depending on the judgment of the experienced draftsman, this space is adjustable. Punctuation marks are easily obliterated, and better readability can be attained with good spacing and arrangement.

For greater legibility and neatness, notes can be aligned at the left to present an even margin. This is not a hard and fast rule, but it is a dependable one. Notes may also be staggered along a slanted imaginary line. Nevertheless, the overriding purpose that should be kept in mind is getting the notes as close to the point of application as possible; for example, the topmost note directed to a floor slab should describe the topmost material in the floor slab construction and so on down the line. This method will result in an uncomplicated system of leader lines. Leader lines may be drawn freehand in sweeping curves or drafted in some sort of angle [skew to the drawing]. Another accepted method allows the freehand leader line to be quite distinguishable from any of the object lines and is thus preferable. The angle does not always have to be constant, but neither should it be allowed to become haphazard. Leaders should point away from the first or last line of a given note, never from the center, and should connect with the material to which the note refers.

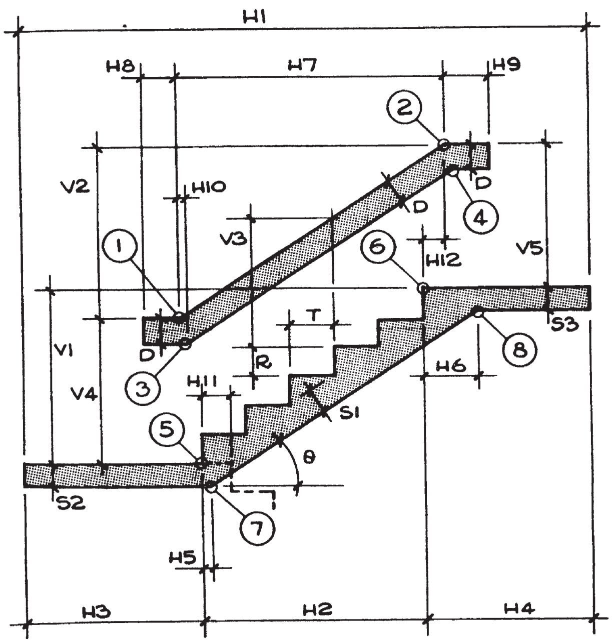
When notes contain nomenclature, it is important that the same terminology be used throughout. What appears on the plans should appear on elevations, wall sections, and so on. All drawings should agree-most of all with the specifications. It is good practice for the specifications writer to decide what nomenclature will be used in all documents, unless, of course, it has been predetermined in the office manual. If there is no office policy, the drafter should take the responsibility for checking the specifications to ensure that his or her work conforms. Lack of uniformity in nomenclature [e.g., concrete block as opposed to concrete masonry units] can only lead to confusion, confusion that is compounded if sundry unstandardized abbreviations are mixed in. Some agencies [mostly governmental] require standard nomenclature, and the office will be judged on how well it conforms. Nomenclature for identifying notes is important in that it eliminates the need for repetitious lines; it is far easier to letter the word "brick" on an elevation with only a small amount of symbology than to show the wall's entire coursing system.

Some note of instruction is often a necessity; it will not always relate to a specific kind of material but it will let the contractor know that a certain condition must be met. It is best, however, to make it a mandatory statement; for example, it can order a projection of brick in a panel beyond the face of the normal masonry line – in other words, a 1-inch projection – or it can instruct a contractor working on a renovation project to "match existing wall construction." A note can also clarify intention; a good example is "Slope floor to drain." It should be concisely phrased to make a point that could be difficult and cumbersome to display in a drawing. Most notes are merely simple labels.

Effective communication is basic in the construction industry and the drafter must learn to make his or her requirements clear to all. Some notes involve identification or location; room names or room numbers are examples. It is important that each space be identified for specific purposes, such as scheduling or reference.



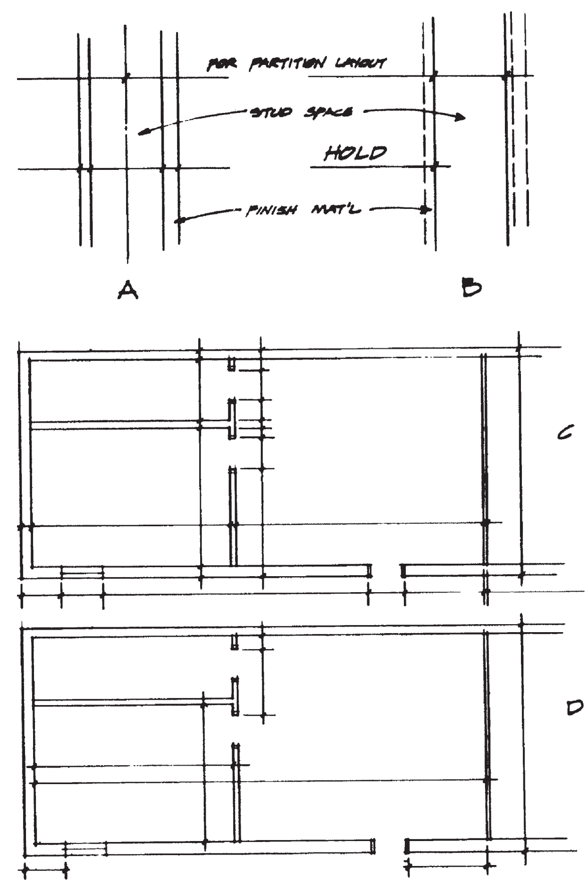
Drawings showing various ways to dimension changed situations. Note the circles and angles; the use of repetitive features; and the variety of wall layouts from angles, curved walls to isolated columns.



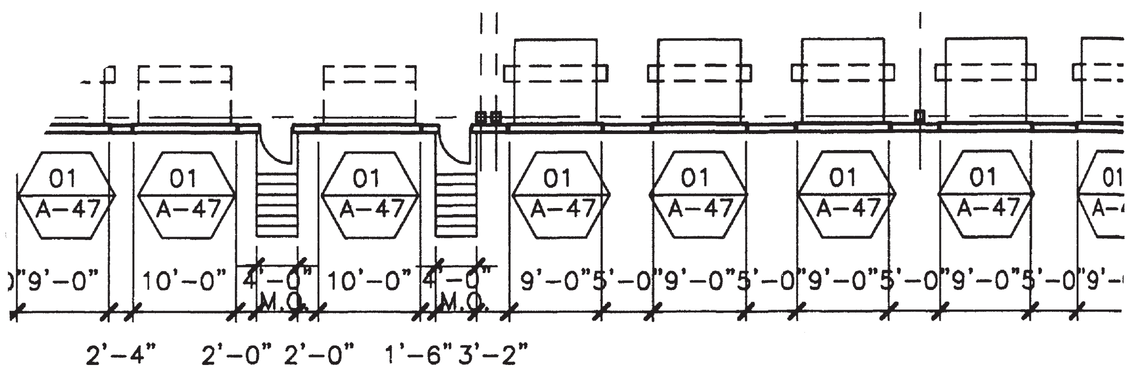
1. Θ = ARCTAN (R/T)

2. IF V4 = V5; THEN H2 + T = H7,
   AND Θ = ARCTAN (V2/H7),
   AND V1 = V2

3. XR = V1 / R



Stair only Office standard showing the necessary dimensioning for a flight of stairs.
This sheet helps to ensure listing of all information required for layout and construction.



FLOOR PLAN
1/16"=1'–0"

Two portions of floor plans and required dimensioning. CAD produced, so some narrow locations have drafting work that overruns others. Care is required and alternatives methods required if reading of drawing is impaired.

BUILDING CODES AND STANDARDS

Building codes chiefly safeguard the health, safety, and welfare of the general public. By establishing safe building practices, both in design and execution, they endeavor to reduce all possible hazards faced by potential occupants of buildings. Ideally, strict adherence to the ultimate building code would eliminate all elements of danger normally inherent in any building; that this ideal may never be attained is no reason to deny the value of its underlying principles.

The earliest humans, dwelling in caves or beehive huts, had only themselves and their immediate families to consider as they planned and built their shelter. They learned from experience how much space they needed, what degree of permanence a shelter should have, and what materials would combine to satisfy their requirements. Two factors of their gradual evolution altered the primordial nature of early humans: the discovery of fire and the use of communication. Soon they became part of a community formed for mutual protection and preservation.

People's attempts to provide adequate shelter have been limited by their technological knowledge and the availability of building materials. From one world area to another there is wide variation in building techniques and materials. Indeed, in the United States we have learned that dwellings remarkably suitable to prevailing conditions in New England are a ridiculously poor choice in the Southwest.

For the same reasons [climatic conditions, community practices and economy, and native material resources] a building code written to protect public safety in Boston, Massachusetts, will be largely without application in El Centro, California. Certain generalities, which pertain equally well in all areas of the country, are based on common sense and, strangely enough, have been learned by unfortunate experience, only to be incorporated in building codes too late to prevent the first loss. Such generalities stipulate regulations for fire exits, maximum capacity for various rooms, and requirements for installation of panic hardware.

Many contractors and builders, some architects, and sometimes manufacturers of building materials object to the restrictions imposed by building codes. Often these objections reflect self-interest and, if allowed, would inure to the detriment of the public. Steel manufacturers and fabricators have argued that adequate safety factors are incorporated in their products, making additional design regulations excessive and wasteful. Writers or codes know that people are all too fallible, and manufactured products can demonstrate this fallibility. The old adage "It is better to be safe than sorry" justifies the extra ounce of precaution. Some designers would welcome the opportunity to utilize a structural steel member to its maximum capacity, as stated by the fabricator, if the building code failed to impose specific design limitations. The collapse of a bridge with its normal traffic load because one structural member of the span proved inadequate is reason enough to suspect the "built-in" safety factors in all steel components.

Building codes are written and adopted to protect everyone. The codes are legal compilations of minimum standards, set forth to establish a consistent level of public health, safety, and welfare. However, they guarantee nothing. They are part of a complex legal network that concerns design and construction of projects. The codes are the law of the jurisdiction, and as such, deserve the full and complete attention of each design professional. Every young professional must learn, early, that adherence to the law [i.e., the rules and regulations of the governing code(s)] is mandatory; it is necessary to the continuation of a successful practice.

The codes are neither conceived nor intended to be prohibitive documents that "force" designs and designers into set, or predetermined, scenarios. There are options, and usually there will be several easy to achieve the required compliance. The designer who is fully conversant with the codes will understand, know, and utilize these options to the greatest benefit of the client and the project. One must be alert to react properly to various levels of regulation. From the federal to the state, to the county, and hence to the municipality, usually the more stringent regulations will take precedence. In some instances, however, the regulations of one level of government will preempt those of the lower jurisdictions.

Moreover, it is necessary to understand that the codes are not "Consumer advocate" documents, complete in every aspect and in minute detail. The authority of the code[s] and code officials is restricted and does not involve items or conditions of workmanship, fit, nonstructural maladies, and so on. The code is seeking properly constructed, structurally sound buildings that create no hazard or threat to public health, safety, and welfare. Minor and cosmetic details that may be problems pose no such threat and hence are not covered by the code nor regulated by the official. Generally, the codes seek to do for the general public what it cannot do for itself collectively, nor what each of us can do individually – that is, to match risk with commensurate protection. What is allowable in Brown County, Ohio may well be illegal practice in Dade County, Florida. The average restrictions in force in a small Midwestern town with its broad streets and low-rise buildings will be more relaxed than the "musts" and "must nots" of a large eastern metropolitan center in which the population is dense and buildings soar 70 stories into the sky. The applicable code offers protection to the designer, the client, the insurers, and all users of the facility. No designer, architecturally trained or otherwise, can be sure of the implied reliability of the materials used in his or her building; the designer relies on the product's reputation and the accountability of the manufacturer. If for any reason a material built into a structure in accordance with the code stipulation fails, the designer is absolved in the ensuing litigation. More than this, the designer's conscience can remain clear; the designer has performed his or her task and has adhered to the building code. If a failure causes bodily injury, the client is freed of blame in the final analysis, for again the design complied with the prevailing code. When reason for failure is determined, the cause is noted, responsibility affirmed, and the code modified to reflect the newly discovered facts. Awareness of code requirements and restrictions has saved the professional careers of many architects.

"Public health, safety, and welfare," as an umbrella term takes under its protective cover all manner of related subjects. The density of a given neighborhood, controlled by zoning laws, is further protected by the building codes. A zoning law will designate an area as single-occupancy residential and, further, specify "setbacks" and yard areas. A building code governing the same residential neighborhood requires a building permit, which will notify the authorities that a new building is about to be erected. Building, plumbing, and electrical inspectors must certify the construction for its adherence to the codes' mandates and for overall adequacy, thus ensuring that the minimum standards have been met. Properly executed, this procedure serves to maintain structural integrity and produces sound buildings. Because humans are subject to corruption, the result may not be so optimistic as envisioned, yet the system can serve us well. Violations are the exception, not the rule.

Building regulations [codes] are the result of civilization's imposing itself on the individual. The codes now afford protection for both the individual and the structure as a result of the tragic history of unregulated construction in developing communities. Poorly constructed buildings, built very close together, were susceptible to collapse and fire, and easily could involve adjacent structures in a short period of time. History has recorded many such disasters, the most notable being the fires in Rome, London, San Francisco, and Chicago. All started small, only to rage rapidly through the city, not only devastating property but causing peril to citizens. It should be apparent that some regulation is vital to the continued safe and orderly development of urban areas. However, such regulation in rural areas usually meets with a good deal of resistance because the hazards seem negligible; buildings on a farm may be hazardous to each other, but they pose a minimum threat to other farms in the area owing to the distance separating them.

In the building code of Hammurabi, perhaps the most famous of the ancient codes, it was ruled that if a building collapsed and killed the owner, the builder was to be killed; if a child was killed, a child of the builder was killed, and so forth. Drastic? Yes, yet this was a direct reaction to substandard construction that was beginning to mar a developing civilization. It also emphasizes the basic premise of the codes: laws adopted to govern construction and to provide penalties for violation of the minimum standards.

As technology and methods of construction changed, more and more building regulations were enacted. As civilization refined itself, the hazards increased. Although early civilizations, which built by trial and error, were replaced by more studied construction, the introduction of fire into the buildings presented an entirely new array of hazards. The potential disasters posed by these hazards caused governments to regulate the construction of such things as thatched roofs, fireplace construction, and space between buildings, in an effort to restrict and confine the hazards. However, hazards are inherent in everything we do; hence they have become part of our way of life. We accept this situation in an effort to gain both personally and financially. Each new aspect of life contains some risk, but people are anxious to use new methods and materials in an attempt to make life better. This is particularly true in the construction industry. Many officials, particularly in the fire service, opt for a very tightly regulated, basically "hazard-free" construction, which is simply neither practical nor feasible. So a balance within the building and fire codes has been struck, whereby certain hazardous uses, methods, equipment, or materials are allowed, but they are controlled, restricted, and protected so the threat of loss [of both life and property] is minimized.

The first of the "modern-day" building codes was developed by the insurance industry. Basically, it was aimed at reducing property loss because the industry was vulnerable for payment resulting from loss of property. Further, early in the twentieth century, in an age of weekly wages of $ l, the value of the materials used far outweighed the value of the labor involved. In essence, labor was fairly cheap, whereas the building represented a substantial investment.

As the years passed, people's values changed, and so did their priorities. This is particularly true in countries where human life is held in the highest esteem. The codes reacted accordingly, and now the major thrust of the building codes is the protection of the public using the structure or facility; this is followed by the protection of fire fighters, the surrounding properties, and finally the structure itself. There is no attempt to abort, or negate, the value of the building or other property [and the codes provide adequate protection here], but the first "thought" of the codes is human life and its protection.

Building codes are sets of legal documents that set forth minimum standards and which, when adopted, are converted into the prevailing law of the jurisdiction. That adoption also "locks" the local enforcing agency [and officials] into a fixed system with very little discretionary power. It is the wise design professional [and his or her staff] who recognizes these factors and reacts to them. This should take place in the earliest portion of the design phase, where the code should be met "head-on"; any problems or infringements should be evaluated and proper solutions worked out with the enforcement agency. The building codes should be perceived as a vital part of the design process. They should be considered an integral part of the basic program for the construction and should be addressed like any other portion of the "problem-seeking" programming phase of the work. They should carry the same weight as any program requirement of the owner. The codes are "additional parameters" within the design process and are not a hindrance to good design or budget control; a beautifully designed, elegant, award-winning structure can still be a patently hazardous building if it does not meet the provisions of the codes. The elements of good design, unfortunately, neither negate nor remove unsafe and hazardous conditions.

The national Codes and Standards Committee of the American Institute of Architects [AIA] openly decries the fact that "many architects find the code documents baffling, and their administration frustrating. At the very least, most architects find the interrelationship between codes and the design process a dull business." This most unfortunate situation is very counterproductive and can lead the professional directly to a liability-threatened problem. To counteract this trend, the Committee is advocating emphasis on more education [at all levels from student to fully experienced practitioner, it is hoped], closer relationships with code-producing agencies and code change procedures, and increased [and, we hope, continuous] "codes and standards" communication to the practitioner. Furthermore, efforts toward increased awareness regarding "risk-conscious" design [which involves all life-safety elements-fire and smoke control and prevention, flood damage prevention, seismic design, dysfunctional design, air quality, etc.] will strive to reinforce the Committee's contention that "a quality building depends totally on risk-conscious design."

Moreover, it should be recognized that the use and occupancy of a building will have a continual detrimental effect on the structure; poor housekeeping, ignored maintenance cycles, improper uses, and abuse of the building will add to the hazards and fire loading and will further imperil the occupants. Much of this will be done without the knowledge, much less the approval, of the design professional or the code agency. Therefore, the codes try to ensure that the initial construction is safe and provides, at the very least, the minimal protection required.

It is common belief that the building officials are the parties solely and totally responsible for code compliance and enforcement. However, in most states the registration laws for design professionals impose the burden on those professionals; they are to meet the provisions of the codes to protect public health, safety, and welfare. In some states they are even required to report to the building officials any acts they observe that are in violation of the codes! This surely reflects the will of the legislative powers who deem code compliance to be a major necessity. It clearly requires a cooperative, coordinated "joint effort" between design professionals and the building officials. The antiquated view, still held by some individuals, that these two factions are constantly in adversary positions, should be immediately and quickly forgotten. For a complete discussion of building codes, standards, and the interface between them and the design professional, and the relationship of both to the code official, see the author's book Construction Regulations Handbook, listed under "General Practice" in the Suggested Reading List.

The "commitment to comply" begins with a valid and in-depth code search during the design phase of the project. All factors must be researched, options chosen where available, and a general pattern of compliance established. In the best spirit of cooperation, the building official should be utilized early in this stage as a "consultant"; he or she will most always be willing to discuss approaches, options, and proposed solutions and perhaps reveal some subtle, obscure provisions that may aid the project or may restrict some element of it. Just as the umpires and managers gather at home plate before each baseball game to review the ground rules, so too should the professionals gather to review the full parameters of the codes. There is no doubt that the codes are extremely complex and involved documents and are becoming more complex as innovations in the construction industry force constant revision. Surely, though, it makes good sense to find out early in the design stage that, for example, another exit stair is required. In this preliminary work the stair is incorporated much more easily, as it will not disrupt fixed design features, program parameters, final estimates, firm bids, or issuance of the building permit. Drastic changes may be necessary, but major disruption of the project design or construction is avoided. Disruption is not the intent of any code, but without prior knowledge the enforcing agency can only apply the code when the documents are submitted for permit.

Working drawings should be viewed as an extension and a refinement of the commitment to comply. The requirements of the codes should be constantly checked, and the addition of pertinent and proper details of the requirements should be included progressively in all of the project documents as well as during the construction cycle. It is true that a great many of the code provisions must be considered or incorporated in the basic design of a building. Certain analyses, conclusions, and determinations must be made and the results accounted for in the basic planning [such as the number of exits, placement of stairs, number of plumbing fixtures, use and placement office walls, location of rated construction, etc.] so that proper facilities, construction, relationships, and area sizes can be established.

In the working drawing phase of the work, the minute detail of the code provisions must be accounted for. Some code features used or incorporated in a broad manner must be refined and detailed properly to reflect precisely what is required by the code, and what the design professional has chosen as a response to the requirement. [It should be noted that most model codes are performance oriented with several possible solutions to any requirement, as opposed to specification codes whereby only one solution is permitted.] Rated assemblies, for instance, must reflect the assembly that was used to establish the rating. The construction must match exactly the construction of the test assembly. No variations should be allowed, or the rating is nullified. No longer can a partition be labeled merely as having a "one-hour rating." Now the detailed construction of the wall must be determined, and the detail depicted on the drawings. Further, the location of the wall must be shown, and the proper information also incorporated in the specifications. Most building departments now require that any notation for a rated assembly should include the listing number of the assembly that is assigned by the testing agency.

In this way, the proposed construction can be compared easily with the test data. So, too, the inspector easily can check the actual construction against the design "commitment." The codes tend to lag behind technology and thus evoke cries of restrictiveness, obsolescence, and design inhibition. However, it should be understood that most modern building codes are "consensus" documents. These codes are changed regularly to reflect the opinions and views gathered from many sources in the industry. A majority vote of the code group's members incorporates into the code those changes that are deemed proper. Delays in testing, evaluation, and establishing criteria for safe and proper use of new materials and methods of construction are constant. If a new material is going to be used in a project, it is wise to check with the building official so progress will not be stalled later while approvals are collected. Be prepared to submit test data about the material and do this as early as possible. There is an active, and intense, program of approvals in the industry, but physical and economic factors have a hard time keeping pace with the 5,000 new materials coming on-line each year. Moreover, there is usually an appeals procedure that can be utilized if the building department is unwilling, or unable, to approve a material or system. An established board within the jurisdiction can hear the case, evaluate the submitted data, and issue a ruling supporting the denial, allowing the use of the material, or allowing the use with conditions. Here, again, there is a time factor that may have an adverse effect on the progress of the design or construction.

Another complicating factor is the massive array of information and requirements contained in the various standards merely referenced in the codes. Often a small code provision will refer to a standard that introduces hundreds of pages of data that may have an impact on the project. Although the information is not written directly into the code book, the requirements are bona fide code provisions and must be met. The need for research, resolution, and understanding is again quite apparent.

New, or substitute, materials should never be introduced directly into the field; the inspector, almost without exception, will not allow it and may stop the work until proper information and test data are submitted and approved. It should be understood that the field inspector is required to check the actual construction against the approved documents. Therefore, the solutions or options must be resolved with the plans examiner and the building official before the project is approved and the permit issued. Furthermore, any noncode elements in the project that are changed should be coordinated with the building department as they occur, or the inspector may question the change.

In the year 2000, publication and adoption will begin for the newly written International Building Code [IBC] and its companion documents. Previously, there have been three model code organizations in the United States: Building Officials and Code Administrators, International, Inc. [BOCA], the

International Conference of Building Officials, International [ICBO], and the Southern Building Code Congress, International [SBCCI]. The groups and their members represented portions of the United States, but no building code set covered the entire nation. Each group promulgated and modified their own version of the codes; and the three varied one from the other. The single new code will eliminate the variations, as more and more jurisdictions adopt the new codes. The target is to have the IBC applicable to all of the same 20,000 individual jurisdictions in the United States, and to as much of the en tire world as possible. The three current groups will no longer publish and amend their codes. The timing and cycle for changes in the IBC has not yet been determined, but it is certain that changes will occur as technology changes, or as differing code-related situations arise.

In any event, it is the design professionals who are responsible for reviewing the code [as applicable to their project], and for creating a design and documentation that complies with the code provisions on [or "as of"] the day the application for permit is submitted. The professional, therefore, must be aware of the latest changes. This further points up the benefit of working with the building official as a consultant early in the project; it is the official's job to stay current and be conversant with the very latest changes and additions. After a strong initial code search by the design professional, it is far less time-consuming if he or she consults with the building official to determine whether the conclusions drawn, and the design developed, are valid, than to correct errors later. Under the model code system, and with local codes, the local authority is the final word and holds the responsibility for final interpretation of the code and final approval of the project. This provides for the incorporation of local law into the model codes and may cause variances from the "pure" model code provisions. In essence, no code should be taken for granted just because it is based on a model code. Therefore, the code and code official should be checked several times during the production of the working drawings to ensure that all current provisions are met and to see how any changes, or variations, may have an impact on the project in unexpected ways.

In the last few years, building disasters, both major and minor, have been attributed to a wide range of causes, and there is no clean, clearly defined way to reduce or eliminate them. In most structure fires, ignoring the basic code provisions in the design stage has led to death owing to lack of sufficient exiting facilities, rapid expansion of the fire via combustible materials, and toxic poisoning from burning materials and furnishings. In other situations, the building was found to be in keeping with the codes when it was built, but the addition of flammable decorations and other fire loading [furniture, carpeting, etc.] led to the loss of life. In still others, the initial code-abiding construction was negated by blocking exits, cutting holes in fire walls, and other such "conveniences" that helped the owner meet his or her needs, or facilitate easier operation, or sadly, save a few dollars in remodeling. Again, lives were lost and property was heavily damaged-tragic cost from all points of view.

In some cases, disaster resulted from poorly conceived details, faulty changes of details, or work that was not executed according to approved drawings. The common factor in all of the examples seems to be time. Time is not taken to conduct a thorough code search; time is not taken to resolve code problems with the code professionals; time is not taken to obtain a permit and proper inspection; time is not taken to research and detail construction properly; time is not available for complete, objective checking of documents before they are "put on the streets"; and time is not taken to be prudent in making revisions or in actually building the project. No doubt it takes a nearly superhuman effort to produce a modern structure on time, within the budget, and in the safest, most code-abiding manner, but such effort must be the daily endeavor of the construction industry.

Within this effort, though, the working drawings serve as a very distinct, precise, all-encompassing, and poignant checkpoint for compliance, if they are approached in the proper manner from the outset. Day by day more time-saving production techniques are being discovered, refined, and adopted in the professional office, but there still must be that human decision and commitment by the design professional to do the job right from beginning to end. The time saved in production should be diverted, at least in part, to the cause of prudent, life-saving design and construction.

Copies of all pertinent codes can be found on the shelves of drafting offices or centrally located in a design library. Each person delegated even the most minute drafting assignment on a sheet of working drawings should become familiar with the governing code and should be aware of any violation or infraction of the code stipulations so that a damaging error will not reach the contractor. The more office personnel trained to search out code transgressions, the more likely the office will engender a reputation for competency and thoroughness, two qualities requisite to good work. This is increasingly true, because, as noted in Chapter 3 "A Perspective on Working Drawings," code compliance on the part of the design professional is virtually nonnegotiable. Court decisions have placed a tremendous and meaningful emphasis on the professional's obligation to perform code searches and to meet the applicable provisions. The following is a list of code discrepancies compiled by a building department [OBBC is the Ohio Basic Building Code; HCBC is the Hamilton County

Building Code]. The list contains the discrepancies/problems which are seen most frequently. This listing was made prior to the department being computerized, but still served the purpose for notifying applicants in response to a permit application. With computerization, now, it is much easier to utilize this listing, via Word Processing or other programs, when the Plan Reviewers compose response letters. It serves to show the type of items "missed" and the type of detailed information that is required. Following the list are examples of code search forms that expedite the code search for each and every project.

BUILDING CODES AND STANDARDS

INTRODUCTION

1. The referenced plans and specifications have been examined and found to have conditions which do not comply with the OBBC.
2. The referenced plans and specifications have been examined and additional information is required to conform with the OBBC.
3. The revisions to the referenced plans and specifications have been examined and the following items still do not comply with the OBBC.

INSUFFICIENT INFORMATION

1. Article I Administration Section 4101:2-1-19 requires the documents submitted for a permit to contain sufficient information for the Plan Examiner to conduct a meaningful Critique.

ESTIMATED COST

1. Specify cost of architectural and structural work only [total project cost less HVAC (heating, ventilation and air-conditioning), electric, and plumbing] on building application form.

SURVEY

1. Please show the location of the building relative to the property lines and adjacent buildings on the same site, complete with dimensions and the stamp or seal of the surveyor [HCBC Sec. A-18(H)(6)].

CONSTRUCTION TYPE & USE

1. Please indicate the type of construction claimed in accordance with Article 4 and the Use Classification in accordance with Article 3 [Section 4101:2-1-19].

NAME, ADDRESS

1. Documents submitted for a building permit are not valid unless each sheet has the name, address, and telephone number of the preparer [HCBC Section A-18-G].

PER CODE

1. In no case shall the Code be cited ["as per Code"] or the term "legal" or its equivalent be used as a substitute for specific information [HCBC A-18-G].

ADDITIONS

1. Article 1 Administration 4101:2-1-11[C]. If the structure is increased in floor area or the number of stories, the entire structure shall be made to conform with the requirements of OBBC in respect to means of egress, fire protection, light, and ventilation. Additional information on the existing structure must be furnished with regard to the requirements listed above, including all building dimensions and construction details. Section 908.0 offers the alternative of a fire wall.

USE CHANGE

1. Section 4101:2-1-11[A] in Administration of the "OBBC-Change of Use": The use of a building shall not be changed unless or until the building and the building service equipment therein conform to the requirements of OBBC for buildings of the proposed new use group classification.

PART USE CHANGE

1. Article 1 Administrative 4101:2-1-11[B] "Existing Buildings or Structures" states, "Part change in the use of a building shall be permitted if the portion of the building being changed is separated from the remainder of the structure with the required vertical and horizontal fire separation assemblies complying with the fire grading in Table 902".

GROSS AREA

1. The gross area of the building exceeds that allowed by Table 501. Section 502 must be addressed in total for exceptions to Table 501, i.e., Section 502.2. This must be shown on the site plans and approved by the local fire prevention officer having jurisdiction. Section 502.3 is second alternative.

HANDICAPPED

1. All buildings open to the general public must comply with Section 512.0. Notable omissions from the drawings are Parking, Entrance Ramps, Doorway Grading, Toilet Rooms and Plumbing Fixtures, Drinking Fountains, etc. for the handicapped. Please submit manufacturer's literature or detailed drawings for verification. Buildings and facilities required to be accessible by this section must comply with ANSI Al17.1 1986.

FIRE WALLS

1. Section 908.1 requires fire walls to be self-supporting with structural stability under fire conditions to allow collapse of construction on either side without collapse of the wall. Strength and stability shall comply with the provisions of Articles 11 and 2l.
2. Adjacent construction may not tie into the fire wall. Lateral walls and roof structures abutting fire walls must be separated by nonstructural joint seal or caulk to allow the adjacent construction to fall clear of the fire wall.
3. Section 908.5 requires fire walls to be continuous from foundation to 2'-8/1 above the roof surface. The wall may terminate at the underside of the roof deck where the roof is of noncombustible construction or fire retardant treated wood for a distance of 4' on either side of the wall.
4. Fire walls must be continuous from the outer face on one side of the building to the outer face on the opposite side.

FIRE SEPARATION WALLS

1. Section 910.6 requires all fire separation walls to extend from the top of the fire resistance rated floor to the underside of the roof sheathing continuously.

UL NUMBERS

1. All rated assemblies, walls, floor/ceiling, beams, columns, etc. must have the appropriate assembly number from an approved testing agency shown on the drawings or contained in the specifications.

EXTERIOR WALLS

1. Fire resistance rating of exterior walls shall comply with Table 906.2.

OPENING PROTECTIVES

1. Section 906.5 requires approved protectives be provided in every opening which is less than IS' vertically above the roof of an adjacent structure within a horizontal distance of 15'. An alternate is to rate the adjacent roof/ceiling construction for not less than 1 hour.

STAMP OR SEAL

1. Please submit all calculations for sizing all structural members for the building, design loading, strength, etc. or have the Architect or Engineer responsible for the design stamp or seal the drawings per Section 4101:2-1-22[C].

VEHICULAR OPENINGS

1. Buildings with overhead doors or other vehicular access openings are required to comply with Section 609.0 unless the owner submits a letter stating that no vehicles will be allowed in the building at any time. [Significant requirements of Section 609.2.4 involve floor drains with grease interceptors and an exhaust system.]

STORY BELOW GRADE

1. Section 807.3.1 requires the floor/ ceiling assembly and all supports below the grade level be protected by providing a fire resistance rating of not less than one hour. An alternate is to provide an approved fire suppression system for that floor below the grade level.

STORY ABOVE GRADE

1. The definition of a "story above grade" is as explained in Article 2, i.e., any story having its finished floor surface entirely above grade, except that a basement shall be considered as a story above grade when the distance from the grade to the finished surface of the floor above the basement is more than 6' for more than 50% of the total perimeter or more than 12' at any point.

20 SQ. FT.

1. Section 1002.15 requires an approved fire suppression system in every story or basement of all buildings where there is not provided at least 20 sq. ft. of opening entirely above the adjoining ground level in each 50' of exterior wall in the story or basement on at least one side of the building. The minimum dimension of the opening is 22".

CEILING HEIGHT

1. Section 708 requires the lowest projection in an occupiable room or habitable space to be not less than 7'-6". Show a cross section through the basement indicating the ceiling height to the lowest projection.

PLUMBING

1. Section 915.4 requires that all vertical pipes arranged in groups of two or more which penetrate two or more floors and which occupy an area of more than 1 sq. ft. and vertical ducts which penetrate two or more floors, shall be enclosed by construction having the fire resistance rating specified in Table 401. Section 915.4.1 permits a shaft alternative using approved through-penetration firestop devices or systems.

2. Section 915.4 requires that all combustible pipes and ducts which penetrate two or more floors [including the slab on grade] be enclosed in construction having the fire resistance rating specified in Table 401. Section 915.4.1 permits a shaft alternative using approved through-penetration firestop devices or systems.

ANCHORS

1. Section 1704.8 requires top plates to be anchored to walls

min. 1/ 2″ diameter anchor bolts embedded in poured-in-place concrete not less than 8″ and in unit masonry construction not less than 15″ [two block courses]. There must be a minimum of two anchor bolts per section of plate which shall be placed a maximum of 12″ from the ends of each section. Intermediate bolts must be spaced a maximum of 8' on center. This must be shown on the plans.

8″ ABOVE

1. Section 1704.9 requires all frame construction to be a minimum of 8″ above finish grade. This must be shown on a typical wall section.

PRESSURE-TREATED WOOD

1. Section 1712.3.1.3 requires that sleepers and sills on a concrete or masonry slab which is in direct contact with earth shall be of approved naturally durable or pressure-treated wood.

PERIMETER INSULATION

1. Section 3101.2.4 requires perimeter insulation to extend downward from the top of the slab for a distance of 24″ and have a thermal resistance [R] of not less than 4.43.

FOOTINGS AND FOUNDATIONS

1. Section 1205.1 requires all footings to be a minimum of 30″ below finish grade. This must be shown on a typical wall section.
2. Please refer to Section 1209 for concrete footing requirements.
3. Please refer to Section 1212.0 for mat, raft, floating, and monolithic foundation requirements.
4. Please refer to Section 1212 for pier foundation wall requirements.
5. Please refer to section 1224 for dampproofing, waterproofing, and drainage tile requirements for foundation walls.

RETAINING WALLS

1. Please refer to Section 1223 for retaining wall requirements.

TRUSS

1. When truss construction is involved in a building it is necessary to submit structural calculations or a truss loading diagram with the stamp or seal of the design engineer.

TYPE 2C CONSTRUCTION

1. This building is of 2C-type construction and no combustible construction materials may be used. This includes blocking in walls, furring strips and nailers, substrates for laminates and other decorative surfacings, and framing lumber for fixed case goods [Section 403.1].

DOORS

1. Section 812.3 requires all door openings to provide a free and clear width of not less than 32″.

EXIT-AT-ALL-TIMES FUNCTION

1. Section 812.4 requires all egress doors [doors from occupiable rooms or spaces] to be readily openable from the side from which egress is to be made without the use of a key or special knowledge or effort. This must be shown on the plans or in the specifications. List hardware function numbers for all doors and the name of the lockset manufacturer.

KNURLED KNOB

1. Section 825.3 requires doors leading to dangerous areas to be equipped with knobs, handles, or bars that have been knurled.

ROLLING GRILLS

1. Section 812.5 requires rolling or sliding grills to have emergency manual release and lock operation from the inside without the use of a key.

TWO EXITS

1. Section 809.0 and Table 809.2 require not less than two exits from all rooms and spaces.

DEAD ENDS

1. Section 810.2 requires exit access passageways and corridors on floors required to have more than one exit to provide direct connection to such exits in opposite directions from any point in the passageway or corridor. The length of a dead-end corridor shall not be more than 20'. [See definition of "corridor."]

FIRE DOORS

1. Fire resistance rating of fire doors should comply with Table 916.

DOORS IN SERIES

1. Section 812.2.3 requires doors in series to have a space between them of not less than 7' measured in the closed position.

SLEEPING ROOM EXITS

1. Section 809.4 requires an emergency escape route from every sleeping room having a net clear opening of not less than 5.7 sq. ft. on the second and third floors, an 5.0 sq. ft. on the first floor [minimum height dimension-24″; minimum width dimension-20″]. The sill height may not exceed 44″.

AISLES

1. For the exit route through the area, show the required aisle width [Section 805.1].

EXIT ACCESS

1. For the exit route through the storeroom, show a 44″ wide striped aisle posted with a sign-″EXIT ACCESS-DO NOT BLOCK″-to comply with Section 807.2.1.

OCCUPANT LOAD

1. With reference to Section 806.0, specify the occupant load for this building.

RAMPS

1. Section 815.0 ″Ramps″ must be complied with, specifically 815.4. Landings are required on both sides of doors and all landings must have a minimum length of 60″.

EXIT ENCLOSURES

1. Section 816.0 ″Interior Exitway Stairways″ must be complied with where applicable and, specifically, subsection 816.9.2 ″Enclosures.″ All interior exit stairways must be enclosed in fire separation assemblies of a fire resistance rating in accordance with Table 401. Section 910.6 requires these walls to extend to the underside of the roof above.

STAIRS

1. Section 816.2.2 requires the minimum headroom in all parts of a stairway to be not less than 6'-8″.
2. Section 816.3.1 requires the least dimension of a landing to be not less than the required widths for the stairway.
3. Section 816.4.1 requires all stair risers to be not more than 7″ and all treads to be not less than 11″.

GUARDS

1. Section 827.0 requires guardrails to be at least 42″ high with intermediate rails, balusters, or other construction such that a sphere with a diameter of 6″ cannot pass through any opening. Stair guardrails may be not less than 30″ high.

1. HANDRAILS Section 828.2.2 requires handrails to be 34″ to 38″ high. Handrails that form part of a guardrail may be 34″ to 42″ high. Section 828.2.3. requires handrail ends to extend at least 12″ beyond the top riser and at least 12″ plus the width of one tread beyond the bottom riser.

EXTERIOR STAIRS

1. Section 819.0 ″Exterior Stairways″ must be complied with where applicable.
2. Section 819.1 requires exterior exitway stairs to be protected from accumulation of ice and snow.

ROOF ACCESS

1. Please refer to Section 817.0 ″Access to Roof.″

EXIT SIGNS

1. Show exit signs complying with Section 823.0. Exit signs, supplemented by directional signs, are required in all buildings, rooms, or spaces required to have more than one exit.

NIGHT LIGHTS

1. Section 824.1 requires that all means of egress shall be equipped to provide one footcandle of illumination continuously during the time of occupancy. Lighting shall be controlled from a location inaccessible to unauthorized persons. Night lights shall be wired on a circuit independent of all other building circuits except emergency or exit light circuits.

EMERGENCY LIGHTS

1. Section 824.4 requires emergency egress lighting with an intensity of not less than 1 foot-candle at floor level along all corridors, aisles, passageways, and stairwells in all buildings, rooms, or spaces required to have more than one exit.

LIGHTS

1. Documentation [photometric chart] must be furnished showing the intensity of illumination and the light distribution pattern for the emergency egress lighting fixtures specified. Manufacturers literature is sufficient documentation, provided this information is furnished.

INTERIOR SURFACES

1. All interior surfacing materials must have their fire behavior characteristics documented in accordance with Section 922.0 and Tables 922.5 and 922.7. Manufacturer's literature is sufficient documentation, providing the flame spread rate, smoke developed, and fuel contributed information is furnished.

FIRE SUPPRESSION SYSTEM STORAGE

[Applicable Use Group]

1. Section 1002.14 requires an approved fire suppression system in all portions of use group [A, B, E, I, R1, R2] occupied for storage or workshop purposes. A layout of the fire suppression system and a properly executed ″M″ application must be submitted.

FIRE SUPPRESSION SYSTEM FURNACE

1. Section 1002.18 requires an approved fire suppression system in all furnace rooms, boiler rooms, and utility rooms with fuel fired equipment [other than electric].

LIMITED AREA SPRINKLER

1. Section 1005.0 requires that a layout of the limited area fire suppression system and a properly executed "M" application must be submitted. The layout shall locate the heads and supply piping.

PULL STATIONS

1. Sections 1017.3.1 and 1017.4 require a manual fire alarm system be installed in all A4 and E structures with pull stations not more than 5' from each exit. The height of the manual pull station boxes shall be a minimum of 42" and a maximum of 54/1 from the floor to the activating handle.

ZONES

1. Section 1017.7.4 requires each floor to be zoned separately.

SMOKE DETECTORS

1. Section 1018.3.5 must be complied with. When more than one automatic fire alarm [smoke detector] is required to be installed, the detectors shall be hard-wired in such a manner that the activation of one alarm will activate all the alarms in the building.

HAZARDOUS STORAGE

1. Please identify materials, if any, to be stored in the proposed building in accordance with NFPA Vol. 3, Chapter 1, "Definitions" for "Combustible Liquids" and "Flammable Liquid" listing the appropriate subclassification [Classes I through III] [Table 306.2].
2. Determine the maximum quantities of each class of liquid to be stored and list the unit of volume for each size of storage vessel. If single unit tank storage is proposed, so state and list the capacity [Table 306.2].
3. Please identify storage areas for explosive gases or fire-enhancing materials [oxygen, nitrogen, hydrogen, etc.] [Table 306.2].
4. Inside storage rooms must comply with all the appropriate requirements of NFPA Vol. 3, Chapter 4, Section 4.4. Some significant requirements of this section are: fire-rated construction, automatic fire suppression systems, explosion-proof electric wiring and equipment, and mechanical exhaust ventilation systems.

SPRAY BOOTHS

1. Please refer to Section 622.0 for requirements for paint spraying, spray booths, and fire protection.

FIRESTOP

1. Section 921.6 "Firestopping" must be complied with, specifically, 921.6.5 through 921.6.7.

DRAFTSTOP

1. Section 921.7.1.1 "Draftstopping" in Use Groups R-l and R-2 is required to be in line with the tenant separation walls when the walls do not extend to the floor sheathing above.
2. In the attic and concealed roof spaces, draftstopping is required so that any horizontal area does not exceed 3000 sq. ft., per Section 921. 7.2.2.

CORNICE

1. Please refer to Sections 921.6.5 and 926 for exterior trim and fire-stopping requirements.

WALK-IN COOLERS

1. Section 2002.1 provides that documentation must be furnished on the fire behavior of all insulated walk-in boxes or coolers. Manufacturers literature is sufficient documentation, providing the flame spread rate, fuel contributed, and smoke developed data are provided for the finished panel, not for separate components alone.
2. Section 2002.3.3 allows a maximum thickness of 4/1 of foam plastic in freestanding walk-in freezers or coolers less than 400 sq. ft. in areas to be covered by not less than 0.032/1 thick aluminum or 0.016/1 thick corrosion-resistant steel.

GLAZING

1. All glazing must comply with the requirements of Section 2203.2 [tempered or safety glass]. All doors and adjacent [within 12//] sidelights and all glazed panels within 18// above a finished floor must comply.
2. On non-egress doors, all mirrors on doors and adjacent side areas within 12" must be tempered glass or glued 100% to solid backing.
3. Section 807.2.4.1 does not permit mirrors on egress doors.

GLASS ROOFS

1. All glass roof structures, skylights, etc. must be shown to comply with the required live and snow loads in accordance with Article 11. Glass roof structures must also be shown to comply with Section 2204.0.

ROOF

1. Please refer to Section 2301 roof classification and use requirements.

FIREPLACE

1. Please refer to Section 2402 for masonry fireplace con-

struction requirements.

SERVICE SINKS

1. Section 4101:2-28-08 [C] See each Use Group table for requirements for toilet fixtures, service sinks, and drinking fountains.

TOILETS AND HEAT

1. A letter from the owner is required attesting to the existence of toilet and heat facilities under his ownership on this property with a maximum distance of travel from the proposed building to the facilities not to exceed 300 feet [Section 4101:2-28-08].

MEZZANINE

1. Please refer to Section 605.0 for requirements for mezzanine.

MALL

1. Please refer to Section 601.0 for requirements for covered mall buildings.

SIGNS

1. Section 601.13.4 requires all edges and backs of plastic mall signs to be fully encased in metal.
2. Please refer to Sections 2901 and 601.13 for general sign requirements.

DRAINAGE

1. Please show rain-carrying equipment on the building discharging into a storm drainage system or natural swale.

TEMPORARY

1. Please refer to Section 626.0 for requirements for temporary structures.

DEMOLITION

1. Please refer to Section 3007 for precautions during demolition and excavation.

CLOSING

1. Please submit three copies of any new or revised drawings to this office. Revisions to drawings should be clouded, pochéd, crosshatched, transparent felt pen, or in some other manner differentiate between the original and the revisions.

WORKING DRAWINGS

Communication between members of the design team must be open, free, continuous, and complete. There is no place for guesswork or thoughtless inclusions. Responsibility is imposed on everyone from the project architect to junior drafters. Working drawings are the graphic communication between the designer and the contractor. Therefore, to convey the designer's concept in full, the working drawings must be clear and concise. Their production should be aimed at an easy flow of information to the contractor on the job site. Further, because the drawings are a part of the contract documents, they are legal documents that impose various obligations on the parties to the contract-that is, the owner and the contractors. A simple diagram will help to show the proper alignment of the contract documents. This diagram charts each design team member and shows the distinct separation of information vital to the success of the documents. The design team consists of the designer, the supervisor [i.e., partner-in-charge], project architect or job captain, the consultants [structural, mechanical, and electrical engineers, landscape architect, graphic designer, interior designer, construction manager], and the drafting force, from registered architects to junior draftsmen, specification writers, and miscellaneous personnel [typists, reproduction specialists, and so on].

In addition, some part of the design team must function as quality control, governing and reviewing all work and all decisions made during production. Each member of the team must be aware that the owner can control only two of the three major factors affecting the project: scope, quality, and cost; for example, no owner can validly demand the biggest building [scope], the best of everything [quality], and the lowest price [cost]. Obviously, this would be impossible to achieve, and the owner must choose the two factors that should be given priority. The design team then functions to provide the third factor and complete the project successfully. Example: if the owner requires a building of a given size and has a minimum budget, the design team must carefully evaluate the quality of the materials to be used. In this way a building can be built within the budgetary requirements. Evaluation must be done at almost all levels during the working drawings phase, because it is here that the various elements of the overall design are detailed. Although this sounds like a high-level process, it can affect the smallest items and the least significant draftsman working on the drawings. Nearly everyone makes some sort of decision along the line. However, these decisions must be consistent with the project requirements. We can no longer afford draftsmen who sit at their drawing boards eight hours a day doing mundane work on the contract documents, never fully aware of the uncommonly buy costly "errors and omissions" impact of their work. We must have an enlightened drafting force.

An experienced architect will have knowledge of about 500,000 items of construction material systems, devices and other items. Of course, this knowledge comes in varying degrees, but on any given project thousands of these items may be involved. It is easy to see that errors can become commonplace. This is a sensitive area in the practice of architecture, because each year there are thousands of disputes, claims, and lawsuits entered against professionals for their errors [see discussion in Chapter 12]. A number of design professionals have found themselves on the losing end. To protect themselves, architects commonly buy costly "errors and omissions" insurance, which in reality is their liability protection. Usually there is a very high deductible in these policies, which the firm must pay before the insurance company makes its payment.

Obviously, there is a pressing need for consistency, diligence, and extreme care in the preparation of architectural documents. In this regard, there cannot be enough emphasis on the use of checklists in the preparation of working drawings and specifications. Quite often such checklists are designed to function for both the preparation of the drawings and the concurrent writing of the specifications. The basic idea is that when an item appears on the list and is incorporated into the project, both drawings and specifications must respond as necessary. This type of coordination goes a long way in reducing gaps, glitches, and other project problems.

Projects today are so complex, so legally and financially sensitive, and with so many items to be incorporated, that one simply cannot rely on memory or on others to recall all of them. Of course, we cannot always immediately apply some items, in that they are required but need other information prior to their use. In like manner, because of the lack of a direct hands-on relationship in CAD [as there is in manual drafting] drafters do not develop a feeling for the natural progression of the work. Usually they are given a direct and confined assignment, which causes them to focus on a small portion of the work, and not the ancillary items. In addition, where the drafter/CAD operator is not fully trained in the technical aspects of construction, the problem is even more imposing. However, by using a checklist, or lists, there is a much greater chance that all items will be "caught" in turn and will thereby produce a complete, uniform, proper, coordinated result. The Victor O. Schinnerer Co., Inc., a provider of professional liability insurance, in cooperation with several professional organizations and insurance companies, has made an exhaustive study of the formal disputes, claims, and lawsuits in which design professionals have been a party. They found that almost two-thirds of the claims are directly attributable to the drawings and specifications produced by the professionals. Therefore, it is mandatory that a neat, well-organized, and complete set of drawings be the goal of any professional designer or office. These drawings constitute perhaps the most important service rendered during the design phase.

In the extensive review made by Schinnerer indications are that these errors can be categorized as resulting from the following:

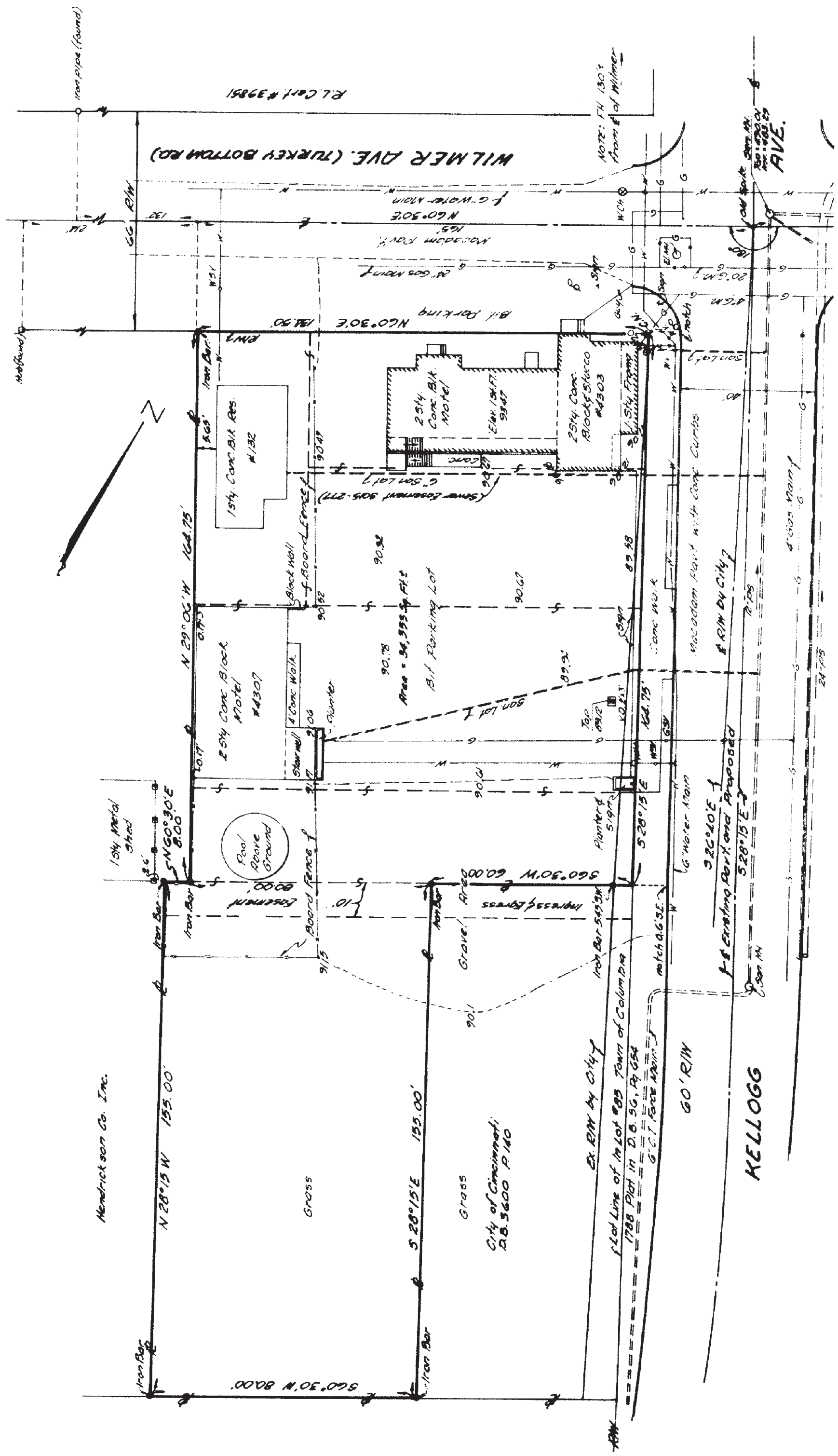
1. Poor communications within the design team
2. Lack of field experience of all members of the team
3. Superficial review, or perhaps no review at all, made by a qualified supervisor

In each of these categories a breakdown in the function of the design team is the major problem. Communication between all members must be open. Just because one person is mainly concerned with writing specifications or selecting materials rather than actively detailing the drawings does not mean that this work is less important. Perhaps the term "design team" should be emphasized to anyone entering the profession; a team, no matter whether in sports or law enforcement, can be successful only when everyone pulls equally. This most assuredly requires communication between its members.

In this day of pushing construction to the limit and minimizing time to save the cost of buying money, sometimes inexperienced personnel must be hired. This is unfortunate, for perhaps the most important experience gained by any drafter is that provided by the application of his or her own drawings in the field and the problems the drawings may have created; it would be helpful if we all had the time in our offices to ask field superintendents to show, if possible, how and why a detail had to be changed and whether it was due to a breakdown in our drawings. In fact, this information should be catalogued and reviewed whenever possible-not to undermine the draftsman's confidence but to provide constructive criticism. Mentioning the time factor brings us to the third item. Major responsibility for any job, no matter how large or small, rests "with the firm's principals, those who have their names on the door but whose time is taken up in so many activities that they may not be fully aware of all of the workings of any particular project. T hey are forced to delegate their responsibilities to other members of the team. Again, as the Schinnerer studies vividly show, the critical aspects of architectural drawing so commonly and grossly neglected are the use of check prints, the critical/objective eye for accuracy, completeness, and cross-referencing, and, most important, the final review. The same or additional checklist[s] used in preparing the documents should be utilized at the end of the production phase-as the documents are made ready for issue, bidding, construction, and so forth. Not only is this final and objective check required to pick up the necessities of the project, but also the nuances, the major and minor twists and turns that the project scheme requires. A project can be placed in severe jeopardy without such a check.

Yet, standardized/generalized written checklists are not all that is required. All projects have unique and special circumstances that fall beyond the scope of checklists. Human eyes and knowledge are required. Often items so slight that they are not listed on checklists will elude observation and detection. It is only the human intelligence that catches such items, by first knowing where to look and where to be cautious and on the look-out interrelated items on a checklist may be isolated from one another. They may be checked off the list, but it is only through human knowledge that these items will be reviewed in tandem and coordinated, ensuring not only that they are present but that they are in proper order. Checking involves much more than just seeing that a drawing is proper and complete – dimensions must add up, text spelled correctly, line work proper, and so forth. To thoroughly check, one must relate the drawing to its place of use [where it applies] and to its surroundings. Are the walls shown as they are indicated in the plan or elevation? Similarly, where a drawing references or indicates another drawing [a wall section designator on an exterior elevation, for example], the checker must look up the referenced drawing: Are the title and designation correct? Are the sheet numbers correct? Do the drawings correlate? Any failure in these or other aspects must be tracked down and resolved.

Some professionals assign time periods to checking. A sheet, they say, can be checked in 20 minutes. Maybe, maybe not! Doesn't it depend on how well, or how poorly, the drawings on the sheet are done? If cross-referencing is faulty, doesn't it take additional time to straighten it out? In reality, this makes better sense. If a project takes several months to document, should the important task of checking be confined by time restraints? Perhaps the documentation time was well used to produce a well-executed set of drawings, then checking time is reduced. But if that documentation time is misused and produces a convoluted, messy, poorly done set of drawings,



The land survey is necessary as it depicts the current size and layout of the land parcel and all features – man-made and natural – that exist on the site; all of this impact the construction as they must be dealt with or removed. In addition the legal land description information is shown along with all utility lines in place [those in use and those abandon] This drawing is used to create the site or plot plan for the new construction. Accuracy is paramount in this drawing and its data.

wouldn't it be wiser to spend more time on checking so the documents being passed on will be better, accurate, easily used, and coordinated? The proof is in the statistics derived from Schinnerer's studies. If budgets and shortsightedness push comprehensive and objective final checking aside, the instance of claims will increase! Perfection is an unobtainable goal, but minimizing disputes and claims is well worth the effort. It is well worth being an integral part of the time/money budget on every project. Two words are key to good checking – comprehensive and objective. Check everything thoroughly, and do it in a professional and dispassionate manner. No matter who executed a drawing, things must be as right as we can get them.

Continuity and completeness of the working drawings must be ensured, for they are among the most important elements of the total contract. It is vital that they be prepared carefully in order that the contractor may implement them properly. The contractor should not be expected to interpret the drawings; he or she should not be made to guess. The drawings and specifications should form a complete package-clear, accurate, and arranged in logical sequence. Experienced professionals believe that it is really their duty to provide proper coordination during the construction between the working drawings and the specifications. Care should be taken to avoid redundancy or repetition, but at the same time, it is important to recognize any point at which further communication may be needed, and to provide it. The main objectives are simply to do a good job, to protect the firm that is producing the drawings, and to render complete service to the owner by ensuring an easy, errorless, argument-free period of construction.

A few guidelines from the Schinnerer Co. are as follows:

1. Insist on neat, legible drawings.
2. Implement an office manual of working drawing standards and procedures to ensure continuity and uniformity.
3. Maintain open channels of communication between all personnel working on the project.
4. Coordinate drawings with engineering consultants.
5. Arrange drawings in logical sequence.
6. Remember to coordinate the drawings with the specifications as a means of controlling conflicts, contradictions, and ambiguities.
7. Insist on a review of all drawings by a principal or qualified supervisor.

As in any type of mechanical or critical manufacturing process, the time and effort expended by quality control can contribute to the architect's success and overall professional reputation. It will also help to prevent involvement in lawsuits that might be resolved to the detriment of his or her financial status.

In general, a few long-standing principles can be set down in regard to working drawings. These principles never change, and if the design team is aware of them decisions can be easier:

READABILITY

Technically correct information, on construction contract drawings, is better portrayed when there is distinct separation between materials, devices, and other items. Only rarely does the architect utilize an "exploded view," which in essence is an assembly or installation guide. Normally, sections and details show the work in close proximity, as it will exist when finished.

Therefore, there is a need to be sensitive to, and to execute all drawings by:

- using variations in line weights, within a limited palate;
- treating similar edges in the same manner;
- following the principle that everything cut in section is depicted with dark lines for edges;
- distinguishing between edges of materials and thickness [of thin, sheet material such as sheet metal, floor coverings];
- understanding what the various parts are made of, and mentally visualize what they look like from an end or "cut" view;
- showing nothing on the interior of the drawings should be darker than an outer object edge; the darkest line on a section or elevation is the grade line;
- ensuring that material symbols do not even , approach the line weight of the material edges;
- finding, and understanding the use, delineation and weight of other lines, such as center lines, dimension lines, extension lines, guide lines, etc. – these should never override any line within the body of the drawing.

All of this can be easily accomplished, IF you approach every drawing, from the outset, with the thought of using varied lines, and where you develop [in association with others, i.e., a fairly uniform system used by all] a single format for the lines. In this way we can direct, control, and prevent "free-lancing" which only makes for confusion and badly executed documents-none of us want this!

OTHER CONSTRUCTION DRAWINGS

Although the main objectives of a project are contained in the working drawings, other drawings must be prepared before the working drawing phase, immediately after the working drawings have been issued, and as a finale to the project.

During the programming phase of any project the owner is required to supply the designer with information in regard to the tract of land and the site conditions that prevail. This information is, in effect, a survey of the property. In a remodeling project, or when designing an addition, the architect may be responsible for measured drawings of the existing structure. This represents an added service to the client, but provides the architect with reliable information and insight to the situations at hand.

In an existing structure it is difficult to judge just what effect its elements may have on later decisions in the new design process. It is necessary, therefore, to record the layout and general character of the building and to document its construction accurately. In some instances the measured drawings may be scheduled and taken in phases; for example, the initial layout and overall dimensioning of the structure may be scheduled before the programming and preliminary design phase. It may be necessary to go back to the building and measure more accurately or completely the sections that are involved in the new construction.

Parts of the existing structure that are to remain intact and those that are to be removed cannot be determined initially, but they should be located on the drawings as soon as possible. In some offices the degree of accuracy of these locations is not acute, but it is generally good policy to produce a set of measured drawings to represent the existing structure and to eliminate the element of surprise in the reconstruction stage that will usually mean extra work and added costs.

Measured drawings include the structure of the building, its finishes, and all mechanical work. It takes just as much effort to relocate a steam line, a water line, or a piece of radiation equipment not recorded in the field measurements as a column, a window, or a door opening. The most important features to be picked up accurately are those elements that are to be modified by the new construction. These elements should be properly sized and precisely located.

Often the owner may have the original working drawings of the structure, in which event it is necessary only to compare them with existing conditions. It should be noted that without regard for the detail of the working drawings, many factors must be considered. The project may not have been constructed exactly as the working drawings indicate, but minor variations will cause problems in the renovation.

In measuring a building some persons at times become industrious to the point of obsession. Such conscientious work pays off, but it is not always convenient or economical to return to the site to check one little item or to garner one small bit of information. If the measuring crew can be charged initially and headed by a competent design professional who knows what is needed and in what form, the return trips will be reduced and the information will be of top quality. It is always helpful, particularly if existing drawings are available, to draw a skeletal plan so that a print may be taken to the field for on-site note taking and to provide a basic form on which information can be recorded. If there are no drawings available, the profile and features of the building must be drawn in the field before being dimensioned.

In taking dimensions, small inaccuracies here and the rounding off of readings there tend to accumulate. Error is compounded; for example, if a long room with many windows and door openings is to be measured, each pier and each opening should be done separately. One full-length, overall dimension will then serve as a check against the string of smaller dimensions.

It is important also that workers directly involved in the project be equally involved with the measured drawings, for a situation once seen may be recalled and an impasse may be resolved as the drawings progress. One unfamiliar with the project will have no advantage of this sort.

Basically, the measured drawings should be thought of as a set of working drawings in reverse. Here is the building: it has doors and door swings, window swings, ceiling heights, and column locations that must be shown so that a floor plan or an elevation can be fitted together. Identify the various materials of the building: flooring, base, wainscot, walls, ceilings, and so on. If damage is observed or a peculiar condition noted, it should be detailed. As in a new building project, certain elements of the program demand that certain decisions be made by the design professional. So, too, in the measured-drawing sequence certain features of the existing structure will force certain decisions. A column may be removable, but it must be studied first for reasons of economy. In other words, is it more economical to move the column than to realign the new structure?

Measured drawings, although taken roughly in the field without T square and triangle, should be drawn in "hard lines" [drafted] and kept on file. They should be done on good-quality paper so that they can be used, without damage, throughout the building program. In extreme conditions in which a large building, such as a steel mill, is being measured, it is more economical and convenient for the design professional to set up a team in a temporary field office in the structure itself. As the team completes the measurements, the information is fed directly to the draftsmen in the office, and as this information is being recorded the draftsmen will spot overlaps, gaps, or errors in the drawings.

In addition to the working drawings, the supplemental drawing is usually done after the working drawings are complete. The need for supplemental drawings may occur as the project is being bid or built. Supplemental, bulletin, or addendum drawings are issued for clarification, corrections, or alterations or to provide the contractor with additional information. Often in the rush of finishing the working drawings certain details may be inadvertently omitted. In fact, some details may be omitted intentionally so that there can be more study before the contractor formulates a bid. Supplemental drawings become a part of the construction contract documents, just as if they were part of the original working drawings.

A supplemental is first seen in the form of an addendum drawing. During the bidding process questions may be asked by the bidders, or in a review of the drawings the design professional may find inaccurate or incomplete information. If the change is simple, it can be described and referenced to the pertinent drawings on an addendum sheet, which is then issued to the bidders. If, however, the information is more detailed, a drawing should be made on which the information must be presented as clearly and concisely as possible. The drawing is then printed and issued to the bidders before the bidding date. It is vital that all bidders receive a copy of this addendum so that the information can be shared equally. There is ordinarily no particular area of work on which an addendum is based; it depends on the need for change.

The bulletin drawing, as it is commonly known, is the true supplemental drawing. Until the time that a particular problem is discovered in the field, everyone has assumed that the information necessary to the total installation is on the drawings. For one reason or another, something is not fully covered. By using the supplemental drawing, or bulletin, the design professional can clarify the situation.

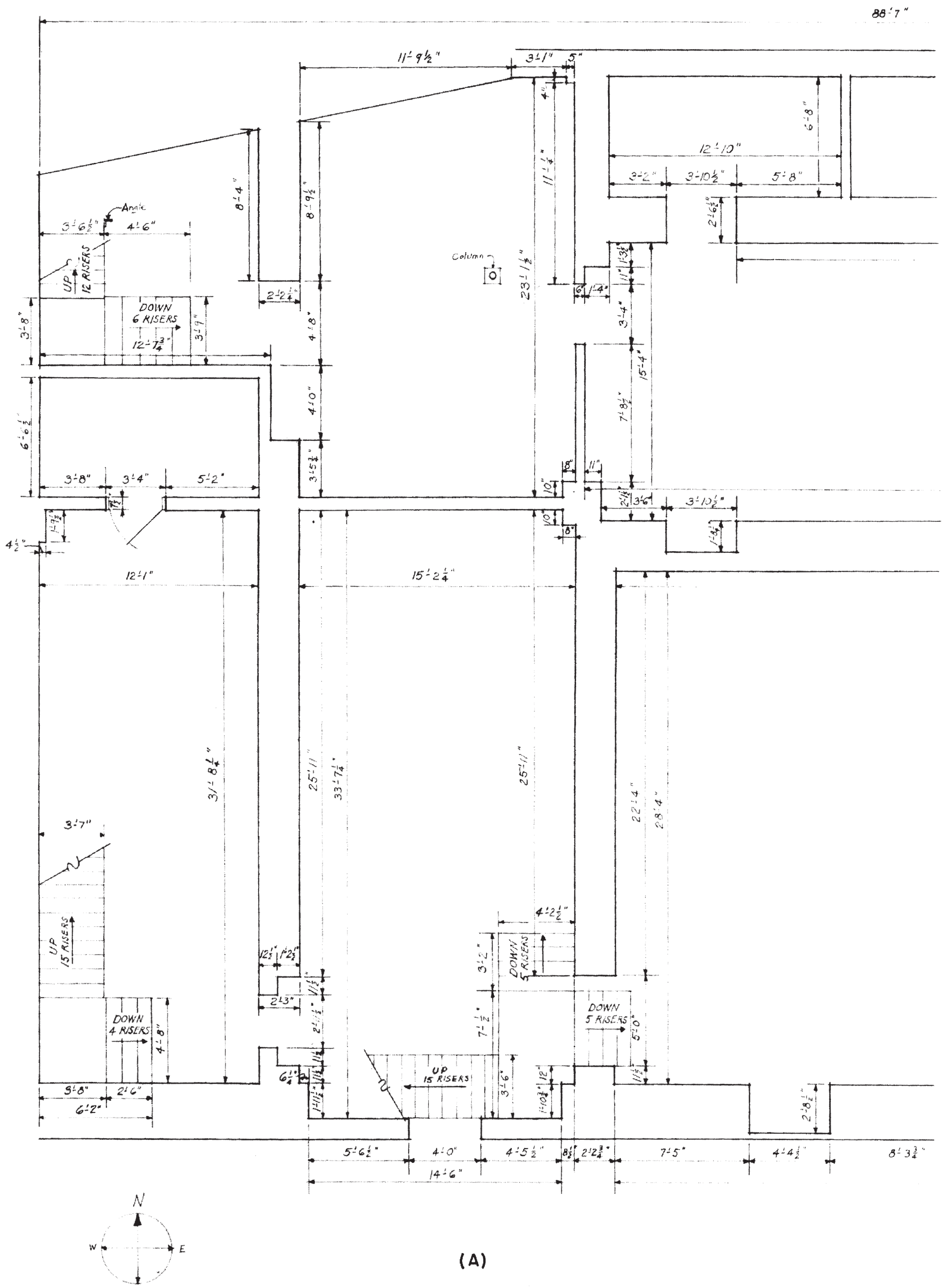
Various types of information may be involved: the location of an anchorage system, a special pattern of decorative material to be used on a wall, or a matter of glazing details may prompt a bulletin drawing. Perhaps a larger-scale detail than shown on the original working drawings is required. For the most part this is a clarification rather than a corrective drawing. A situation that requires correction may be remedied with the bulletin drawing.

The shop drawing that appears during the construction phase is unique because it is not produced by the design professional but by the supplier or manufacturer of a particular item, material, or system.

Shop drawings are interpretations of the work required on the working drawings. The interpretation is made by the manufacturer or fabricator of the material, product, system, or equipment in question. In essence, they are produced as instructions to the "shop" where they will be fashioned into those items required on the construction project. Actually, they are instructions to the shop; they are submitted to the design professional mainly to show what is proposed, how it will be made, and so forth. The professional can then assess whether or not the planned work is in keeping with the overall design scheme of the project.

As instructions to the shop, these drawings can be quite detailed and contain information not produced by the professional but necessary for manufacture or fabrication. They have a high "detail content" in that the producer wants to provide a good product, fully suitable for the project, but not excessive in sizing, operation, or cost. This does not signal a struggle. Rather, the manufacturer wants to sell the product, but does not want to lose money on it, nor does he or she seek to be forced to do work not explicitly shown on the professional's working drawings. Exacting, then, is the best description of shop drawings; thus, they have to be based on sound and good information from the professional.

Recently, shop drawings have been given a new status by design professionals. Many professionals list a minimal amount of design criteria, usually in the specifications, and then require that the contractor or fabricator for the work produce the necessary shop drawings. Unfortunately, these drawings often are required for review by the regulatory agencies before the permits can be issued. Because these drawings are produced at a time well-removed from the initial permit process-



(A)

This is a drawing created by field measurement of the existing building. It is vital in renovation projects since it depicts the current existing conditions that will impact new construction. A field crew will actually measure the structure and then prepare this drawing.

ing, the approval process is hampered and often forestalled. Roof trusses and fire suppression system drawings are excellent examples of this scenario. Although this is an open attempt to shift responsibility, it also is part of the exculpatory clause system, discussed in Chapter 12, "A Perspective on Working Drawings." Despite any other information, the professional remains involved in the processing of shop drawings and is never completely removed from it.

These drawings are submitted to the design professional, who stamps each sheet to indicate approval. On the stamp is a disclaimer that defines the responsibilities of all parties and indicates that the drawings have been checked for design compliance only. In other words, the drawings are in the configuration that the design professional has required, but the professional is not responsible for the fit of the items on the job or for their coordination with other materials, adjacent surfaces, or systems. This responsibility is the contractor's.

It is most important that contractors be totally familiar with the contents of the shop drawings. They should also be aware of their own responsibilities. To cite a case: A material may be supplied to a contractor after the manufacturer of the material has submitted shop drawings produced under his or her supervision. The drawings will be checked for fit and compliance by the subcontractor who holds the contract with the manufacturer. Once this first check is done, the subcontractor must submit the drawings to the general contractor, whose duties include rechecking for compliance. Here, again, responsibilities must be firmly set. The drawings are then forwarded to the design professional for his or her approval. A great many persons are charged with checking the drawings, and it is essential that each of them pass through as many hands as possible and be carefully examined by all. In this way the entire chain of construction command is made aware of the impact that a given material will have on the job. Each checker must know the extent of his or her own area of responsibility.

SITE IMPROVEMENT PLANS

Although the terms *site plan* and *plot plan* are used frequently, the term *site improvement* plan tells a much fuller story. It describes the drawings more accurately.

This plan shows the entire scope of the project, including all its ancillary features. The drawings are executed at a small scale to incorporate the totality of the project: the site and the building and all its services.

The site improvement plan is based on a survey of the property. The information it contains should include an accurate graphic description of all property lines. The survey is furnished by the owner, and if an updated one is not available, the owner should be encouraged to have a new one made. Any competent registered surveyor can provide the necessary data. A complete list of essential survey information can be found at the end of this chapter.

A property owner is often confident that he or she knows everything about the property: where it begins, in what direction it lies, and how big it is. In reality, the owner may be quite ignorant of the facts. For instance, the owner may describe the property as running along “that fence line” back to “about where the tree is” or “over there to that clump of bushes.”

These are not accurate descriptions and are not valid information for the architect who is preparing the site improvement plan. Each piece of property is shown and described in a system of books, papers, and drawings kept up-to-date by the local government. The methods may vary, but land measurement is an official function of the city or county. Each parcel of land is described and shown, no matter how large or small. A rectangular system developed by the federal government and widely applied in the United States utilizes latitude and longitude to form rectilinear townships, which are divided into sections, each 1 square mile in area. The smaller divisions are made to accommodate the smaller pieces of property. Each property owner can find his or her particular lot, parcel, or tract, regardless of its location.

Architects pay close attention to the data available to them. The prime function of the survey is to show the extent of the property lines. Each line that forms the perimeter is described by the surveyor by direction and length; for example, North 30 degrees East [N 30° E]. Curved lines are given by the radius, the length of the arc, and the direction of the curve. Each lot is assigned a point of beginning [POB], which is a corner of the property located in relation to some prominent feature: a curb, a manhole, section line [which, of course, is imaginary], or centerline of the street. This point of beginning is also described and located in the deed. Angular bearings always read from north or south, and each lot line direction starting from the POBs established. The example North 30° East shows that the line is 30 degrees East of true North. This angle is called the bearing of the line; it can be taken from north or south, whichever produces an angle less than 90 degrees [90°]. To complete the bearing data, a length is assigned to each line and measured in feet and decimal parts of a foot with the civil engineer’s tape. At the end of the line the surveyor installs a marker, which may be a formal concrete monument, an iron pin, or a wooden stake, and which establishes permanently the exact corner of the property. By utilizing the bearing of the adjacent line, the surveyor can turn the angle at the corner. It is then possible to show the perimeter of the lot graphically.

Other items of importance to the architect in the realm of the surveyor’s work can then be located. Iterns of the most value are the elevations at the corners of the property and features such as hills and valleys. To obtain this kind of survey, the owner must ask for a “topographical survey,” rather than a line survey, which will give only the property lines and the bearings.

A topographical survey can be made in two different ways; first, by applying a 25- or 50-foot grid over a map of the property to show the points of intersection of each elevation, and, second, by using the contour method, which connects these points with isobar lines to give an accurate picture of the slopes and ground features of the site.

The United States Geological Survey has referenced various points throughout the United States directly to sea level data. By finding one of these datum points, we may establish a direct relationship between any piece of property and sea-level elevations. For convenience, local surveys usually use data in the immediate neighborhood. Elevations can be referenced to manhole covers, fire hydrants, concrete pillars, or other permanent fixtures. Whatever the basic point of reference, it is assigned a zero elevation. All the elevations within the site will relate to this particular datum point, called a “bench mark.”

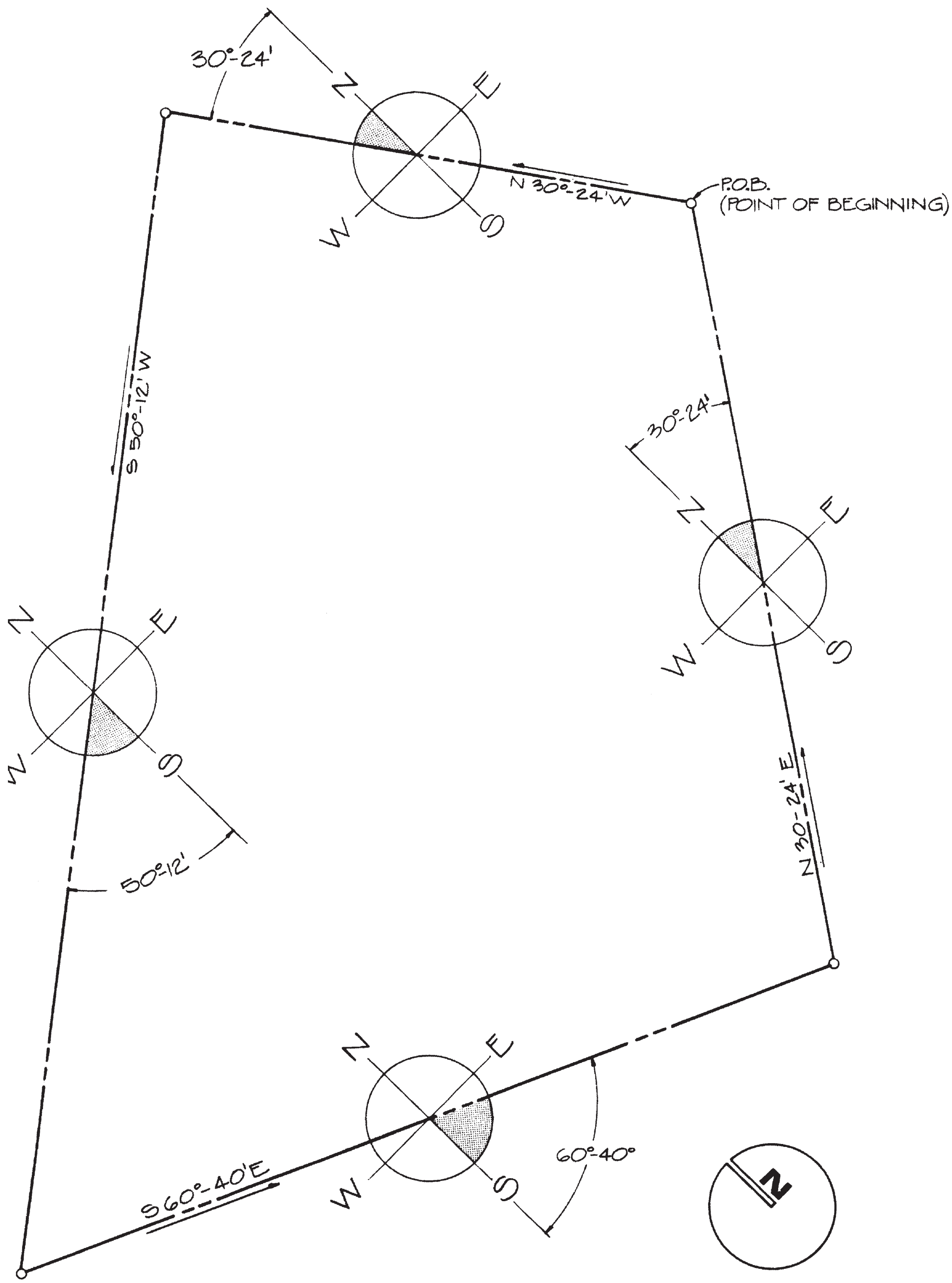
With a little practice in reading contours, architects can easily develop a sense for the "lay of the land." They can find the high points, the depressions, the valleys and can visualize the slopes that must be dealt with in the design. On all site plans or surveys a uniform vertical distance between the contours is established. This distance will vary, depending on the scale of the survey. A small-scale map makes· several feet between contour lines the standards; a large-scale map will show the contour lines one or two feet apart. Contour lines are labeled according to height so that they can be followed in length.

Contour lines that lie close together indicate a sharply rising slope; those more widely spaced show a gentler slope. The examples illustrate what can be read from these features. Consider a pail of water in which a line is drawn at the water line; some of the water is then removed so that the level is lowered, and a new line is drawn. Because the sides of the water pail are not perpendicular when viewed from above, a system of concentric rings will appear. These rings represent the contour lines of a depression.

From the contour lines, we can also draw sections through the site, to scale. These serve to illustrate the slope of the land, and the relative difference in elevation from point to point along the section. Coupled with the contour information the sections provide the information necessary to estimate the amount of cutting and filling required. In most projects, the structure will be located at an elevation somewhere between the high point, and the low point of the land. The contours reveal how much of the "high ground" must be cut [reduced in height], and how much must be filled increased in height. A single site plan is often adequate to show the project design, but in areas in which demolition and rebuilding are planned, other drawings must be considered. It may be necessary to provide a site demolition plan that will show the features or structures to be removed. Add to this the site improvement plan of all new features and buildings. A grading plan that will combine existing conditions and the new grade may also be required. A utility plan may be added to describe extensive water, sewerage, electrical, and telephone installations, all of which are part of the site improvement. There is no perfect answer; the totality of the project will dictate the type of drawings and the number needed. In a downtown area of a major city the utility systems are extremely complicated and may lie several levels beneath the street.

INFORMATION REQUIRED BY SURVEY
1. Surveyor's seal
2. North arrow
3. Stakes and other markers; lot dimensions and bearings
4. Adjacent lots within 200 feet; alignment, occupancy of existing building [denote vacant lots]
5. Lot area [square footage]
6. Easements
7. Street status" [existing or proposed]; dedicated or not, abandoned
8. Width of streets and alleys
9. Width of pavement and type of pavement
10. Location of curb; edge of traveled roadway
11. Distance to intersecting street or streets
12. Location and width of sidewalks; note if none
13. Location of street sewers
14. Location of tree branches
15. Location of building lateral
16. Sea level elevation of invert at point of connection bearings
17. Location and size of water main and closest fire hydrant
18. Location and size of all other utilities [gas, lots] electric, and telephone]
19. Existing elevation at each of four corners of property

It is vital that the utility plan on which the existing systems must be shown be included in the set of drawings. It must also be proved that the new project, although utilizing the existing systems as required, will not disrupt or destroy them. The surveyor, in showing the complexity of the site, will sketch in such things as trees, if they stand alone, or a clearing line at the edge of a wooded area. The survey should locate power and telephone poles and any manmade structures, such as a retaining wall, public utilities of every type, and any other features that may have legal implications. These features are



A portion of a survey which shows the legal boundaries of the land parcel.
This data is taken from the deed to the property and establishes the layout of the property lines, so the marker left in the field can be found and the imaginary lot lines established, so construction does not cross the lines and can be built in correct proximity to the lies.

CHECKLIST: SITE IMPROVEMENT PLANS	
1.	Property lines, with bearings, corner angles, and all markers; location of lot [political subdivision], street names, lot number, and all pertinent data regarding the lot
2.	Building location, zoning setback lines, easements, clearing line, ground floor elevation, bench mark[s], grades at building, dimensions of building, dimensions of other features or buildings, dimensions of all overhangs or extended features beyond the building line, and [in dotted lines] the layout of any planned additions
3.	All utility lines, on the property or in the adjacent streets: electric, water, sewer, gas, and telephone
4.	All existing paving, whether to remain or be removed: new paving, parking lots, parking stall bumpers, stripping, drives, walks, steps, platforms, terraces, signs, flagpoles, playfields, equipment [both mechanical and playfield], drinking fountains, light standards, and curbs or walls [decorative]
5.	Fences, structural retaining walls, areaways, and pools
6. 7.	Existing structures, foundations, or cellars; trees, shrubs, both those to remain and those to be removed; structures to be relocated and any underground voids of various descriptions
8.	Storm drainage on both paved and unpaved areas; catch basins and yard drains
9.	Contours, existing and new; contour elevations
10.	Legend showing all symbols and materials used on the plan
11.	Contract limits; note items not in contract [NIC]
12.	Name and address of surveyor who supplied survey for site improvement plan
13.	Location and log of test boring holes; legend of log symbols
14.	Temporary facilities; roads, fences, toilets, offices, and sheds
15.	Material storage areas for use by various contractors
16.	Areas for on-site parking

called easements. In many cases utility companies are granted easements, contained within which, usually underground, are utility lines of one kind or another. These easements are granted to provide maintenance capabilities for their installations. The agreement in general is that an easement will be open at all times, and, indeed, if there is trouble, may be torn up and repaired or replaced. The work will take place within easement, and the easement will be restored to its original condition on completion of the work.

It would be foolhardy to plan any part of a structure over an easement. This fact emphasizes the importance of showing all easements on the survey, because not only are they a practical matter but they can become decision makers in the project's initial design.

Most governmental agencies have systems that invoke restrictions on a site. The architect must be cognizant of these restrictions. In many areas of the United States zoning codes are strictly enforced. These codes are written to protect the property owner, although at times they may seem prohibitive when the owner is in conflict with their regulations. The basic purpose of zoning is to segregate, by function, the various types of property. This segregation prevents a high-hazard or

GENERAL CHARACTERISTICS OF CONTOUR LINES ON SITE PLANS

1. Contour lines connect points on the ground of LIKE elevation above sea-level, or a local bench mark. Every point along a contour line has the very SAME elevation.

2. Every contour closes on itself, somewhere, either within the limits of your drawing, or elsewhere on the earth's surface. In the latter case, the contours DO NOT stop, but run to the edge of your drawing.

3. A contour line that closes on itself within the scope of your drawing is either a SUMMIT (a HILL), or a DEPRESSION. Depressions are usually indicated by a "lowest spot" elevation, and small "tick" marks on the low side of the contour; a "top-most" spot elevation is noted within a summit (hill). RIDGES are elongated summits (hills).

4. VALLEYS are indicated by "V" shaped contours which point UPHILL (UPSTREAM for waterways); the contours run up the valley on one side, turn, cross the stream, or area, and run back down the opposite side.

5. Contours across CLOSELY LOCATED, or INTERSECTING streams, form an "M" shape with the outer points directed UPSTREAM.

6. The HIGHEST contours along RIDGES, and the LOWEST contours along VALLEYS always occur in pairs.

7. The water-level lines in ponds and lakes are really a form of contour line, since the water always lies LEVEL (at the same elevation) within the pond or lake.

8. Contours spaced fairly equally indicate a uniform, sloping surface. On a plane surface, the contours are straight, evenly spaced, and generally parallel.

9. Widely spaced contours indicate RELATIVELY SLIGHT SLOPES; a "more-level" condition; nearly true level occurs between contours of like elevation.

10. Contours spaced closely together indicate a STEEP SLOPE; the steepest slope occurs where these contours are the closest together (always!) as this is the shortest distance between the contours.

11. A CONVEX slope is noted by contours spaced at WIDER intervals going UP the slope; a CONCAVE slope by contours spaced farther apart going DOWN the slope.

12. Contours may appear COINCIDENT at vertical excavations, shear drops, and buildings or other structures; actually they follow along the sides of these formations, and ARE continuous.

13. Contours ONLY CROSS each other in the case of cliffs, overhangs, natural bridges, and pierced or arched rock; here the lower level contours are shown as dotted (hidden) lines of unique style.

14. Contours NEVER split in two; they occasionally occur side-by-side, and numbered the same.

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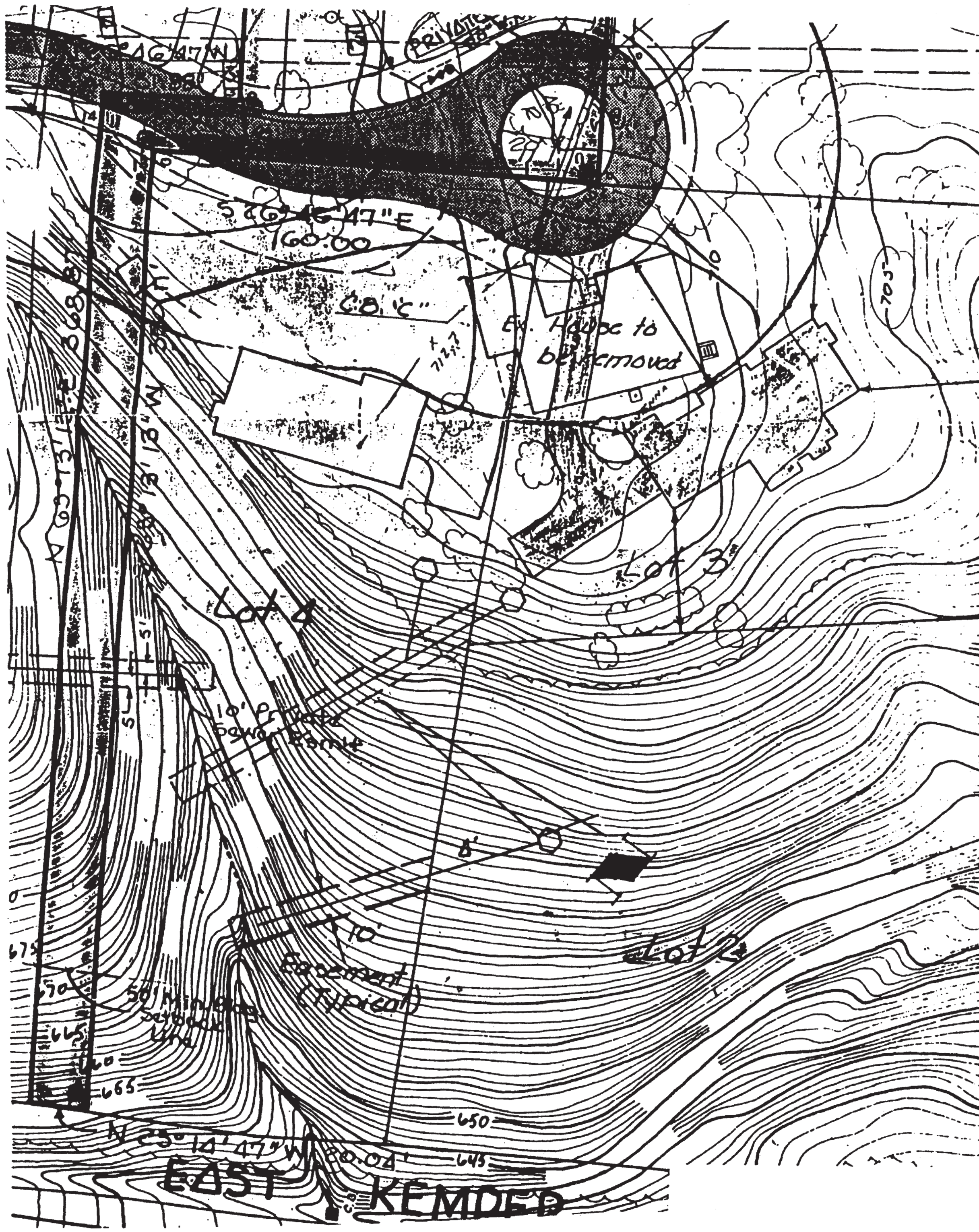
nuisance type of industry from locating in a residential or a noisy manufacturing plant from being built next to a nursing home. Zoning codes also impose restrictions relating to adjacent buildings by establishing setback or "yard" requirements; for example, front yard requirements may be in the range of 30 to 50 feet or more back from the road on which the property fronts. This restriction means, essentially, that the building can be no closer to the street than the distance set for yard requirements. Similarly, side and rear yard requirements can be codified and usually are. The owner is restricted to a buildable area within the property lines. None of a project's major buildings or structures may be erected outside this area. Gardens, parking areas, play areas, and similar installations that are limited to surface treatment may occupy the setbacks. These restrictions should be shown in the site improvement plan. The raw survey, provided by the owner, must be converted by the architect to its proper form before the site improvement plan can be drawn. In many areas of the country, a survey is required when filing for a building permit and must accompany a set of drawings of all features. Still, however, the site improvement plan will contain much of the survey information that is adaptable to a particular project.

An example of a layout of land contours and an index that notes what each formation of the land [show by the contours] means.

IDENTIFYING LAND FORMATIONS BY READING CONTOURS	
	On the map at left, the numbers indicate the following land formations;
1.	Paved roadway with swales on either side, for drainage.
2.	Small pond-contour around shape at water line.
3.	Stream-size may vary-"V" contours point UPstream.
4.	Streams which intersect-"M" shaped contours-point UPstream.
5.	Uniform slope-contours equally spaced.
6.	Plateau-flat area noted by "closed" [circular] contour.
7.	Summit point-highest point [spot elevation] on the hill formation.
8.	Flat area between contour which returns on itself.
9.	Ridge or valley-points UPhill on valley, DOWNhill on ridges.
10.	Steep slope - contours closely spaced [see 13].
11.	Architectural" contouring-man-made land formation via grading.
12.	Gentle slope to left [widely spaced contours]; a flat area [can you find it?]; and a steep slope.
13.	Fairly uniform, very gentle slope-very widely spaced contours.
14.	Cliff-contours one over the other-drop off-vertical slope.
15.	Deep valley with larger stream-"V"s point UPstream.
16.	Gentle, uniform slope-widely and evenly spaced contours.
17.	Paved roadway with gully or ditch along side for drainage.

A site improvement plan should directly reflect the survey and can be drawn at any one of several scales. Because the survey is really an engineering drawing, the scales used are set by the civil engineer's scale; for example, 1 inch can equal 10, 20, 30, 50, or even 100 feet. This scale is used rather than the architect's. Sometimes, however, for one reason or another, the project demands that an architectural scale be used, but usually the civil engineer's scale provides adequate drawings, smaller in size but still legible. The architect must necessarily have some knowledge of surveying. He or she should know what the various terms mean and be able to deal with all survey data. The architect must be able to interpret contours and to convert this knowledge to his or her own use. With this capability and a design background, the architect can produce an accurate, carefully considered, though omplicated, site improvement plan.



A site plan that shows the complexity that some projects can encounter. Without these contour lines the problem would be compounded in that knowledge of the site, and the modifications required for construction would be missing. Depicted is a site with a very steep slope [note numerical values of contour lines to the right].

LAWNS AND PLANTING PLANS

Landscaping is reasonably the province of trained specialists, namely, the landscape architects. In former years the emphasis of expertly planned landscaping was almost totally on the aesthetic enhancement it provided. Today we recognize the importance of what is planted and where it is planted as a major factor in energy consumption control. Landscape architects can contribute greatly to the total success of building projects by providing another means of reducing rising maintenance costs while meeting demands of the growing number of environmentalists, and by enhancing the basic design concept. Considerations relegated to other members of the design team in years past properly become the initial contribution of the landscape architect today. The landscape architect should be an original member of the design team, along with the structural and mechanical engineers, to utilize his or her highly specialized knowledge to the fullest.

The profession of landscape architecture is ably represented by the American Society of Landscape Architects [ASLA], which is the result of a merger of two representative groups. This will provide for a stronger, more unified voice, solid representation, and an organization more responsive to the needs of the profession. This should also provide for stronger financial backing and the easy achievement of more goals for more people. Overall, the group will function in a manner similar to the American Institute of Architects [AIA] and will be active in all aspects of the profession, for the good of the profession as a whole and for the individual practitioner.

Where once it was common practice simply to make a lump-sum allowance for contracting a landscape architect toward the conclusion of a project, these professionals' vital input is now so well regarded that they are contacted early to become part of the first planning stages. Their particular specifications and drawings will be developed in stages, accompanying those of the other design members. Even relatively smaller projects profit immensely by the inclusion of a landscape architect from the inception of the design.

However, should the client's budget be insufficient to permit a contractual relationship with a landscape architect throughout the design planning stages, this professional may be employed as a consultant, on an hourly basis, from the beginning. An understanding may be reached so that a satisfactory price is reached for the consulting landscape architect to provide necessary landscaping plans, details, and specifications for the finished drawings.

The landscape architect will shed a different light, another approach to the thinking of the design architect's preliminary schemes. This specialized professional adds greater dimension to paved areas, auxiliary entrances, and interior and exterior vistas by incorporating a vast experience with individual characteristics of all growing plants. The landscape architect's suggestions for use of foundation plantings, for sound abatement plantings, as well as for natural growth to provide wind and light barriers, have added a new chapter to the traditional aspects of aesthetic appeal and soil erosion controls.

Should the consultant landscape architect's service be more than the client's budget permits, services can frequently be available through seeking advice on an hourly basis, with a provision for only very general schematic drawings [the most preliminary sketches] for drafting, in the building architect's office. However, the planting schedules and details should be reviewed by the trained professional before being made a part of the completed drawings. This arrangement reduces drafting costs for the landscape architect and permits a more flexible arrangement.

Because landscape architects are registered professionals, they are held liable for all facets of their work. Accordingly, they must be permitted the same freedoms and privileges granted the other design professionals. They correctly reserve final control over their drawings and specifications. Their working drawings are as individualized as those of design architects; their schedules are more complex than the schedules design architects place on drawings. Landscape architects must incorporate the common name of every plant as well as the botanical [Latin] name to avoid confusion when the bidding process begins.

Bidding will be done by plant nurseries, ever increasing commercial enterprises, many of which are staffed by trained horticulturists, but overall expertise varies to a great degree. In all likelihood the commercial horticulturist will have far greater comprehension of the landscape architect's drawings and intent than will other members of the design team. At no time should questions about the lawn and planting drawings or specifications be directed to or fielded by any other than the original designer. Although the drawings may contain some relatively standard details comparable to many standard details occurring on building drawings, these two are strictly within the purview of the landscape designer, and all questions should be directed to him or her. It is a fair assumption that a good working relationship exists between the landscape architect and the many commercial nurseries in any given area; such is the nature of both areas of endeavor to promote a strong interrelationship.

Drawing techniques of landscape architects, like those of other designers, exhibit wide variation. As a professional, a landscape architect may request guidance from the design team captain to correlate his or her drawings with those of the other members of the team so that the entire set of drawings will present an accomplished integration of professional skill. Although the landscape architect's drawings may be executed on the sheets printed specifically for the project, with combined names of all professionals involved in the project design, these drawings will bear his or her professional registration and seal.

Symbolism, rather than an attempt for precise depiction, has become the easiest route to good landscaping drawing. Some symbols are standard from one landscape office to another; other symbols are unique to the offices from which they emanate. A particular designator may represent a particular plant. The designator is explained fully in the drawing legend and occurs again in the schedule. Some landscape architects prefer symbols that resemble the intended plantings; for instance, a general treelike shape showing drip line or foliage brings more excitement to the drawings than does a mere dot with a number placed next to it.

It is imperative that the landscape drawing be done at a reasonable scale, eliminating small, confined areas. The outline of the building or buildings should be laid out without detail. Often the practice dictates the building outline be screened, "ghosted," or drawn on the reverse side of the sheet, permitting changes in the landscape drawing itself without constant redrawing of the major structure.

All vehicular driveways and paved areas [walks, patios, or similar site improvements] must be shown distinctly without being obtrusive. It should be remembered that strong contrast is required between landscape delineation, the building, and paved areas. Darker landscape symbols will print more sharply and present a direct overview of the landscaping. Once the landscape architects confer with the design team they will devise and coordinate their technique to adjust to the major intent and technique of the team. Drawings may attempt to suggest approximate spacing of plantings, but final resolution of these measurements rests with the schedules included with the drawings. Drawings are presented to illustrate the landscape architect's concept with greater, in-depth information carried in the specifications. Certainly, the pattern of the plantings and the location on the site are conveyed by the drawings; the specifications will demand the spacing, depth of planting, and conditions determined by the landscape architect. Schedules on the drawings will indicate the precise plants indicated by each symbol on the drawings.

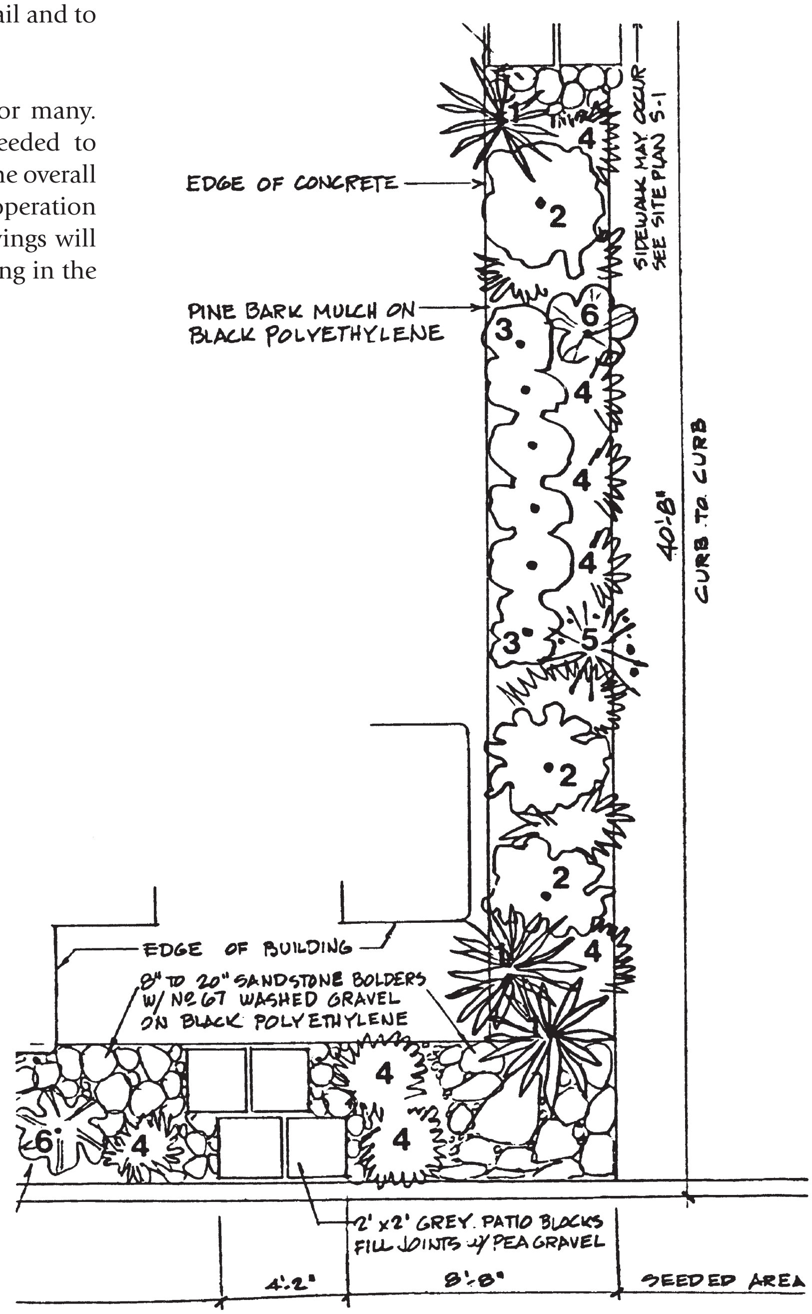
Symbols and indicators used by the landscape architect seldom conflict with those of any other discipline used in the project. A preplanning session, during which principals from each discipline to be incorporated on the project become acquainted, allows the landscape architect to discuss his or her customary approach to design and presentation with those principals. Usually, each member brings representative drawings to this session and institutes a familiarity at once with his or her particular techniques. At this time any confusion of symbols can be dispelled.

In the simpler landscape drawings the number of rows of plants and some indication of their spacing may be given directly on the drawing. The symbols for these plants will be definite and distinctive, and the dimensions will be no tighter than the nearest inch with plants, and the nearest foot with large plantings such as trees and sizable shrubbery. Trees to be planted may be similar, or even of the same variety, but of differing heights; the symbols will relate one to another. The schedule will give both botanical and common name beside the symbol, the size [height, caliber, or diameter and, in some instances, age], desired spacing, total quantity on the site, and, finally, remarks, which will include information specifically for these plantings, such as a requirement for "bagged" or "balled" roots.

Some architectural projects today rely heavily on the work of a landscape architect to provide either exotic plantings for interior atria, specimen plantings in exterior courtyard displays, or, sometimes, a combination of the two. These requirements may be in addition to the requirements for his or her knowledge of environmental controls by use of natural plantings. The design team captain may become more competent to discuss the matter by reviewing documents obtainable from the United States Department of Agriculture, the Environmental Protection Agency, and, most particularly, the United States Division of Forestry. This professional may then better understand those matters of special interest to the landscape architect on the project and be better prepared to intercede on his or her behalf with other members of the design team when potential conflicts of interest arise. A more complete and readable set of drawings will be obtained when the special input of each design team member has been recognized early in the planning stages and the input coordinated and incorporated into the entire project from its inception.

Because the landscaping drawings form part of the bidding package of working drawings, these drawings should reflect the same attention to line work, clear and precise delineation, with quickly comprehended, distinct symbols that characterize all other sheets in the total working drawing set. Line variation must be observed to prevent obscuring detail and to avoid loss of emphasis.

Landscaping working drawings may be one sheet or many. The designer will select the number of sheets needed to present properly his or her intent and contribute to the overall set of drawings in proportion to need and to the cooperation he or she receives from the entire team. These drawings will reflect the landscape architect's design for the building in the proportion the design team captain has suggested.



Portion of a CAD produced site plan. Note the amount of information shown. To do all of this manually would have been a difficult task.

FLOOR PLANS

The most important architectural drawing is the floor plan. It contains more information than all the other working drawings and is consulted in varying degrees by almost all the tradespeople on the job at one time or another. All drawings derive at least some of their information from it.

The floor plan represents a tremendous amount of the project designer's time spent in analyzing and meeting the needs of the client. The designer must take into account traffic patterns, working relationships, and arrangement of the rooms and must place the window and door openings. He or she must superimpose the layout of the structural members and locate the innumerable components that go into making up a complete project.

It is ironic that the amount of text in this chapter dealing with floor plans is relatively small as compared with the importance of these drawings. It is almost impossible to put into words the data that the architect and architectural draftsman must enter on them. Perhaps the easiest way is to envision the layers of information that are laid on the basic room arrangement, layers that are built up until the final plan can be presented.

Basically, the floor plan is a horizontal sectional view of the building taken about 4.5 feet above the floor line. This is done, of course, to cut through the majority of openings in the walls and to provide a view of the equipment installed inside. Nothing, from the smallest dimension to the largest component, can really escape the floor plan. The word detail takes on an altogether different meaning. Perhaps the best illustration is the list of items to be encountered on the floor plan of almost every project:

1. All necessary dimensions
    a) Outside walls
    b) Window and door openings
    c) Edges and thicknesses of materials
    d) Interior partitions
    e) Sizes and locations of terraces, walks and drives
    f) Special construction items
2. Window symbols and door swings
3. Window and door identification marks
4. Types of passageway through partitions
5. Stair symbols and notes showing the direction of rise, up or down, and the number of rises per run
6. Necessary changes in level occurring in areas of the building into the exterior
7. Thresholds and symbols for plumbing fixtures in the kitchens, baths, and laundries
8. Built-in cabinets, shelves, and rods in closets
9. Areas of mechanical equipment, duct space, pipe chases, vertical conduit runs, fireplace, and stacks
10. Configuration of the roof [on one-story plans]
11. Medicine cabinets and other installed accessories, fire extinguishers, fixed cabinets, and laboratory tables
12. Notes indicating the size, direction, and spacing of framing members
13. Scuttles to upper or roof areas
14. Special overhead construction
15. All structural features cut by the horizontal plane, such as columns or bearing walls
16. Symbols for various pieces of mechanical equipment, including water heaters and air handling equipment
17. Slopes in floors
18. Cutting planes, showing detailed sections
19. Titles or numbers for all rooms, spaces, hallways
20. Correct symbology for all materials cut by the horizontal section and their proper size and location

This is but a partial list, and only the requirements of the job and the experience of the draftsman can tell the full story of the floor plan. It is important that the plan be accurately made, for so many other drawings are traced directly from it [in part or whole] or, to varying degrees, derive information from it. The plan must be constantly updated as new information is gathered. It is often the initial source of changes that will involve the entire project and, consequently, the other drawings.

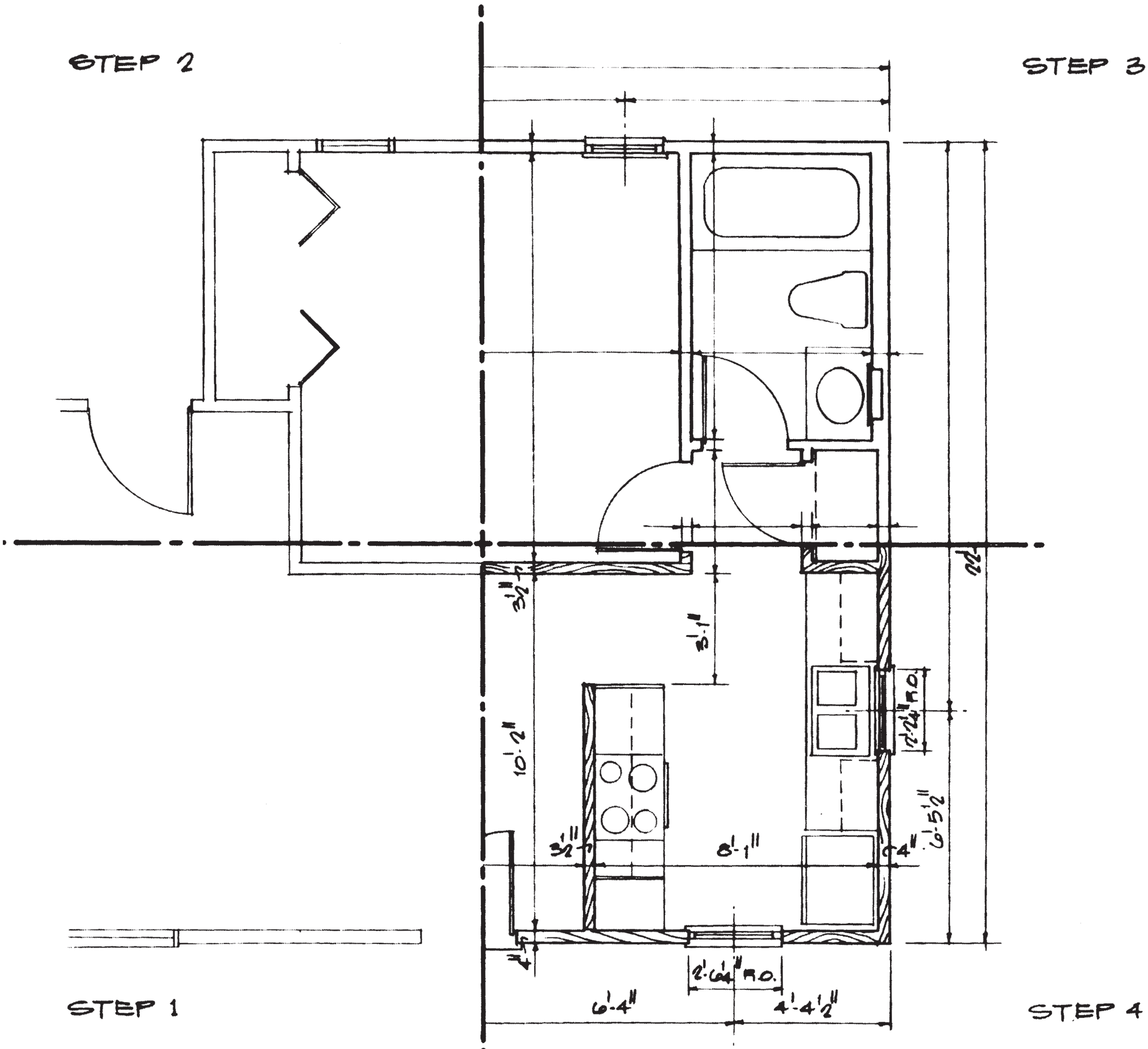
It is essential, for instance, that error-free areas be dimensioned properly. Dimensioning has been discussed in the preceding chapters, in which we showed new and more streamlined methods. It must be done completely so that the building will tie together. Office procedures dictate different practices; in some offices actual dimensions, and in others nominal dimensions, may be used. A drafter, of course, must be ready to meet any criterion imposed by his or her employer. Often depending on the size of the building, a small scale one-eighth-inch or smaller floor plan will be drawn so that the entire building may be placed on one sheet. If this is done, it imposes a new set of criteria on the amount and type of

CHECKLIST: FLOOR PLANS
1. Fully coordinated dimensions; overall dimensions; opening locations, features of the building, masonry, and column centerlines; make sure that each room and partition is located and sized.
2. Room names and numbers and finish information, if applicable; reference to large-scale details.
3. Floor elevations, floor covering patterns, mat recesses, changes in elevation and materials, ramps, curbs, bases, and gutters.
4. Wall material symbols, furred spaces [for pipes and ducts], recesses, openings, panels; locate wall features and attachments.
5. Ceiling heights, changes in height, breaks, bulkheads, tile patterns; locate diffusers, lights, and other ceiling appliances; include skylights and monitors.
6. Door marks and swings; show thresholds and saddles, special door features, and refer to details.
7. Windows, showing layout, swings, and mullions; interior glass in doors, partitions, and borrowed lights.
8. Show plumbing fixtures, stalls, floor drains, and reference to large-scale layouts and details.
9. Show stairs and stairwell dimensions, number of risers, and direction of travel; include handrails and references to large-scale details.
10. Fire extinguishers and cabinets, access panels, drinking fountains, expansion joints, folding partitions, gratings and pit covers, ladders, scuttles, lockers, shelving, special trenches, cornerstones, corner guards, barriers, bumpers, convector enclosures, telephone booths, roof leaders [downspouts], part-high walls, chalkboards, tack boards, folding and coiling grilles and grates, and railings.
11. Equipment and cabinet layout for laboratories, science rooms, home economics units, arts and crafts studios, and shops; equipment that requires special footings.
12. Plans for kitchen and equipment for special functions.

information shown on that particular plan. Selected areas of the plan will have to be blown up to a larger scale and shown on other sheets; for example, an entrance complex at the front of a building may involve a large plaza, a stairway, a retaining wall, handrails, a flagpole, and similar features.

To show all the construction at a one-eighth-inch scale would produce a mass of lines; it would be completely unreadable, even if it could be done. It would have to be drawn at a larger scale on another sheet on which even the handrail brackets could be shown fairly close to scale, the stairs could be detailed, the construction and expansion joints in the concrete slab could be detailed and dimensioned, the location of the flagpole could be set, and the relation of the retaining wall, sidewalks, curbs, and other paving could be established in a clear and concise manner. Actually, this principle applies to many areas of a building; rest rooms and locker rooms are usually drawn at larger scales. Rooms containing equipment, such as laboratories in schools or office buildings, shops, lounges, retail sales areas, office complexes, and gymnasiums, are blown up.

This is perhaps the most important lesson that the draftsman must learn about the floor plan: how to deal with scale. How much to show. Where to stop. It must be kept in mind, of course, that we cannot put out a skeletal drawing at one scale and constantly refer to other drawings. It would lead to a tremendous amount of confusion among the workers. This technique cannot be defined here; we cannot set definite parameters; we must rely on experience. In these pages we discuss techniques for approaching the working drawings and, in particular, the floor plans and how they can be developed.

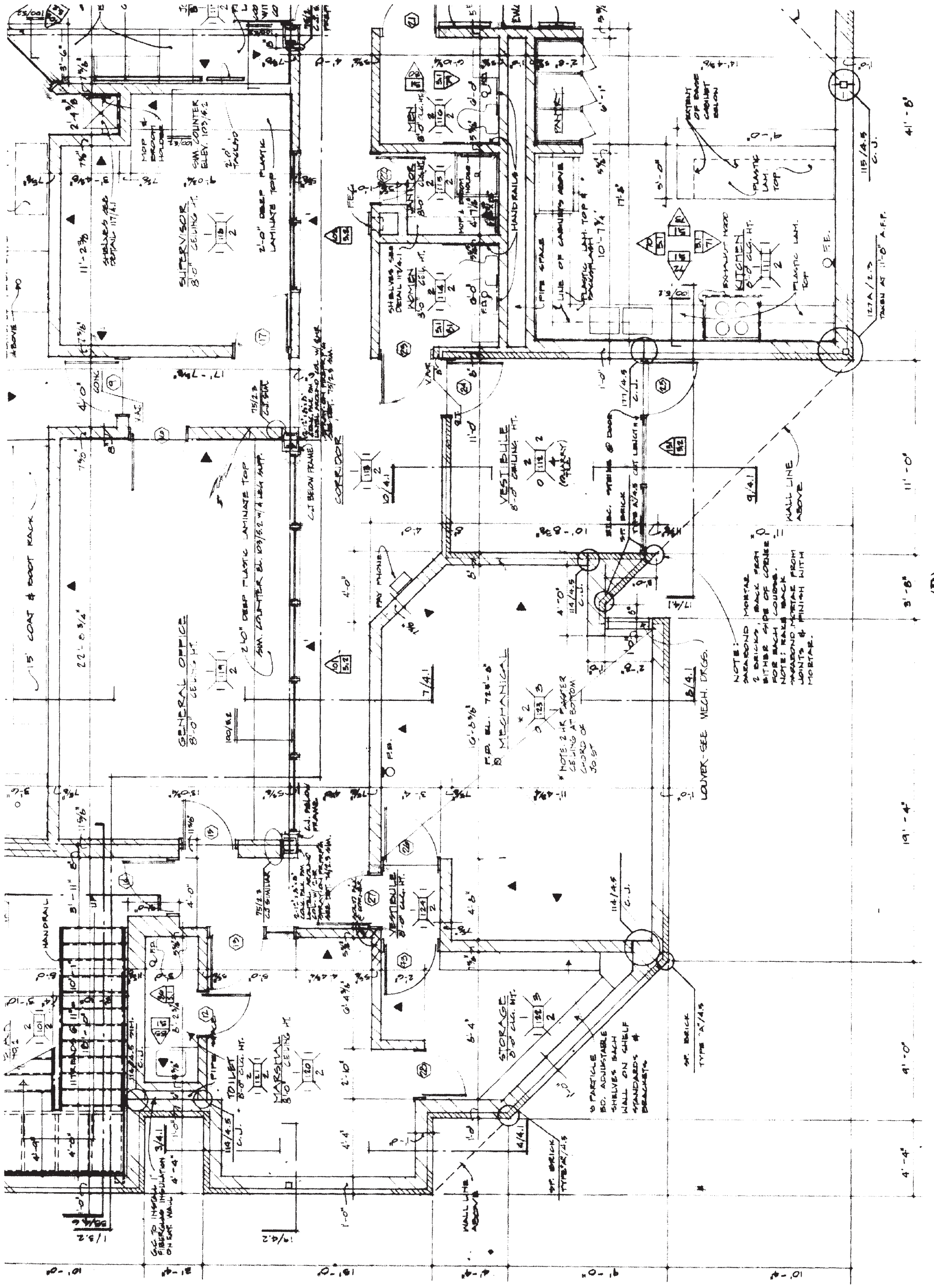


A sequence of drawings showing the progression in developing a floor plan. Each step adds information that is required. There are no shortcuts in this although each step need not be strictly executed as it is here. Note the light line work and meticulous planning that is used to locate the information properly.

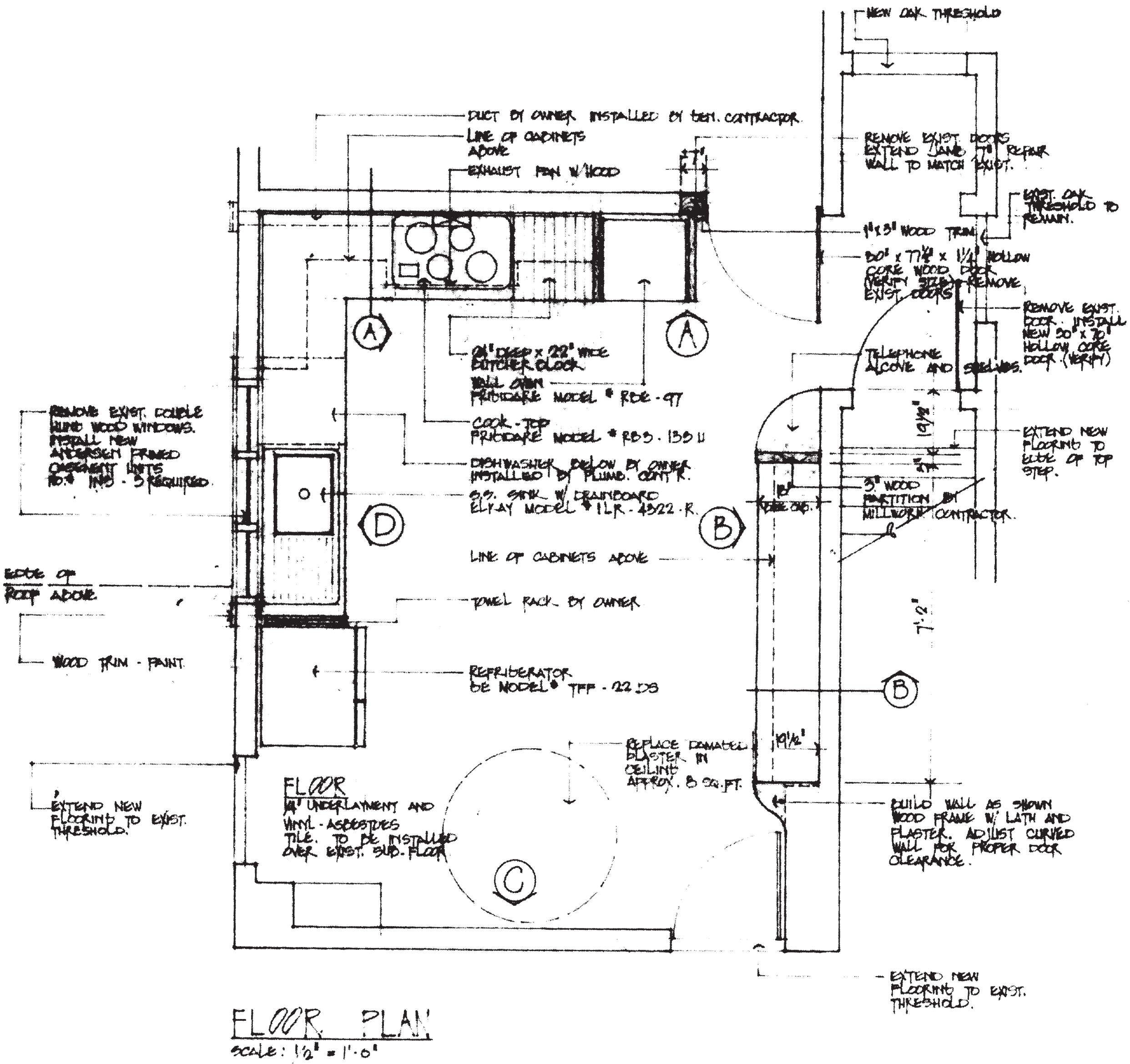
Only experience can take the draftsman beyond them to the production of a complete project.

Reflected ceiling plans are really another form of floor plan: However, they should not be confused with floor plans, as they each show a separate and distinct view. The reflected ceiling plan utilizes the floor plan for the general layout of rooms [door opening occur under the ceiling and need not be shown]. Then the drafter must imagine that the floor is a mirror! In this view, then, looking at the floor one sees the reflection of the ceiling. This reflection must show all of the ceiling features that are planned for the various rooms and areas; ceiling support grid, light fixtures, sound speakers, etc., as noted in the following checklist.

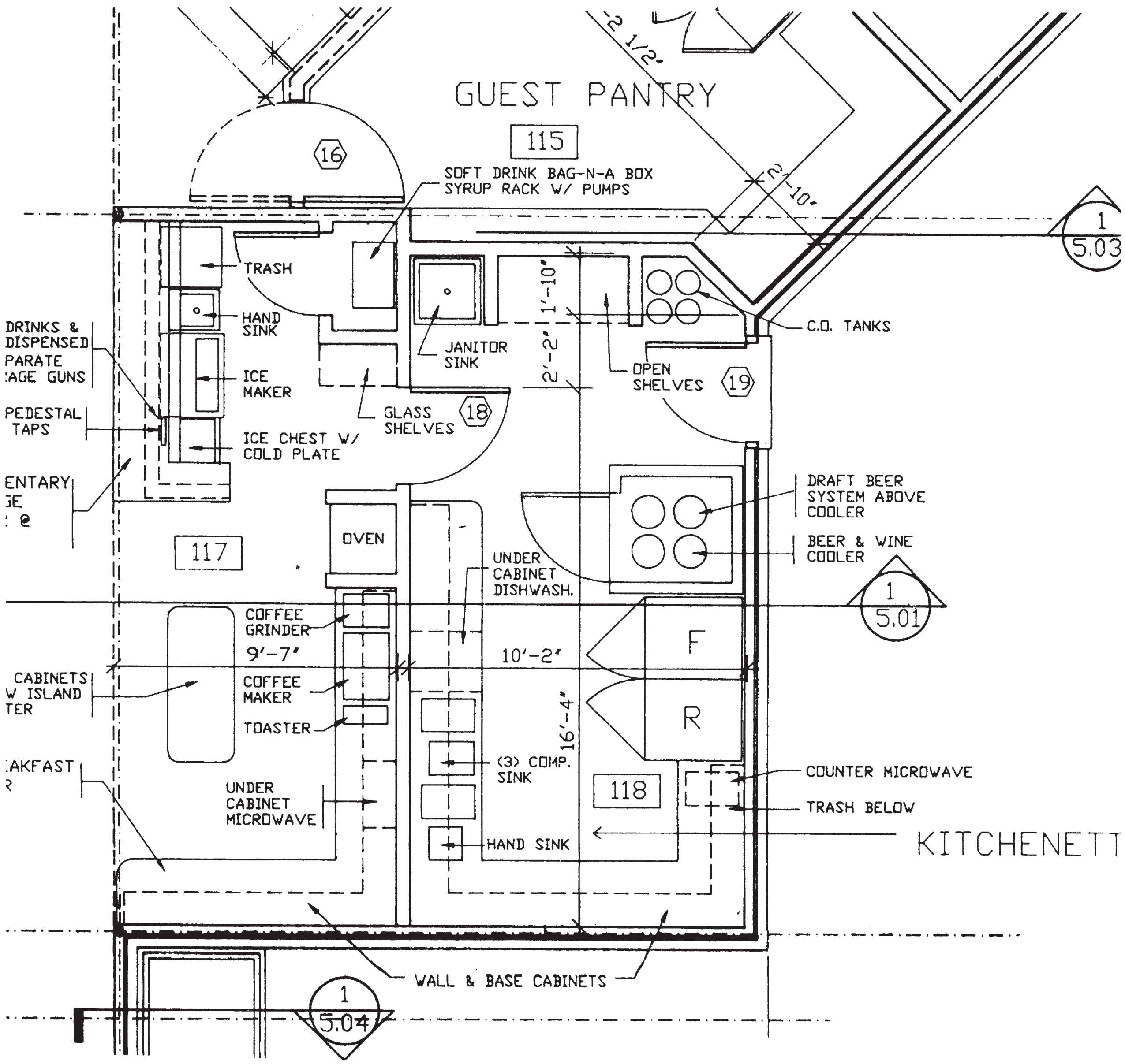
CHECKLIST: CEILINGS [REFLECTED CEILING PLANS}	
1.	Remember the principle of the reflected plan [the floor is a mirror; draw the plan as if you were looking down into it].
2.	Show all features of the ceiling materials, wall faces and profiles, exposed beams, and other construction.
3.	Show all light fixtures, anemostats [diffusers], access panels, scuttles, skylights, drapery pockets and tracks, trim around columns, and similar items.
4.	Check clearance of structure and duct work and co-ordination of all mechanical items; show all borders, trim cornices, control joints, coves, changes in ceiling height, bulkheads, structural supports, piers, columns, and sprinklers.
5.	Show the ceiling pattern desired, with proper dimensioning; coordinate with building features or window mullions as desired.



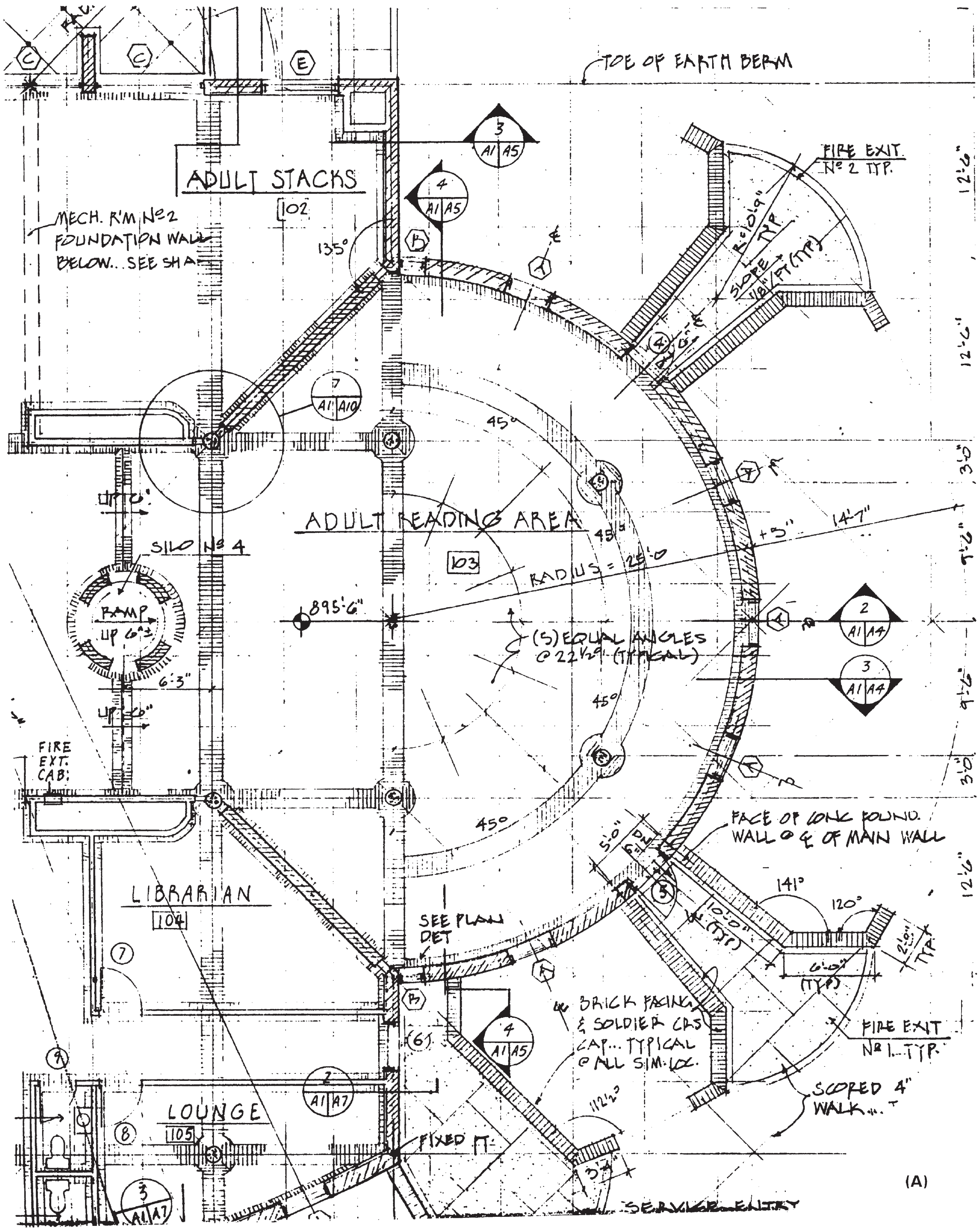
This is a floor plan drawn to a larger scale for clarity. This same area is part of another floor plan that depicted t he entire fire station building. Since there is such complexity in this area, a larger plan was used to provide clearer information and more information for the construction process.



Example of a very large floor plan [note scale] used since the project work is confined to the one area. Not only is the layout [new and proposed] shown, but much of the other information and information is also included. The lesson is the moderation of scale to the work area involved and the amount of information to be included – this flexibility is vital to the architect.



A "unique" CAD floor plan in that most of the items are distinctive and not repetitive. It shows the adaptability of CAD and the good variation in lettering size that has been adjusted to the various plan features.



A very complex plan produced by traditional manual drafting methods; this might be an extremely difficult CAD project because the irregular configuration and numerous angles involved.

FOUNDATION PLANS

Although the foundation system may entail only a small part of the total project, it must provide a firm, stable, fully designed base for the entire structure. It is responsible for the distribution of the total weight of the building and supports as well as all live loads imposed on it. The foundation must serve its purpose without uneven settling or collapse. All other systems of the building depend on it to function properly.

The foundation consists of three basic parts: the bed or soil on which it rests; the footing, which is the widened section resting directly on the bed; and the wall, which rises from the footing to a level above the ground. Before we can understand the drawing of a foundation section or foundation plan, we must be familiar with the basic foundation systems.

The foundation wall may consist of a series of columns or pedestals. If, however, a solid wall is used, it is called a continuous foundation, the system most commonly employed in lighter construction-dwellings and light industrial and commercial buildings. The building load is carried to the soil by the walls and footings. In most areas building codes will require that the footings be horizontal at the bottom and that any slopes or changes in elevation be done in steps. Stepped footings are not uncommon.

Another form of foundation, primarily residential, is the grade beam system. Grade beams are used extensively when no requirement is made for a basement and underground construction is minimal. A reinforced concrete beam at grade level surrounds the building's perimeter and is supported by a series of piers extending down into the undisturbed soil. In essence, the system is a series of piers topped by the beam, which spans from pier to pier. This type of foundation system can be used on sloping sites or when earth slippage is a possibility.

Spread foundations form another system, in which the walls above the footing are thickened to form a buttress. Spread footings are isolated one from another under the walls. This system, used beneath columns, helps to distribute the load. Spread footings are often reinforced to carry the entire load imposed on them. They can be flat, stepped, or sloped, according to the building design or the site.

The mat or raft is a heavier foundation, consisting of a stoutly reinforced concrete slab that extends under the entire building; the slab spreads the building load over the site to form a cushion on which the building rests. On uneven soil, columns rest on individual footings, some of which may settle more than others, and cracking and straining may develop. With the mat foundation, however, everything acts as a unit; the building actually floats in its excavation. The name "floating foundation" is applicable.

Concrete piers of one type or another are used when suitable load-bearing soil lies some distance beneath the surface. The selection of piers is predicated on the cost reduction factor. To excavate the site to solid soil may incur excessive cost. By drilling or driving piers down to the load-bearing soil, the required load-bearing capacity can be provided without the extra cost. Piers come in a variety of sizes. Shafts with or without inner linings or casings can be drilled to the desired depth and filled with concrete. The drilled shaft is called the caisson, a term reserved for shafts in water or water-bearing-soil. Piers may be enlarged into a bell shape at the bottom. These bells distribute the weight of the pier over a larger area, a system employed primarily in a good load-bearing soil that is not so firm as bedrock. As noted earlier, these piers can be capped with a grade beam system.

One other system for reaching load-bearing soil employs piling. Pilings are lengths of wood, concrete, or steel that are forced or driven through the unstable strata until soil is found that can support the estimated load. Piling is a system familiar to people living in the metropolitan areas where the clang of the pile driver can be heard forcing the metal piling into the ground.

There is no set pattern and no particular criteria for choosing one of these systems over another. The choice becomes the prerogative of the structural engineers. They, of course, must study the log of soil borings made for the particular job and evaluate the total load that the building will impose. They also study the capacity of the soil. In many instances a site will contain good and bad load-bearing soil, and it is not uncommon for two foundation systems to be used in the same building. Indeed, there can be more than two systems, depending on the soil conditions.

The drawing of the foundation plan is done in two parts: the architectural plan and the structural foundation plan. In many ways the plans are similar because they are based on the same information and building configurations. They also differ radically. The architectural foundation plan shows the entire foundation system at the point just after backfilling operation is completed. It also shows all components such as the foundation wall, wall footings, column footings, grade beams, and caps of piles, piling, and any superstructure building [crawl space columns]. This plan is drawn at the level of the basement or subbasement floor; no first floor or basement construction is shown on the architectural foundation plan. Sometimes the basement plan can be combined. The draftsman should be aware that there will often be two separate plans. It is possible in a one-story, slab-on-grade structure to incorporate the footing foundation plan if it is done carefully and precisely and each feature is clearly pointed out on the drawing.

The foundation plan locates all foundation features horizontally. The building rests securely on the foundation; therefore, it is important to show the sizes and locations of its walls, grade beams, ledges, pockets and recesses. It is equally important to determine the location of footings and columns for the building's superstructure. To feed information to other drawings, the bottoms of the wall footings are located vertically; the critical sizes of the foundation features are given. The foundation plan is singular because no other plan drawing gives vertical dimensions.

The foundation plan is the basis of the design of the structural framework of the building. The grid is laid out for all columns extending through the building and applies as well to the footing foundations beneath the columns. The grid system is discussed at length in "framing plans."

The foundation plans reflects the overall character of the building, for the building's visible elements must be carried down and firmly attached to the earth underlying the structure. With this fact in mind, we know that the plan must account for all elements, for from it the features of the foundation are developed in minute detail.

A basic, but different, philosophy relates to the two types of structural detail shown on any set of drawings. The features of the foundation show the general configuration of the architectural elements, but the most important concept, illustrated in considerable detail, is how the foundation engages, holds, and supports these features. The reinforcing steel and other structural elements are not included. In diametrical opposition, the structural drawings contain all these details. Each reinforcing bar in a concrete structure is delineated with brackets, stirrups, ties, and the other elements of good design. In steel frame, of course, the anchor bolts, welding symbols, and all construction features required in column and footing connections are meticulously drawn.

At first glance, the foundation drawing appears to be extremely simple. Neither material nor structural symbols are employed. A wall is merely two parallel lines, properly scaled to indicate its thickness.

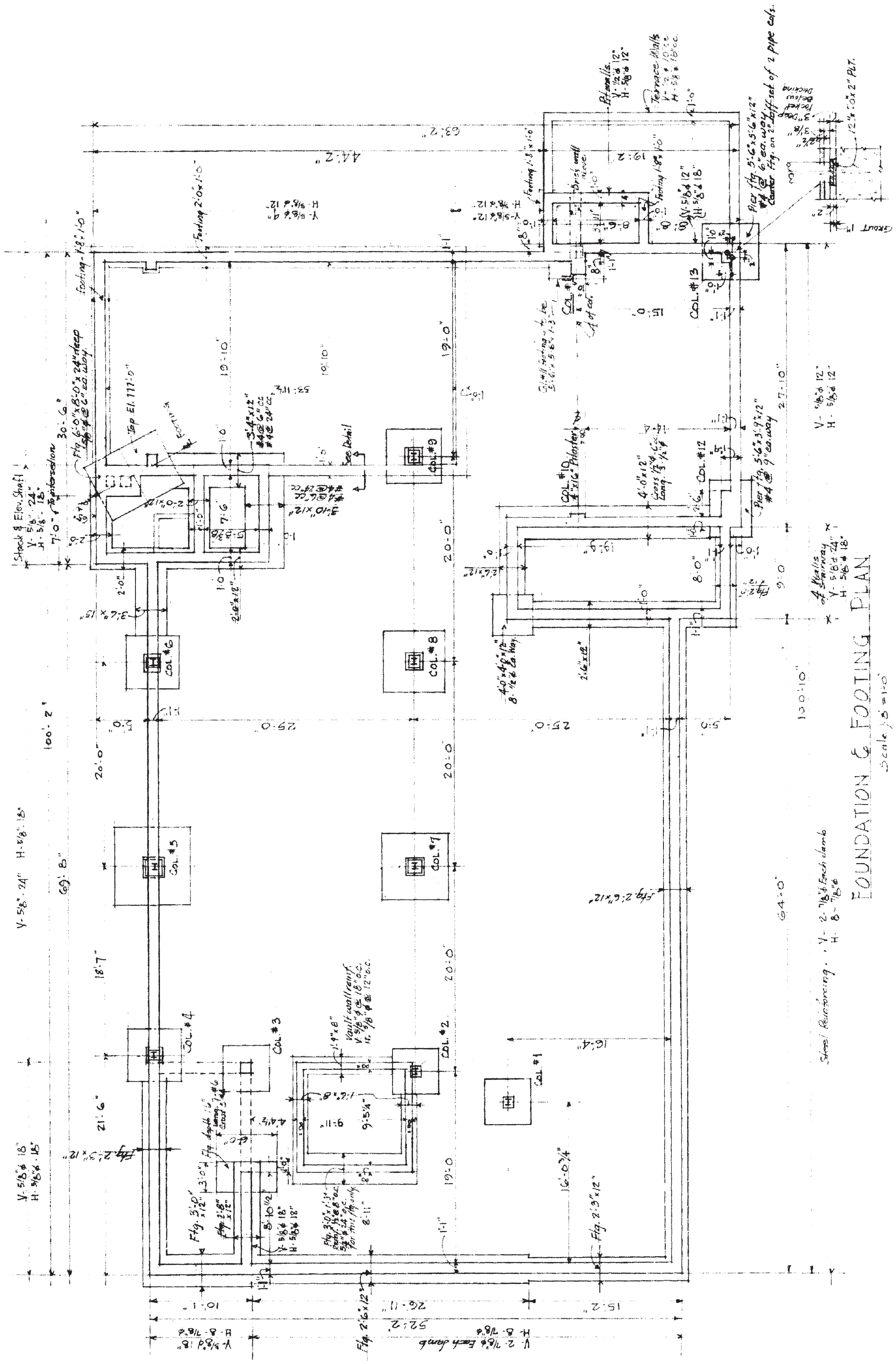
Some firms use colored pencils on the reverse side of the sheets to tone the structural elements. This tone, made with a yellow pencil or hard lead in a standard lead holder, is dark enough to distinguish between the element and the white background of the paper but not dark enough to obliterate the structural detail. The tone is not indicative; it merely emphasizes.

The foundation plan must be complete and minutely detailed. Although many features of the building will be tied directly into the foundation system, other elements [such as brackets, offsets, ledges, or decorative motifs] may create a different profile. The foundation plan is not always just a tracing of the first floor plan; for example, a basement vault will require a larger and more complicated foundation.

Foundations must also reflect the building loads to be imposed. For larger and taller buildings architects will design lighter structural systems and select lighter interior materials so that a disproportionate amount of the budget money will not be devoured by the understructure.

The foundation system is caught between conflicting requirements: the building above it must support itself and all live loads it must carry. This requirement, as translated to the base, forces a certain configuration. Underneath the foundation is the bearing soil, which may have an excellent bearing capacity, such as rock or shale, or may be poor load-bearing sand or old fill. The foundation system must react to the load above and the footing beneath; if necessary, it must be expanded over a wider area to accommodate the load, which cannot be more than the soil itself can support. If the design is faulty, the building will fail or its parts will be irreparably damaged.

The design of the parts is something that cannot be slighted. The foundation must be a unified whole, for nowhere is the old saw about the weakest link more applicable than it is here. From time to time the architectural draftsman may have to deal with the structural drawings. To keep consulting fees to a minimum, an architectural firm sometimes engages a structural engineer to design the foundation; the drafting is done by architectural personnel. It is more important that the draftsman understand that every note must be accurately transcribed and that every element must be accounted for strictly according to design. This work calls for absolute caution and demands clear, concise information. Further, if there is any question in the drafter's mind, it is vital that he or she have access to a superior for an immediate solution.



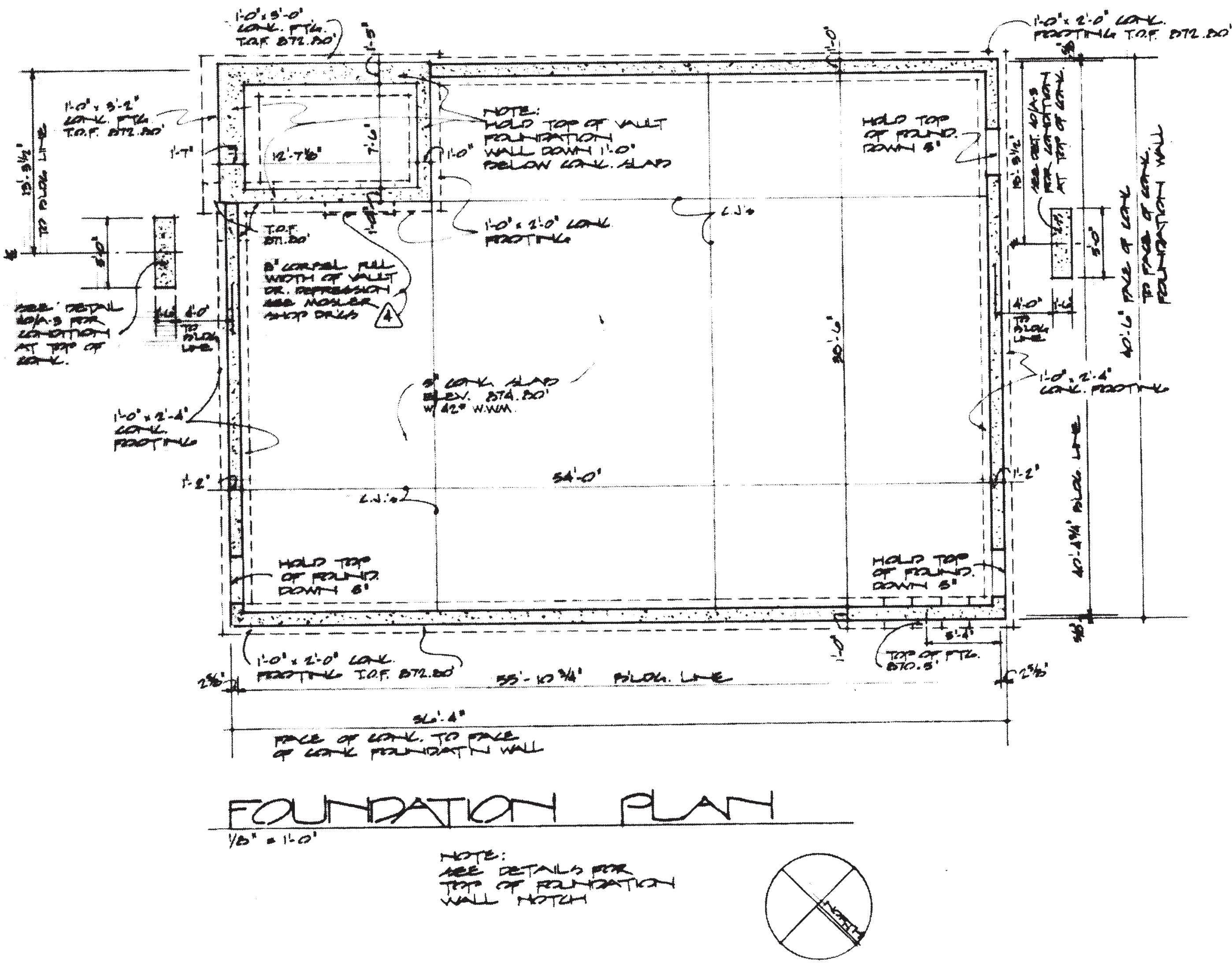
A foundation plan showing both continuous and isolated footings. Note the changes in footing size as well as the listing of reinforcing to prevent numerous sections. Note, too the angling of on footing to avoid a bad soil condition.

The lines that define the various structural features must be black and heavy so that all features can be readily distinguished. A wide variety of line weights will characterize the complicated details of the various elements. The foundation plan, in particular, will contain extremely small items for which the line work is crucial. Clear, concise lettering will eliminate confusion between letters and structural symbols. Careful proofreading is essential.

The foundation plan follows the design of the building, both literally and figuratively. As the heaviest part of the building, the foundation carries all the upper load. Walls on the upper floor of the building are thinner. Walls nearer ground level become wider as the load from above increases.

The system design terminates in the foundation. After the upper building requirements have been determined and the plans laid out, the foundation system can be designed and drawn.

The "fast-track" method of construction, frequently used now, requires that the foundation system be designed early in the project sequence. Fast-track is a method of construction, which reduces the total time for design, and construction. Usually these phases are done one after the other [the design/documentation is fully complete before construction is started]. However, a significant amount of time can be saved by starting construction while final design and documentation is still in progress. Documents are issued as completed to allow a continuation of the construction. However, the foundation system must be in place in order for other work to be installed. This requires that the foundation be designed prior to the upper superstructure of the building; and while every design load and answer has not been resolved. Astute professionals can work in this fashion utilizing experience based analysis and computations for their design. This procedure may seem impossible to implement, but the fast tracking system demands it. The foundation system is contingent on the preliminary architectural drawings. Once the foundation structure is imbedded in the earth [and hardened, in the case of concrete], there is no way to make changes without tremendous expense. Therefore, early decisions must be made that will affect later design considerations. Architects and consulting structural engineers must learn to adapt to this new process, for the fast tracking system is an overall time saver.



The foundation plan of a fairly simple building. It still contains all of the elements of a larger plan and includes a slab-on-grade, floor with no basement. Note change changes where the loading [a vault] is located in the upper left; also there are isolated footing/piers to support some planned decorative features of the building.

FRAMING PLANS

Framing plans for floor and roof construction can be derived directly from the floor plan and must incorporate all information that deals with the configuration of the building. Further, the framing plan shows the layout of the supporting features such as bearing walls, columns, beams, and girders. In preparing plans for framing, the outline of the building should be drawn on the back of the sheet, so that in the event of erasures or changes in the framing system it will not be necessary to redraw the entire building plan.

The basic building plan should show all walls without window and door openings to indicate a level of horizontal section, or plan, above the openings, at which the supporting member would rest. In drawing the backup for the framing plans, it should be kept in mind that in these particular drawings the overall building plan is a subordinate to the framing system. Therefore, a change in line weight to a lighter tone is in order. A darker, heavier tone is used for the framing-system members. Halftone printing, or screening, is another method in which framing members are shown on the correct surface of the drawing sheet.

The framing plans are meant to complement the architectural plans. These are strictly structural drawings intended for the location of all the structural members and features and should show such things as floor slabs on grade, framing members installed integrally with the floor, and framing members installed separately. In regard to these matters, some basic framing systems that require specific drawings are suggested; for example, a building framed in wood or steel is shown with isolated structural supports [columns] and individual beams, joists, girders, and purlins. A reinforced concrete building may have a system of flat slabs that span between column points or a monolithic floor system poured in one piece that would require a slab and a joist and beam system.

With concrete, which arrives on the job in plastic form, the entire system would be poured at one time. Thus, the requirements for concrete framing plans are different from those for wood or steel. Although the same types of members are shown, they must be presented in a different way. Refer to the examples and the various framing systems illustrated.

Framing plans must include all the building's structural components: horizontal and sloped slabs, stairs and ramps, and the framing members themselves [foundation walls and columns, bearing walls, and so on]. It is not necessary to show nonbearing walls or partitions on the framing plan. Such extraneous matters tend to complicate the drawing. If a wall has no structural value in the building system, it need not be shown.

There are a great many components in any roof or floor framing system. The systems are similar; for example, openings may occur in both floor and rooftop penetration by components of architectural and mechanical systems. It is important that not only the major structural elements be shown but also those that may be of a minor structural nature that would frame openings. These members are sized by the structural engineer and should be noted by the system by which various materials are designated. Wood is called out in the nominal sizes of available lumber or timber, such as 2 x 4 and 4 x 8. Steel members must be called out by their correct designation and by their depth and weight per foot.

In concrete structures the framing plans must indicate individual floor slabs, whether on grade or suspended between columns. Each floor must be delineated because the reinforcing of the slabs may change from bay to bay, depending on the superimposed load in the bay. Other variants such as recesses, stairs, pits, ramps, grade beams, or openings affect the slab's design.

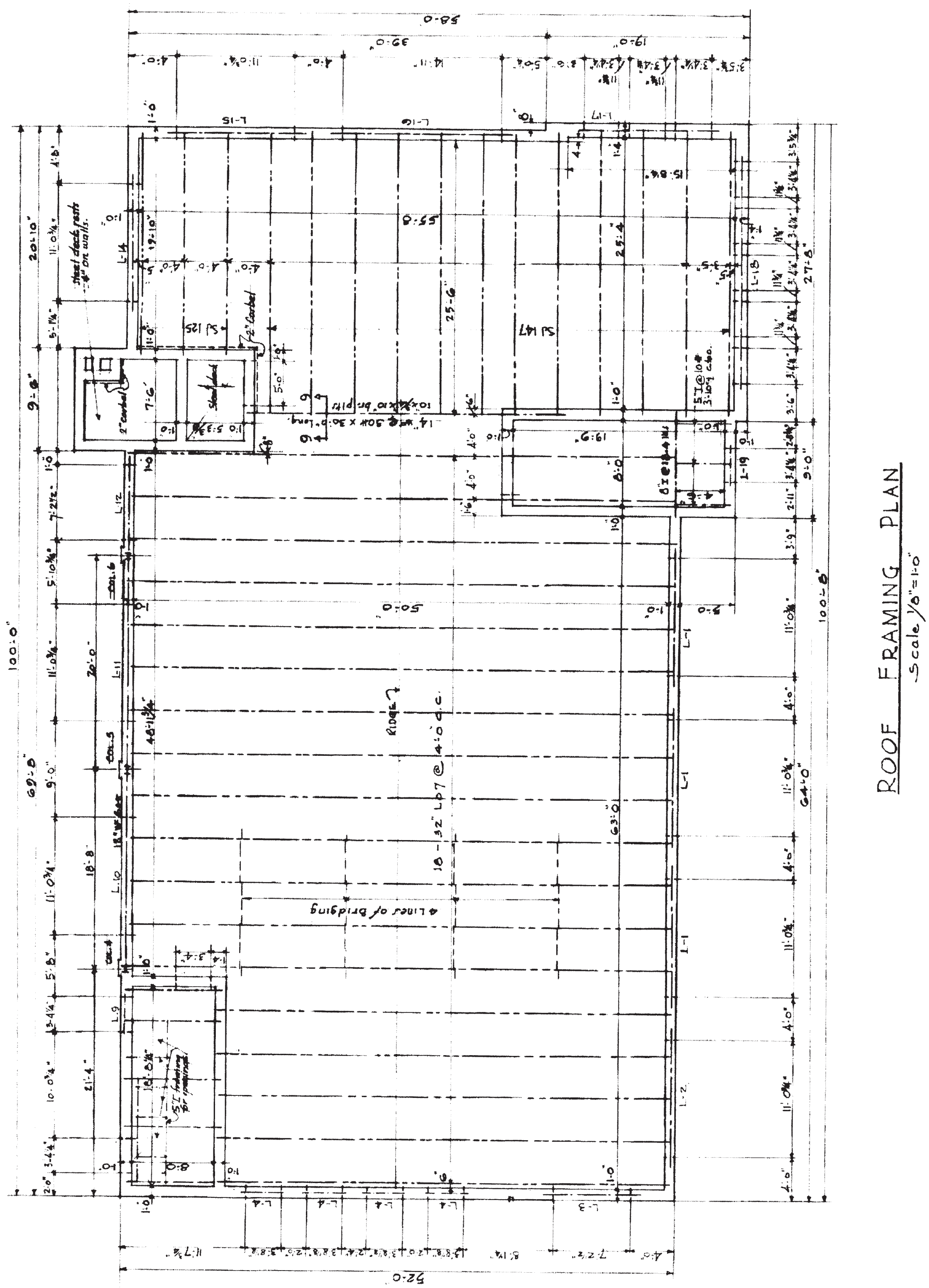
Sometimes structural members are isolated from the total system. A case in point is the loose lintels that support the walls above any openings. They must be shown correctly in their proper location and size on the architectural elevation, again giving their location, type of member, amount of end bearing at both ends, or the symbol designator that cross references them to the lintel schedule.

The framing plans really become a function of the complexity of the building. If a building is composed of arches, trusses, heavy girders, and beams that support the floors and roof, the system becomes complicated. On a residential plan it is possible merely by the use of a doubleheaded arrow to indicate the size of the members and their proper spacing. Following this thought, we arrive at heavier joists, bar joists, and steel lumber, all used in lighter commercial construction. Again we indicate the size of the joists and the spacing; a modified residential indication will suffice for simple spans [beam to beam or wall to beam] or joints bearing on opposing walls. A more complex system of heavier members, used to collect smaller members, to carry the total weight of the building requires a more elaborate framing plan with more intricate indications. In some offices the entire structural system will be laid out to show all members, their spacing, and accessories [bridging, anchors, headers at openings, and so on] in their correct locations and to scale with their appropriate designators. This is a conservative approach, time-consuming, but a safe course to take. The complete layout ensures that all members are shown and nothing is left to guesswork; the entire system can be plotted and studied.

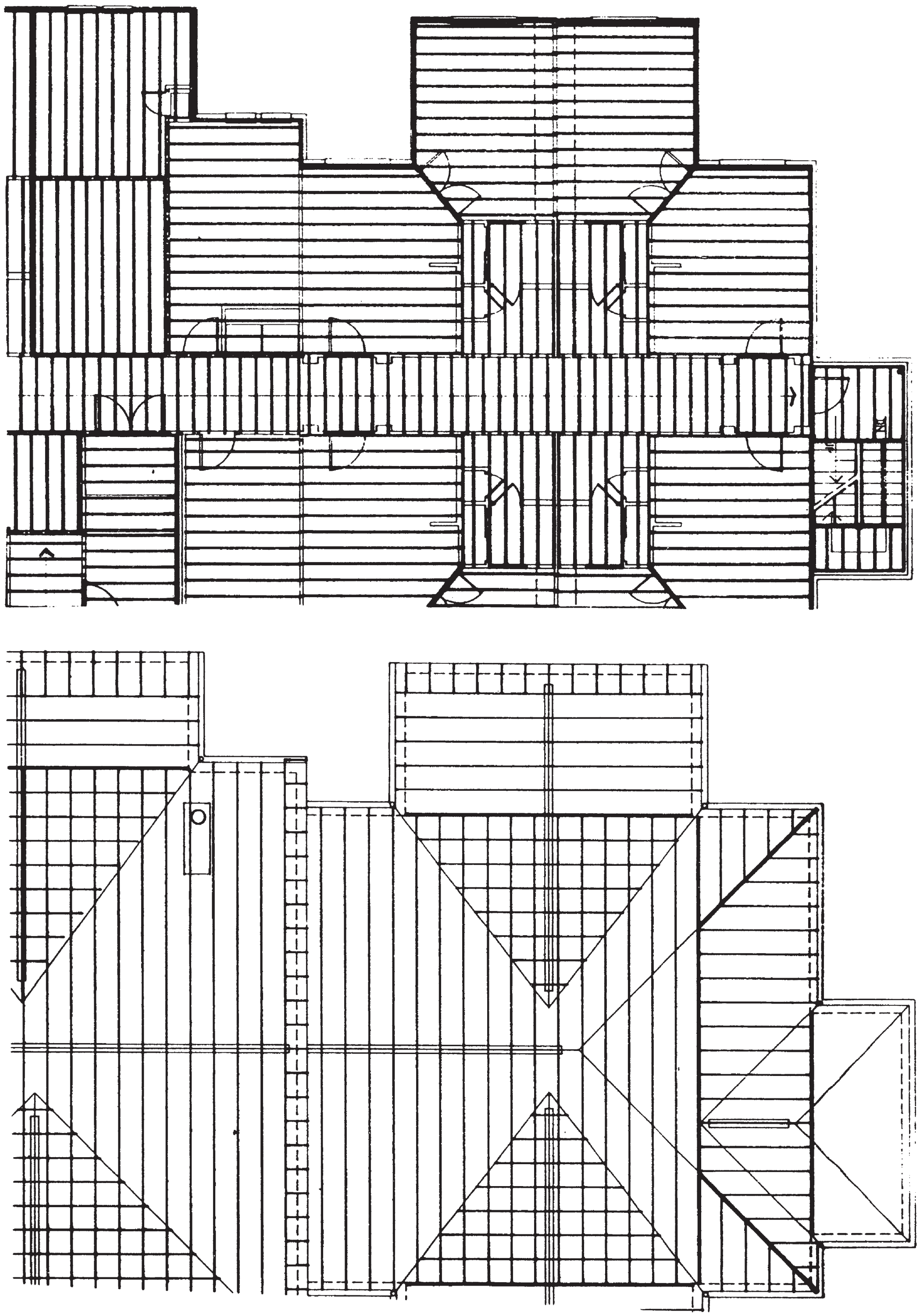
The framing plan is usually drawn at the same scale as the floor plan. As stated earlier, the framing plan outline can be traced. Commonly, if there is a system of columns, a structural grid will be set up to mark the centerlines of the columns both ways. By using letters of the alphabet along one.. line and numerals along the other, each column can be given an individual name; for example, C-3 or r-7. This nomenclature facilitates referencing other information to a particular column. Architectural symbols are usually not entered on the framing plans, an obvious effort to keep them simple. Section symbols are shown because the structural framing plans require that a number of sections and details be given. These details are connections, bearings, anchorage, and other related matters. The framing plans can become complicated and confusing unless interested concern is displayed on the drafted sheet.

Concrete construction presents much more of a challenge because of the opaque nature and the integral characteristics of the concrete system. When members stand apart from one another, as in wood or steel, the drawing is greatly simplified. Here individual members are shown by a centerline designation, be they steel or wood. In concrete, however, the beam width is indicated by a double line. If there is a series of joists, it must be shown because the joists will be constructed with pan-type forms and the spacing must be laid out to show their width and the voids between them. The slabs must be individually designated so that the reinforcing can be specifically designed for each bay. The columns and connections of the flat slab system to the columns must also be detailed on the framing plan.

Many more sections are required in a concrete system because of the diverse situations; few are typical. This is not to discourage the young architect from designing in concrete. Each building must be evaluated on the requirements of the project and the system that will work best for it. It would be foolish to space steel bar joists 6 inches apart merely to make it easier to draw the framing plan when perhaps a concrete system, even with its more complicated drawing, would function better for the client who needs maximum load-bearing capacity in a building. This chapter points out the variations between systems, and, again, the system must be chosen by the structural engineer. His or her selection must fill the requirements of the building project.



Typical example of a framing plan [this one for a roof; a floor would be similar] that shows the basic supports and the various layers of framing – main beans and supports, joists, purlins, etc. Includes information about the size, spacing and the clear span dimension the supports are required to span. Usually developed from a floor plan, but showing only the various walls and supporting partitions.



Portions of two CAD produced small-scale framing plans. The upper plan is for the floor system; the lower for the roof. Obviously, these are incomplete and require the dimensions and notes pertinent to the framing.

ROOF PLANS

The roof plan explains the overall configuration of the roof and the elements that rest on, or penetrate, the roofing membrane. That every project must include a roof plan is not a hard and fast rule. Usually, a roof plan is justified only when additional construction data are needed; for instance, a roof plan is seldom required in residential work. A section through the building may show the trusses or the structural framing members, and the framing plan as well will carry some of this information. Not many elements in residential work penetrate the roof-there may be vents in the attic, plumbing vents, and a chimney or flue; however, the number of items found in roof plans of commercial, industrial, or institutional projects is shocking.

A roof plan is tantamount to a bird's-eye view of the building, similar in some respects to that shown on the site plan. It is, however, drawn at the same scale as the floor plans. The drafter should prepare an orthographic projection to show the tops of the walls and wall caps or copings. He or she will enumerate and, indeed, locate in size such things as scuttles, chimneys, drains, skylights, stacks, roof-mounted mechanical equipment, scuppers, gutters, and the pattern of slopes that may be built into the roofs surface. The roof plan is simple in concept, if one adheres to the principle that there should be positive drainage or slope in all roof systems. No roofing contractor or manufacturer will give any kind of guarantee on a dead level roof that allows water to pond on it. Ponding forces the water to seek any opening through which it can leak into the building.

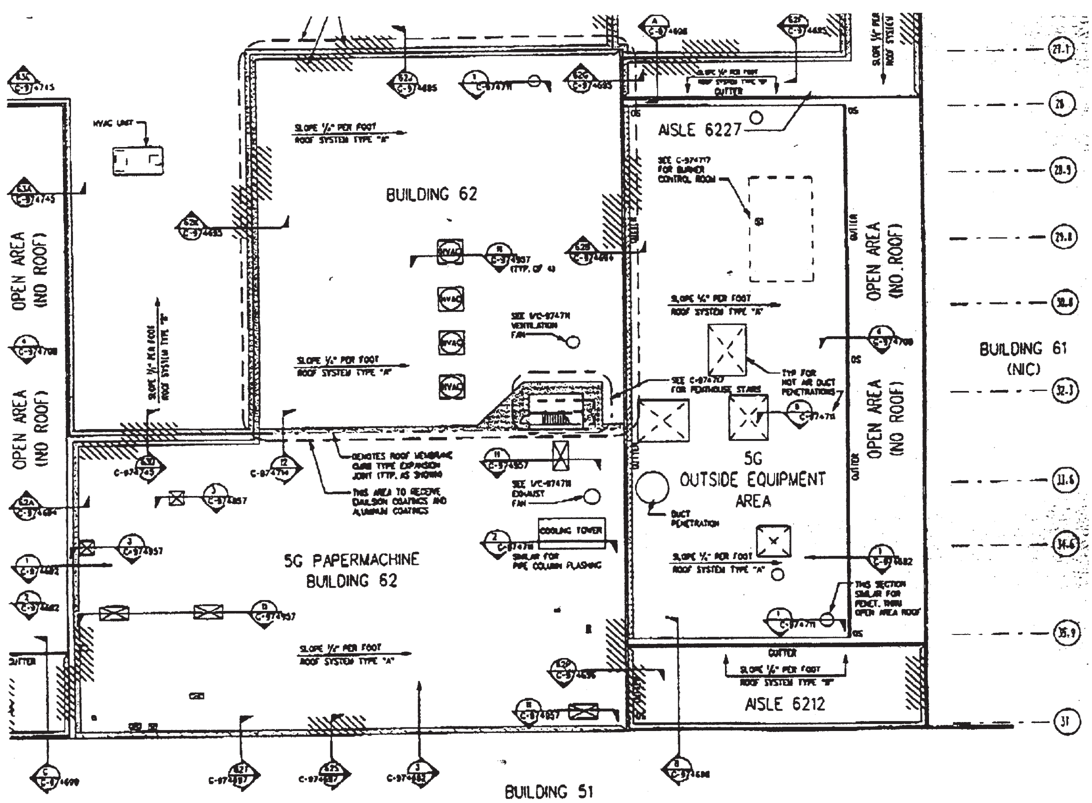
Many odd terms are used in building up the sloped portions of a roof. Pointed out in the example, they include frogs, crickets, and saddles. It is important, of course, to design the roof plan with the floor plan and to coordinate roof drains and roof leaders with the vertical runs carried down through the building without being obtrusive or destroying any of the design features. It is also important to locate the various pieces of equipment mentioned, in coordination with the other systems in the building. In some instances protection pads may be required to protect the roofing against foot travel. This is especially true when insulation is installed above the roofing membrane and is susceptible to crushing.

The roof plan can reflect the structural grid; the contractor, viewing the drawings, will immediately recognize column points and structural features in the roof structure. Everything that is roof-mounted, such as flagpoles, radio and television antennas, air-handling units, condensers, exhaust fans, atmospheric reliefs, and fire dampers, must be shown.

Each of these items or systems and their components must be properly related from the roof plan to the roof framing plan. Most of the items will require some sort of support or support frame, which in turn must be supported by the roof framing. Other items require openings in the roof, for access by personnel, or for duct work, or equipment. These openings [and their curbs, housing, etc.] also must be supported by the roof framing; obviously one cannot create a usable opening

CHECKLIST: ROOF PLANS
1. All necessary building dimensions; overhangs, canopies, and roof surfaces.
2. All dimensions to walls, column centerlines, or other permanent features.
3. References to large-scale details.
4. Indicate drainage of roof; slopes to drains, high and low points, saddles, frogs, and crickets; drains and leaders, scuppers, and gutters.
5. Indicate materials of roof and cornices as well as parapet walls; note type of coping on walls.
6. Show all roof-mounted mechanical equipment, scuttles, smoke vents, access panels and doors, and vents.
7. Show special paved areas, fences, railings, stacks or chimneys, bulkheads, and fire walls that extend above the roof surface.
8. Locate and properly reference ladders, splash blocks, stairs, penthouses [for equipment and elevators], ridges, valleys, eaves, special lighting, flagpoles, snow guards, and lightning rods.

which crosses roof framing members. Coordination is vital to the success of properly installing all of these items. The roof and all openings must be made watertight by the roofer. He or she must provide adequate insulation and diagonal cant strips to facilitate easy installation of the roofing without cracking it. The roofer must have some indication of the extent of the work and must be informed of all its features. It is helpful in some instances to show section markers on a roof plan. The type of roofing required, the dimensioning of the various features, and some indication of the slope, the high and low points, and the valleys and drains are essential and must be shown. Meticulous drafting is worth the time; the overall size of the building's configuration, the offsets, widths of copings and walls penetrating or surrounding the roof and the location of all equipment are required. Here, again, absolute coordination with the roof framing plan must prevail. Although a roof plan is not required, it is of great value in competitive bidding. The contractor needs to know as much about the building as is humanly possible. The drawings are not complicated, although in some cases, if not carefully executed, they can be misleading.



An unusually complex roof plan. This is for an industrial bulking with a good deal of equipment, piping, ductwork vents, hatches, etc. located on the roof. The roofed area [the roofing work itself] may be fairly routine and straight-forward [including slopes, drains, edge conditions, etc.], but is greater complicated by all of the penetrations, curbs and other items through and on the roof that must be made weather tight.

EXTERIOR ELEVATIONS

When preparing exterior elevations, it is important to keep in mind that these drawings revert to orthographic projection. All plans mentioned in preceding chapters are horizontal sectional views. The elevations are exterior views of the completed project. In a remodeling job the exterior elevations may show existing conditions with the changes or additions that are to be made. However, some knowledge of the wall sections, their construction and the layout of their openings, is essential before the elevations can be completed.

Elevations can also be projected directly from the floor plan. The layout of windows and doors, the location of offsets, and other features of the overall design can be taken directly from the floor plan. Exterior elevations are usually drawn at the same scale as the floor plans to facilitate this projection.

Normally it is good practice to use the common reference symbols for elevations; these symbols include reference symbols for windows, column lines and elevations, section "flags," and detail markers. It is important to account for all major components of the building.

Vertical dimensioning of the elevations should be continuous. The footings and foundation walls can be located horizontally by plan, but their depths are shown on the elevations. Perhaps the easiest and clearest way of recording height elevations is to show them as projected lines outside the building configuration on one or both sides of the drawing. In this way vertical dimensioning and elevation marks [e.g., First Floor Slab, elevation 101′-4″] can be applied on each of the levels. The most important thing to remember is consistent dimensioning; if dimensions are shown to the top of the masonry, the dimensions should be given to that point on all elevations. Any point may be chosen, of course, but the same reference must be used on all drawings.

If additional floors are planned for some later date, they can be shown on the present drawings. The vertical control that the elevations provide is most important to the completed project, whether done in one phase or several.

With reference to orthographic projection, the length and width of the project are clearly indicated on the plan, but it is not until the elevations are made that height is indicated. As in orthographic drawings of a simple block shape, we must have all available information before building can begin. Until now the project has, to a large degree, been graphical. Perspectives and renderings have been drawn as the eye sees them. In the working drawings and, in particular, the exterior elevations it is important that we draw what we know, not what we see. Everything should be done exactly to scale; the distance between floors should be exact and there should be no introduction of the principles of perspective-no foreshortening, for instance, that would give a false impression of the true dimensions of the building.

Just as perspective is based on the horizon line, the elevations are based on the grade line. Most of the elevations and dimensioning should begin at this line and progress upward or downward from it. It is important to show the height of the windows and any other openings that occur in the building's exterior walls. These dimensions cannot be shown on any other drawings. On a building that has some sort of pitched roof much of the roofing information, which includes everything from the materials to the slope diagram to the height of the ridge and the width of the overhang, is entered on the elevations.

Also shown are the depth of the fascia, the gutter system, and the various pieces that compose the trim. As a rule it is important that a minimum of four elevations be drawn so that the building can be completely described, but the actual number required must be evaluated on a project-by-project basis. If the building is angular or complicated in plan, any number of elevations may be needed. As many as 12 or 14 are not uncommon. Perhaps the basic element of the elevations should be discussed here. The elevation should be taken at 90 degrees to the surface of the wall at which the draftsman is looking. If an adjacent wall is at a slightly different angle, it will require its own elevation, and so on around the building. If a wall is at an angle to the plane of the elevation, there will be natural foreshortening, thus getting back to the principle of perspective which, again, will only lead to confusion and perhaps errors in the field. To understand fully the use of elevations a short review of the drawing requirements may be helpful.

1. All necessary dimensions: floor to ceiling heights, window heights, stack heights, tower heights, footing depths, roof overhangs, height and depth of all special features
2. Grade line, floor lines, and ceiling lines

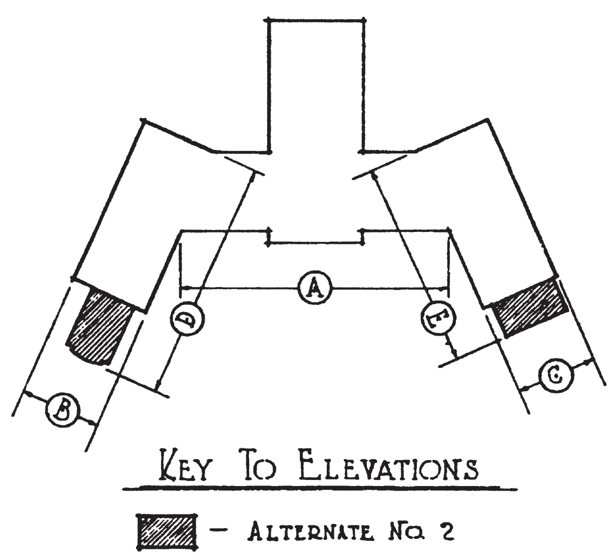
3. Correct identification of windows, doors, louvers, or any other wall penetrations
4. Footing and foundation lines, which are shown by broken lines below the grade line to indicate that they occur out of sight
5. Roof slope, if applicable
6. Exterior material symbols as well as the notation accompanying them
7. Attic, crawl space, or roof configuration
8. Notes that indicate special features
9. Indicators of sections, wall sections, or details
10. Exterior steps, stoops, roofed-over areas, and railings
11. Columns and shutters
12. Dormers
13. Flashings, gutters, and downspouts
14. Proper title and scale

Elevations are more properly identified by a directional title such as north or south rather than left or right, which is elementary for viewing the building. Left and right are applicable only when no directional information is given on any of the drawings.

In an attempt to expedite the drawing of elevations some offices have been utilizing the procedure of only partial poché of the building elevation. If the building is symmetrical, the center line can serve as the dividing line. For a building that is not symmetrical, it is correct to establish a diagonal line on the elevation as a demarcation for the material indicators. The building's poché, which defines the materials, occurs only on the one side of the demarcation line, whereas the other side of the building is shown only in outline form. Line weights also playa most important role in poché. It is good practice to put down a heavy grade line extending well beyond the building to illustrate what happens to the grade outside the building's perimeter. The dark outer line of the building's elevation, which divides the building from its surroundings, is properly just a shade lighter than the grade line.

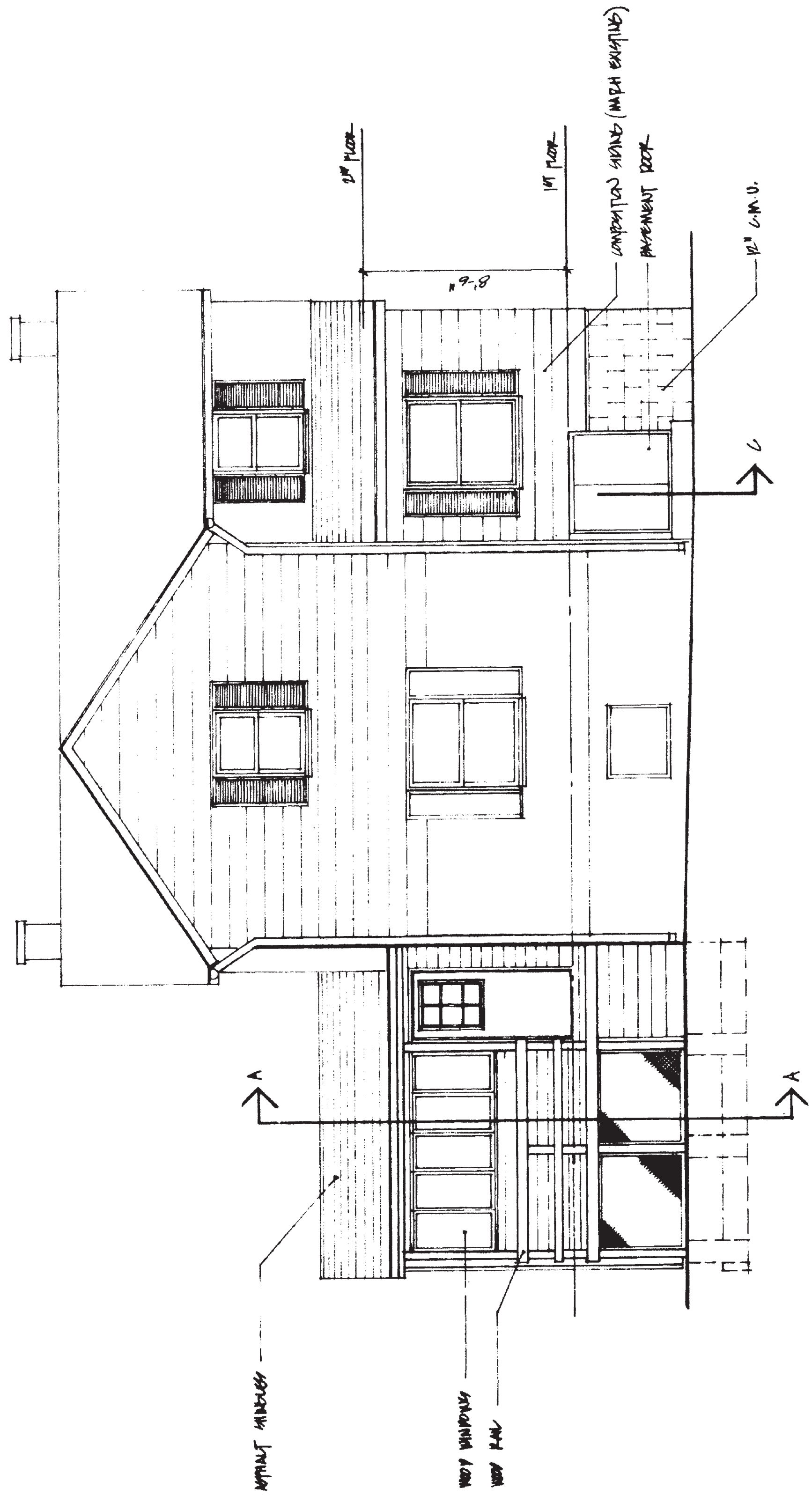
This is the outline of the building from the ground, up the sides, over the roof, and back down the other side; it takes in the eaves or fascia offsets as well as all penthouses. Openings in the walls, particularly masonry walls, should be given a darker tone than the coursing of the masonry. This is not meant to add interest to the drawings but is a matter of emphasis, a means of getting away from monotone drafting. Not many symbols are involved on the elevations, but if the planes and the edges of the building are made to read with high contrast, the drawings can be successful.

Perhaps the easiest way to consider elevations is as drawings that show the work of the rest of the building. Until the workers see the elevations, they will be working with only two dimensions of the building; the elevations give them an exterior view and the third dimension. It is interesting to note the contrast between the rendered elevation and its working drawings and to compare them with photographs of the completed building. This sequence is exactly what the elevations provide; they make the building come alive by bringing it from the design idea to reality.

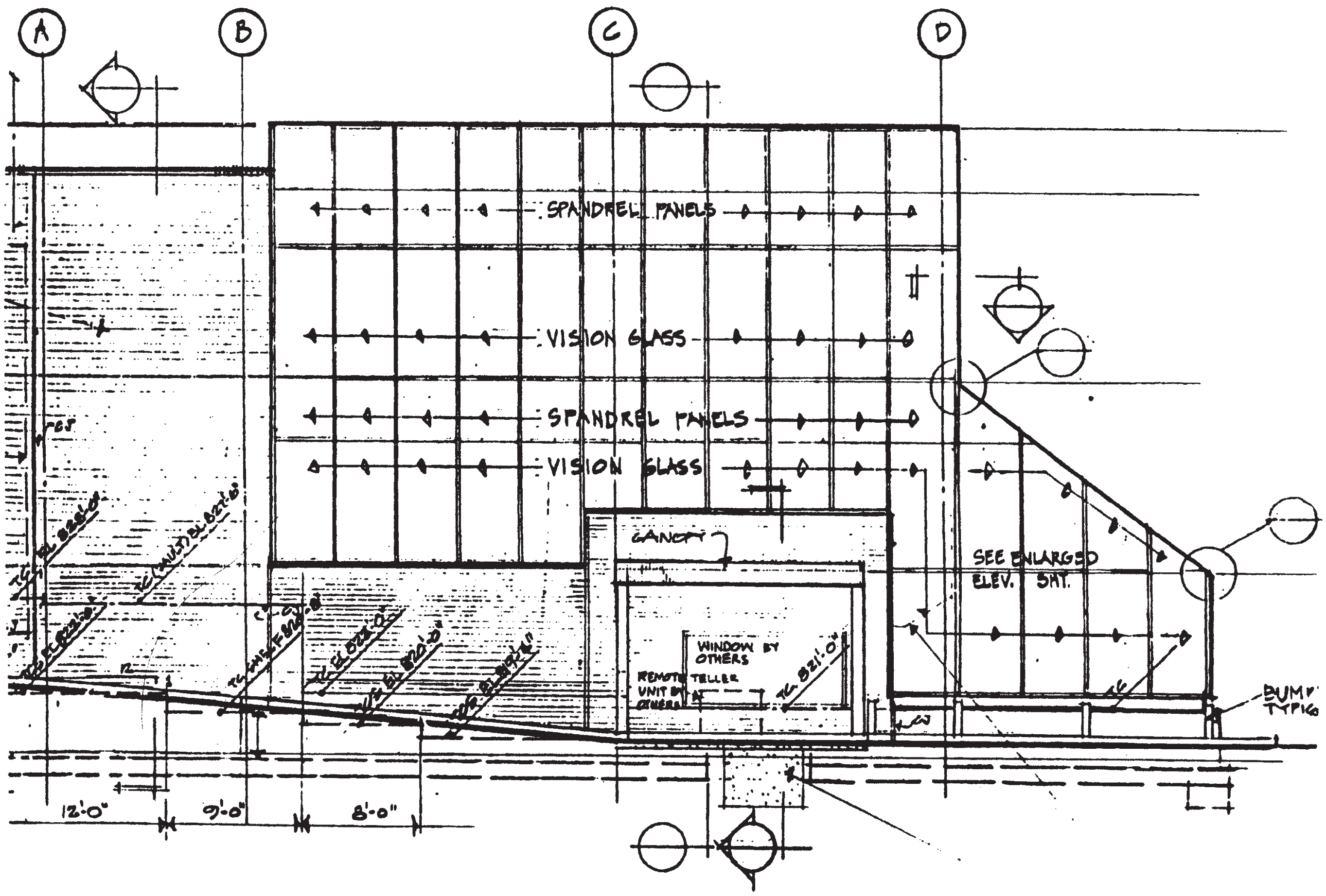


A fairly complex key plan used to show where the numerous building elevations [exterior] occur. Excellent choice to clarify drawings and act as an index. Note, in particular, the number of elevations required to depict the building properly and completely.

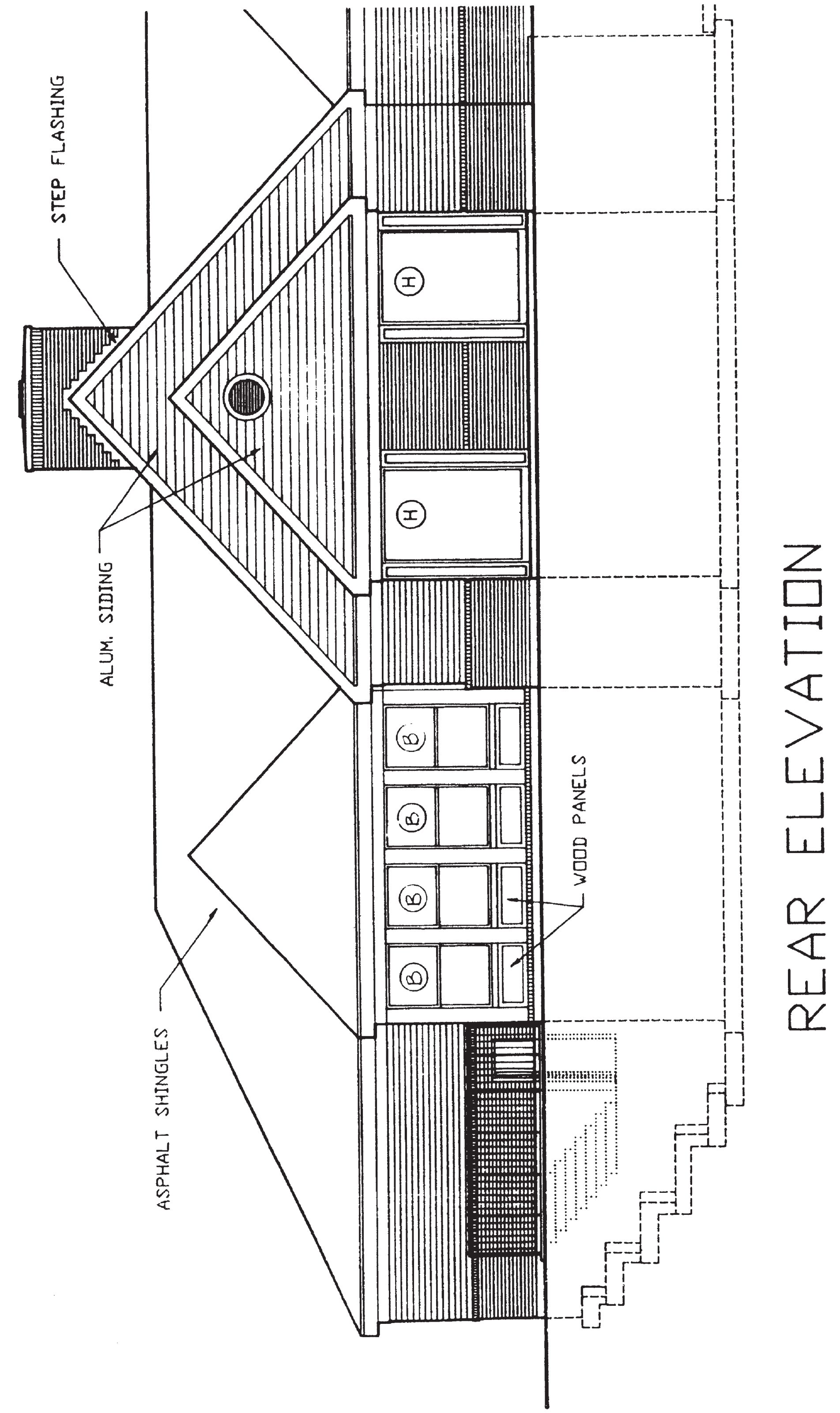
CHECKLIST: EXTERIOR ELEVATIONS
1. Key plan, if necessary, to indicate North arrow and locations.
2. Materials; notes and indications.
3. Show all window and door openings; dimension heights that relate to floor line; type of opening by correct designator: do not draw in every detail of similar openings; operable portions of windows [casement, hopper, or projected].
4. Indicate column lines, floor lines, horizontal brick courses [do not include vertical brick jointing], and grade elevations.
5. Show ladders, louvers, railings, vents, roof slope diagrams, downspouts, boots, access openings, splash blocks, gutters, chimneys, sidewalk levels, curbs, ramps, ridges, eaves, decks, and penthouses; also parapet walls, trenches [to be left open], beams, footings [dotted line below the grade line], finished grade line [heavy line weight] showing the ground adjacent to the building; water outlets [hose bibbs, siamese connections, and fire hydrants], fresh air intakes, meter boxes, section lines [for wall sections], projections or recesses in the building, and raised or sunken areas; panels, pilasters, columns, signs, cornerstones, awnings, electrical fixtures and outlets, dormers, gables, hoods, canopies, balconies, flashing, counterflashing, roof scuttles, roof features [skylights, crosses, ventilators, snow guards, flagpoles], gates, fencing, parking blocks, bumpers at loading docks, clocks, and plaques.
6. Check dimensions thoroughly with plan, finish grade with site plan, details with their reference system, and all similar features of the building; indicate fascia cover spacing and any other special features that must be included.
7. Describe foundation system's isolated footings, stepped footings, and so on.
8. Give dimension spacing for control and expansion joints in all materials requiring it [which can be seen in the elevation].
9. Show the profile of the building; materials that overlap and project beyond wall surfaces; also items above the roof line.
10. Check drawings with all other disciplines for proper coordination as often as possible; prevent errors from reaching the field.



An exterior elevation with the floor levels noted, and the designators showing where a building section is taken through three building. In addition while still incomplete [window and door marks missing, etc.] note the detail in the panels at the lower left.

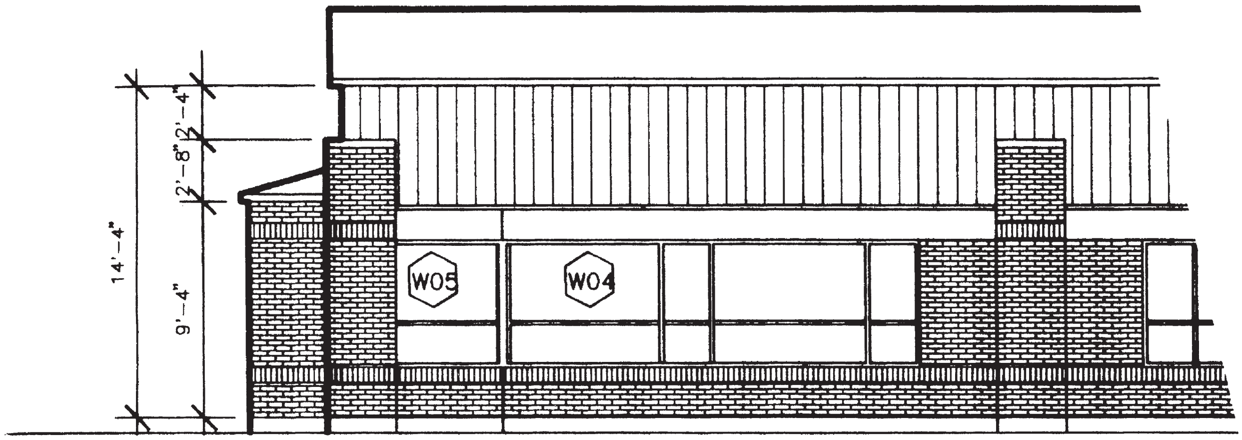


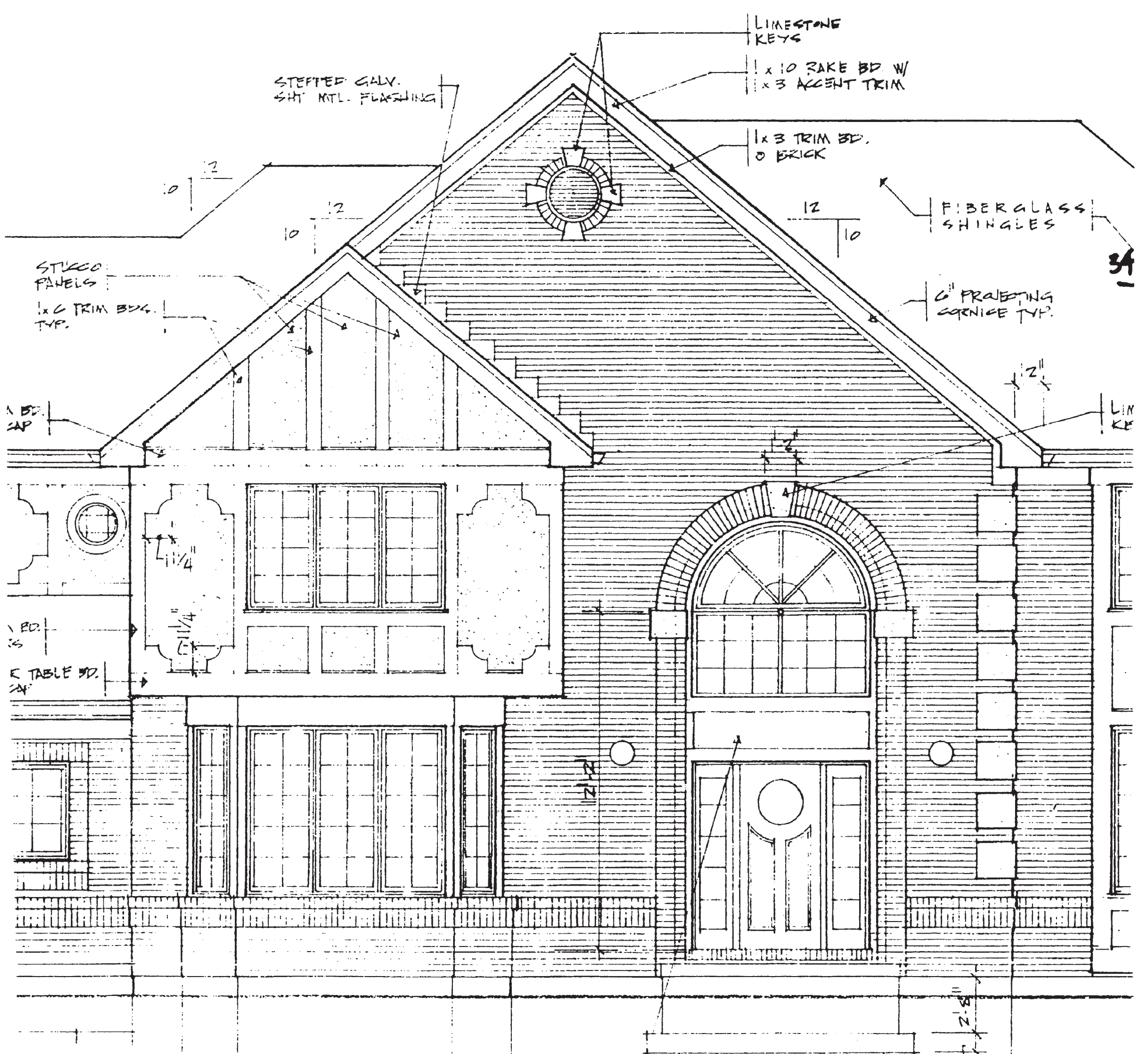
Another elevation in progress. This shows a complex building that has been depicted in a clean, clear manner with some innovations in notation and in carefully planned locations for cross-section markers.

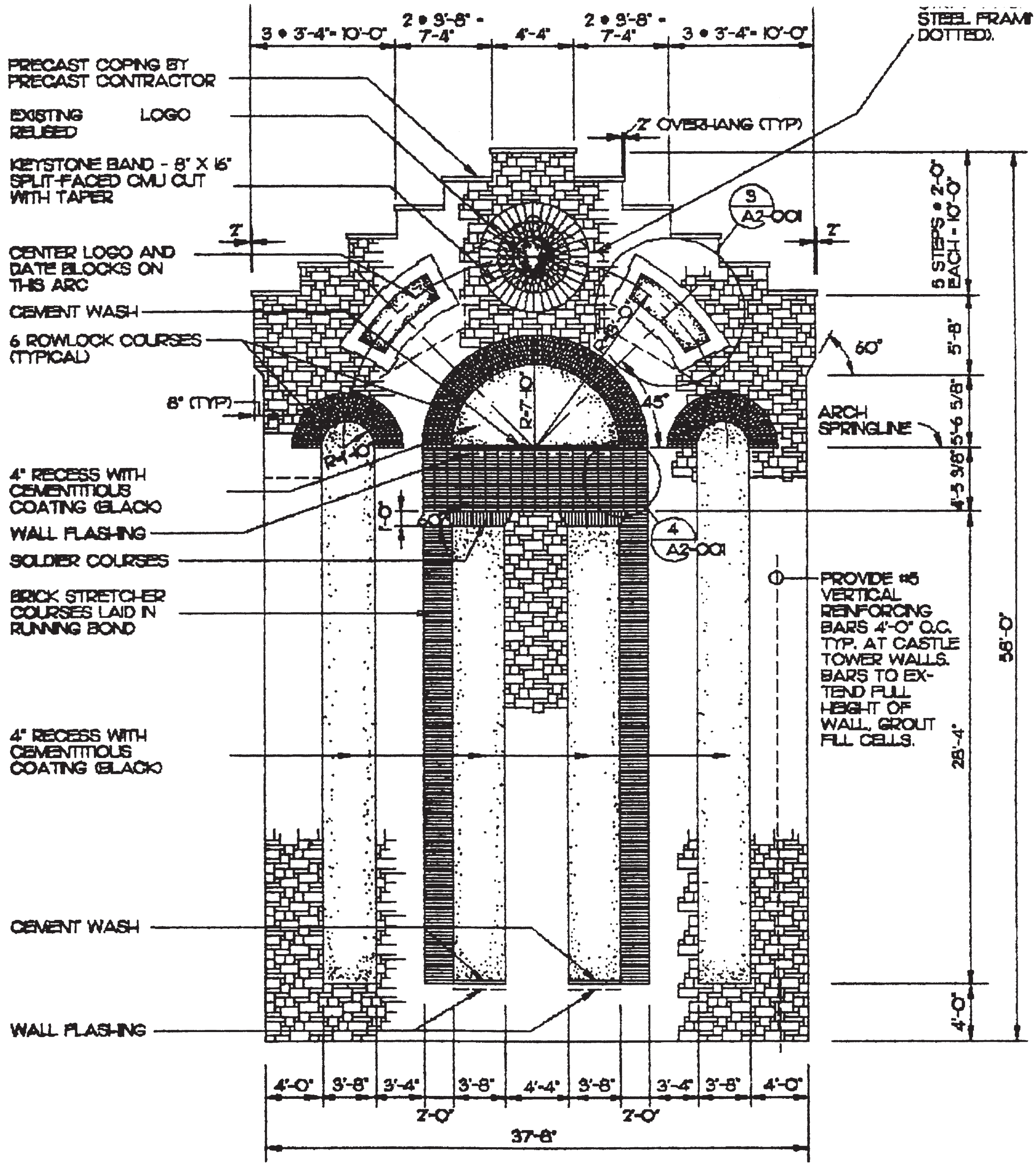


Portion of a CAD-produced elevation with good line weight and overall definition. Note area, at left which has become murky because of the overlay of railing spindles [vertical pieces] that includes too many lines. Varied lettering size is good.

A series of elevations that show varied results. The first is a little too heavy and would improve with more and better line weight variation. The second is a portion of a building elevation used to illustrate the coursing of the stone work, the pattern and other distinctive details to be placed in the wall Unusual, but good example of extent of work often required to fully explain the construction. In the third there is some weak manually drafting and very complex detailing. The last is a CAD drawing that, while fairly clear and clean, does show that there is no need to show every brick and every panel joint to get the required point across.


14'-4"
2'-4"
2'-8"
9'-4"
W05
W04


LIMESTONE KEYS
1 x 10 RAKE BD W/ 1 x 3 ACCENT TRIM
STEPPED GALV. SHT MTL. FLASHING
1x3 TRIM BD. @ BRICK
FIBERGLASS SHINGLES
STUCCO PANELS
1x6 TRIM BDS. TYP.
6" PROJECTING CORNICE TYP.



MASONRY TOWER DETAIL 5 A2-001

SCALE: N.T.S.

INTERIOR ELEVATIONS

Interior elevations are designed to reveal the interior features of a building, particularly the finishes and equipment. They are basic orthographic views of various room walls and are simple drawings meant only to inform bidders and contractors of the finishes, configurations, dimensions, and anything else applicable to these walls.

In an effort to give some instruction regarding every type of drawing that may possibly be utilized in a set of construction contract drawings, training in some academic arenas devotes an excessive amount of time, effort, credence, and emphasis to interior elevations. Often this is carried to the extent that the student thinks that these particular drawings are [1] necessary in every set of drawings and [2] required, no matter how little they contribute to the passage of information regarding the project.

Of course, both of these premises are faulty. First, and perhaps foremost, it must be remembered that the production of a set of architectural working drawings is for the basic purpose of conveying all of the necessary information in the clearest, most complete, and most concise manner possible. There is absolutely no need to provide drawings just for the sake of following tradition, meeting some unnamed requirement, or performing an old academic function – that is, to keep performing a function that aids learning but is not necessarily required to depict a project. Interior elevations are not required in every set of working drawings.

Second, in today's world, where it is increasingly necessary to produce proper working drawings in ever shorter periods of time, needless drawing is counterproductive, even if rapidly produced via computer-aided drafting [CAD]. In addition, where inadequate or contradictory material is included, it only adds to the liability exposure of the design professional. For example, to produce elevations of toilet rooms [a notorious "necessity"] where common, standard, stock-item installations of toilet compartments [partitions] and fixtures are used, is sheer nonsense.

What is there to show, in that instance, that is new and different from the catalog "cuts" of numerous partition manufacturers? The size of the doors, pilasters, and panels, the location of hardware, the spacing and vertical heights-all are standard. In addition, all of this information will be shown on the shop drawings submitted for the specific installation. These are reviewed by the design professional to ensure general compliance with the design concept and the area dimensions shown [field verification by the supplier/contractor]. Unless there is a unique or "new" configuration, the elevations are without rationale.

To carry this further, there may be "unique" toilet room installations and features [layouts, equipment, accessories], that provide some rationale for limited elevations. Often, even these can be eliminated, as the "blown-up" details [sections, perhaps] of the vanitories could be made to show all of the necessary detail and locations. These include, in part, soap dispensers, paper towel dispensers/receptacles, mirrors, hand dryers, and light coves. The locations and mounting heights of other items can be noted on the plan[s] or included in schedules [graphic or written]. Certainly, if there is a unique pattern of decoration ceramic tile pattern on the walls, for example, then the elevation[s] again would prove of value.

The key point a student should learn is that interior elevations should be used where they clarify or provide information not readily available elsewhere. This use, however, must be very judicious. It is a judgment call, which the student professional should be prepared to make or to inquire about. Moreover, there is also an obligation to ensure that these drawings are fully coordinated and cross- referenced with all other components that deal with the same information [in different views, at different scales, etc.].

The number of interior elevations directly reflects the complexity of the job. In the set of working drawings for a modest building project there will be few interior elevations, for only minimal equipment will be required by contract. These elevations are often used to show typical equipment, such as metal toilet partitions, which are standard, stock items; the detailing of these items should be conscientiously avoided.

Because of the many and varied forms of building today, interior elevations are helpful to all concerned. This is especially true when room configurations, the lines of the structure, or the finished elements [walls, ceiling, built-in features] occur at an angle or in some way differ from a flat or perpendicular surface. Such deviations should be included as part of the outline of the interior elevation.

Exploring further, we find that we are concerned with only one wall in each view. The limiting lengths between opposite walls and the floor and ceiling lines are shown. The finished ceiling line is usually shown without duct work or piping above it. The elevations are intended to identify the finishes and equipment, and structural features are omitted. If a beam projects into the room, it is shown only as part of the outline of the elevation.

Interior elevations are drawn at a larger scale than floor plans and exterior elevations. Many of the accessories and items of equipment are small and require the clarification provided by a larger scale. Although some offices draw these elevations at ¼″ = 1′-0″, ½″ = 1′-0″ is preferable. At this scale, such items as mirrors, paper towel dispensers, and wall containers may be located and dimensioned in proper relation.

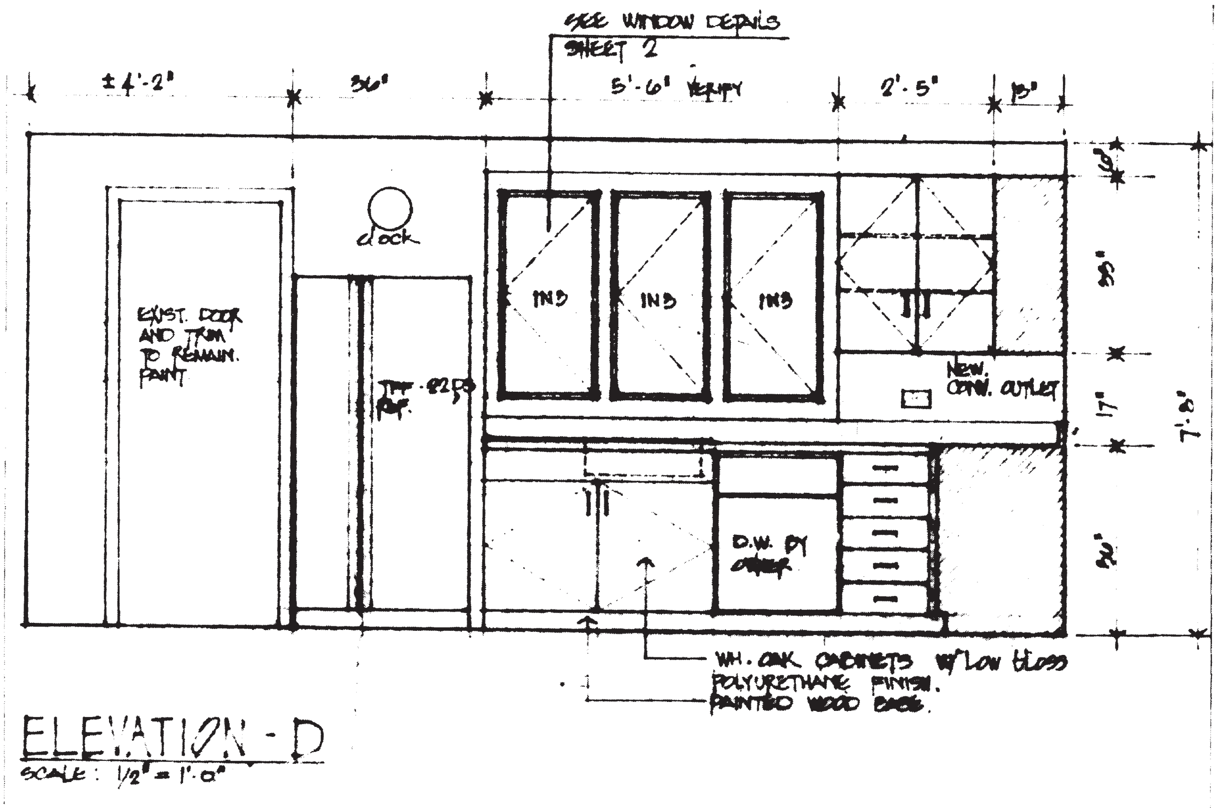
The symbology used on these elevations is, of course, similar to that of the exterior elevations. If tile work or a distinct masonry bond is used, it is reflected in these drawings, as are all windows and doors. Any built-in or freestanding equipment is located on the elevations with names, designators, or model numbers that apply. Door swings, hardware, shelving, and cabinetry are indicated. The examples show how the profiles of cabinetwork appear in the drawings.

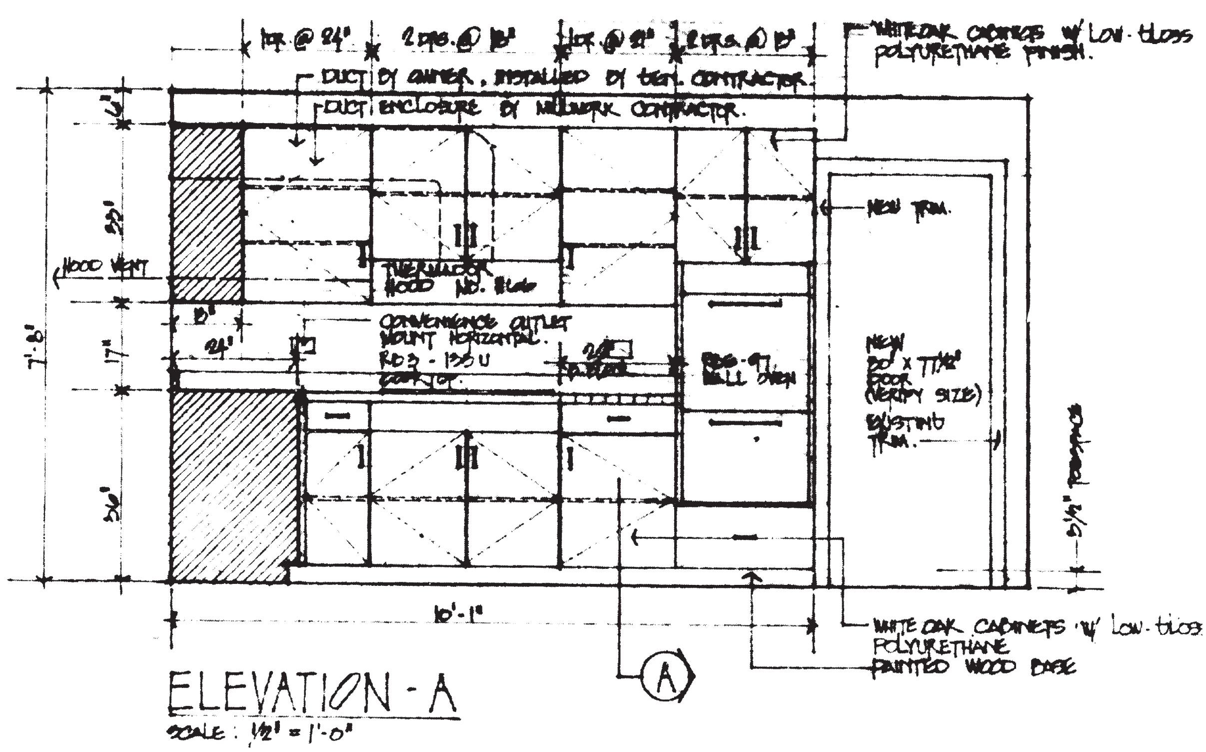
These elevations delineate many small details and specific areas of the building. After vertical dimensioning, horizontal dimensioning and the notes that describe the finishes are added as needed. It is important to show all supply grilles, wall-mounted light fixtures, or other mechanical features in their proper location.

In some instances the elevations become complicated when elaborate cabinetwork or equipment is shown. Their function, however, is to make it clear to the contractor and to provide a basis for other detailing on a larger scale. The details are "flagged" by whatever type of symbology is standard procedure. Notation should be extensive only to the point of including all appropriate features. All moldings or other trim should be located correctly.

The interior elevations, as drawings, are somewhat decorative. Although nothing in the way of color is used, the drawings can be applied to color planning and location later in the project. The drawings are not intended to be illustrations; they are bona fide working drawings and should be presented as such. The information they contain is important, depending again on how complex the area is in regard to cabinetwork and equipment. The interior elevations are often used in conjunction with large equipment plans. They can also be directly beneficial to the interior decorator or architect in the selection of wall coverings, finishes, and color schemes. The interior elevations are an essential part of the complete package of drawings. Their primary purpose is to show all items too small to be entered on the floor plans, but they are also a bridge between the actual construction of the building and its decoration.

CHECKLIST: INTERIOR ELEVATIONS
1. Items of concrete and masonry; height and width of bases, sleepers, facings; mat recesses in slab size, depth, and edge strips; all exposed construction with correct profiles referenced to floor and column lines and other major features.
2. Wood and millwork; except when stock items are used, the following should be fully detailed: cabinets, countertops, doors, drawers, shelving, chalkboards [complete with tray, tack strips, map hooks], display cases, lockers, recesses for telephones, wardrobes, and all items of trim.
3. Metal catwalks, ladders, handrails, nosings, pass windows, shutters [rolling].





Interior elevations of a kitchen remodeling. Note cabinet door swings, and electrical outlets shown. Good level of detail shown without overwhelming the drawing and confusing the requirements.

CROSS REFERENCING

All information on a set of working drawings becomes valueless if it is not properly coordinated and cross-referenced. This system is time-consuming but necessary to the success of the project. A great number of definitions, neither in alphabetical order nor cross-referenced, would be useless in a dictionary. To find a definition would be nearly impossible, as impossible as the proverbial needle in a haystack.

On architectural working drawings a totally coordinated and complete system of cross-referencing begins on the individual sheet layout. Every working drawing set contains any number of sheets, depending on the complexity of the job, each of which should have individual identification, commonly known as the sheet number. Every office has its own system of numbering, beginning with the simple numerical. Some offices separate the drawings into categories: architectural sheets are prefaced with an A, mechanical sheets with an M, electrical sheets with an E, and so on, through the various divisions of work. This system of identification speeds up the location of information; it is helpful in searching through the drawings to find a particular category.

Many offices with more complex projects use a series of catalog, or category, numbers: one series of drawings will be strictly site plans, details, and related site work; the second series will be floor plans for all levels of the building; the third will contain the elevations and building sections; the fourth will be wall sections and details; the fifth will be stair drawings; the sixth, the interior layouts, reflected ceiling plans, and similar drawings; the seventh, interior details. Categories may be omitted; for instance, the next category may be the tenth, which will contain the structural drawings; the eleventh, the mechanical; and twelfth, the electrical drawings. The unused categories may be filled later, if required. Any logical sequence can be set up; there is no formal format.

A system may be set up by which the drawings are cataloged according to the Construction Specifications Institute [CSI] format of 50 divisions. Some divisions can be aligned; for example, Division 26, Electrical, would be given category 26 on the drawings, and Division 12, which is furnishings, would include all movable furniture in the building. Many of the other categories, however, become too complex; the divisions cover material that will be used in a number of areas around the building and involve many different trades.

In any numbering system it is important that the number be permanently affixed, in bold characters, in a prominent position on the sheet. More and more offices are going to one of two formats for sheet layout: a vertical title block along the right-hand margin or a horizontal title block along the bottom edge. In both cases the sheet number appears in the lower right-hand corner. In this position the number can be readily located. These two formats, incidentally, allow a clear rectilinear area on the sheet into which the individual drawings can be fitted. In days gone by a small title block, perhaps 4 or 5 x 6 inches, placed in the lower right-hand corner, always left a rather oddly shaped drafting area. It sometimes seemed that the draftsman had cut off the drawing to accommodate the title.

Once the sheet numbering system has been established, it is easy to begin the cross-referencing system. One simple method keeps a running account of detail numbers for each job. Each drawing is given a number in sequence as it is drawn. It may be that a particular drawing will not appear among the final working drawings, having been voided during the drawing sequence or changed or combined with others. All numbers need not appear as long as those that do are consecutive. In this way a detail drawing has an individual identity from the outset. This system also obviates the use of long, elaborate titles for each detail.

Tying the information together now commences. The sequence can be simplified as the building is simplified. On a residence drawing there may be one typical wall section and perhaps one or two other partial sections, which can be simply designated [e.g., A, B, C,]. Obviously, only one or perhaps two sheets are required for these sections; they, in turn, can be easily cross-referenced by note. When the building becomes complex, it is a much better idea to combine the section or detail number with the sheet designation, preferably the sheet number on which the detail appears; for example, we may have detail No. 6 located on sheet No. AIO [see page 372]. The designator is then the title of that particular detail/section when referenced on the drawings. A similar designator is used on sheet No. A14 where the No. 6 detail is applied to the work for a simple, full, direct cross reference for users.

Some offices argue that this system has one distinct disadvantage. A section of interest may be found that is not referenced to the sheet from which it was taken. This valid criticism has given rise to a system of section markers to denote the name or number of the section, the sheet from which it is taken or cut, and the sheet on which it appears. This system requires more elaborate designators but eliminates the gap in the information. More care must be taken to make sure that the complete designator is always used. Again, there is no standard system.

Designators may be any shape; a simple arrow, a filled-in arrow, an arrow and circle combination, a simple circle, an ellipse, a hexagon, a segmented circle, or a double underscore. It is most important that the designator appear on the plan or elevation at the spot where the section is cut. Proper reference must be given to its location on a particular drawing of the set. The system can be modified by adding titles or informative notes near the section designators.

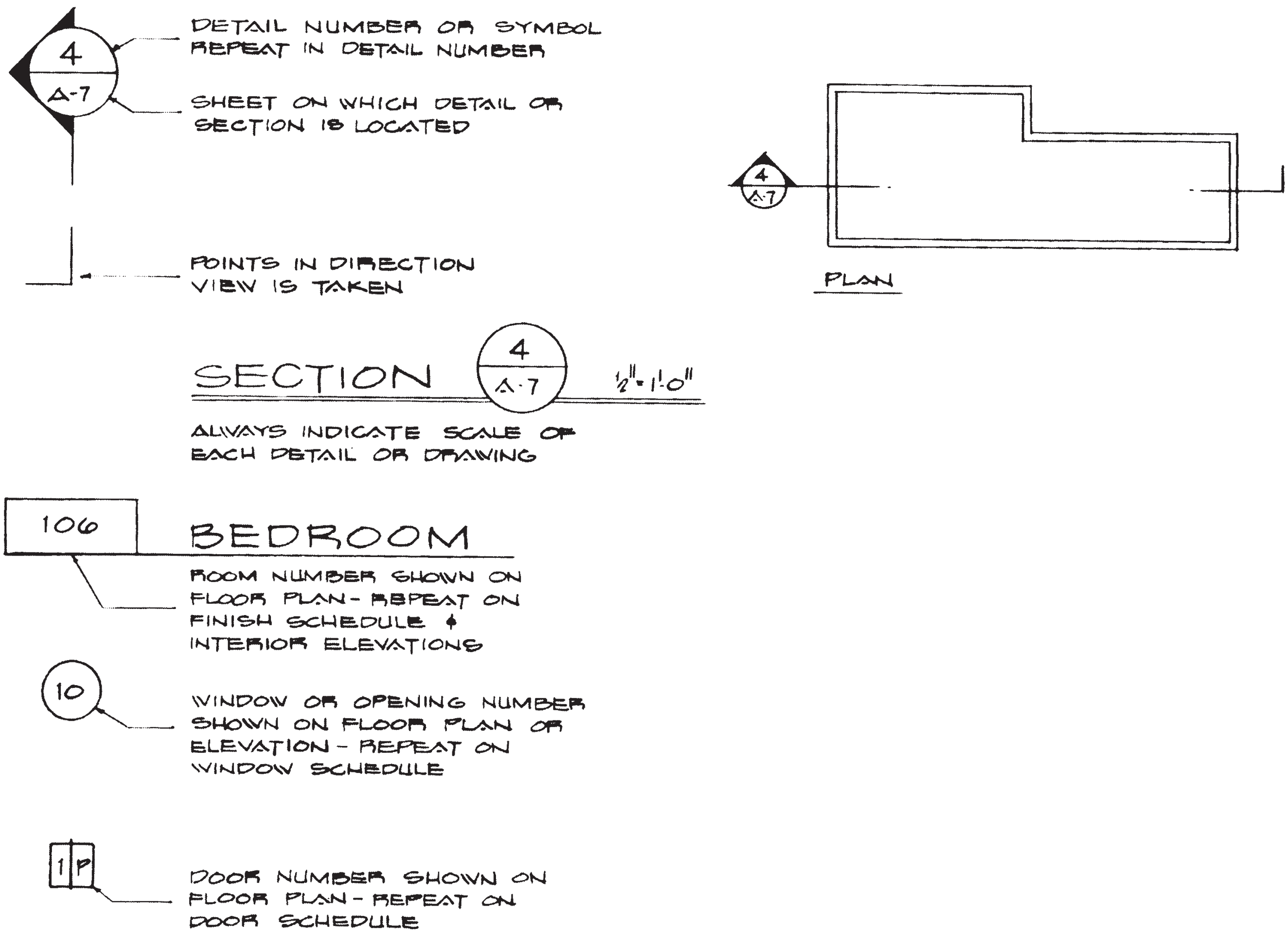
The system chosen should be straightforward; there should be no possibility of confusion. Experience will show that some systems work better than others, and nothing short of trial and error can teach this lesson. The foregoing is a catalog of ideas to be adapted as necessary.

Many coordinating systems have been tried. Some offices bind the structural foundation drawings in the set immediately after the site plan. The latter is used for excavation and grading. Foundation drawings are followed by the architectural drawings that approximate the sequence in which the building will be constructed. When the floor plan is inserted, it should be followed by the roof plan, with the roof framing plan [another structural drawing] in between. The appropriate mechanical drawings should directly follow the architectural drawings. This system does tend to confuse, however, for various divisions of labor are scattered throughout the set. Unless there is a consistent policy of tight coordination, it does not work well.

The most conventional system depends on no particular sheet numbering or category. In other words, any set of categories can be used. The site drawings are normally placed first and are followed by the architectural and structural drawings. Plumbing, heating, ventilating, and air conditioning, and electrical drawings are next. The title sheet should carry the name of the project, all symbols used, and the legends of the designators. General information about the project, its location [perhaps by vicinity plan], and the technical data for office filing and client's identification should be included. Some projects demand other drawings, for example, for special piping, fire protection, or sprinkler systems, which should be placed in the category with which they are most closely associated. The title block will show the title and location of the project, the names of the architect, structural engineer, and consulting engineers, the names and addresses of their firms, and the name of the construction manager if one is employed. It also has space for a list of revisions. Drawings are often reissued over a period of time, and the dates on which they are reissued or completed are important, for they may be the deciding factor in any subsequent court action. Scales used can be listed in, or near, the title block; required licensing seals [those of the architect and engineers], with accompanying registration numbers, and the sheet title all must appear in the title block. In addition, the telephone number of the architectural office and the name of the owner of the project should be clearly stated on each sheet. This is mandatory for individual distribution.

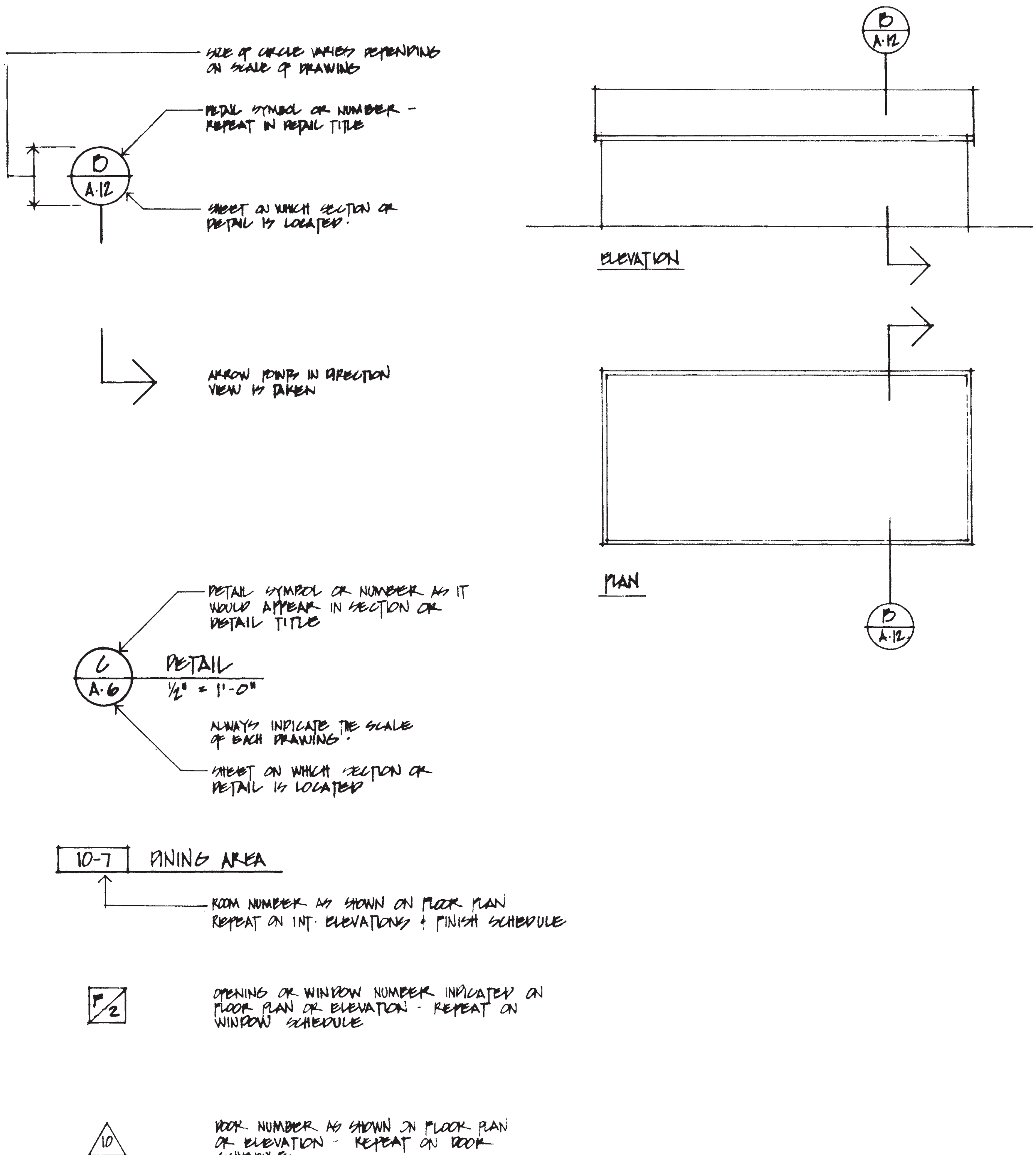
Most offices have established this method of communicating a project's essential data. One system mentioned earlier in the chapter, that of categories, allows the insertion of extra sheets without drastic interference in the numbering system. The decimal system [l.1, 1.2, 1.3, etc.] is a good choice. Another sheet can always be added at the end of the category simply by employing the next number. The category number is to the left of the decimal. If an added sheet logically fits between 3 and 4 in the consecutive numbering system, it must be given the label 3-A or some other means of identification must be introduced.

It can be seen that even this coordination of drawings should be kept simple, direct, and unconfused.

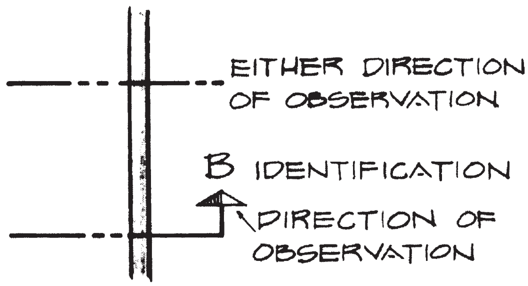


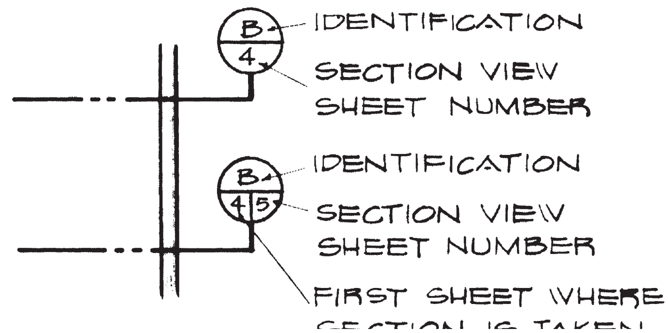
(A)

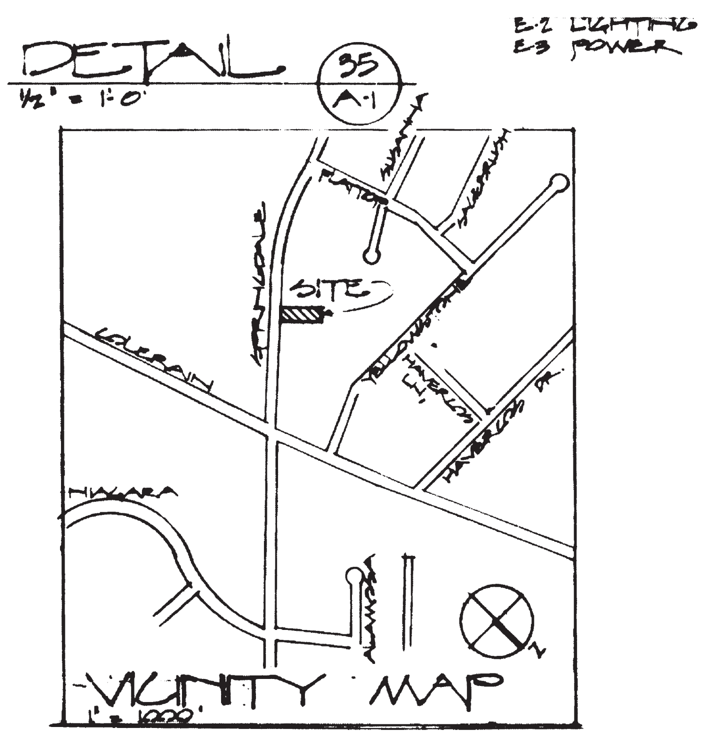
A series of markers or designators dealing with various types of section, along with other notations. Also, shows their use and locations on plan views. These may vary with the standards set by individual offices.


SIZE OF CIRCLE VARIES DEPENDING ON SCALE OF DRAWING
DETAIL SYMBOL OR NUMBER - REPEAT IN DETAIL TITLE
D
A·12
SHEET ON WHICH SECTION OR DETAIL IS LOCATED.
ARROW POINTS IN DIRECTION VIEW IS TAKEN
B
A·12
ELEVATION
PLAN
B
A·12
DETAIL SYMBOL OR NUMBER AS IT WOULD APPEAR IN SECTION OR DETAIL TITLE
C
A·6
DETAIL
1/2" = 1'-0"
ALWAYS INDICATE THE SCALE OF EACH DRAWING.
SHEET ON WHICH SECTION OR DETAIL IS LOCATED
10-7
DINING AREA
ROOM NUMBER AS SHOWN ON FLOOR PLAN REPEAT ON INT. ELEVATIONS & FINISH SCHEDULE
F/2
OPENING OR WINDOW NUMBER INDICATED ON FLOOR PLAN OR ELEVATION - REPEAT ON WINDOW SCHEDULE
10
DOOR NUMBER AS SHOWN ON FLOOR PLAN OR ELEVATION - REPEAT ON DOOR SCHEDULE

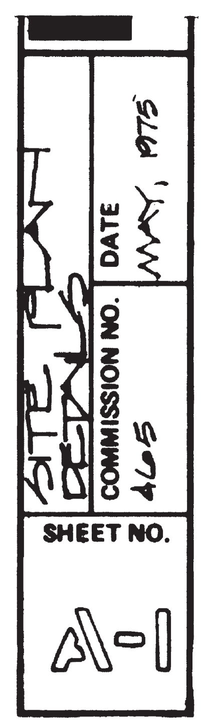
(B)

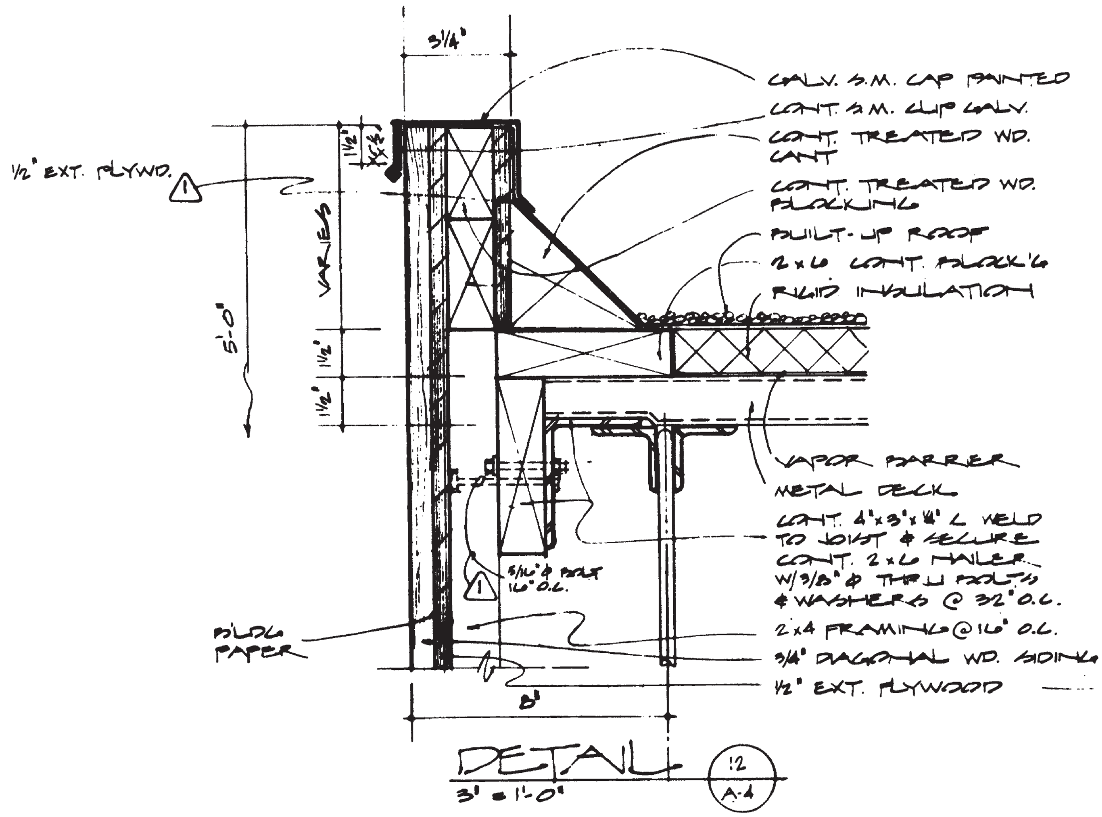

EITHER DIRECTION
OF OBSERVATION
B IDENTIFICATION
DIRECTION OF
OBSERVATION


B
4
IDENTIFICATION
SECTION VIEW
SHEET NUMBER
B
4 5
IDENTIFICATION
SECTION VIEW
SHEET NUMBER
FIRST SHEET WHERE

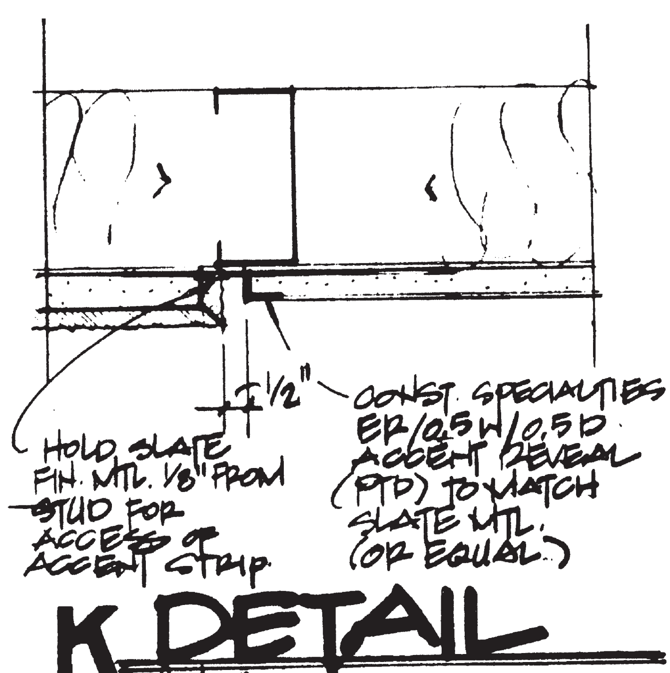

DETAIL
35
A-1
SITE
VICINITY MAP


STATE OF OHIO
2119-2217
REGISTERED ARCHITECTS

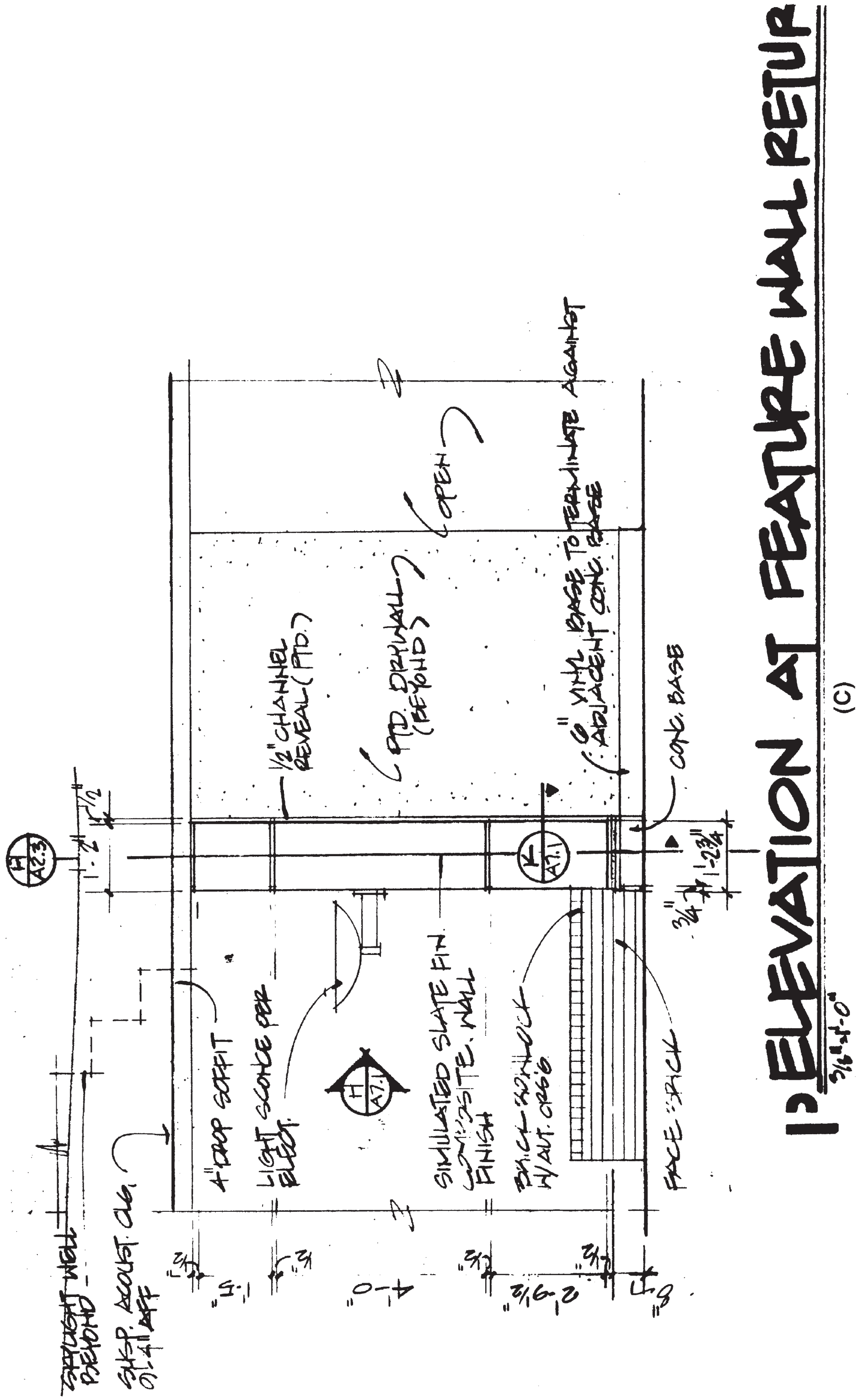

DATE
MAY, 1975
COMMISSION NO.
465
SHEET NO.
A-1



Example of a drawing revised or modified after initial issue [see small numbered triangles that point to the changes made. This system s important to job control so all parties have access to and understand what, exactly—is required and nothing is left to chance.



(D)



Elevation of a decorative interior wall Note the designator for the detail K on sheet A7.1 – and the detail [lower illustration on left side] shown in isolated and expanded scale to show the work involved.

WALL SELECTIONS

As noted before, floor plans contain a wealth of information usable by all trades engaged in any building project. These plans show the position and construction of all walls and partitions. However, because the scale of the plan is small, wall construction details cannot be shown. It is important, therefore, that even the simplest project contain at least one drawing known as the "wall section."

The wall section is a vertical cut through and perpendicular to the outer face of the exterior wall. It need not be extensive; detailed information about the inside of the building is not necessary in this drawing. The wall section is aimed at detailing the construction of the wall itself. It is vital that it appear in every set of drawings, even those of a modest residence, to illustrate the joining together of the various parts. Items as minute as a guttering system, downspouts, moldings, vents, and small nailers or blocking required in the construction are shown.

Different offices approach wall section drawings in different ways. The more conventional method is a large-scale drawing, perhaps as large as 1½″ = 1′-0″. In some offices the section may be produced at ¾″ = 1′-0″, or slightly smaller, accompanied by a series of large-scale details taken from the section. Neither system can be faulted, because large-scale drawings are presented in both. The choice rests with the degree of complexity of the building and how thoroughly the construction information should be conveyed.

The advantage gained from wall section drawings is twofold: exact construction details are clearly illustrated and large details need not be repeated. If a concrete warehouse is being detailed, it is unnecessary to show the entire 20-foot concrete-block wall. Of course, it is essential to show its intersection with the roof, floor slab, and foundation and those systems that depend on it. In the total vertical rise of the wall there may be as many as 10 or 12 feet that are nothing more than block laid on block, the drawing of which adds no information for the contractor. Many offices, with the assistance of a pair of break lines, eliminate this section of the wall and provide a system of details properly aligned with one another to serve instead. In this simple warehouse example we have a detail that shows the footing and foundation complex, another at the sill [or where the floor, the top of the foundation, and the wall intersect], and still another at the cornice where the roof system and wall intersect. Vertical alignment is mandatory in these drawings. Just how a particular material is carried from the sill to the underside of the roof system should be instantly apparent. Correct drafting and material indications denote the simplicity of the construction. In more complicated work it becomes a matter of showing the details involved. A high-rise building, which frequently has multiple basements, is a good example. The basement walls may vary in detail; therefore, whenever a variance occurs it should be shown on the wall section. In most high-rise buildings the first, or main, floor is unique in function and construction and proper detailing is a must. The second floor may also be unique as the upper extension of the main entrance, but above it the floors become repetitive. From the second floor upward the wall section may be termed typical and, once properly delineated, may be eliminated from the drawings. The interjection of a typical floor necessitates additional detailing, and so on, until the meeting of the roof system and walls is reached. When many atypical floors are added, the wall section may grow long and complicated and have to be placed sideways on the sheet to be shown in its entirety. For many jobs a sheet 30 or 36 inches wide will suffice; the wall section can be drawn at a large scale, properly aligned, and still fit into this measurement.

When only large details are prepared, there is no question that some continuity is lost. Nevertheless, the project architect may elect to use the large-scale detail system because of its specific design advantages. It is also possible to draw sections at large scale [½″ or ¾″ = 1/′-0″] to show the wall sections. These sections, in turn, act as an index for the large-scale drawings mentioned earlier. So we have still another system. The building section introduces a new element into the system of drawings, as we show in Chapter 26.

It is possible to build a simple structure with one wall section, for the construction is the same throughout the building. However, this is often neither true nor desirable. Again, experience must dictate the number of wall sections and where and why they are to be cut. Yet too many sections should not be cut, and special attention should be given to ensure against repetitive drawing and garbled information and to reduce the opportunity for error.

The first wall section in any project should be labeled "typical" to indicate that it appears frequently and is the most common to the building. Once this has been established, there is a norm of construction and we can begin to evaluate the necessity for other details and wall sections by variance from it. In the example it can be seen that the high element of the building, a simple block shape, has one detail-one wall section used exclusively in its construction. The low element of the building has two distinct systems; one-is the curtain wall [panel wall] and the other, stone veneer. The criterion for wall sections is clean-cut. Each type of construction should be detailed in a wall section. As seen in other views, the typical section appears in the main building block on all four sides; the other wall sections do not apply so extensively. The decision to draw a detail rather than a wall section is governed by whether a one-time or limited area [detail] or a condition that occurs frequently and over a large area [wall section] is to be shown. The difference between the detail and wall section is not serious, but we usually try to main the separation between them.

In the wall section any material that is cut should be strongly outlined to indicate a cut section. Proper architectural symbols should be drawn in the cut areas. Notice that in wood framing a stud with sheathing on one side and wall finish on the other will have a strong black line around it. The stud is not cut, however; it is shown in elevation as the section is cut between the studs. The top plates are cut because they run horizontally. Joists and rafters are seen in elevation and only one in each case is shown. Most of the materials, which are continuous along the wall rather than intermittent [e.g., the framing members], are cut. To produce readable, concise drawings we must identify the materials with correct architectural designations. If the symbols are inconsistent or indistinct, the section will be worthless. We must be able to recognize a particular molding as finished wood as opposed to wall sheathing, which may be a plywood panel. It is equally important to identify metal items, such as flashing, gutters, and other thin materials, by a heavy black line. Structural members of varying size must be shown, the larger with the standard steel symbol and the smaller members blackened.
Careful drawing guarantees the demanded elements of construction. Nothing should be left to the whim of the contractor. All parts should be studied and put together as the design dictates. All items, even of a minor nature, should be considered carefully. A piece of blocking may be required to attach a cabinet to a wall. If it is required, show it! In brick veneer the top of the brickwork, under the soffit, must be closed. How is this to be done: with a simple molding or with a supplemental trim board?

Brick coursing should be indicated on the wall section. How many courses of brick are to be laid from the top of the foundation wall to the underside of the soffit and the top of the brick-work should be indicated accurately. We state unequivocally the number of courses required and the point at which the brickwork ceases.

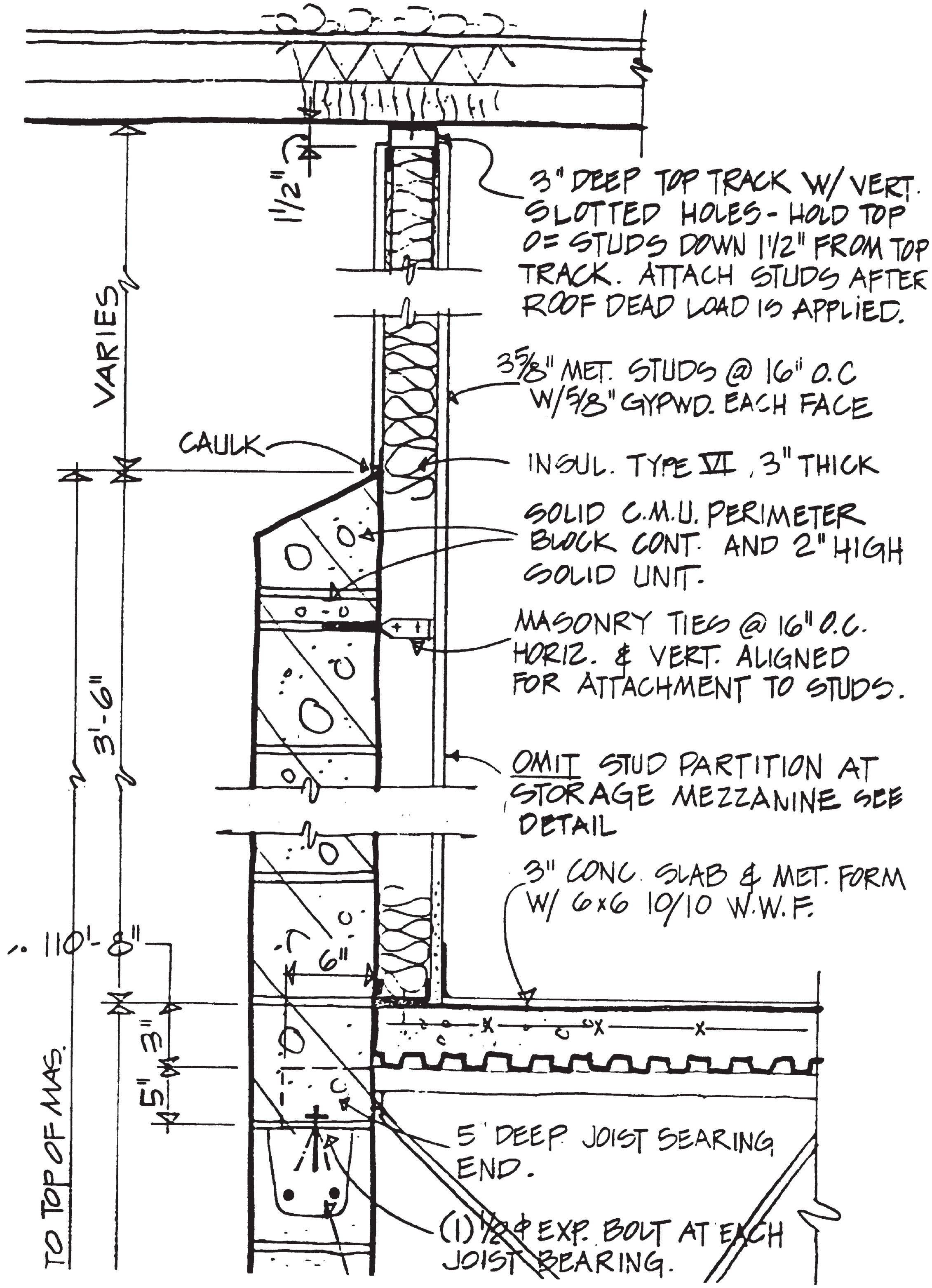
CHECKLIST: WALL SECTIONS
1. Show all materials in their proper location and thickness, all "cut" material strongly outlined.
2. Indicate proper symbology for all materials; standard or noted symbols; symbols must be clear even at small scale.
3. Identify all materials and use proper notes and no specification wording; use the same terminology as the specifications for each item.
4. Fully dimension sections vertically and horizon tally; use complete dimensions from bottom of footing to top of section; dimension to easily recognized locations [top of masonry, etc.].
5. Coordinate section with column lines or building lines whenever possible.
6. Use a scale adequate to provide the information required; a small scale can destroy communication.
7. If one section is similar to another, with only slight changes, do not redraw the entire section; use a similar outline, add the new features, and refer by note to the other section.
8. Tie the section in to the cross-reference system by number or designator; use descriptive titles when necessary.

Although it is not necessary to illustrate how the pieces are nailed together and with how many nails [this is usually a specification item, and a widely used workbook, Manual for House Framing, Nailing Schedule, is specified], the inclusion of extraordinary construction may require this intricate detailing. In general we rely on contractors to provide substantial construction, properly nailed, for they are familiar with the technique of nailing and the types and sizes of nails. Again, however, the design professional is responsible for the design concept; how do we want the building put together? Often, sitting in the office, we can think of methods that may or may not work well and may have to be modified in the field.

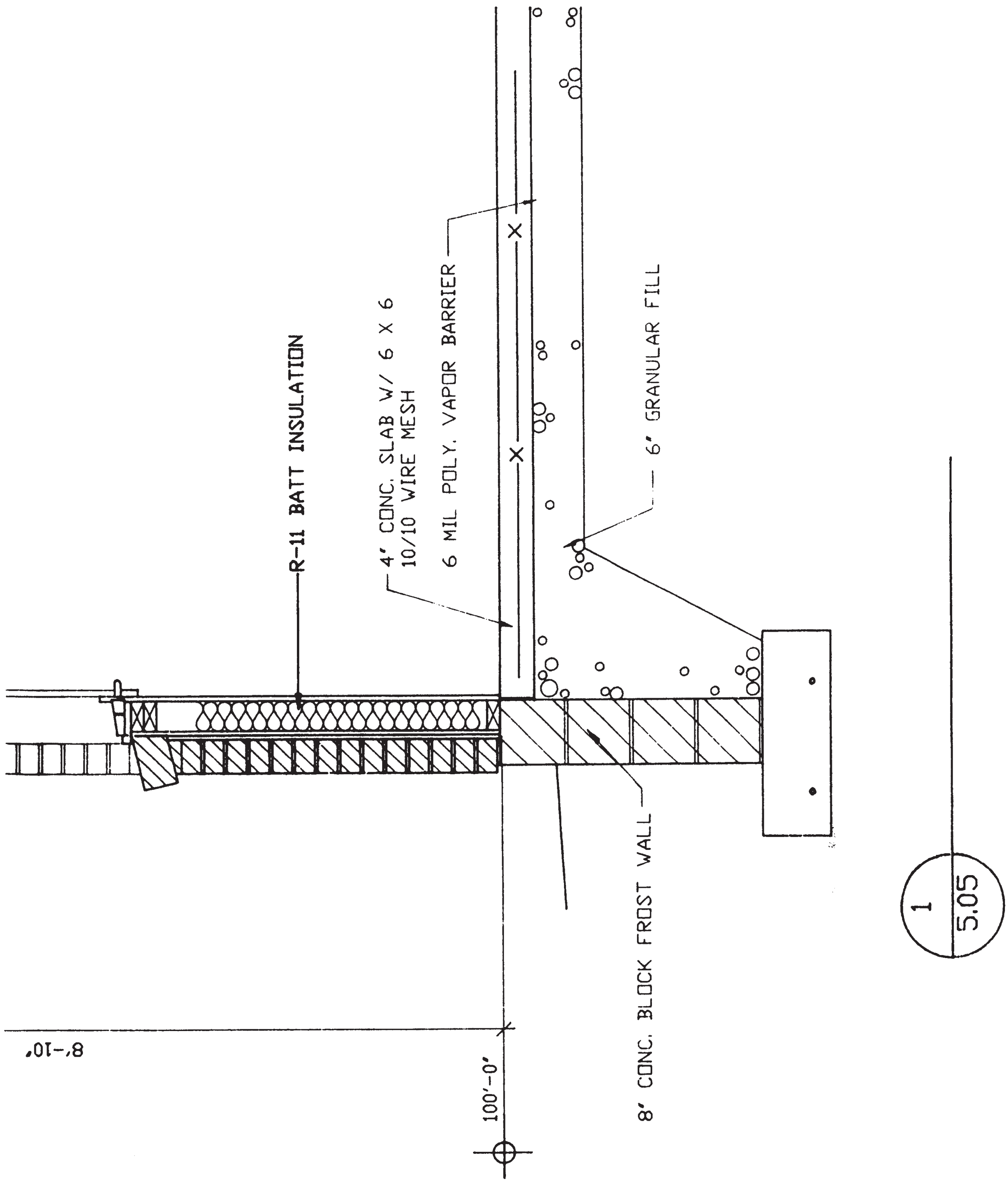
There should be no reluctance to put down any system of construction that is workable. No one can be entirely familiar with all materials or the requirements for their connection, but we can offer suggestions that, to the best of our knowledge, will work.

When we need break lines we must remember to place them in pairs to indicate that the wall section has been broken and that part of it has been removed. The break lines should fall at intervals along the height of the wall where no important detail occurs and no construction of substance will be obscured. In the wall section we must become intimately aware of the "nuts and bolts." In fact, we are concerned with showing reinforcing bars, anchor bolts, and items of small size and minute detail that must appear in order to meet the requirements of the job. We must ensure that they are not obscured or deleted.

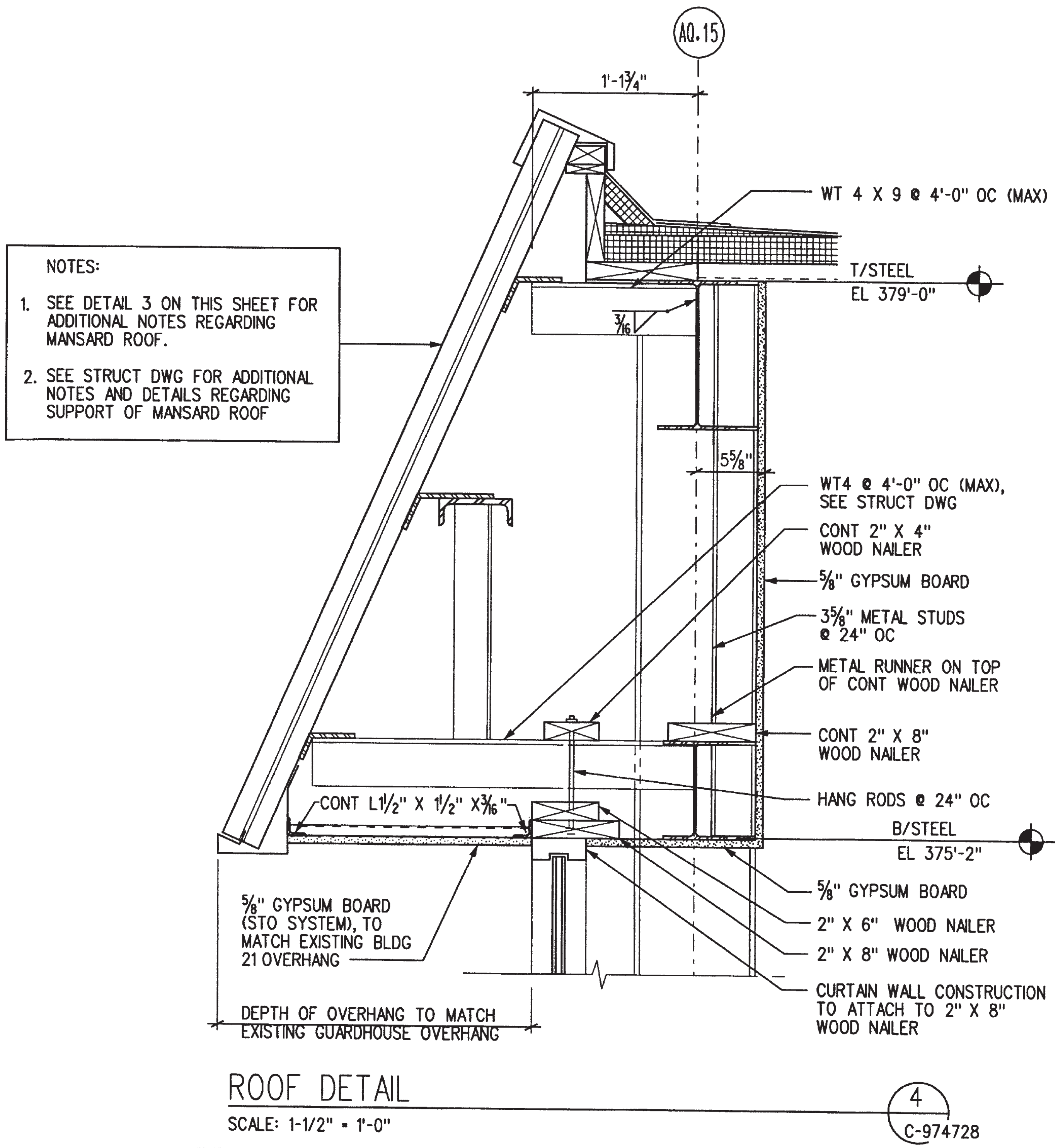
As already stated, notations on wall sections should be entered on the drawings in a clear and concise manner, properly placed and marked by accurate leader lines. The wall section should be dimensioned vertically and horizontally to give the exact requirements of the particular construction. Wall sections should be titled individually for clear differentiation. In cross-referencing, the wall sections must be shown on the exterior elevations with some type of unique flag or indicator. The plans will show us the configuration and extent of the building; the elevations will show us how the outside face of the building will appear. The wall sections are a vital part of the construction information because they show us what the wall is made of and how the various pieces and parts are put together.



Example of complex and elaborate wall section executed in freehand style.
Sometimes used, this is also the type of sketch given over to CAD operator for incorporation into the drawings via CAD.



Good example of a simple CAD wall section.
Good line work and weight varied to separate materials for easier reading.
Lettering also varied to suitable size.



The top portion of the section "blown up" to larger scale to better show and explain the required construction.

BUILDING SECTIONS AND SECTION-ELEVATIONS

It is true that between the floor plans and the exterior elevations we are able to acquire full comprehension of a building project. The floor plan is a horizontally cut section that provides us with a layout of the rooms and the openings into them. The elevations show us the floor-to-floor heights in their correct dimensions, but these floors are revealed to us only in the form of a single line on the elevations, and we are unable to recognize the full complexity of the building construction. In an effort to provide the contractors with more exact information and to explain the construction to them fully, the architect will provide sections cut vertically through the entire building. These sections generally fall into two classifications: longitudinal, on the long axis of the building, and cross or traverse sections across its narrower dimension. The indicators for these sections are applied to the floor plan sheet and properly cross-referenced. The sections go through the building from left to right to the exterior walls on either side, to the bottom-most part of the basement or foundation system, and to the top of the roof.

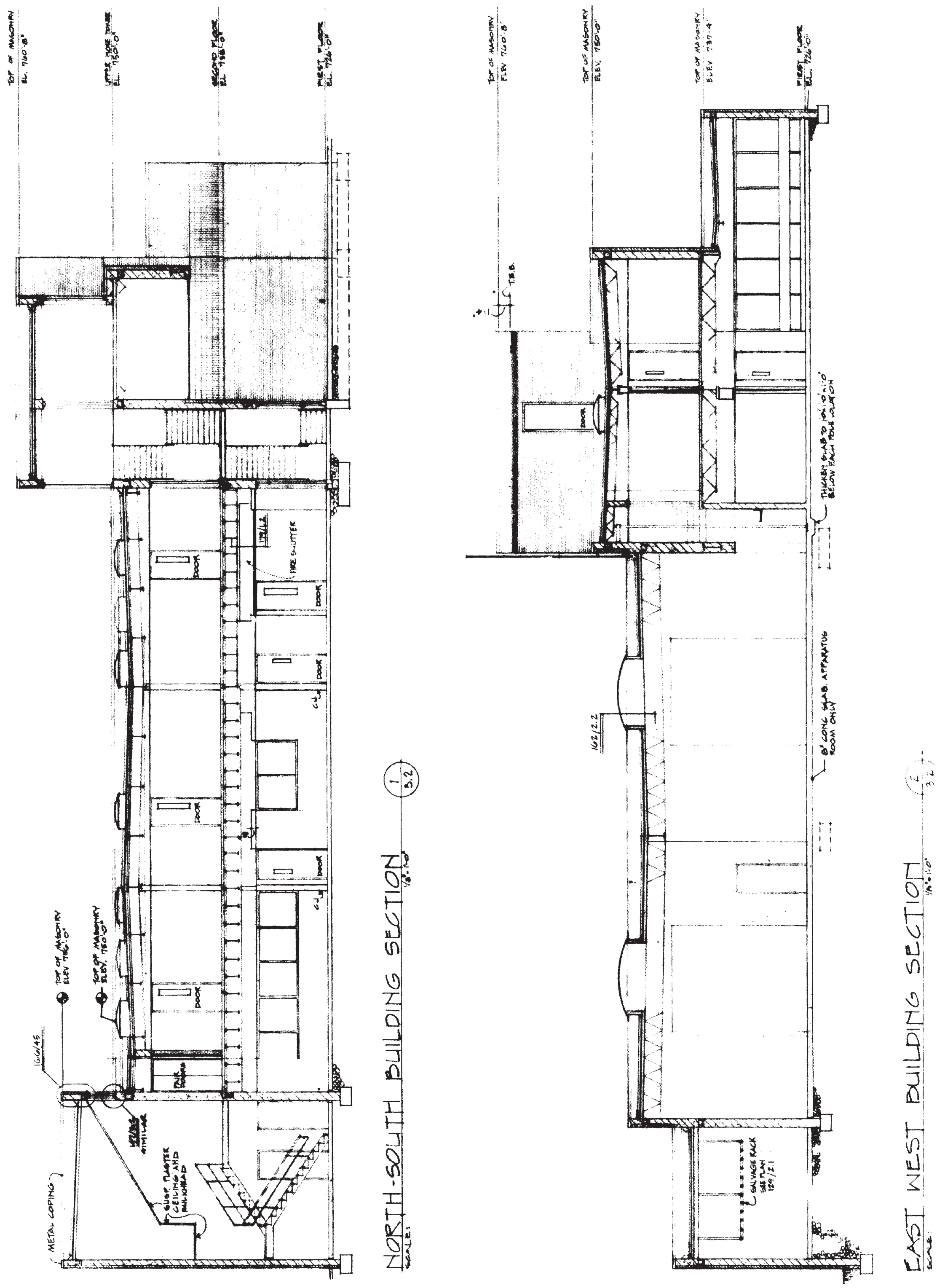
The section line need not be entirely straight; we can sometimes indicate an offset if we want to show a particular feature or other conditions at another location in the building, although there should not be a great many offsets in any particular section. In other words, there should be good reason for showing them; even so, the deviation should be a matter of only a few feet. Referred to as small-scale sections because they will be produced at the same scale as the floor plans and the exterior elevations, they are used primarily to locate and measure the floors, roof, and the exposure of critical intersections between floors and walls. The sections may also expose edge conditions at openings. Basically they are oriented vertically to reveal information not shown on other drawings. They will usually show features that appear on other large-scale details and, in a sense, are an index of these details. They can be used to pinpoint the application of a particular detail. In a simplified manner they show all the features of the building, wall openings, wall projections, suspended ceilings, partitioning, wainscots, cabinetwork, chalk and tack boards, borrowed lights, doors, and frames, once again to provide total information. The concept of the building section is to cut the building with all details in place, to look in a particular direction as denoted by the designator, and show everything in front of the cut line. Many items are cut. If there is cabinetry and the section marker passes through it, it will be shown in section, like the walls, ceiling, and floors. If there is a door in a partition beyond the cutting plane, it will be shown in its correct location, but in elevation. Corridor openings, columns, and any feature of the building that can be seen from the section line will be shown. In high-rise construction these particular drawings are sizable. They can in some instances be the same size as the elevations and must be worked out in basically the same way. It is obvious to all that an elevator shaft must be continuous, without offsets or jogs, from top to bottom. This shaft is incorporated into the drawings merely to show what happens when the floors intersect it and how the detail is treated, for in every job the treatment may be different. So it becomes a verification process for the contractor; it also fully meets the requirement for total information. We try to go in two directions with building sections if at all possible, at 90 degrees to each other to reinforce complete information. Framing systems for roofs and floors are often basically oriented in one direction, and a section of this construction, which shows the elevation of the joists, is really not very informative. However, a section at right angles to the joists, which would show their number and spacing, is much more informative. Therefore, the two-section complex, cross and longitudinal, is most important in any project, no matter how large or small. In some offices the concept is slightly different. They carry the idea of the sections being a catalog of details a few steps further. Rather than producing them at the same scale as the plans and elevations, they give them a larger scale, perhaps ½″ = 1′-0″, to show more detail in the way in which the pieces are fitted together. Generally, these sections do not stand alone; it is impossible to draw them large enough to tell us everything we want to know. If the building has many unusual details, the larger scale is justified, but we must still draw large-scale drawings to show all the varied parts. Again it becomes a matter of concept. What can we show and what is the best way to show it? Backed by experience and correct office procedure we can formulate reasonable answers. Of course, architectural symbols must be used as in wall sections; a material that is cut must be marked by the appropriate symbol.

Column lines [perhaps interior elevation markers] and section markers are also shown. These drawings in many instances will appear to lack interest as compared with other drawings in the set, but the facts they contain are important, and in spite of their bleakness they can clear up a question, verify a condition, or be generally helpful to the contractor.

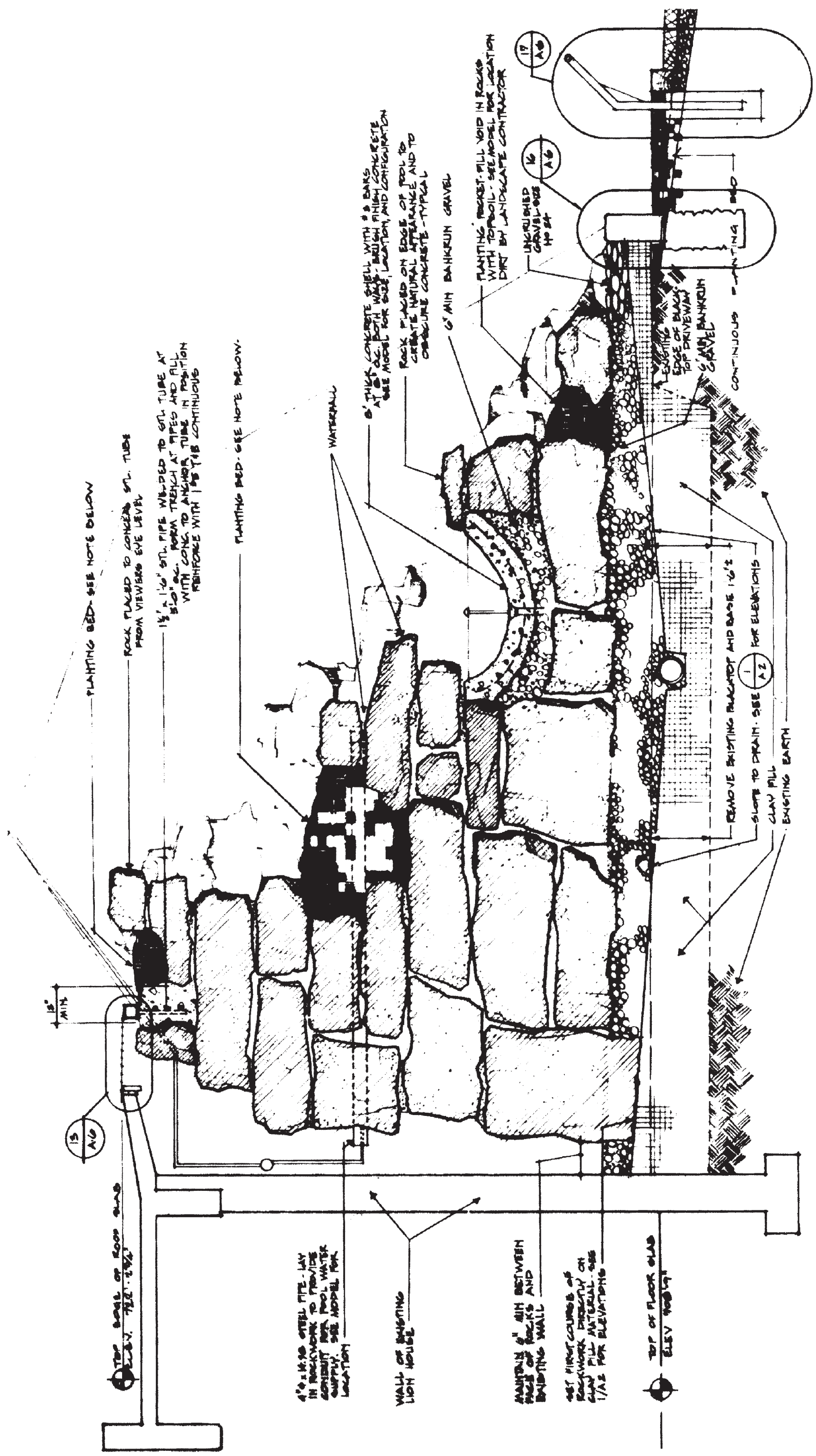
Sometimes it is hard to visualize a project in its completed form when only beams, joists, and columns are apparent. Therefore, the more complete information we can transmit to the various trades, the greater the likelihood of realizing the project as it was conceived. These building sections help to complete the package.

In some projects the configuration of the building is such that it may be advantageous to cut a section through one part, which, however, may reveal another. In practice this drawing known as a section-elevation. Here we can cut through part of the building as a building section, extend the drawing as needed, and show the appropriate elevation adjacent to the section. It is not always possible to show the complete project on four or five elevations, but if we continue them with sections we can show the lines of the roof ridges, gutters, and trim as they are carried through. These elements are then reflected in the sections. What is under that line? What is being joined together and why? This information can be correlated on the building section-elevation. Here, again, is a means of gathering the facts the contractor needs. It is not an ambiguous device so long as it is clearly labeled and its location and function are clearly presented on the plan.

CHECKLIST: BUILDING SECTIONS AND SECTION-ELEVATIONS
1. Show complete vertical dimensions; tie major features of the building together.
2. Identify the section and coordinate with the cross-referencing system.
3. Because of lack of scale and complete data, indicate materials only in general terms; that is, concrete block, concrete, brick, wood beam, steel column.
4. Show interior features, lightly and in general terms [not a lot of detail]; indicate all wall outlines, doors and frames, cabinetwork, and similar items.
5. Locate mechanical items: water coolers, louvers, fire extinguishers cabinets, and so on.
6. Check all finishes with room finish schedule.



Examples of full or total building sections [cut through the entire building] Done to a small scale, these are used to orient the reader to the various elevations of the building and their location. Not used to provide much detailed information, there are specific details noted which cross-reference to larger scale details elsewhere in the drawing set.



Highly unusual "wall" section is really the wall construction for an animal enclosure at a zoo. Note at left how this work is tied to the adjacent building. Exceptionally well crafter detail drawing with good information, and cross-referenced to other details.

SCHEDULES

Much of the information required on the drawings can be organized in schedules. Because of the volume of the data, the schedule presents an easy and convenient format for delivering information to the contractor without obliterating the drawings. A schedule is much more concise, yet totally efficient.

The extensive information contained in the schedules can be lettered in a smaller space than the notes that must be entered on the drawings near their point of application. To describe a single door requires a number of lines of lettering; by scheduling, the door's more descriptive information can be provided in a very concise manner.

Although schedules have already been in use for many years, they are becoming increasingly popular with architects and contractors, particularly in view of the number of formats and automated methods available. The schedules need not appear on the drawings. Many offices add them to the specifications.

This makes sense because legend items can be typed on the schedule form and reproduced as part of the specifications booklet. Typing, of course, does away with the need for hand lettering, which is inordinately time-consuming for the draftsman.

Some offices type their schedules on clear decals that can be applied directly to the drawings. Again, this method eliminates hand lettering. No matter what the presentation, the data must be complete, concise, and clear.

Schedules contain numerous facts about the building materials; some include room finishes, windows, doors, lintels, footings and columns, beams, borings, louvers, fans, and diffusers. Other schedules are needed for radiation, fixtures and appliances, cabinets, equipment and furnishings, and trees and bushes. From this list it can be seen that the schedules are not necessarily confined to one particular set of drawings or trade.

Schedules can be as detailed as the job requires; this chapter presents several examples. Individual offices have set procedures, or outlines, into which such schedules fit, and their formats and texts vary considerably. Perhaps a new system will be suggested or, at least, the overall approach to schedules from differing sources may be considered. In general, if the schedules are hand lettered on the sheets, their lines should be spaced about 1/4 inch apart and, utilizing 1/8-inch lettering, centered in this space. The drafter will complete the lines of information in the separate columns. If there is need for a smaller, more compact schedule, 3/16-inch spaces with 1/16-inch lettering are adequate.

The schedule should be properly titled with title-sized lettering, larger and bolder than the lettering used in the schedule itself. A heavy border around the entire schedule distinguishes it from other work on the sheet.

Most schedules contain two columns on the left-hand side. One column will be for the same marks or designators used on the drawings to indicate the materials to which the schedule entries refer. The next column may carry the names of the items or some other means of identifying them. From here the schedules vary widely, as seen in the examples. We touch on each one only briefly so that the examples themselves will be more effective.

The room finish schedule is, perhaps, the most extensive and the most important. There is some latitude of approach to its presentation, but possibly the best method is to place it on the right-hand side of another sheet if it does not fit on the floor plan. Reference between floor plan and the room finish schedule can be facilitated by turning the right-hand edge of the drawing sheet over far enough to make the schedule visible. If the schedule is placed toward the left-hand side [or in the center of the sheet], the set will have to be opened wide or the sheets turned back completely to expose the schedule.
Each area [room] of the project is assigned a number. This is the designator to which we refer in the room finish schedule. It is also helpful, since a great many persons, including the owner, will handle the drawings, to identify these areas by name or function. In this way a lay person, unfamiliar with the numbering system and caring more about the data contained in the space, will be able to recognize them instantly. As shown in the example, the room finish schedule, which progresses from the floor upward, lists the type of flooring, the base or baseboard installed to seal the juncture of floor and walls, and the finish on the walls.

Common practice enumerates the four walls by the cardinal points of the compass [east, west, north, and south]. If a building is placed askew to compass north, a plan north, grid north, or building north is indicated; each room will have a north wall in the orientation. Ceiling material and height are also given. If wainscoting is included, it is listed separately between the base column and wall entries.

A large "Remarks" column, in which specific items may be called to the attention of the contractor or a specific dimension or finish may be noted, is a wise addition. As some of the examples show, equipment may be included in the room finish schedule and there may be notes on trim or millwork. Schedules may be presented in many ways. One example enters the headings and abbreviations of the materials used in each block of each applicable column. This means that a legend must be added to the room finish schedule to explain the abbreviations. A more extensive schedule lists all types of materials used on the job; this format is shown in another example. The room finish schedule is, to some degree, simplified by a dot or circle placed in the materials column applicable to the area. The type of finish [natural, stained, painted] can then be added. Basically, this is the prime function of any finish schedule; to point out the areas that are to be painted or finished. Other examples show a variety of room finish schedules that may be adapted for use; other nomenclature and designators are the choice of the office or designer. It becomes a matter of knowing what basic materials to include in the room finish schedule.

The window and door schedules, although never combined, are similar. Again, each opening, whether window or door, is marked by a distinctive designator or mark, which should be recorded in the left-hand column of the schedule and followed by the size of the unit. Another column should show door thicknesses, for these dimensions may vary from unit to unit. A column headed "Type" applies to both door and window units and explains the functions and construction of each. Some practitioners choose to include the manufacturer's name and catalog number, a practice that is frowned on because this information is properly stated in the specifications and should not be repeated on the drawing.

The window schedule may include such information as type of glass [glazing] and the material from which each unit is to be fabricated. The door schedule lists the basic material of the doors, their details, the finish to be applied, and any labeling [fire rating] that may be required. The Remarks column is appropriate in both cases.

Frequently the presentation of window and door schedules is graphic rather than tabular. The graphic presentation is accomplished by drawing simple elevations. The designators may be applied to the elevations and the function of each door spelled out with its size and construction and other pertinent information. Either type of schedule may be used; it is important that a distinction be made between the designators so that a door cannot be mistaken for a window.

Every opening that appears in the building must be supported by a lintel to carry the weight of the wall above it. Here, again, a proper designator is applied; in simple fashion it could be L1, L2, L3, and so on. If the lintel is composed of several items [steel angles placed back-to-back], its schedule will include a small detail. The unit is described, and the sizes of the separate members are given with a notation of the overall length of the full member, which includes the required bearing [that part of the lintel that extends into the wall at both ends of the opening]. This schedule need not be extensive, but all necessary information should be readily accessible to provide for the fabrication and installation of the units. The footing schedule shows the sizes and depths of the footings, the reinforcing, and the strength of the concrete. It may also include the column piers that project from the footings. This information may be combined with the column schedule. The examples show two types of column schedule: one that indicates the steel members, which show where the bottoms of the columns occur and how high certain members must extend before changing size [in relation to the floor elevations]. We must also show the overall sizes of concrete columns, their reinforcing, ties, and any changes along their lengths.

The beam schedule follows the column schedule by showing sizes, reinforcing, ties, and any individual peculiarities. In many instances beams with differing designators are actually the same size. The procedure depends on the office. In practice, a schedule may contain beam marks [designators] that indicate consecutive numbering; therefore, any number of beams may have exactly the same configuration and reinforcing. Only their location will differ. In other schedules beams that are similar will have similar designators. The schedule can be written either way. The log of test borings is a form of schedule; valuable information is shown partly by graphic means and partly by notation, usually on the site plan or on one of the front drawings of the set. The test boring log is a graphic and written display of the underlying earth strata-the soil beneath the proposed structure. This information is essential to the contractor in the bidding procedure; the contractor must be familiar with the type of soil to be excavated and built on.

The rest of the schedules listed above follow the same format. The idea is to place a simple designator on the drawing that refers to the item's data in the schedule. The plan drawings locate the items; the elevations show the items in their proper location. All terminology, nomenclature, model numbers, sizes, and finishes are listed in the schedule.

ROOM FINISH SCHEDULE

SPACE	SPACE NAME	FLOOR	BASE	WALLS	FIN.	CEILINGS			REMARKS
						MATERIAL	HT.	FINISH	
1	VESTIBULE	Q.T.	NONE	BL./D.W.	V. FAB.	WD. DECK	±10'-10"	STAIN	
2 & 2A	ENTRY & ALCOVE	CARPET (N.I.C.)	VINYL	D.W.	PAINT	WD. DECK	±10'-10"	STAIN	
3	OFFICE	CARPET (N.I.C.)	VINYL	BLK/D.W.	NONE/PT.	WD. DECK	±10'-10"	STAIN	
4	CLOSET	CARPET (N.I.C.)	VINYL	D.W.	PAINT	D.W.	8'-0"	PAINT	WD. SHELVES & ROD
5	WOMEN	V.A.T.	VINYL	D.W.	V. FAB.	M.P. D.W.	8'-0"	PAINT	
6	MEN	V.A.T.	VINYL	D.W.	V. FAB.	M.P. D.W.	8'-0"	PAINT	
7	KITCHEN	CARPET (N.I.C.)	VINYL	D.W.	PAINT	D.W.	7'-4"	PAINT	
8	DRYING AREA	V.A.T.	VINYL	D.W.	V. FAB.	D.W.	8'-0"	PAINT	
9	MULTI. PURPOSE RM.	CARPET (N.I.C.)	VINYL	BLK/DW	NONE/PT.	WD. DECK	±10'-10"	STAIN	
10	STAIR	CARPET (N.I.C.)	NONE	BLK/DW	NONE/PT.	WD. DECK	VARIES	STAIN	STAIR TO HAVE 2 HR RATING
B1	EQUIP. ROOM	CONC.	NONE	BLK.	NONE	D.W. (2 THK.)	10'-10"	PAINT	2 HR. RATED CLG.
B2	AMBULANCE PARKING	CONC	NONE	BLK.	PAINT	D.W. (2 THK.)	10'-10"	PAINT	2 HR. RATED CLG.

(A)

Example of a Room Finish Schedule. In general, show how information can be placed in tabular or table form for easier reading and correlation than in individual notes. Many variations are available as the schedule [room finish and others] can be customized to the information necessary to be provided. Often the office standard will set the formatting required.

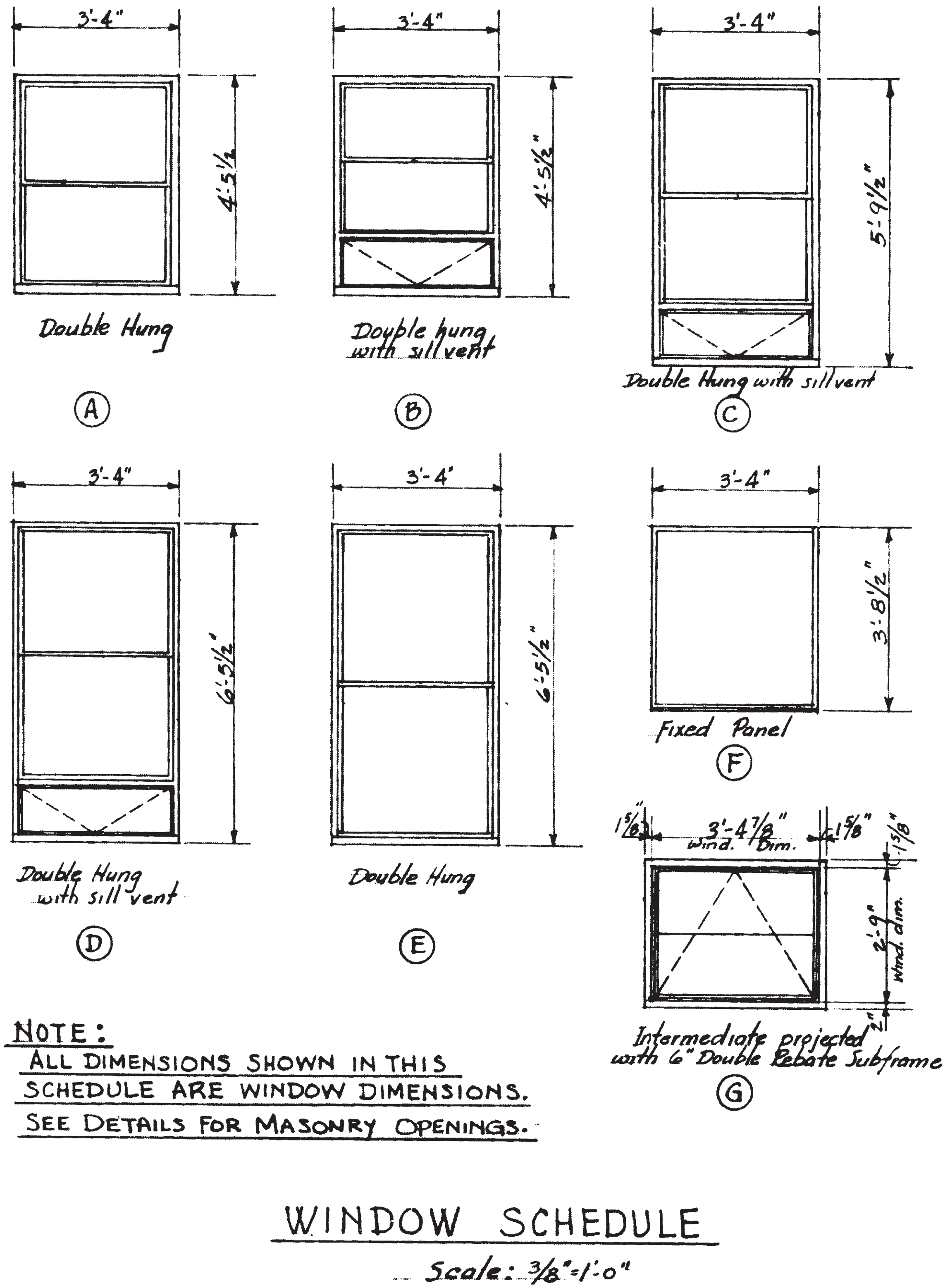
KITCHEN EQUIPMENT SCHEDULE

ITEM NO.	DESCRIPTION
1	1 - PRESENT STEAMER, 3 COMPT. - TO BE RESET.
2	2 - PRESENT KETTLE, 50 GAL. - TO BE RESET.
3	1 - FLOOR DRIP PAN - PART TO BE REMOVED. ADD NEW END PC.
4	1 - ROAST OVEN, 2 COMPT. CONVECTION TYPE
5	1 - RANGE - FOUR BURNER - CABINET BASE
6	2 - FRYERS - AUTO LIFT BASKETS W/TIMERS & DRAIN BETWEEN
7	1 - GRILL ON STAND
8	1 - COFFEE URN - TWO 6 GAL. JARS
9	1 - URN STAND
10	1 - PRESENT HOOD - ADD NEW FILTERS W/FRAMES & LIGHTS 14,000 CFM VEL. 2243 FPM
11	1 - MIXER - 60 QT. W/VEG. SLICER
12	3 - CLEAN POT & PAN STORAGE CABINETS - PORTABLE
13	1 - DONUT FRYER W/DROPPER
14	1 - DONUT FRYER TABLE - PORTABLE
15	2 - CARTS - TWO SHELF
16	3 - INGREDIENT BINS - ROLL UNDER COOKS TABLES
17	2 - COOKS TABLES
18	1 - POT SINK W/DRAINBOARDS
19	1 - SANITIZER FOR SINK COMPT. - ELECT.
20	1 - DISHWASHER BOOSTER W/36 BOWL & CUP RACKS AND 6 PLATE RACKS
21	1 - PRESENT DISPOSER, RESET IN TABLE AND NEW RINSE SPRAY O.H.
22	1 - SET SOILED & CLEAN DISH TABLES
23	2 - HAND WASHING LAV. BY P.C. TOWEL DISP. & WASTE CAN. BY G.C.
24	1 - TRAY TRUCK (CELL INMATES) W/COFFEE, SOUP & CREAM DISP.
25	2 - POT FILLER SWING FAUCETS W/SUPPORT BRACKETS
26	1 - WORK TABLE - PORTABLE
27	1 - VEG. PEELER W/DISPOSER
28	1 - VEG. SINK AND DRAINBOARD
29	1 - PRESENT ICEMAKER
30	1 - OFFICERS REFRIGERATOR
31	1 - PRESENT SLICING MACHINE
32	1 - PREPARATION TABLE
33	1 - WORK TABLE
34	1 - TWO COMPT. WALK-IN REFRIGERATOR/FREEZER
35	1 - LOT COMPRESSORS AND REFRIGERATION EQUIP. FOR WALK-IN
36	1 - LOT REFRIGERATOR SHELVING - PORTABLE
37	1 - LOT FREEZER REFRIGERATOR SHELVING - PORTABLE
38	1 - VENT HOOD ABOVE DISHWASHER
39	1 - SERVICE SINK, BY P.C. TOWEL DISP. & WASTE CAN BY G.C.
40	1 - LOT (6) SECTIONS STORE ROOM WIRE SHELVING
41	SPARE NO.
42	1 - PLATE DISPENSER (4 STACK 10½" DIA.)
43	2 - BOWL DISPENSERS (BOWLS IN D. W. RACKS)
44	1 - CART FOR BEVERAGE DISPENSERS & BREAD
45	2 - CUP DISPENSERS (CUPS IN DISH W. RACKS)
46	1 - PRES. MILK DISPENSER ON PORT. STAND
47	3 - COUNTER SERVING SECTIONS - PORTABLE
48	1 - SPOON DISPENSER W/6 CYLINDER HOLDERS
49	3 - COFFEE DISPENSERS - 5 GAL. EACH (THERMOS)
50	1 - CREAM DISPENSER - 2 QT. - PUSH DOWN PUMP MODEL
51	1 - CONVEYOR TOASTER, 1200 SL. PER HR. CAP. ELEC.
52	1 - STEAM TABLE - 2 PAN SERVING SHELF W/BREATH GUARDS - PORT.
53	1 - STEAM TABLE - 3 PAN SERVING SHELF W/BREATH GUARDS - PORT.
54	1 - CART W/DISH BOXES FOR COLLECTION OF SOILED TABLEWARE
55	1 - CONDIMENT TABLE (BY OWNER)
56	SPARE NO.
57	SPARE NO.
58	1 - RANGE - ONE OVEN
59	1 - HOOD W/FILTERS AND LIGHTS - (FAN AND DUCT BY VENT. CONT'R.)
60	1 - HAND WASHING LAV. BY P.C. TOWEL DISP. & WASTE CAN BY .....
61	1 - REFRIGERATOR - NORMAL TEMP.
62	1 - WORK AND SERVING TABLE W/SNEEZE GUARD
63	1 - PRESENT TOASTER, 4 SLICE
64	1 - WORK TABLE
65	1 - UTILITY SINK W/DRAINBOARD
66	1 - BEVERAGE TABLE W/CABINET BASE
67	1 - CREAM DISPENSER - 2 QT. - PUSH DOWN PUMP MODEL
68	1 - COFFEE DISPENSER - 3 GAL. (THERMOS)
69	1 - CART W/DISH BOX FOR SOILED TABLEWARE

* SEE DRAWINGS & SPECIFICATIONS FOR ALTERNATE "K-1"

(A)

The equipment "schedule" would be used with a large sale kitchen layout floor plan. The various pieces of equipment would be located on the plan and referenced to this schedule. Note this is by far more easily produced via CAD and other electronic motifs.

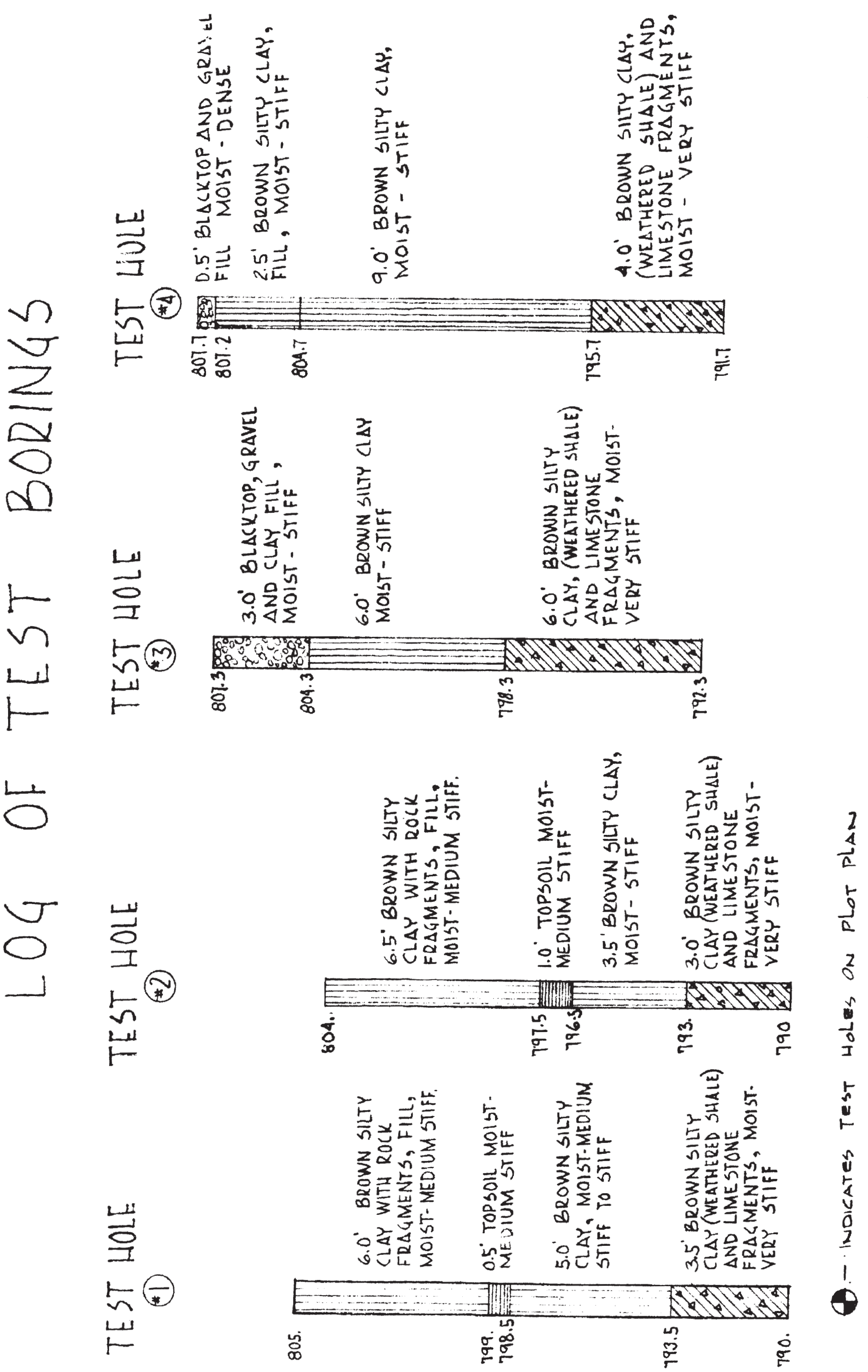


A graphic schedule for windows, which uses the elevation of the units to distinguish types and sizes. Much more easily done than through written data. On the exterior elevations there is only need to show the outline of the units and the correct type designators from this schedule.

DOOR SCHEDULE

DOOR NO.	TYPE	MATERIAL	DOOR SIZE W	DOOR SIZE H	DOOR SIZE T	DOOR FINISH	DOOR BUCK MAT'L.	DOOR BUCK TYPE	THRESHOLD	REMARKS
1	A	H.M.	36"	80"	1¾"	PAINT	H.M.	C	ALUM.	'B' LABEL
2	A	H.M.	36"	80"	1¾"	PAINT	H.M	C	ALUM.	'B' LABEL
3	B	WOOD - S.C.	36"	80"	1¾"	PAINT	WD.	B	NONE	
4	C.	WOOD - H.C.	88"	80"	1⅜"	PAINT	WD.	A	NONE	BI. FOLD
5	B	WOOD - S.C.	30"	80"	1⅜"	PAINT	WD.	B	NONE	
6	B	WOOD - S.C.	30"	80"	1⅜"	PAINT	WD.	B	NONE	
7	B	WOOD - S.C.	30"	80"	1⅜"	PAINT	WD.	B	NONE	
8	SLID.	ALUM.	96"	80"	—	BK. ENAMEL	—	—	ALUM.	SLIDER W/ ⅛" INSUL. GL.
9	B	H.M.	36"	80"	1¾"	PAINT	H.M.	C	NONE	'B' LABEL
10	B	H.M.	36"	80"	1¾"	PAINT	H.M.	C	NONE	
11	O.H.	ALUM.	132"	120"	—	NONE	WD.	—	NONE	OVERHEAD DR. W/ MOTOR OPR.
12	O.H.	ALUM.	132"	120"	—	NONE	WD.	—	NONE	OVERHEAD DR. W/ MOTOR OPR.
13	D	H.M.	42"	84"	1¾"	PAINT	H.M.	C	ALUM.	

Tabular door schedule [can also be done graphically] fashioned to provide all pertinent information. Often schedule includes the required hardware schedule for easy correlation of door and necessary hardware items. Many formats commonly set by office standards.



Log or schedule of soil testing borings. Note how tops are set at corresponding elevations and entire length of boring is depicted to convey all the soil information garnered from the individual boring. Necessary data for the structural engineer to design the foundation system. Holes will be located on site plan in their correct locations to cross reference boring data to specific location[s].

- - - - - SCHEDULE OF HARDWARE SETS - - - - -

The following Notes apply where indicated in the SCHEDULE Chart below

a. Flushbolts installed on inactive leaf only
b. Flushbolts- manual type
c. Astragal only at double-egress doors
d. Astragal only required
e. Pivots required in lieu of butts
f. Double-acting closers required
g. Set shown is required for each leaf
h. Sound seals per door schedule
i. Lockset; Classroom function type- on active leaf
j. Dummy trim required inactive/narrow leaf
k. Surface bolts on room/interior side

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	Set Number
P	P	P	S	P	S	P	P	P	P	S	S	S	P	P	S	P	P	S	S	S	S	S	S			Single/Pair
HM	HM	HM	HM	HM	HM	HM	HM	HM	HM	HM	HM	HM	HM	HM	HM	HM	HM	HM	HM	HM	HM	HM	HM			Material
		X		X													X	X		X		X				Label
PAIR OF DOORS; NONLABELED	SHOP DOORS; NON-LABELED	SHOP DOORS; LABELED	EXIT DOORS; RIM DEVICE	CORRIDOR DOORS; LABELED	DOUBLE-ACTING DOORS	EXTERIOR PAIR; 2 EXIT DEVICES	EXTERIOR PAIR; ONE EXIT DEVICE	CONFERENCE ROOM; PAIR	EXTERIOR PAIR; NO EXIT DEVICES	EXTERIOR DOORS; NO EXIT DEVICE	NONLATCHING/LOCKING DOORS	NON-LATCHING DOORS	EXIT DOORS; EXPOSED VERT ROD	EXIT DOORS; CONCEALED VERT. ROD	EXIT DOORS; CONCEALED VERT. ROD	UTILITY ROOMS; NO LABEL; PAIR	UTILITY ROOMS; LABLED; PAIR	UTILITY ROOMS; LABELED	UTILITY ROOMS; NO LABEL	LABELED DOORS; NON-LOCKING	DOORS; NON-LOCKING	OFFICE DOORS; WITH LABEL	OFFICE DRS	ENTRANCE ASSEMBLIES	ENTRANCE ASSEMBLIES	Function
																							X	X	X	Hdwe by Dr/Mfr.
																									X	Cylinders Only
X	X	X	X	X	X*	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X			Butts
	X	X						1	1	X						X	X	X	X			X	X			Lockset
																				X	X					Latchset
2		2	X	2		2	2	2	2	X	X	X	2	2	X	2	2	X	X	X	X	X	X			Door Stop[s]
X	X	X	X	X				X			X	X	X	X	X	X	X	X	X	X	X	X	X			Silencers
2	2	2	X		2*	2	1	1	1	X	X	X	2	2	X	X	2	X		X		X				Closer[s]
											X							X	X							Mop Plate
2					2																					Kick Plate
	2	X					1	1*	1*							X	X*									Flushbolts
								X*								X*	X*									Sound Seals
			X	2		2	1						2	2	X											Exit Device[s]
		X		X		*	*					.	1	1*												Astragal/Coordin
2					2							X														Push/Pull Set
						X	X		X	X																Weatherstrip'g
						X	X		X	X																Threshold
				X				1																		Hold-opens
2*																										Surface Bolt[s]
k	i	i			e. f, g	d	d	b, j, h	a					c		h	a, h									*- See notes above as listed at left

In lieu of simply listing hardware sets, it can be included as a schedule peer this example. This allows direct reading of what the set requires along with the information about the door itself and functions. This schedule can also be included in the specifications, if desired.

THE MATTER OF DETAILING

Project success is truly a "matter of detailing"! So, it is imperative that the strongest of cases must be made for the process of detailing!

Most of the other drawings in a set of drawings for construction are a form of index. Most are small in scale and shown mainly generalities of the project; length, breadth, heights, locations, etc. – expansions of the design concept. But in the main they are make reference to myriad details! These details are the larger scale, intricate and insightful graphic illustrations that show the individual "pieces" of the construction; how they are to be fitted together; and how, combined, they function to best serve the project [i.e., keeping the elements out of the building; providing structural stability; enhance its appearance; create numerous useable spaces, etc.]

This is not to overemphasize or give undue status to an essential and important activity, that some people [both inside and outside the profession] see as inconsequential. Every drawing has its own important contribution to project construction – and success. So there can be no pretense that detailing is the dominant, pre-eminent or superior function in the design and construction of architectural projects; but neither can it be claimed that it is minimal, inconsequential or unnecessary! It is, however, the primary facilitating factor in achieving a successful project!Rather it is to give simple due credit, in the grand scheme of architectural and construction projects, [and indeed to the whole of the professional services provided by architects]. Detailing remains the eminently important task that is too often murky in the minds of many, minimized by others and maligned by far too many. In addition, most unfortunately, many professionals do not understand the work involved, the necessity for it, and how to best accomplish its intent.

DETAILING: The requisite skill and process used by design professionals, in the seeking, collecting, evaluating, selecting, manipulating, adapting, fitting, combining, and application of the minutia of construction information and knowledge [devices, materials, equipment, and systems] and their accurate depiction, as a wisely-selected, carefully conceived, isolated, and limited areas and well-executed graphic representations as small portions of the construction [accompanied and supported by appropriate and informative notations to the detail itself]; developed, viewed, and adjusted, with benefit of foresight, to; faithfully adhere to the design concept, ascertain/meet needs, solve problems, assess constructability, check relationship of parts, test future maintenance, and note how any or all of these may be revised, improved or simplified and its location in the total project – all fully understandable by, and useful to the trade workers building the project.

Fig. 34-1
Detailing defined

"Designing details is not a neat, linear, fully logical operation. Like any design process, it is engagingly messy and complex. It involves false starts, wrong turns, mental blocks, dead ends, backtracking, and moments of despair – as well as purposeful progress, intelligent decisions, creative synthesis and gratifying moments of inspiration, in sight and triumph."

- Edward Allen, FAIA
Professor of Architecture [ret.]
Oregon; MIT; Yale University;
Washington and Montana State Universities

There is no way to shy away from, avoid or equivocate on this single, simple fact and direct premise that persists, undeniable and irrefutable:

To produce successful works of architecture, from the most modest to the most innovative/revolutionary, the architect [and allied staff including designers] must have the wherewithal to utilize drafting skills [in one mode or another] to create meaningful depictions of the construction, calling upon and based on the application of a large and deep pool of construction knowledge in a format/configuration/manner fully supporting and true to the design concept.

The rhetoric of badgering, sermonizing or pontification simply fails in any attempt to deny or refute the truth that detailing is the overriding, fundamental, pre-requisite skill for all architects. Design may be considered as the architect's premier skill or forte, and may be to one's liking, but it must rely on detailing to be successfully executed. The higher the level of detailing skill [coupled with at least commensurate construction knowledge] the greater the capacity of the architect for innovative problem solving, flexibility of thinking, depiction of sound construction, good communication of the information and consistently successful projects.

The level of skill in detailing is the basis that determines the level of satisfactory achievement required in the finished project – high skill demands high result, etc.

Neither is this [mainly because there is no need to] an apologetic attempt to glamorize or glorify one function of professional practice for architects. It is really to provide a more balanced view of practice and one of the tasks that is vitally needed, and which require skill, insight, flexibility and a good depth of construction knowledge. It does not [and there is no suggestion here] supplant design as the primary tasks in architecture, but rather this is openly stating the importance that detailing is to the final design concept – that which is approved by the Owner, and anticipated by all parties.

While these concepts may seem extremely simple, they are true. But beyond them are numerous solutions that provide for, or meet the concept. Once one of those solutions is selected as appropriate to the project need, then it is for detailing to properly incorporate that concept selection into the project work documents – that is, to provide all of the information required to correctly utilize the selection [product or system] selected into the overall construction of the project. Detailing is a demanding task within what is really a simple process – simple in its basic function of communication; demanding in what it must cover and convey. It may sound simplistic and trite to say "communications", but there are aspects that must be respected. The detailing of a building or other structure is an even more crucial activity when;

- the project is a streamlined, non-ornamented, sleek, clean, simple, open design;
- the project is very complex and involves intricate relationships
- there is construction that needs to be, or that you wish done, in a manner different from the ordinary, or commonly done way

For valuable communication, there must be a message "sender", a "receiver" to collect the message, and they must be of the same mind. But the language of design is far different from the language of construction. This situation must be resolved if the project is to be successfully executed. That is the various parties must easily understand the

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Detailing functions to convert and augment design information into useable construction information, in a form that can be clearly, easily and promptly communicated to the contractors, suppliers and manufacturers [and their field personnel] for proper execution; therefore in large [and important!] part, it is a communications tool!

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language of the messages and how to react; they must have at least enough of the same expertise to relate and understand both the information and the other part's intentions. The consequence of communications needs to be the ability to provide appropriate action – this is crucial in construction! Mere misquotes and misunderstandings can be extremely costly in time and money – as well as in the effort to resolve them.

By far, the most crucial operation in construction is the taking of the idealized design concept for the project –

based on the owner's program –

and transforming it and all its parts into meaningful construction information, both graphic and written, and the clear and timely communication of the resulting information to the contractors and their personnel, for execution of the work.

NOTHING occurs on the project until this is done!

The design or design concept for an architectural or construction project is a function of the knowledge, skill, expertise, rationale and creative mind of the designer. The designer[s] takes the wide variation of information from the Project Program [developed with the owner] and proceeds to apply and formulate physical areas, and relationships to meet the various elements of the program. This is taking raw, usually verbal information and converting it into shapes, areas and locations that resolve the problems and specific situations cited in the program. Design by its nature and definition deals in concepts and broad aspects of the overall project. It deals in relationships, spatial and personnel, aesthetics, image, etc. and with only passing information about materials and construction.

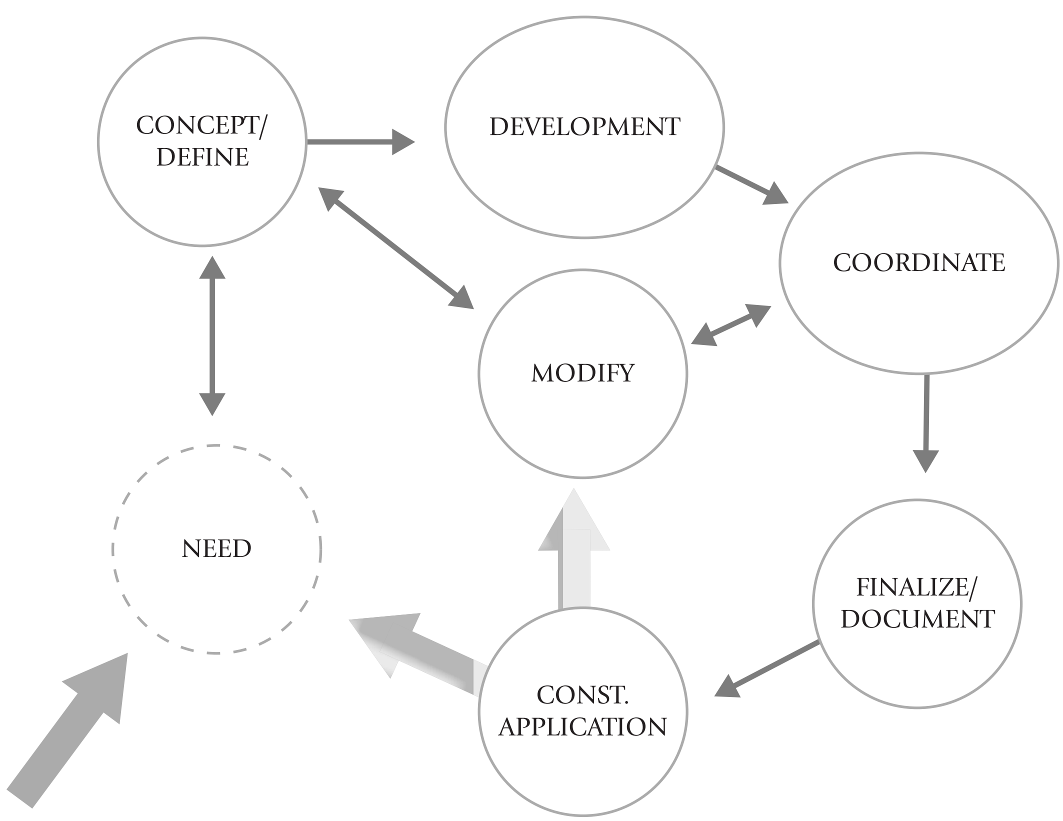
The process is then adjusted, refined and developed until the designer is satisfied with it and can present this to the owner with confidence that the program has been resolved – and the project will have a physicals appearance acceptable to the owner. The design concept for the most part at this time is a mental image within the designer. But there is nothing in these documents that show "how" the structure is to be constructed! The concept and preliminary design needs to be augmented, and further explained through other documentation. Basically, though it is at a place with where the owner can visualize and understand the grand overall scheme and appearance, so much so as to approved it and allow for its construction.

The first truly intimate view of the project begins in the Design Development phase. Here the generalized information of the project design concept is revealing in the selection and incorporation of materials, systems, devices, equipment, construction methods, etc. A masonry exterior walls, in the design concept, now becomes as more specific but still somewhat conceptual as brick, concrete masonry, pre-cast concrete, or some other system.

Next the project must be documented in both words and graphics. This is the phase where construction/contract drawings and specifications are created and developed. All of this is done to render the applicable information specific to the current project – meeting the intricate and numerous conditions created within the design or necessary to execute the design [as approved]. In the truest sense this process is converting design and conceptual information into communications to the contractors and their field personnel who will actually perform the hands-on construction.]

In architecture, the documentation must necessarily be changed from the initial generally conceptual, illustrative and "artistic", to the more extensive pragmatic, definitive, specific, instructional and explanatory that is easily read and assimilated to facilitate proper construction.

It is easily seen that the latter need precise information, directions, and instructions, so they can formulate and bold the project from "raw" generalized material into the specific project forms and construction. The masonry wall here becomes a composite wall, 12″ wide with face brick, and concrete masonry unit backup, with joint reinforcement, etc – and all the applicable devices and features to serve the project well. In the essence of the old saying, "A picture is worth a thousand words", the graphics on the drawings are highly explanatory to the trade workers. In addition, however, there are thousands of words required, since not all of the necessary information can be shown graphically. Hence the project specifications.



Within graphics is the sub-category of "details" – those invaluable snippets of information to display the numerous parts and relationship required within given portion of the total project work.

The two functions – design and detailing – are essential to the project's success, and they need to be both understood and coordinated for their common goal. In truth they are inseparable – and most important to each other. The design sets the needs, direction and tone of the work while the detailing adds the minutia of information required to actually build the design concept. Without the other, each would flounder and prove inadequate to delivering the project satisfactorily. This is the current, and will remain the on-going reality and for the foreseeable future, even in the face of ever changing technologies in both design and documentation methodology. And additionally, to know and visualize how the necessary construction can or will be accomplished and the capacity to clearly communicate all this to the trade workers on the job site. This must be instilled, not just learned and understood, in every professional, and the developed skill made part of individual Standard Operating Procedures in regard to what must be done, and how. The inability to communicate using appropriate detailing will doom individual and collective efforts to produce quality and faithfully built projects.

It is an absolute necessity that every architect know how to put buildings together! And rudimentary to that is the need for functional ability to apply construction knowledge! The inability to detail, in a productive manner, is a shortcoming that prevents the design professional from meeting the professional charge to give technical credence and substance to the project's construction.

What the detailer brings to the project, first and foremost, is a depth and breadth of construction knowledge, not otherwise available to the owner, and the ability to envision how segments of this knowledge can be adapted and properly applied to the construction of the design concept.

The process of creation and developing meaningful details is complex, and multi-faceted to include all considerations about the detail itself and its fit into the project work, as seen in the chart following. There is no suggestion that each detail be laboriously taken through this process, but the process is applicable to each detail. The various factors do come into play, on occasion, so in reality the chart is portrayal of a mental process the detailer is wise to follow and use as checklist. It is impossible to understate the fact that the ability to "detail" is the overriding rudimentary skill that every architect [from student on] needs to learn, understand, engage, develop, conquer and use consistently, in a graphically-descriptive, -informative manner. It is the most crucial communication link between design concept and realized project.

Starting as a student and throughout one's career as an architect it becomes more and more natural to understand that an architectural project is not finished at the approved design concept. but only when the building can be turned over to the owner for occupancy and use. The transition from concept to implemented reality must be seamlessly executed so the built work is architecture and not just a building. That implementation is replete with details!

Granted those professionals more dedicated to design functions may not use detailing, directly, but it is necessary that they understand the principles involved, the approaches required, and the content essential in detailing the construction required. It is through the details that the nuances and refinements of the design concept are shown, built, and provide the design concept as conceived, desired and approved.

To the vast numbers of architects, interns, drafting staffers, and related personnel, detailing is a requisite that is to mastered, nurtured, developed, refined, and utilized in both routine and innovative ways [as required by specific project conditions]. It is here – in the details – where the essence of the construction lies. It is here where the underlying support for the construction – and the design features and refinements – resides. It is here where the "building is put together" in the documentation.

The specifics of the details are depicted in one of two formats: one is an isolated piece of construction [a floor drain installation, for example] that may or may not be repeated on the project. The other is commonly called a "typical" drawing indicating that while shown but once, it is really applicable over a large area of the work [e.g., a parapet detail that applies along several hundred feet of roof/wall construction]. Usually this single detail is merely referenced in various locations where it is applicable.

Details create a mosaic of drawings that, if taken in proper sequence and relationship show the construction of the building, in 2-dimensions. With the on-set of whole building modeling [i.e., BIM] details will be depicted in 3-dimensions consistent with the entire modeling program. Although obviously different in depiction, the details will still be required to illustrate the construction involved in a manner suitable to proper communication of what is to be done. Hence it is shown that most of the traditional values now in-place for detailing, will survive and remain to guide the new modeling programs.

Detailing is simply not something that comes quickly, and is easily conquered; it is wide-ranging, quite variable, multi-faceted, and continually open to the dynamics of changes and new directions in construction materials, systems, methods and overall building design. It cannot be approached lightly, or offhandedly introduced, taught, picked-up, assimilated, applied, adapted, resolved and instilled in a few hours of class time. And it needs to be a skill carried into the professional office, and not something one anticipates being taught there – only adjustment and refinement should be required in the office. There is an inherent need for the student, and the young professional, to catch the essence of the process, and fully understand what must be done, early-on; and to accept the challenge to do the necessary work! Beyond this is the desire, need/understanding of the process, and the continual collection of information, resources, feedback, and experiences to enhance and widen one's detailing background. It requires a wide breadth of construction knowledge and a flexible dexterity that leads to understanding how work can be designed, applied and incorporated. In fact, it is very much an on-going,

EXAMPLES OF DETAILS THAT CAN BE MADE "STANDARD"

The items listed are some of those that are often repeated from project to project because there is no particular project requirement to make them more specific or different. While certainly not unimportant, these items are more mundane, not subject to design concept influences, and represent manufactured or fabricated items produced by mass production [not custom built for a specific project].

HM door frames; in various wall types
[CMU, gyp, etc.] and widths
Bollards/pipe guards
Overhead door mounts
Stairs;
- Interior/exterior
- Steel, concrete, wood
- Tread-riser, landing dtls
- Stringer closure to wall
- Handrails- stringer or wall mount
- Applied floor covering
- Nosing; abrasive

Curb/sidewalk; ramps
Parking block;
Stripping;
Parking stall stripping
- ADA
- Interior aisles

Toiler partitions;
- Layout
- Std stall; std ADA
- Hangers/bracing/ceil bulkheads
- Accessories in room;
- mounting heights
- Recesses

Concrete joints
Thresholds/transition strips at change in floor covering

Wall base; vinyl, wood, ceramic tile
- Set-on
- Coved
- Straight
- Recessed

Terrazzo/Tile setting systems
Applied floor coatings;
Resinous
epoxy
carpet
tile- ceramic, quarry
sheet material
Casework; counters, worktops
- Cubicles; layout, equip

Recessed cabinets for equip [FEC, etc.]
Roof accessories;
Curbs
Hatches
Reglets
Coping
Flashing
Fascias
Millwork; running trim
[chair rail, coves, dentils, base, crown mold]
Civil engineering items such as
curbs, head walls, rip-rap are examples.

Fig. 34-2
Partial list [examples] of details that can be placed in "standard" format for re-use. Number and types determined by the individual office.

career-long process, as one continually encounters new design configurations, materials, processes, and circumstances.

Three problems have arisen and continue to plague fundamental detailing. First, the change from manual to computerized drafting has desensitized the drafter in that there is no “feel” for the drawing, no essence of readability, technique, or understanding content. CAD has come to represent a computer operation and NOT a detailing or drafting operation. The CAD drafter is often one who merely “records” information without regard to what the content is, how it can or should be developed or how the presentation can be enhanced, nor how it is to be used. CAD is a tool that has overtaken, indeed overwhelmed the product it is to produce, but does not bring knowledge and expertise to the conceptual process.

Second, in addition to losing the essence or drafting in favor or merely recording, there is a great tendency to rely too heavily on stored or “standard” details – i.e. those developed once and then used on a reaped basis. This is all well and good, in some cases [e.g., concrete curbs, toilet compartments, etc.] but has come to drive how things are done without regard to relevance. Too often they are not adjusted to new project needs, and are “forced” into place, causing other work to be adjusted to them – all for the sake of not creating new and appropriate details. The result, while consistent with doing things more quickly and at less production cost, is askew of meeting project conditions with pertinent detailing.

Third, is the lack of instruction in both detailing and in construction information/ knowledge. In more cases than not, CAD drafters have high skill in the computer operations, but a low level of usable construction knowledge – simply they are not trained in construction materials, methods, etc. Hence, they bring little if any thing to the detailing process.

This is directly traceable to the educational system which has created computer operations as a separate of distinct work system. Yet that system and associated programs rely heavily on information from other sources. And when that information is unavailable, the operators are at a loss to create meaningful products. CAD is a mechanism with high attributes but devoid on information – a tool misconstrued as being a fully productive system that is capable of providing, in total, whatever is required. Not so!

Detailing is a method of control – control, properly exercised on the part of the design professional over exactly how the project shall be constructed. This is not a charge or direction for the professional to dictatorially command the project, but rather to ensure the integrity of the design concept which has been designed specifically for, and has been approved by the Owner – and more importantly, forms the basis of the Owner's expectations.

Detailing is but one [but the primary one!] necessary process for conveying required information from the design professional [in association with the Owner’s requirements] to the contractors and field personnel. It is a necessary communication process that moves information.

It must be remembered that everything shown on the contract drawings, and included in the specifications, are legal obligations of the Contractors. Further, directions, instructions, and project information need to be clearly, completely and explicitly conveyed to the workers in the field [who do not have the insight or interpretation, and explanation; often they even receive inadequate direction from their own managers]. It is necessary that this information illustrate how the standard, manufactured components are customized and fitted into the work of the project. Obviously, this is a process that must be under the direct control of the design professional.

The Owner, in turn, is obligated to pay only for work done by the Contractors in agreement with their bid or negotiated contractual role to perform the work, “according to the plans and specifications.” The project, in no way, can be allowed to be a wide-open, free-wheeling, free-lancing, “do-as-you-wish”, perpetual-motion, “snowballing” activity – control, then, is essential not only in formulating the specifics of the project, but also in seeing to their correct fabrication and installation! Such control is a mandated contractual function of the design professional, on behalf of the client.

It is the place where technology is directly applied to various parts, systems, and types of construction, materials, and portions of the project.

In this it is necessary to follow a fairly consistent and prescribed path. In approaching this sequence, the professional and staffers must be aware of the information required, the sources of that information, and how they [along??] can formulate or manipulate the various components into correct and proper details – and then how to convey all of that information to the field workers. This is the crux of what the student must become aware of, and then either be given instruction in this sequence, or left to find their way into and through the process. Obviously, instruction provides a most valuable and important bundle of information. This is not project-specific, but is steeped in concept, construction technology, graphic communication skill, and overall and full understanding of the process, its value, the necessity of it, and how best to engage, and provide it. This control is necessary to maximize the chances for a fully successful project one must control every aspect of the project. Not even the smallest of items can be relegated to others. This is the underlying, although unwritten, premise of the Owner-Architect contract. The project need not be "perfect", but must be relatively high in the successful accomplishment of the Owner's approved design concept.

Where detailing is lax, ambiguous, inappropriate, murky, or non-existent, the contractor[s] will attempt to fill in the information required; often without consulting the design professional. At this point control of the work is taken away from the professional, and is exercised by the contractor. However, the reality of the situation is that the Contractor is so bound and motivated toward schedule and budget that the lack of adequate information will not be allowed to impede job progress. The only two options open to the Contractor – proceed as deemed necessary without the information, or risk loss of time to make inquiry – both take control of the work from the design professional. This, of course, is not a good situation, nor one that should be tolerated.

Where the plans and specifications prove inadequate to their task, the contractor will move ahead as best she/he can in an effort to fulfill the contract. Hence, there is an inherent onus on the professional to produce not only proper but complete contract documents. This ensures the proper level of control over the project, as the client expects of the professional.

Details for projects can number in the hundreds [and often, depending on the complexity of the project and construction, the thousands!] Details usually consume the greater number of sheets in any complete set, each of which is replete with the drawings. They can vary from showing the profile of a distinctive molding to showing a large portion of intricate construction. However, the young professional can take solace in the fact that someone else will determine what details are required and how many. there being no set correlation between project type and size, and the number of details. The primary onus is to properly and adequately depict the work, whatever number of drawing is required!

The basic function of detailing is to isolate restricted areas of the work and to depict them, at an enlarged scale usually, so the specific work area/item is revealed, opened to expanded review, and the intended construction, requirements, and methods are noted. The details are extracted from smaller scale drawings, which show their location[s], but not the degree of specific information required to construct the work. This is in full accord with the construction axiom that "the specific rules the general; detail rules concept."

DETAILING SEQUENCE TASK	DEPICTION OF DETAILS AND CONVEYANCE OF INFORMATION
[1] Research	Identify need for information, explanation, direction; Requirement; Problem
[2] Analyze	Find/establish Limits/Area to depict
[3] Assimilate	Choose Scale for clarity/completeness
[4] Conclude	Good drafting/CAD Techniques; lines/notes/ line work/symbols/lettering; adjust as necessary
[5] Decide	Methodology; Construction technique; Materials; Correlate; what does this fit to?
[6] Review	Compatibility; Consistency; Constructability; Coordinate; check other detail/work
[7] Fit to and incorporate with project	Label; correct complete notations; Cross references
[8]Incorporate	Reference; [Key] Notes; Location in Drawing Set [set format]
[9] Disposition	Solely project specific?; Re-Usable? [make standard detail]; Retain [facilitate retrieval]

Fig. 34-3
Chart depicting the tasks to be followed in creating a detail of any type

In large measure modern day construction is a process of modifying, adapting, fitting, assembling and incorporating mass produced, "stock" [standard] products and materials into various forms, shapes, and relationships, all as required by the project at hand. Granted some products are ordered and manufactured or fabricated to precise dimensions and conditions for projects, but the vast majority of products come to the job site in their "normally manufactured form" [even most of those custom-made are composed of stock materials]. It is only a small percentage of the products required on a project that entail special attention, i.e., detailed information regarding a "custom-made" size, construction, shape, or other generally overall attribute. What is unique, on each project, are the methods by which the regular, mass-produced products are re-fashioned, utilized in, connected to, integrated, and interrelate with other project elements. It is here where the process of "detailing" comes to the fore – detailing specific to the conditions set out by the scheme of the design concept for the project.

It is the design professional who, in selecting products, is required to fashion the exact use and configuration of the manufacturer's standard product. This, of course, is accomplished through the details included in the working drawings for the project. The very same product may appear in several projects, or may be used, by the professional, on a consistent basis – but each use requires at least a review of the detail, which shows the specific use and configuration.

In many instances, the standard material produced by the manufacturer will be received by, and fabricated, or re-formed by the subcontractor or supplier, in their shop, or more frequently in the field, on the job site. In order to produce the correct work required for the project, the supplier or subcontractor is required to produce and submit shop drawings for the review of the design professional. Basically, this is an exchange of information – details, if you will – to ensure that the work proposed to be provided indeed meets the requirements of the project design.

Fundamentally, detailing entails:

- What to show;
- How much to show;
- How to show it
  [as to both scale and scope of the drawing];
- and, Where/When to stop drawing.

The latter determination is difficult since it is a learned process and something that cannot be taught. Actually, only field experience and knowledge will allow one to stop detailing at the appropriate point, and permit the workers to provide the minute, final "how-to" to complete the detailed work. For example, rarely is every nail shown on the drawings; usually they are shown only where their placement and number are critical, as in the gusset plate joints of trusses. Sizes and numbers of any fasteners are not included UNLESS so vital to the success of the detail that a selection must be made by the design professional. Here, for example, custom cabinetwork may be detailed in general since a subsequent shop drawing, prepared by fabricator will be the submitted for the professional's review. The contractor/supplier, however, are responsible for the correct size, fit, and construction of the work involved [as per the General Conditions]. This includes selecting and using the proper fasteners.

With all this aid, there is need to address the issue of personnel, knowledge and experience. In the main, detailing is not only best produced by persons who have developed skills for presentation and communication, but who also have the technical knowledge and construction background required for the work. This is not to apply a stigma to some educational programs, but professional offices, "under the gun" to produce quality project documents, on short schedules, are ill-advised to misuse their personnel. Use of people who do not have technical knowledge of construction materials and methods, which they can apply correctly, adroitly and innovatively, are high-risk to the project situation, and the firm – a scenario that will produce more pain than gain! The most unfortunate part of this is that the young graduate or professional cannot gain the necessary experience without hands-on work, and yet that work, unless monitored and mentored, can be counterproductive to the firm's production, the project schedule [in "re-work"], and its reputation [where details "slip through" in poor condition].

In reality, the process of detailing has been, and for the most part remains, a traditional function of mentoring. This is best exemplified in the editorial from the December, 2000 issue of the "Architectural Record" [titled "The Chasm"], and the article from the June, 2001, "Construction Specifier"[titled "The Power of Mentoring"]. Both deal with the mentoring process of education, as applied in professional offices. The editorial incisively points out the long-standing tradition of the "happening" whereby the art of detailing is transferred on a one-to-one basis. This verifies the sequence and the inherent value of the process to the point where it calls upon the colleges to address "project implementation" in their curricula. This triad of information provides a very pointed and poignant review of the situation, and really issues a trumpet call not only to the problem we have [and which will increase in severity] but some semblance of resolution – if proper attention is paid to it.

A few young architects [but not nearly enough] will not only accept this work, but will make it their primary direction throughout their careers. Every young professional makes decisions, conscious and unconscious, about their career. Each precipitates toward a certain type or aspect of professional work which is both to their liking, and where they tend to excel and feel most comfortable. Every architecture graduate is not cut out to be a designer! Some like more administrative roles; some like field operations; still others work exclusively in healthcare, or sports facilities – or educational or industrial projects; some go into ancillary fields of endeavors; and some simply like to "put buildings together" – i.e., detailing!

All to the good! However, the work of detailing is a challenging necessity on every project, and therefore it is something that EVERY architect and prospective architect needs to engage, embrace, and "grasp" – even if the primary interest is restricted to design. Many professionals – young and old – disdain detailing and regard it as unattractive, unrewarding, unappreciated, mundane, drab, nuisance, and drudge work, and certainly something to be avoided at all costs. While each is free to come to her/his own decision and perspective, the fact remains that, in every case, detailing is the technical expression of the project. For this simple reason every young professional/ designer/architect should have commitment, desire, and a "hand" in the detailing, if for no other reason than to ensure that the design concept is met, and faithfully produced by the construction work.

The architect, in every job position including designer needs to understand detailing, not to dictate or control it, but to appreciate the help it lends in ensuring that the process does enhance, reflect and contribute, properly to the design concept. This, though, does not mean that every small part of every detail needs to be reviewed or "approved" by the designer. Rather the "designer" must have the knowledge of detailing to be flexible as to how the design concept is executed, and the limits set forth by each material and system.

Without knowing, in general terms, how to depict, construct, and/or describe the intended construction, the designer cannot hope to contribute to the documentation effort in a constructive manner. Here again, control by the professional is in jeopardy, although the documentation "team" can make every effort to resolve any issues by applying their expertise to the concept – with the designer as their guide.
It is not enough to be

- meticulously accurate;
- all-inclusive;
- impeccable in drafting; And
- painstaking in completeness,

unless there is also an element of showiness, attractiveness, and a aura within the drawing which draws immediate attention to it. Yes, each drawing needs this, although they do not compete with each other on this level. Blandness evokes bland, mediocre, make-do construction, which no construction project should put up with. Working drawings are not intended to be works of art, for display purposes only. They are "to work", by their very name. But with the current capacity to produce very intricate, closely related line work, via the CAD process, it is beyond essential that every drafter perceive the need and interject an aspect of "showiness" into the drawings – not to the point of distraction, but to the necessity for clarity and readability. Users of the drawings should never have to "hunt for", or guess about information, configuration, or intention – they all should be present and readily available, almost at a glance. Each drawing, and detail, needs to capture the reader/user in a way that "demands" immediate attention, reading, and the transfer of valued information.

This may seem like a strange set of attributes to assign to the drawings and details, but it is a truthful scenario. It is subtle in one way, and glitzy in another. It rejects a monotone, and reaches out to the reader. It is the difference between a speaker with inflection, varied pace, and unique phrasing – as opposed to a monologue delivered with sameness, and almost a lack of interest in the subject.

In no way does this suggest that working drawings, and details, be "jazzed up" simply for the sake of attractive presentation. Decoration is useless, and often confusing, but there are still several things that should be done to make the drawings/ details better. Line weight variation, separation of information, separation of drawings, and other aspects of readability enhance the drawing, draw the eye, and hopefully presents a series of valuable pieces of project information. So too it will elicit a higher quality in the actual construction. In a way, good drawings are contagious, in that the resulting work is of a marked higher quality, simply because the drawings was clear enough to direct easy and accurate construction. Simply, quality begets quality!

The definition and detailing of the idea into good workable design therefore depends on drawing as the principle modeling technique. A vital element of the process is the ability to identify and define progress – the detailing of the idea not only allows the designer to record development, but enables clearer articulation of the results. This role in establishing the progress of the design gives the drawing a fundamental influence in detail and construction, but also enables prediction of future performance. This ability to specify size, scale, and shape prior to building or manufacture is common practice today. However, in the late 18th century it was am important stage of development, which was to have a major influence on the planning and organization of construction.

The incremental nature of design is readily detectable in detail drawings, where the process of trial and error is separated from building and manufacturing, and acts as an accurate and efficient model for changes and development. The drawing is the reflection of decisions made, and clarification which enables the architect and engineer to simulate what is eventually produced, and installed in the project. The original need is to identify and illustrate different parts of a proposed building and their relative positions brought about the obvious use of a scaled on a flat surface [the detail drawing]. This subsequent ability to examine the project, in small portions, through drawings reduces and simplifies the numerous decisions that must be made. In the ancient days of the Master Builder, resources were not available for a permanent record of drawings and their use to illustrate progress and decisions. The "drawings" were fleeting, done in chalk, or in the sand, and were scrubbed away as work moved on. As-built drawings were left to coming ages and the archeologists!

Through the years of development in architecture and construction, this aspect of detailing has been refined and made more positive by the introduction of various technologies. What was once drawn [in the sand or on a trestle board with chalk], has evolved in a far more useful and permanent record. First, we hand-made, non-reproducible drawings on opaque media, followed by the "blueprint" system using translucent papers and various reproduction systems including the blueprint, ozalid, etc. Some use was made of offset printing, and then photocopying. Of course, today, we have the electronic creation, development, refinement, and changes in detailing, within a literal eye blink. This, greatly enhances the tracking of development and design compliance of the details as they occur in the documentation cycle – an added feature of control.

Detailing, of course, is a process common to every project, although the complexion and extent of the work, and the number of drawings may vary quite widely. It is a function of the professional effort that must directly reflect and react to the project and the construction involved. The design professionals must create a plan for the detailing process.

In this, their effort must cover all of the crucial elements of construction without needlessly overburdening the construction, adding unnecessary engineering and construction costs, yet with enough information to depict the various elements of the work so they can be easily built. Leaving out information, and not providing complete detailing is as onerous as "over-detailing", or being redundant [especially to the point of confusion]. Only through the mentoring of others, and experience with quite varied projects, can the individual professional come to understand and appreciate the scope of detailing, its limits, and the contribution that must be made to the project.

It must be remembered, though, that there is no relationship between the concept and even the execution of detailing, and the computerization. The entire concept of detailing is an expansion of the design process – we must detail to ensure faithful development of the design concept! It is also the process whereby correct construction can be assured – i.e., giving the necessary information, in a sound, correct and usable form, to the trade workers so they can build, erect, install or create what the project's features require. This process can be executed whether or not there is a computer at hand [details still can be and in some office still are done using fully manual drafting techniques], and whether or not the software available has a wide array of "bells and whistles", and the very latest sophisticated maneuvers and functions.

First off, however, in any discussion of detailing and drafting, we must consider the tremendous disparity between professional offices. This is, of course, a direct function of the size and expertise of the staff, the viability of the practice, the clientele, the types of projects, and the financial resources in each office. There is a host of offices that consist of a single person; innumerable others with perhaps one or two employees, and with minimal computer capability. The office, out of necessity and choice, will fashion its computer operations to match its capability and direction. Often in smaller offices, the personal choice of the single proprietor, or the 2-3 employees or partners, will prevail. In those instances, the software more than likely will be careful chosen to provide the maximum flexibility and capacity for the office, the work, and the expertise of the staff. They then will work with what programming and features they come-by through the purchase of the software they choose.. Cost restricts changes to newer, faster, and more capable software, but this does not necessarily deter the effort of the office. Usually in circumstances like this, the staff becomes highly computer literate, quite innovative, very flexible, and has attained a marvelous command of the computer operations.

In this, there is need to understand that there is no universal system whereby "every" office is doing the same tasks in the same way. There is extremely wide variation [many ways to skin a cat!] which only serve again to highlight the need to adhere to principles regardless of the motif, method, "machine" or program that process and depicts the information. Simplistically, we are looking at situation where the message can be written whether using a yellow or red pencil!

The computer by function, literally replaces the need for more employees, and provides a reliable and rapid method of production. It is easy to see that the computer, in the hands of a good operator can greatly aid the production of projects – especially where the firm is small, and the computer can literally produce the work of several employees [who are not on staff]. While limited in scope and computer operational attributes, these offices have attuned their production to those tools they do have at their command. Combining individual computer expertise and innovation, more than likely their work is highly professional, well executed, and properly to the practice, the clientele, and the projects.

In many cases though [although the numbers may vary] there are offices of high profile, cutting edge computer capabilities. These usually are offices with large staffs and a multi-discipline orientation. Software is multiple programs, and the latest available – easily changed-out when new versions are put on the market. In many instances there are entire departments, staffed full-time within the organizations, which are dedicated to nothing except computer operations – hopefully dedicated in a manner by which they fully support the computer efforts, and NOT to the degree that they drive the professional effort [a wrongheaded direction!]. In the main these offices have professional staffs which number in the hundreds for engineering/architectural; firms, and those multi-office firms with wide-ranging and international practices. The work projects also run to the very large, quite complex, and very costly – hundreds of millions of dollars.

The computer operations are the lifeblood of such firms, since the amount of information required [to be developed, coordinated, transmitted, used, and documented] is monumental. The operation must be rapid, reliable, and in some cases, may operate 24 hours a day – plotting during the night for the next day's operations and transfers. A shutdown for a simple power outage, or for equipment malfunction can be devastating, and extremely costly to the firm, since almost all operations will be stopped, and employees sitting idly by. Of course, in this, detailing could continue in the form of hand sketches and conversations, but actual production of usable details will have to cease.

These larger firms will also have the newest versions/releases of computer work, and such advanced programming as 3-D modeling whereby an electronic model is created which allows development of electronic ["virtual"] design concept, and electronic "walking" throughout the project to view the various elements within the design. This and other similar software programs are used to identify conflicts between walls, pipes, ducts, and structural elements. In very complex industrial projects, the discovery of conflicts [now more commonly called "interferences"] where two or more work items are shown to occupy the same space, and their elimination by electronic means, in the office, is crucial to the progress and cost control of the actual construction. The discovery or uncovering of such "surprise" conditions, on the job site, is disastrous – costly, time consuming, difficult to unravel, and certainly non-productive. The interface between systems' elements can easily be displayed, rotated, inverted, and otherwise manipulated to give the best and most accurate views – some software programs produce actual "clash reports".. While not a direct detailing effort, this work and system can be the source for more details, to explicitly show how instances of interference can be avoided, or other similarly important problem solving.

The design can be viewed further through use of computer generated renderings, and other electronic programs which advance drawing abilities to vivid and expert presentation skills, all with the capacity to manipulate and present numerous variation of the project. The same building design can be displayed in many and varied ornamentation and design concepts, without repeated copies or iterations of paper drawings. Details too, can be created by combining various items, or portions of other drawings, to create new drawings. This extends to stored "libraries" of building component details which can be retrieved, manipulated, and combined to create entirely new details, specific to any project. Overall, the architectural profession currently lags other professions in document production via computerized programs. Initially, the computer was seen as a design tool [as noted above], but with more refined software, working drawing production is now utilizing the computer more and more.

While working drawings remain as the basic product of the firms, their computerization has advanced so their presentation and interference drawings are striking and clever. The final projects are virtually free of major conflicts – and relatively free of problems caused by too many items trying to occupy the same space at the same time. In highly complex projects, this is an essential element of projects, and one, if resolved within the computer that can facilitate and lower the cost of projects. In reality this is part of the detailing process. But beyond this newer configuration there is still a basic need to detail – and to do so completely in context with all of the various requirements and needs each project presents.

There is relationship between the fact that we can, now, produce "better" drawings, in a shorter amount of time, and the fact that comprehensive detailing is driven by project needs. The "better" drawings are still a function of the human mind and decision making as to what to show and how. Speed of replication is handy when deadlines creep up and project requirements call for more information more quickly. This all indicates that CAD is, indeed, a tool; and a very fine tool when in the hand of a knowledgeable professional or operator/designer.

Obviously there is a direct correlation between project size and the size of the professional firm hired to do the design and documentation work – smaller firms do “smaller” projects, etc.. This relationship does get murkier as you move toward the center location between the smallest firms and the largest. In other words, there is a point where firms must decide if production is best increased through use of more mechanization [i.e., computer-aided drafting, and etc.]. This is in lieu of trying to find, hire, and train more staff members.

As the firm expands, it appears that staff size increases, but certainly at a rate much more modest than that of added computerization. In a tight hiring market, it is far easier to find new and better software, than it is to find good new employees. In this, too, is an expansion of services – large corporate clients tend to desire more services, and stronger commitment [meaning more precise, well-documented, and watch-like production of contract documents]. Many such clients actually oversee their design professionals by co-locating staff in the professionals’ offices. To stay abreast of the many facets of not only project document production, but also all of the nuances of the client's management process, requires computerization. Time is charted – projected/forecasted, tracked, and modified with the slightest change in scope. There is always the delicate need to balance effort hours with scope of work. Competition among professionals means margins are close, so the professionals seek high-speed and reliable production techniques, with human input to make decisions required along the way. But the physical production – actual printing or plotting of drawings is but one aspect of the situation. There is still a need to match correct detailing with project requirements. This is still subjective, and not thoroughly analytic.

The process of detailing, while immersed in this scenario, remains a strong and necessary element to every project – bar none! To build the project, the trade worker needs a continual flow of incisive, correct ad detailed information. This is translated, directly into more efficient construction, better progress, and more accurate and faithful project of the design concept. In fact, the word “detail” now has taken on a much more extensive and imposing meaning, in that the minutia of documentation and all of the aspects of the project, in total, must be so widely and deeply and accurately described and recorded, that “details” no longer are simply the vignette drawing showing portions of construction. The use of the word has always encompassed all this, but the emphasis, today, is far more evident in the project minutia than in the project's con-

A QUICK CHECKLIST FOR DETAILING

Questions to ask:

What do I need to show at this location [the primary focus]?

What must I include/show [to convey all pertinent information]?

What would be "nice" for me to show [added information]?

How much do I show [overall area of detail]?

What is the best view to use?

Can this be combined with other information for a better, more informative drawing?

What should I show in the background [for reference]?

What scale should I use for highest clarity?

How does this relate to other surrounding details?

Am I trying to show too much?

What can/should I leave out?

Is it too complex?

it clear; confusing?

What line weights are appropriate?

What material symbols are necessary?

What the best locations for notes/dimensions?

What needs to be cross-referenced?

Fig. 34-4
Checklist for creating actual detail after analysis in Figure 34-3

tract documents [drawings and specifications]. Despite this, however, the import of the drawings remains the very same Every project, no matter its extent or its complexity, can be [and needs to be] reduced to, or expressed in a series of coordinated details. By careful selection of the areas to be detailed, and skill in showing the crucial work, every project relies on the information revealed in the details. Without realizing it, the trade worker, via the details, is exposed to the inner most parts of the project – the substance, nuances, quirks, idiosyncrasies, and minutia of the project, which supports and contributes to the image and function of the finished project. In this, the design professional must function as the translator and the conduit by which conceptual information becomes usable, and the execution of the information, in the details, brings forth the project as conceived, designed, and approved – as it is anticipated

This is best expressed in the aphorism of Ludwig Mies van der Rohe, who was noted for his sleek, clean, straight-forward and unadorned designs – "God is in the details"! He knew that his details would produce elements in the finished project that would be exposed, so they had to be neat, clean, extremely well-executed [both in design and execution], and actually attractive, as they became part of the overall design scheme. His details had to directly contribute to the design concept, since they were, in fact, part of the "ornament" and visual expression of the project. Obviously, then his details had to be of equally high quality, so the actual construction would be an expression of an exacting criterion. While claiming no divine right for detail drawings, this expression does set the bar of value a bit higher, and indeed, sets a standard of sorts. That is the fact that the details must be given the time and attention required to place them in the highest order as they support their associated design concept.

Firms: end

The detailing of a construction project is a highly technical task that must be properly done, neither shortchanging, nor overwhelming the work and all the personnel involved.

This very same perspective is part of the task of detailing the project. From the wealth of possible details, and the variety of materials and devices available, the architect/drafter must decide on which of many scenarios is best suited to that circumstance of the project to be depicted in the detail. Many selections must be made; and decision made to support and incorporate the selections. This all comes from insight and knowledge of the project, the intent of the detail, and how that detail empowers other work, and properly displays or contributes to the overall design concept. Other factors such as cost, availability, longevity, suitability, workability, ease of fabrication and installation, compatibility with other materials, etc. are part of the selection/decision/detailing scenario. The following list is offered not so much as a checklist as merely a list of activities which constitute the process of establishing the need for a detail, and the start of the actual production of the detail drawing itself.

Experienced personnel do much of this list mentally, quickly and without the need for some sort of recording or other documentation. Here it just sets out a logical sequence, which should bring to light the various aspects of each detailing situation. By using criteria such as this, consistently, we can better ensure the development of correct detailing methods, and a satisfactory basis for each and every detail. Certainly overall project needs and parameters are met and satisfied when there is consistency in method, and where solutions are correctly founded by combining the method with the specific [but changeable] circumstances of the project. It is clearly evident, from this discussion, that detailing is not a mere "make-work", "busy-work" exercise with no real value, or contribution. Oddly enough little attention is paid to this effort, and there is no impetus in the educational climate toward understanding both the process and the real value of good detailing. This has directly led to further misunderstandings on the part of others who perceive the need and value to be either questionable or needlessly involved. Hence, there is always pressure and suggestion that time allotted to detailing be minimized or cut short, for the sake of meeting other deadlines. On the other hand, there is a need to eliminate the tendency to "tinker", or to attempt to create "perfect" details, by using elaborate concepts, numerous items, and intricate fashioning, shapes and relationships.

Flatly, the criteria for good detailing should include the need to simplify the work [both in the detailing and in the actual execution of the work]. This requires straightforward approaches, which in turn are related to, or based on experience, and knowledge of what does and does not work.

> The best of carefully conceived and well-executed graphic details, to be fully successful, need to support the design concept; but also must be accompanied and supported by appropriate and informative notations, all fully understandable by, communicated to and directly useful to the trade workers building the project.

Fig. 34-5
Statement reinforcing the need for quality detailing and correct communication

Also, the analysis of whether or not the detail faithfully supports the design concept, and contributes to its construction.

> *"Good design can be ruined by poor detailing; but poor design cannot be "saved" by good detailing".*

In far too many instances, the design and documentation efforts are misunderstood, maligned, and for all intents and purposes, demonized. It is not all that clear why this has come about, and is being perpetuated. However, facts show that management of the process and the project overall has escalated to the point that the resolution of program issues, design of the project, and proper and adequate documentation of the work has been reduced to being a necessary evil

PARTIAL LIST OF DETAILS

This is a partial list of not so much individual details or detail locations, as it is a list of detail "opportunities" or groupings. They all should be considered for every project. They may not all be present on each project, as this is merely an incomplete and minimal list to trigger consideration of the project situation to ascertain whether or not a detail is required. The details selected must, of course, be drawn in such a way as to correctly reflect the design and construction anticipated for the project.

Footing/foundation/basement slab
Footing/drain tile
Isolated footings
Column base details; floor opening
Waterstop between footing and wall
Water- or damp-proofing
Special backfill; drainage
Sill at top of foundation wall w/grade line
Floor construction at /connected to sill
Bottom of upper wall construction
Typical upper wall construction with interior finishes
Window/door sills, and heads; also jamb details
Lintels over openings
Construction at structural members;
columns, beams, etc.
Wall facings and veneer details
Joint[s] between floor construction and wall
Joints between roof construction and wall
Roof edge, or top of wall closure
Gutter, coping, gravel stop
Parapet wall with flashing from coping to roof
Roof construction; insulation, slope, coverings, deck
Roof hatches, curbs, equip. supports;
Through penetrations; wall, floor ceiling
Flashing details at various penetrations
Partition details; each type; fire rating
Masonry wall details; CMU, CMU/brick
Unusual wall configurations; angles, radii, etc.

Ceiling details; layout, penetrations, bulkheads
Flooring; coverings, trim, transitions
Floor patterns, trim
Stair details; construction, finishes
Door, frame/window details
Casework; built-ins; counters
Systems furniture layouts,
Glass frames; borrowed lights
Toilet compartments
Tile layouts, patterns, trim
Tile floor installation
Visual boards; A-V equip
Plaques
Signage; interior/exterior
Graphics; paint patterns
Kitchen equipment
Special room layout and equip
Ladders; ships ladders; alt tread
Elevators/escalators; lifts, dumbwaiters
Mechanical shafts/areas
Trim, surrounds, coves
Paneling; furring; insulation
Skylights
Changes in construction; joinery
Expansion, contraction, construction, isolation joints
Closures
Paving, curbs, ramps
Landscape features [construction]

34-6
Sample list of portions of construction that typically require detailing to one extent or another depending on project circumstances

and a nuisance. Quite obviously, though, without the need for design and construction, there really is no project, per se!

No where else is this more apparent than in a review of project costs. When more than 50 % of the money allotted for a project is easily spent on management, control, costing, tracking, projections, computer time, and so forth, trouble is afoot. It is alarmingly obvious that the professional engineering work that creates the technical solution to the owner's programmed problems is reduced to far too little stature. Somehow attitudes have been changed to the point that this work is marginalized to a dangerous point. High levels of liability lie in this work for both the professional, and the owners. If the work is poorly designed and documented the professional is at risk. But where the owner is party to the process that created the atmosphere for hurried, cheap, and ill-performed work, the owner will suffer both for this act and for the hazards, non-compliance, etc. that may come to exit in the project itself. While not principally responsible for proper incorporation of correct work, the owner does maintain bottom-line responsibility for the propriety of the project. In the seal to get the project moving, and to have its operational at the earliest possible time, the owner contributes, heavily, to the atmosphere of the project and its production. If information flow is sporadic, where changes occur frequently, and where unreasonable demands are made, the owners adds more fuel to the highly volatile situation – some risk comes with such acts.

This is not, though, to point to a new "demon", but rather to instill the thought that it is the content of the documents, both drawings and specifications, that is the most crucial and vital link to cogent, appropriate and useful communication, specific and directed information and bringing the project to a fully successful completion.

The issue that must be raised, though, is how, and how well project design information is developed and evolved into documentation that is complete, clear, decisive, directional, and as concise as possible consistent with clarity and completeness. This all, in turn, must be viewed as to its viability as "construction information" which is in the correct form, correct format, and in such terms as to be fully understood by the various trade workers. Here it must be observed that trade workers are trained to different standards and in different manners than the design professionals. This in itself cries out for the correct and proper interface between the lexicon of the professional and the "lingo", jargon, nomenclature, slang, and other terminology of the workers.

If the workers, by some outside chance are "dazzled" and overwhelmed with the eloquence of the documents, but cannot decipher and understand what is intended, the documents are failures. The documents will be discredited [and may be discarded], and construction will either stall or prove improper if continued. Also, lack of understanding leads either to continual questioning, or to assumption. Interpolation, extrapolation, or proceeding in ways that one [the worker] thinks is correct. At this juncture, control of the project has been lost to the design professional, and could proceed on a very errant, and costly [to rectify] course. All of the latter lead to sizeable and difficult problems, almost without exception!

Clearly a prime function of the design professional is to convert concepts, needs, wishes, desires, and other programmed requirements into real objects ranging from individual pieces of material, or equipment, and formulating areas, surfaces and rooms which serve to correctly support functions of the owner. This is one documentation task that must take place. In addition, this interpretation and translation must be further transformed into another set of words, phrases, instructions, directions, and other verbal and written information which is fully functional and directly usable by the construction trade worker.

THE CONTEXT OF DETAILING:

What needs to be done?

How do we accomplish that end?
By far the most pervasive need for each construction project, is the conversion of concept into tangible things, items, materials, systems, procedures, directions, instructions, and information. Equally important is the conveyance of that information to the workers who are responsible for erecting, and installing the various materials, systems, items, devices, etc., required to produce the final result. That result, of course, is the building or structure that was envisioned in the originally approved design concept. It is the project that owner has come to expect!

The process of this conversion, and conveyance is absolutely essential on every project – bar none! Of course, there is a good deal of variation in the amount, and depth of the information – a direct indication of the complexity of the project itself. Following the axiom that "specific information governs the general", the documentation of a project must be fully commensurate with the result desired/required, and which is anticipated. Inappropriate, inadequate, incomplete, and uncoordinated information will not produce a faithful execution of the concept no matter how expert the effort may be. Yet the level of completeness and the depth of the information are not things that one can capture and codify. Rather, it is a process where the design professional must call upon both training and experience to produce documents which will well serve the workers on the job site, and which will provide the basis for the correct expression of the project.

To uncover and assess the true value and appropriateness of details [even to compare versions of the same basic details] it is best to follow a chart or outline. In this way, each attribute can be investigated, resolved, and decided upon. By treating each potential detail in exactly the same manner, one can be assured that the final decision and configuration of the detail is correct for the project condition – and correctly displayed for use by the trade workers. It is suggested that each detail, and each version of the detail under consideration, be measured against the following:

DESCRIPTION: Brief description of need, location and other related details

LIMITATIONS OF USE: Restrictions on application; items not addressed

DETAILING CONSIDERATIONS: Dos, and Don'ts to be utilized, and show
basic intent of detail

COORDINATION REQUIRED: Locations for use; prohibitions, "watch-outs", pit falls, care to be taken

LIKELY FAILURE POINTS: Reasonable expected results if certain things are done, or which detail cannot resolve; try to expose anticipated adverse consequences

MATERIALS: Type, composition, strength, standard, finishes for each

A.
B.
C.

etc. – list each material in detail

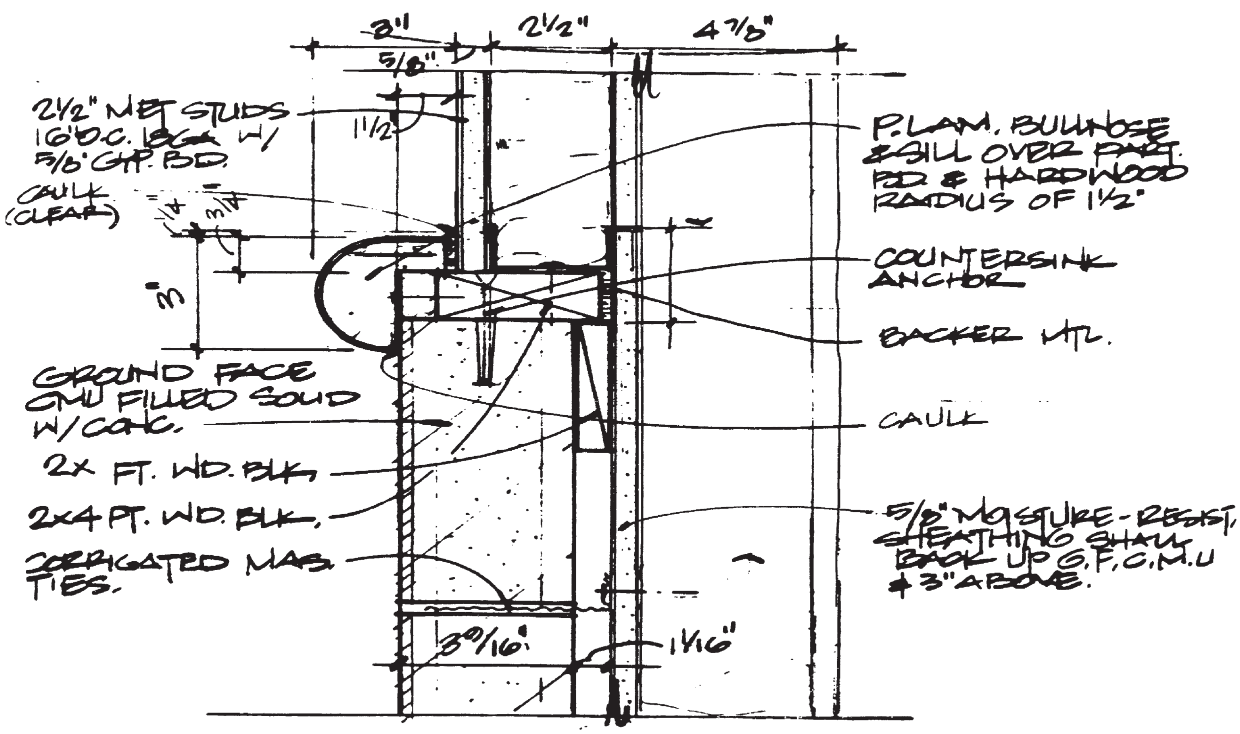
EXECUTION: Direction to be followed both in detailing and in "call-out" notes for trade workers [exactly "how" to do the work shown]; can be done using groups of materials to illustrate their interfaces and relationships.

Simplistically, detailing can be defined as series of related glimpses, vignettes, or snapshots, of a proposed project, taken somewhat in isolation [one to another], and showing limited areas of work. In architecture and construction, of course, these would show selected portions of the proposed construction. In fact, this process is very much like the childhood workbooks of "dot-to-dot" exercises. Both in the workbooks and in architectural work, a hidden "object" is revealed as you connect the numbered dots laid out on the page.

Correct or proper detailing is not so much the showing of everything as it is the showing of the essential elements of the construction.

Most professionals acknowledge and respect the expertise of the contractors' personnel, and use this as the line of departure, i.e., the juncture at which further detailing is suspended. The contractor must be permitted the opportunity to incorporate her/his expertise, methods, means, and procedures into the work. Hence, the size, placement, and proper installation of every item is not involved on the professional's part. Quite often the contractor will use methods of construction/installation which are not what the professional envisioned. However, this does not necessarily make them wrong, per se, simply another way of doing things. More often than not, these methods are equal to, or even superior to those the professional might use or anticipate; there are many ways, usually, to solve a given situation. However, where the professional feels that a distinct and specific methodology is required, this needs to be conveyed to the contractor, i.e., detailed! This interplay is not, and should not be perceived as the professional "giving up" authority or control, but rather as the meshing of the expertise of professional and contractor to the benefit of the client's project. With the vast number of materials, systems, devices, equipment, apparatus, etc., on the market for construction use, this combining of expertise is really crucial to a successful project. Usually it will produce the best possible solution.

There is also an interplay between the professional and the manufacturer of the material, system or device. This is usually played out through the manufacturers' representatives or sales personnel, and the time, literature, and knowledge that is given the professional regarding a specific product and its use on the project. Various construction industry resources provide a passive array of information, so quite often a product will entail a number of installation possibilities. These all may be valid and correct, but usually are not universal [for every installation]; in the main there is one, good and proper method for the condition under consideration. There may be a need to seek this out through personal contact. Here the professional must seek out this information, assess its impact on the project, adjust where necessary/advisable, and then proceed to detail the installation in a method deemed to be "correct", in the view of the professional. This is the point at which the professional's expertise and experience come into balance with the liability risk. Also, this is the point at which the professional engages the prevailing standard of care; "Is this the right thing to do? Is this what the prudent person would do?"



CONSIDER:
1. How is the radius trim attached to the wall?
2. How and when is the plastic laminate applied to the wood radius trim?
3. Can you identify and note the use of the items not described in this detail?
4. What alternative(s) can you offer for this detail to clarify these issues and to make a more workable detail?
5. Do you understand the notes, etc. on this detail?

A detail with some question. This illustrates how a detail conveys information, and how, too often, a very complete looking detail will overlook some information, or create questions that are unanswered.

Fundamental to this is the understanding that detailing is really a matter of making specific decisions and incisive details. The product manufacturers issue details and detailed information, which illustrates the application of their products, as they envision and intend them. Each manufacturer obviously has established some direction, or has seen some need that the product is intended to fill – without this there would be no reason to produce the material or item. However, the material is usually produced in a form which is set by production methods, machinery type or capacity, or other criteria of manufacture. Or the products are made in such a form that makes them easily adapted to the range of normal construction [for example, plywood, siding and similar products in a basic 4-foot by 8-foot form]. These all can be considered as "standard" products, indicating that they are normally sold in the configuration noted; their adaptation is left to the design professional and the contractors..

The crucial matter is ensuring the refining of the details, and narrowing their focus and configuration so they fit and serve the project as shown and required on the contract documents [both drawings and specifications].

In many cases, excessive or "over-detailing" comes directly out of this procedure [e.g., product that come "as a unit" need not be detailed showing all of their parts and nuances] . The professional, in "making sure", will add extra work, devices, products, or other items to ensure proper and lasting installation and workability of the product, construction, or equipment detailed. Often, without due care, needless cost is added for no real return, except added peace of mind and assurance. This is not to say that every sales "pitch" should be accepted outright, but rather that very judicious decisions and additions are required, and only where the perceived installation appears to be marginal, or outright faulty, in the professional's view. This interplay is particularly important today in that new materials and products appear on the scene almost daily; just keeping up is a difficult task. Some of the new product lines are not thoroughly, or well thought out, extensively tested, or engineered to meet the variety of conditions that they may encounter, over the long-term. Professional expertise and experience is the key [and only] factor that can assess and resolve this situation; making "better" is a professional function! Where that function is deemed necessary, it is incumbent upon the professional to detail, precisely, what is required; this includes appropriate adjustments in the specifications where necessary. All this must be done carefully since the professional also has not been exposed to "every condition", and therefore, can create problems by unwittingly obviating the good features of the product or material. While the effort to make better is sincere, the result can be disastrous. Obviously, this is but one situation where the professional fully "earns his money".

The professional, then, has an absolute mandate to create documents, and other communications, to the field personnel, in their terms! To do otherwise, runs the distinct risk of providing information which will be deemed useless [and perhaps will be discarded] simply because the tone, wording or message just doesn't seem to fit the needs and conditions, on-site. To provide the client/owner with a "bad" or marginal [i.e., unsatisfactory] project directly due to lack of adequate communication is unforgivable, and certainly can be the source of nasty litigation.

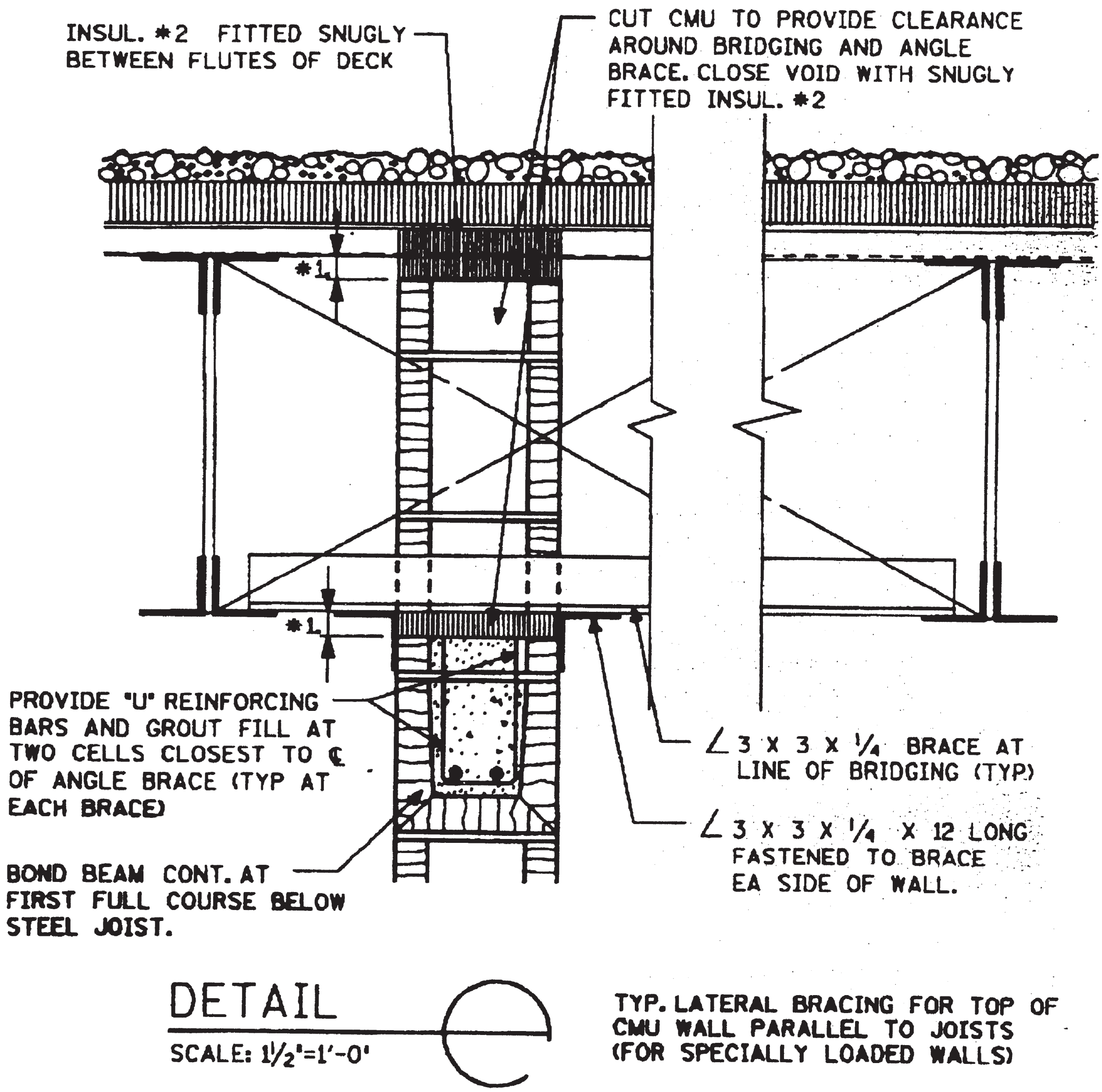
The design professional plays a pivotal role in this. It is only the professional who can interface with and fully understand the extremes of the project spectrum and the nuances attributed to both. One end is the client who talks about a certain list of items. The other is the trade workers and contractors who talk about their list of items, the vast majority of which are not even indicated in the client's list. This is a chasm that requires bridging – bridging created by the professional, who needs the skill to take the "talking points" on one end of the spectrum, and convert them into "talking points" meaningful to those on the opposite end.

Specific to detailing, the communication aspect requires due attention when a particular need or piece of construction is conceived and needs depiction. It is at this juncture where the actual conversion of information takes place. Remember the ultimate use of the drawing is by the trade worker and hence it must be done in the vernacular of the field personnel. This need not [and should not] include the slang, or misnomers so rampant in the field, but does include the correct identifications, instructions and directions.

DETAILER NOTES

*1. GIVE DIMENSION - VERIFY AMOUNT OF DEFLECTION W/ STRUCTURAL DEPARTMENT

*2. GIVE INSUL. TYPE OR NUMBER FOR CLOSURE MATERIAL AT TOP OF WALL AND AROUND JOIST (OR REMOVE FROM DETAIL IF NOT REQUIRED)



A standard detail [for repetitive use]. An office would create this sheet use it and sore it for future use under similar or same circumstance [eliminates repeat drafting]. Note questions to detailer which customize the detail if required.

DOOR AND WINDOW DETAILS

The most efficient way to deal with doors and windows on working drawings is to assign some symbol or mark to each type of opening. These designators are then incorporated into a schedule that provides complete data about the openings in question and the products to be used in them. Although a lot of information may be contained in the schedule, it still remains for the draftsman and project architect to describe the window or door products. It is not enough to give the size, model number, or other discriminating feature. The units must be shown in relationship to the walls.

This relationship necessitates additional specific details for doors and windows. These details may be separate from the schedules, or perhaps a more coordinated system will result if they are incorporated into the schedules. Having found the proper designator, a person using the drawings may go from the schedule information directly to the pertinent details.

To show how the units, whether doors or windows, fit into the openings, a series of sections must be cut, which should provide three major pieces of information, namely, head, jamb, and sill conditions. It is important that all three be shown, the total opening detailed, and all surrounding construction noted. In this system it is possible to outline the clear, or rough, openings between the structural members. The fitting of a typical unit is shown and, finally, of course, the type of finish closure wanted between the rough wall materials and the units themselves.

Many types of windows and doors, and as many methods by which the units can be built into the walls, are available. The possible wall conditions are also beyond enumeration. In addition, the combinations present a problem. By the time window and door detailing appears in the construction sequence, the wall systems will be known; it then becomes a matter of adapting the units to the wall conditions.

This, then, is the reason for the three detail sections: head, jamb, and sill. With only two, the head and sill, there is a gap in the information needed. How must we treat the side [jamb] of the opening? The jamb details are usually repetitive; only one need be shown. The sequence in drawing these details is from top to bottom, vertically: the head detail, the jamb, and, finally, the sill. The details should be properly aligned, as in a wall section, so that the lines between the various drawings can-be read. Details are usually drawn at a larger scale, either 1½″ = 1′-0″ or 3″ = 1′-0″. The larger the scale, the more detail allowed.

The complete detail should be shown so that critical questions may be answered. How does the door frame or window section fit into the wall? How is the unit flashed against the penetration of air and water? How are the pieces fitted together with other construction, perhaps even by other trades? There may be a need for additional details if a transom, impost, muntin, or mullion is specified. The detailing must be adapted to the particular job, and, again, if a detail is peculiar to the standard system [which is being built up by the project architect for his or her own use], it must be fully detailed.

In many instances it is helpful to show even standard details directly from the manufacturer's catalog to describe what is wanted and how it is to be incorporated into the building. There is little chance that a window will be installed in the wrong opening, but if this information is not related properly, then ragged, incomplete, and indecisive detailing in the field will be the result. What does the architect intend here? How is it supposed to be done? A guess is made that the detail will work one way or another, and even though the job may be well supervised, on-the-job control is beginning to disintegrate.

If we do not detail correctly, if we do not show precisely what is to be done in the window and door details, we are not going to get what we want. It will be difficult to prove that the contractor's worker is wrong in the work that has been performed. Wrong in regard to what? We cannot say a detail is wrong because its performance differs from our intent. Whatever our intention, it must be clearly shown in every case. To combine the details with the schedules is a good idea. It may not always be possible as the set is constituted, but it is helpful if it can be accomplished. Determination of the number of sheets devoted to door and window schedules and drawings depends on the size of the project. The details can be drawn on letter-size sheets and bound into the specifications booklet. Even though we are dealing with stock items, the stock units must coincide with the design. They must fit into the construction as specified; there should be no doubt of the ultimate intention in anyone's mind. All pieces of the stock items as well as any necessary trim must be shown.

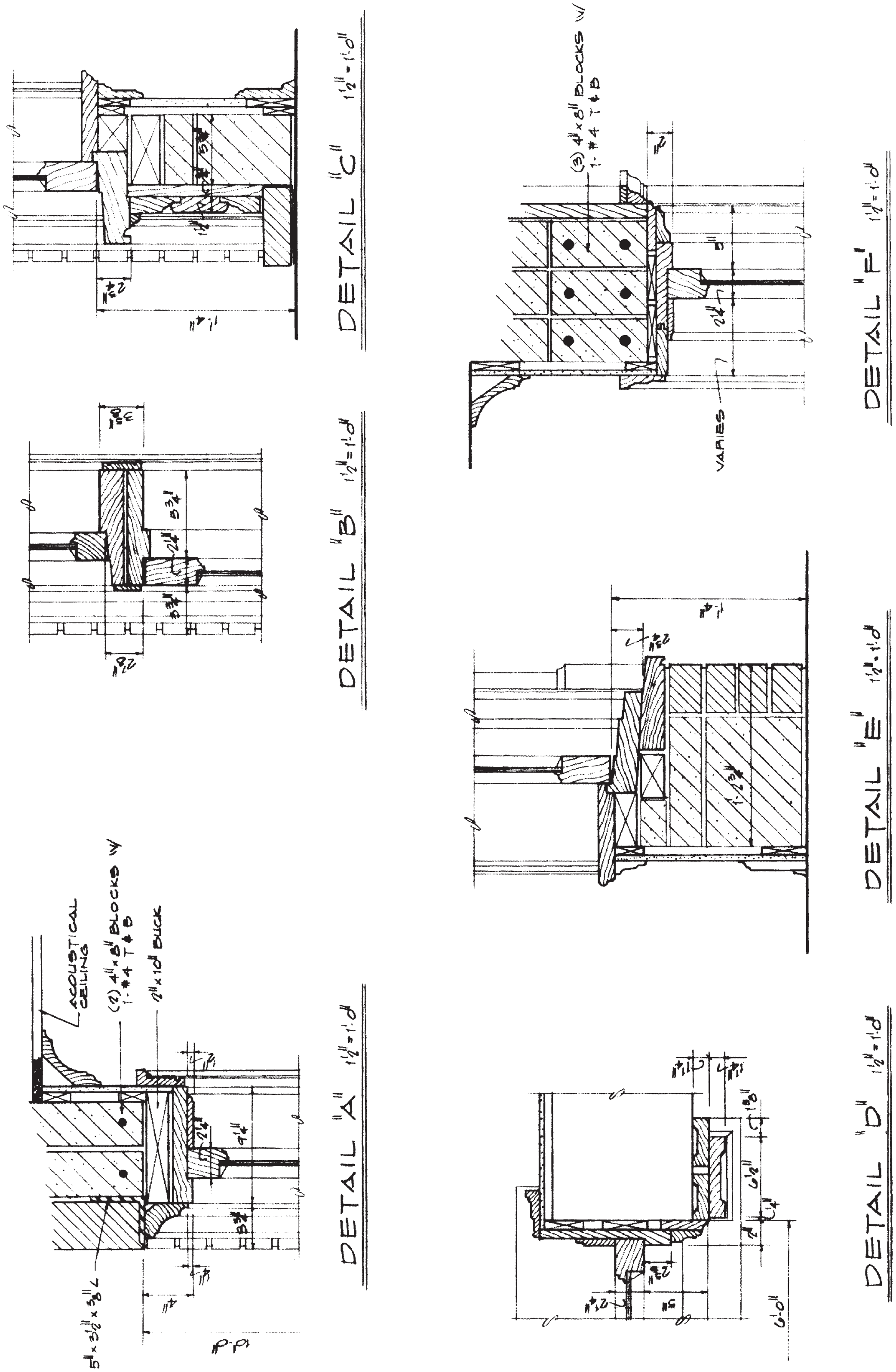
Problems of coordination are common; for instance, if a particular closure angle is designed to seal a gap between a window section and a wall, it must be specified that the trim will be supplied by the window manufacturer, who can furnish an aluminum angle in exactly the same finish as the window unit to prevent discoloration or change in finish detrimental to the detail itself. However, another trade could be required to supply the closure.

We cannot explain how every piece will fit into the construction [experience is the governing factor] or by whom this piece will be supplied, but in a large measure we can control the detail and the supplier. In custom work [the window and door frames are specially built], it is important that every item be detailed.

We must be careful to detail in correct sequence. We do not ask for the impossible because this will only tend to run up the cost, but we should detail within the scope of our project for the effect we want and, going back to the design cycle, according to practice and the state of the art. Customizing does increase the cost; the manufacturer must change his or her method of production for a special size to meet a particular order. The owner, of course, will have to pay for this specialization. This is not to say that we must forget about "specials" entirely. If there is a valid need for an unusual window or door unit, it should be installed. If an item must be oversized or specially constructed to meet the owner's need, it should be ordered. However, to demand minimal changes in stock items for the sake of variation is not reasonable. The total concept of the project must be kept in mind.

It seems odd that a project's drawings must include windows and doors; everyone knows how to put them in! There is a tremendous fallacy in this statement. A skilled worker knows how to install a window or door, but not every skilled worker is familiar with the project at hand and its requirements. It is true that we can walk into a store and select clothing from the racks that will fit and look reasonably well, and we can buy this way. In construction we must be better than close; we must be exact. It is not that we have to be exclusive or to incur unnecessary cost; we can use stock items similar to those bought from the racks. At the same time, we are special and so must our details be special. The complete door and window story is told in good details.

CHECKLIST: WINDOW DETAILS
1. Show all sizes and elevations; operable portions; head, jamb, and sill details.
2. Detail actual installation of windows; coordinate by drawing the window with all applicable wall conditions.
3. Consider the need for the following: screens, frame reinforcing, washer bolts, shades, access for washing, fit of adjacent equipment inside the building.
4. Indicate weather-stripping, thickness and type of glass [in general terms].
5. Finishes of frame material, caulking and sealing, interior closures and trim.
6. Include all necessary blocking and construction that makes the opening ready for the unit.



Examples of head, jamb and sill details for wood windows. Similar details are available and are used for windows of other materials mounted in other types of wall construction. Main point is to show the construction.

MISCELLANEOUS DETAILS

In almost every set of drawings, for a building of any size, myriad details are necessary for a complete and finished project. Many are not easily categorized but instead reflect a need or gap in the drawings that must be filled.

The best solution to the problem [to show or not to show a given detail; what detail to show; how many details to be shown] is a mental analysis of the processes of building the particular complex. The conclusion will be that more information is needed or that all the information required is at hand. A number of facts can then be adjusted. First, the number of details to be shown can be determined; second, the scale of the details can be set, for by showing a particular assembly at a larger scale more can be shown, more information can be provided, and the need for more detailing precluded. This procedure of evaluating needs [how much is needed and when] comes with experience. Total knowledge cannot be gained in an office atmosphere because the architect cannot properly analyze the facts if he or she has not been in the field and does not know at least a little about the actual construction work. It would be marvelous if all students could work in the construction trades in one capacity or another during their learning period. Unfortunately, this is seldom possible. Although it is necessary to fill the gaps with complete information, there is danger at the other end of the scale. This is over-detailing! By over-detailing, we often succeed in getting a stranglehold on the particular project.

The construction costs, the complexity of the building process, the relations between contractor and owner, and, above all, the entire project can be greatly influenced by the type of relationship that is set up in the drawings. Many architects and draftsmen have differing views; some regard the mentality of contractors as bordering on idiocy and think that they must detail every last item in order to hold the contractors in an iron grip that will force them to perform exactly as the drawings indicate. There are others who do not share this view of the contractors' mentality and produce their drawings in a different context.

The more data shown on the drawing, the more knowledge and experience the architect must have. In fact, an architect must be sure of his or her systems and methods or this professional will effect a drastic change in the cost of the project. Perhaps the best catch phrase is that the architect should know what he or she does not know! Applying this maxim to detailing, the architect must know when to stop. Certainly, if an assembly has many pieces from many sources, it must be detailed for the contractor. On the other hand, it is not necessary to tell a contractor to spike two 2 x 4s together by driving four 16d nails through the face of one 2 x 4 into the other. Many specification writers refer to a workbook called Manual of House Framing, Nailing Schedule, which lists the various criteria for proper nailing, the number of nails, their sizes, spacing, and so on, the use of which eliminates a vast amount of detailing in the drawings.

However, if trusses are to be made from wood members, it may be necessary to show the pattern of nailing in the gusset or nailing plates. It may also be necessary to show the number of nails on each side of the connection, but, again, the architect and his or her consultants, because of their superior knowledge and experience, will know what to show and when to show it.

Often one of the biggest areas of conflict will develop when cabinetwork is called for. The architect sits at the drawing board and designs this casework in architectural form. However, current shop practice or good workmanship may dictate otherwise. Again, the situation varies from office to office, but in many instances a design concept is what is shown: the height and width of the cabinet, the materials, the thickness of the top, type of doors, type of base, number of shelves, and the hardware. The basic elements of putting it together are left to the specifications or the contractor's workmanship.

A check on the manufactured items is provided by the shop drawings discussed in a later chapter. Shop drawings show us what the manufacturer has in mind, how he or she proposes to put the item together, and other special elements of the unit. At this point we can compare our own ideas with what is being used.

Detailing is important. Looking through a set of drawings, we may find seemingly minute items that may be vital to the success of the project. They are so vital that we need to be intimately concerned with the project to understand the part the details contribute. The details should not be sheet fillers or mere time killers for the draftsman; they should be well thought out, well planned, completely cross-referenced, and professionally executed. In this way we will not serve up redundant miscellany that will be of no value to the contractor or the owner.

Although relevancy is one of the prime considerations in detailing, another is the time consumed in properly detailing a project. Three factors come into play: underdetailing, overdetailing, and redundancy. The project will run into a great deal of trouble if the detailing is inadequate and does not properly or completely depict the construction required. Experience is a big factor, inasmuch as one must have a feel for what information is required and how much information is necessary. To provide inadequate information leaves the work to the con tractor, who may perform as intended or who may use experiences from previous projects to build the work in some way that is not in keeping with the architect's intent in the current contract. The remedy for such work is almost impossible, and very expensive if work must be razed and rebuilt. Draftsmen should get used to questioning their own work, asking, "Is there enough information here for me to build this work?" In addition, checking with others in the drafting room will expose gaps or inaccuracies in the detailing.

On the other end of the scale is over-detailing, whereby the professional literally imposes a death grip on the work. He or she details the threads on the screws, odd-sized washers, and other such items, to the point that the work is either impossible to build or extremely expensive. And if the contractor is "forced" to perform exactly as detailed, costs will jump even further. Simply, one must know when to stop detailing; again this comes from experience. Some architects feel comfortable only when they control every feature of the work, down to the finite detail; care must be taken that such an attitude is not counterproductive.

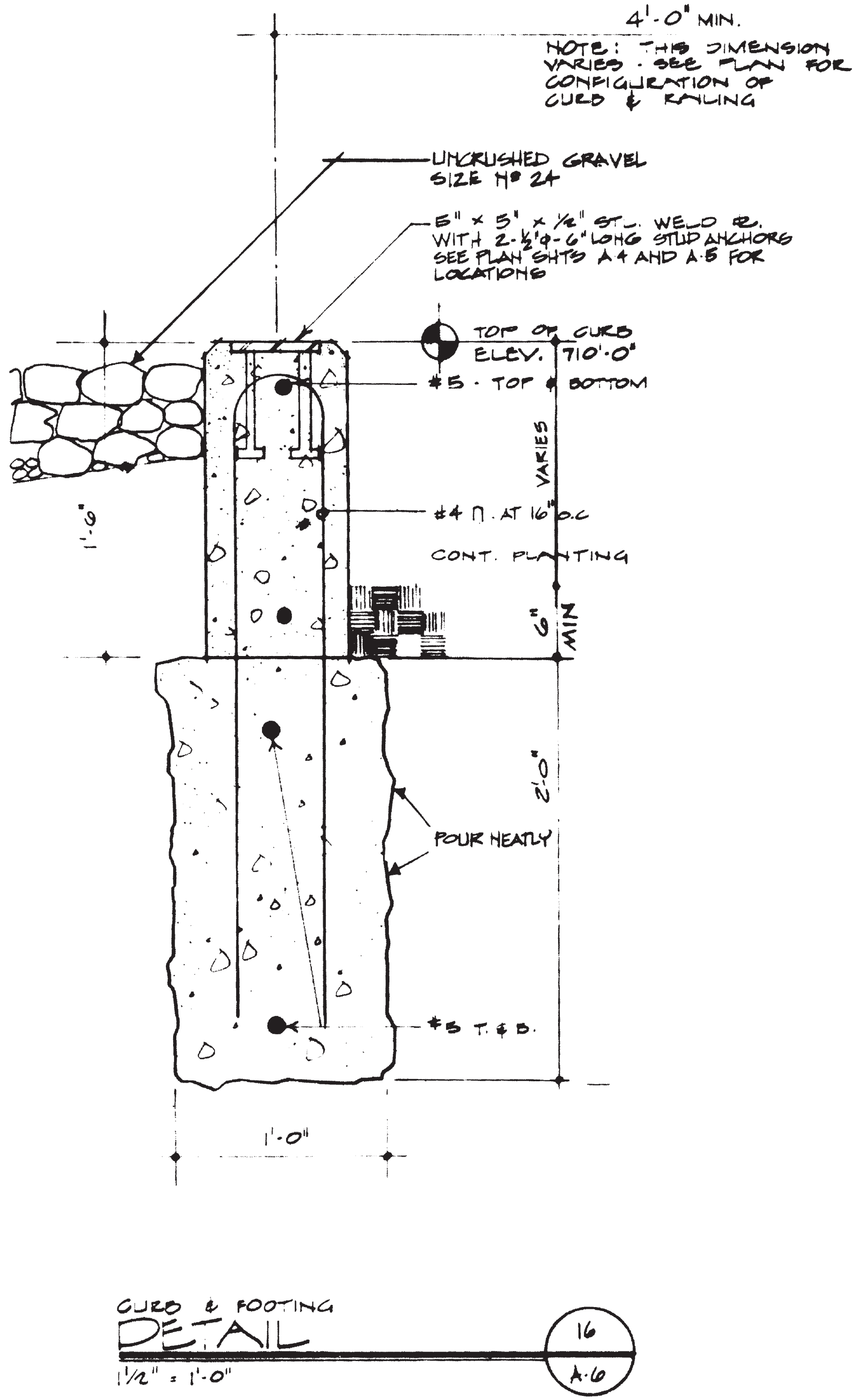
Redundancy has been addressed in the last few years, summarized in the question, "Does this detail need to be drawn again?" The point here is that a great number of very similar details are incorporated in work, even though the projects involved may vary considerably. Flagpole, curb, and roof drain details come to mind quickly; do they vary or, rather, must they vary from job to job when conditions are similar? Should time be spent on each project to detail this work? Should this time be expended again and again? The current answer is a resounding No!

Although considered the height of unprofessional practice in the 1950's, standardized detailing is now a viable and legitimate production technique. The reuse of details is not only advocated, but is recommended, encouraged, and widely practiced. More and more offices are developing systems of standard details, drawn once, retained in retrieval systems, and reused when appropriate. The keys to such a system are proper input, a studied detail free of peculiar features, neatly and properly drawn in a standard format, and placed into a coherent filing system, completely indexed for future retrieval and use.

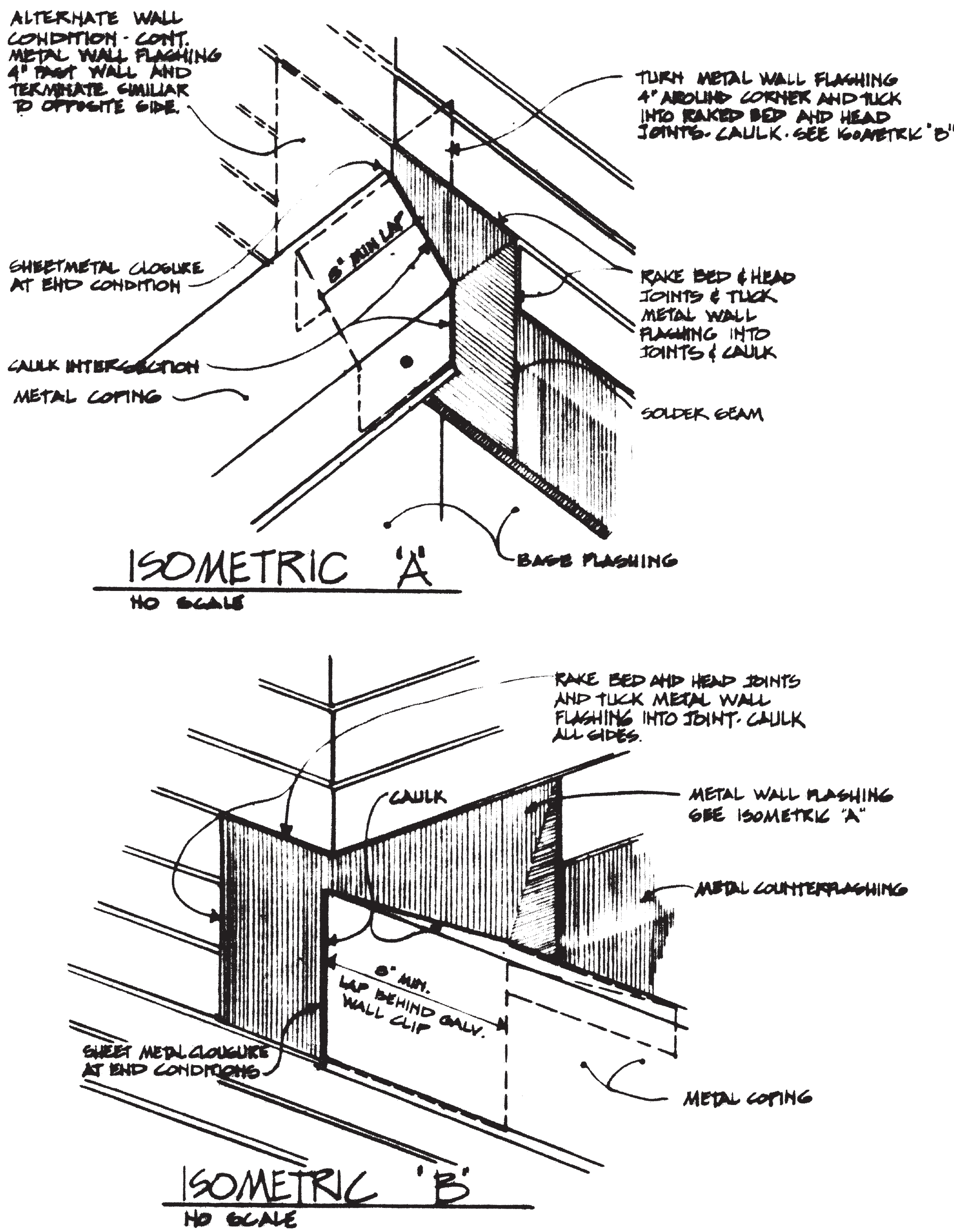
Do not try to approach this system by having each drafter keep "some details he [or she] draws in the drafting table drawer." The system varies from office to office. Some still retain a manual system of simply filing the details neatly, and others use microfilm or computer-aided drafting [CAD] and retrieval systems that produce the detail in self-adhering decal form. It is the concept of standard detailing that is important, not the system that is utilized. Some offices, of course, have moved from very primitive systems to rather involved, sophisticated systems as their needs changed.

The most recent approach has been the establishment of a detail bank. This is a commercial venture whereby one can subscribe to, or actually buy details from, a central source [not another office] that has an excellent background in this work. The cost is moderate when considered with the cost of redrawing the same work over and over. Moreover, in utilizing the bank, one buys the highest level of expertise and can therefore raise his or her level of work.

To make any of these systems work there must be a way for the field personnel to comment on the details. This feedback is a vital part of the detailing system. Here, problems in the field caused by the standard details can be recorded on the file copies, so that in the future adjustments can be made to avoid repeating the problems. Of course, if too many problems occur or drastic changes are required, the detail should be reevaluated and redrawn as required.

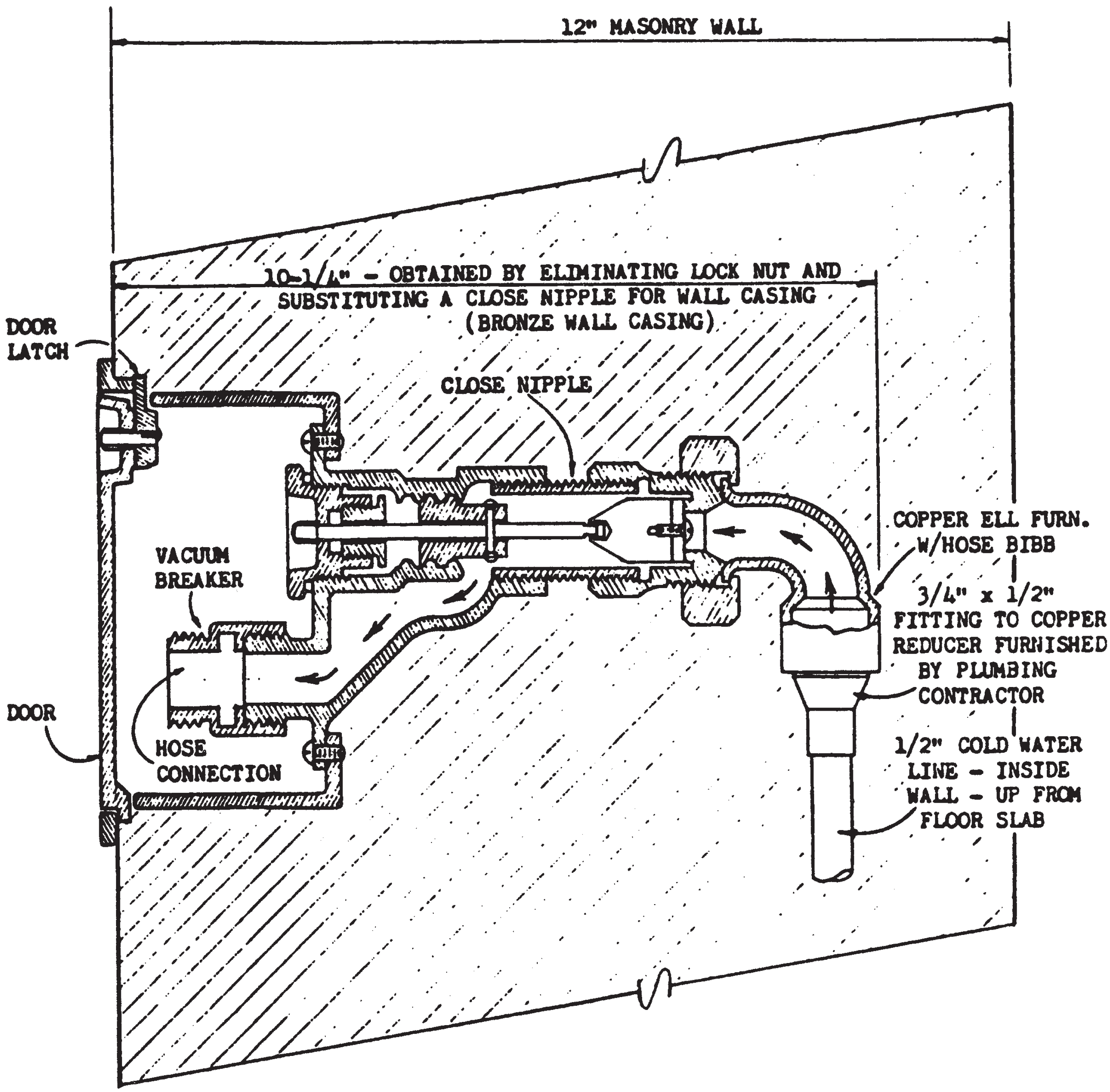


Even rather mundane work such as a concrete curb [shown] is often detailed to show exactly the construction required. This detail is a good candidate for conversion to a “standard” office detail [for repetitive use] to save the time of re-drawing it.

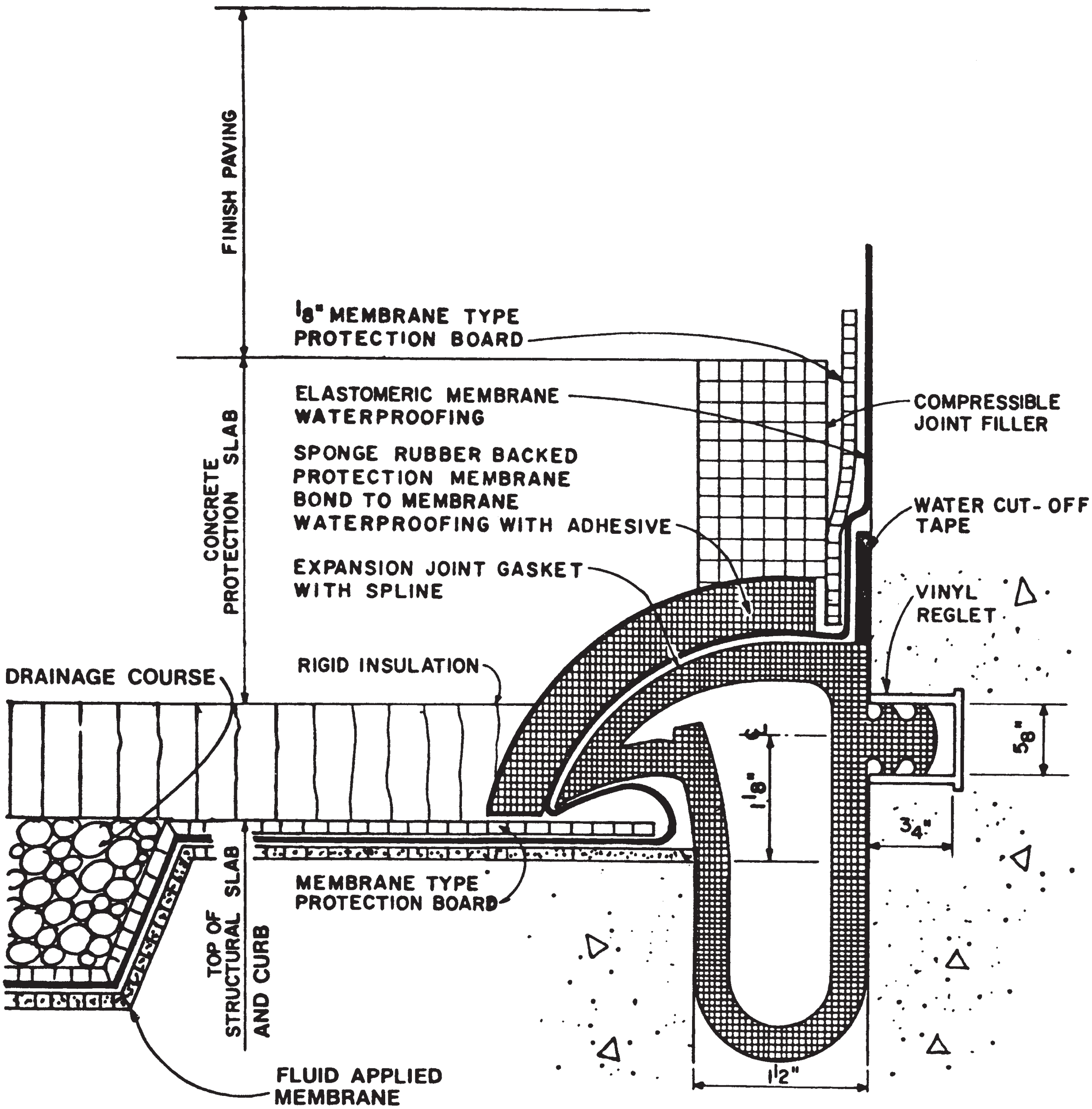


(A)

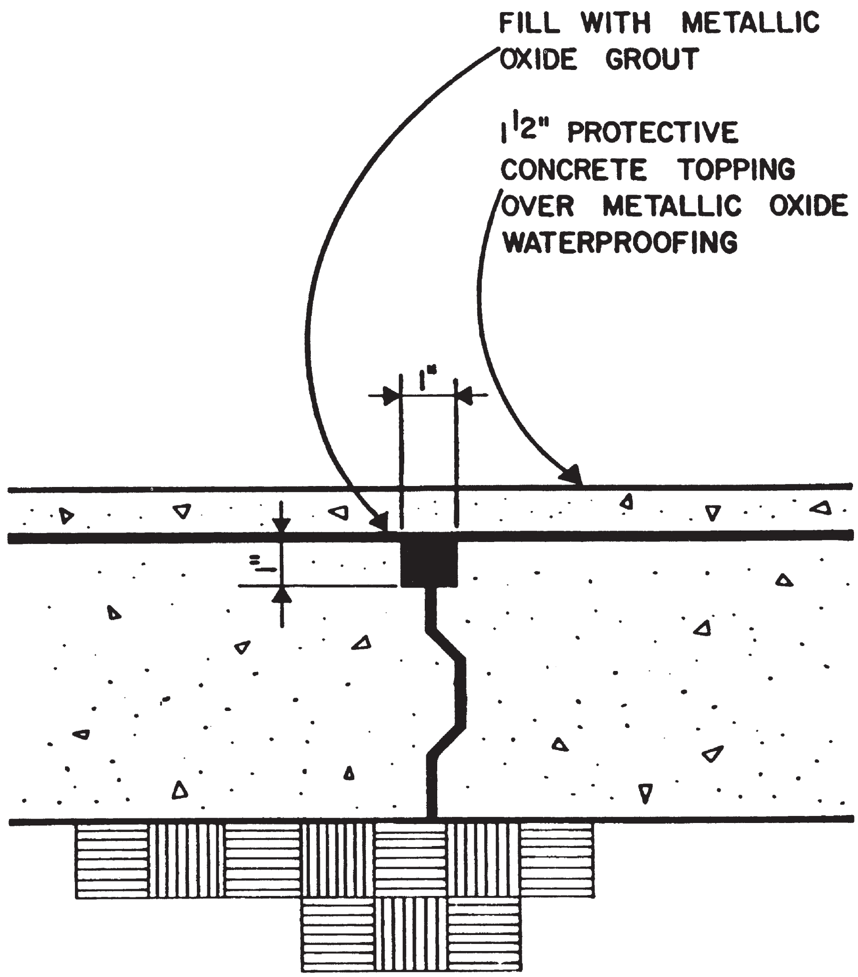
In rare occasions it is necessary to show the work in a more realistic manner, and this is best done through use of isometric projection. Here the drawing is rotated so three planes are visible. This provides a view close to what the eye normally sees and enable intricate work to be better displayed and explained than it could be shown in normal 2-dimensional working drawing manner.



An excellent example of needless, time-consuming “over-detailing”. Since this hose bibb would be ordered by model number and provided as a manufactured unit there is absolutely no need to how this view and minutia of its construction. There is nothing in this view of value to the contractor and has taken valuable time for drafting [by any means].



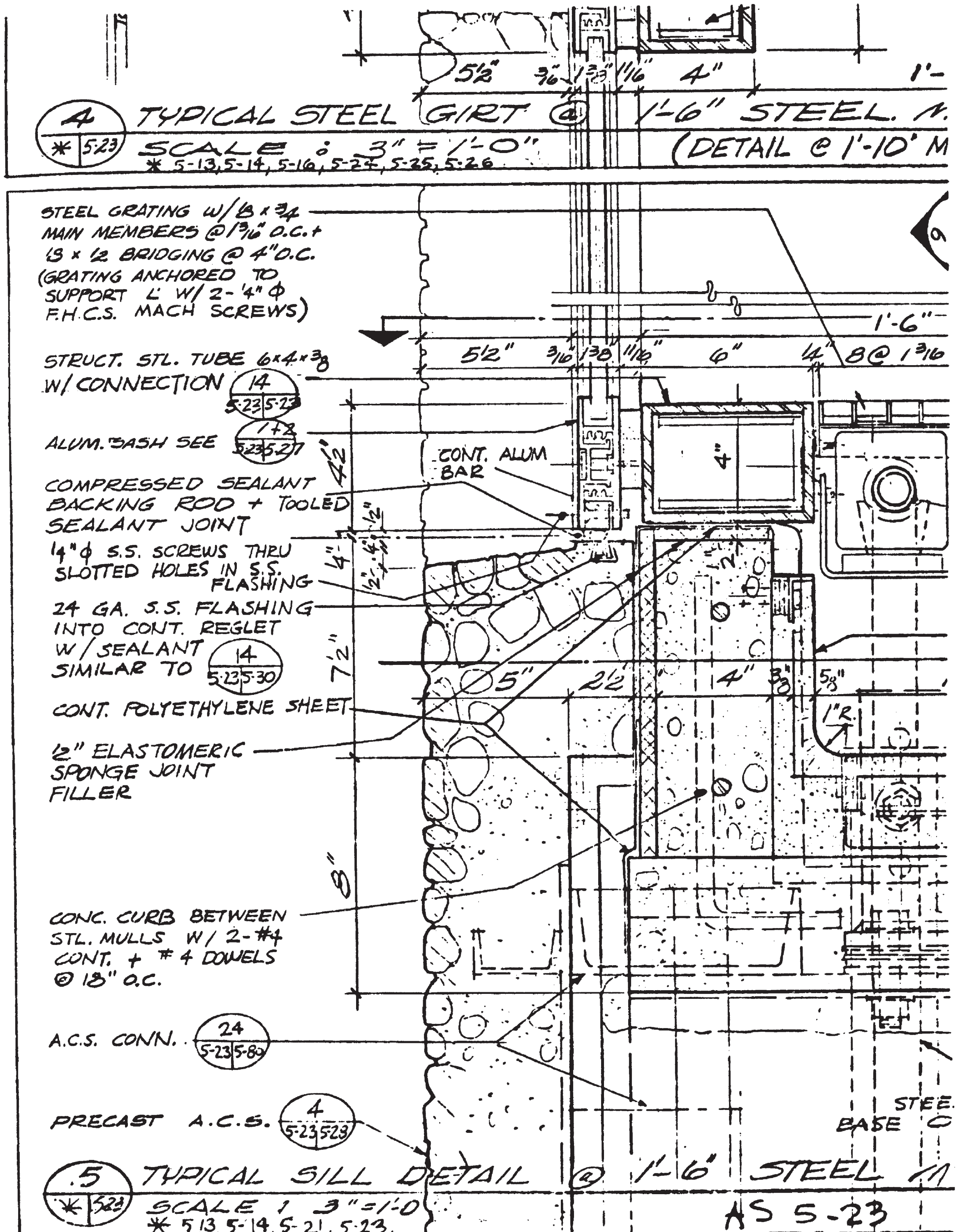
FINISH PAVING
1/8" MEMBRANE TYPE PROTECTION BOARD
CONCRETE PROTECTION SLAB
ELASTOMERIC MEMBRANE WATERPROOFING
SPONGE RUBBER BACKED PROTECTION MEMBRANE BOND TO MEMBRANE WATERPROOFING WITH ADHESIVE
EXPANSION JOINT GASKET WITH SPLINE
COMPRESSIBLE JOINT FILLER
WATER CUT-OFF TAPE
VINYL REGLET
DRAINAGE COURSE
RIGID INSULATION
5/8"
1/8"
3/4"
MEMBRANE TYPE PROTECTION BOARD
TOP OF STRUCTURAL SLAB AND CURB
FLUID APPLIED MEMBRANE
1/2"



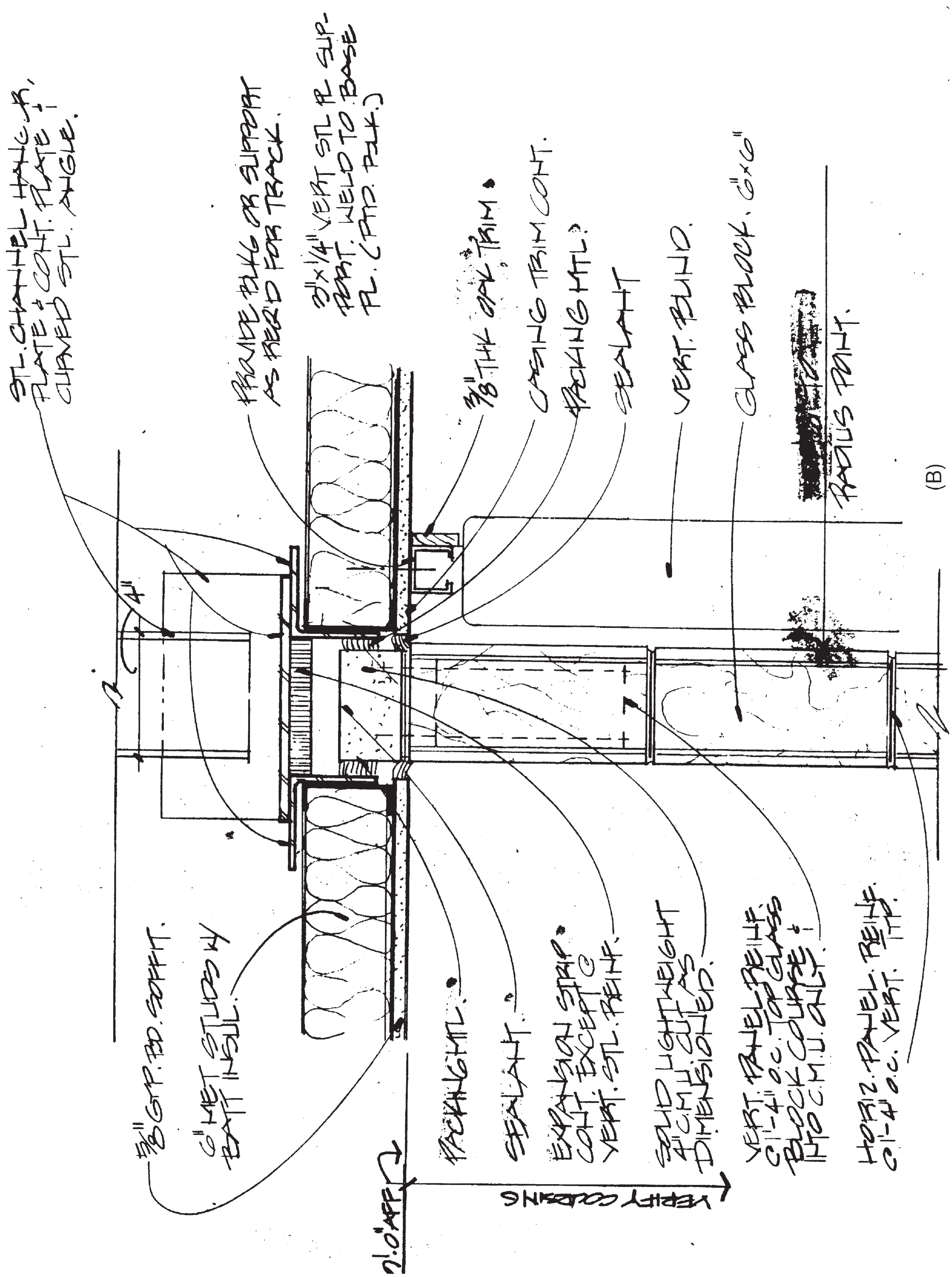
METALLIC OXIDE WATERPROOF'G FLOOR CONSTRUCTION JOINT

DATE 10-1-70 | SPEC. REF.
TYPE | STD. DET. NO.

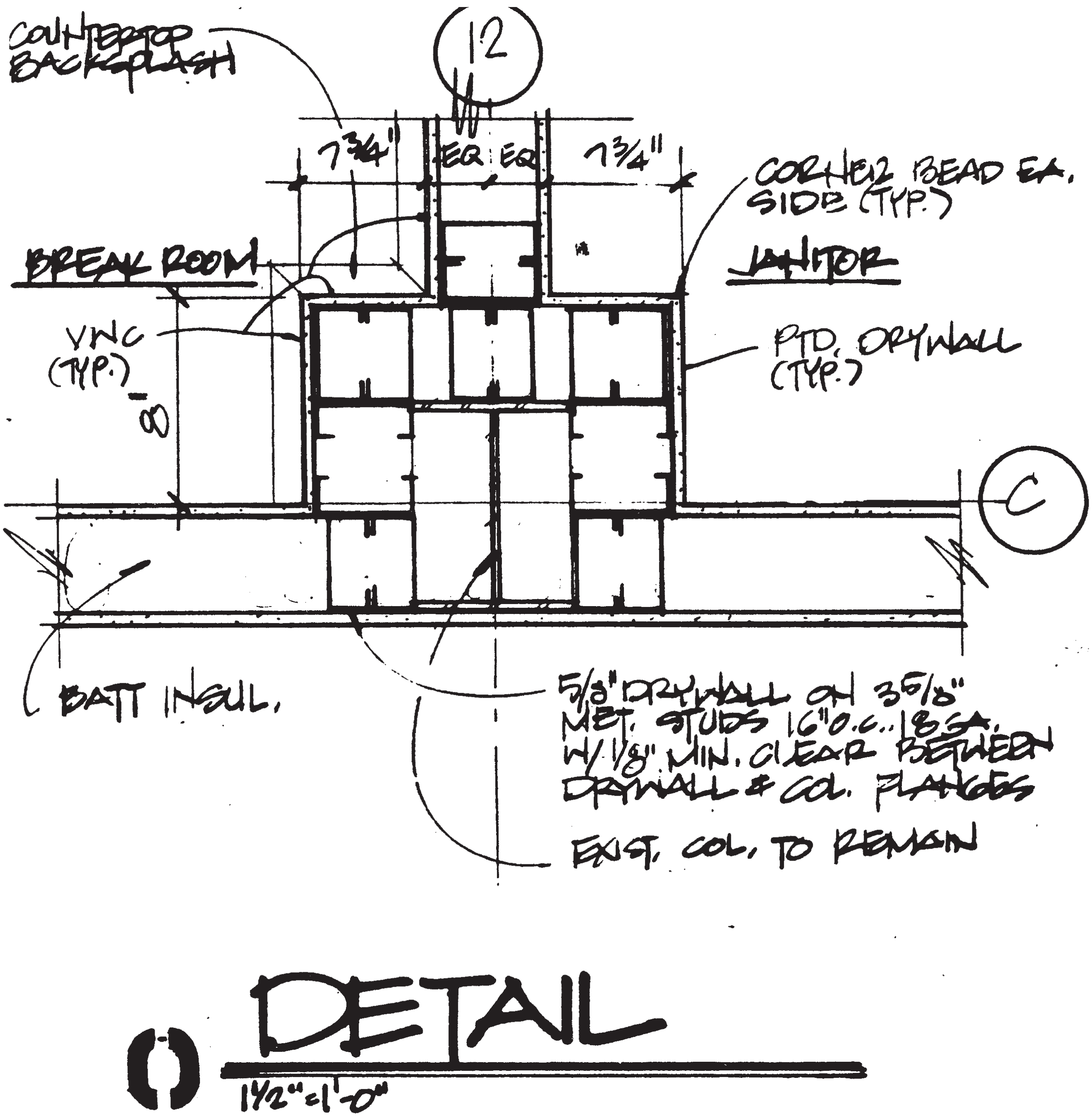
Highly sophisticated details developed either by offices, trade agencies or other sources, primarily as standard details. Obvious this level of detailing consumes a large amount of time, which is not available, normally, in the office. These are excellent examples of "standard" details.



Produced via manual drafting this is still an excellent example of how complex and involved some details and sections can become. Here it is most vital that good line work be used, good material symbols to separate the materials, and careful location of notes and dimensions. Also, it needs to avoid "over detailing" — here in the form of trying to show too much or irrelevant information.



This detail comes very close to being cluttered and murky, what with the long curved leader lines. The drawing is well done, but the decision to align all the notes is questionable; at least they all need to be moved closer to their point of reference to eliminate the long leaders.



This is the detail for the intersection of two interior drywall partitions. The point of including it is the great number of studs that have been used in the framing. Are there any there that you would eliminate and still proved well constructed partitions?

STAIRS AND FIREPLACES

The title of this chapter seems to have combined two diverse subjects. There is a basic lesson to be learned in these two particular categories that can be incorporated into the total building.

The need to detail is inherent in architectural working drawings. Pieces of construction must be literally taken apart and drawn at large scale to show how they are to be fitted together. This is indeed a major part of the architect's drawings.

Piecing together exactly how much detail is needed in his or her conception of a project is a very hard lesson for the average young architect. If showing a unique item that does not involve standard procedures or standard materials, the architect must, of course, detail minutely to describe exactly what he or she wants and how he or she wants it. By so doing the architect is telling the con tractor that he or she accepts no other way. This system presents the contractor with a problem, and talks or negotiations may be required. Young architects, however, should be aware of the fact that minute detailing [to the point of over-detailing] can be dangerous.

First of all, it is impossible for one person to know everything about all construction systems. The contractor will often see, or know of, a better way to put a series of materials together. The architect, seeing it another way, may introduce more cost by virtue of more elaborate equipment or material needed or more time required. The project budget will suffer.

Here appears that particular point, similar to the finite line between love and hate, at which the young architect must learn to stop detailing. It must be said that under-detailing is even more dangerous, because assumptions will be made by the contractor. The client may be shortchanged by shoddy work that cannot be rectified without additional cost, usually to the architect, who did not do his or her job properly. This is the experience factor in architectural practice, not only to know what to show but how to show it and where to stop.

The categories of fireplaces and stairs are prime examples of this dilemma of detailing. For many hundreds of years, people have been trained as masons or bricklayers. Part of their training has been concerned with the totality of the masonry system-not only walls and corners but such details as corbelling, decorative bonds of brickwork, tying walls together, and fireplaces. Many years ago, fireplaces constituted the heating system; masons became experts in building them, and even today some of the older masons may still be specializing.

A good fireplace is, of course, architecturally pleasing, but it is also one in which the draw [the operation of the fireplace] is excellent. It makes no difference what the exterior shell of the fireplace may be. Primarily – it can be paneled or brick-faced; it can have a metal hood over the opening or any number of other motifs. The configuration can be varied: a single opening, an open corner exposed to two sides at right angles, or two openings through which one can look from room to room. Some fireplaces are open on three sides, and some are freestanding.

No matter what the system, the basic detailing remains the same. A fireplace must have a properly proportioned opening and should be pleasing to look at [a rectilinear opening is much more desirable than a square]. Some have openings in which a person can stand upright. Once the size is determined, the firebox itself must be properly shaped, usually tapering toward the rear, and lined with high-temperature firebrick. [Common brick will not withstand the excessive heat and will crack and spall.]

The next important factor is the height of the chimney and the size of the flue. The chimney should extend at least 2 feet above the high point of the roof. The orientation of the building and the prevailing winds must be considered for both the height of the chimney and the placement of the fireplace. Flue size can be adjusted if a height problem affects the draw. Generally speaking, the higher the fireplace, the greater the draft speed involved. The wind and the surrounding buildings must be taken into account. A flue that is too large is better than one that is too small. [If it is undersized, the flue will not provide sufficient draw for the smoke, which will pour back into the room.] In the preferred method, a vitrified clay lines the chimney mass up into the flue. Without this lining, cracking has a tendency to appear that will allow seepage of water into the masonry and thus facilitate deterioration.

The architectural detail of the fireplace requires a number of dimensions; here, again, overdetailing should be avoided. A plan should show a section and its dimensions to make sure that the chimney is properly designed. An elevation is particularly helpful to show the client the decorative form of the fireplace.

In studying the section of the fireplace, we note that the firebox slopes upward to the damper. The throat above the damper slopes back and up into the smoke chamber and then to the flue. A good mason will know how to place the brickwork and will also be familiar with the correct dimensions and angles even though they are not shown. The mason should be held responsible for providing an operable fireplace.

Here it can be seen that if we begin to put in what we think would be a "good" shape for a smoke chamber, it is conceivable that the chamber will not work. Dampers of steel and cast iron come in stock sizes. On the various charts available, all dimensions of the fireplace have been figured out and proved workable, in which event it is not necessary to detail every feature of the fireplace, for again some misinformation could cause failure.

Many general rules of thumb may also be applied. Sloping walls immediately above the damper are usually set at 60 degrees above the horizontal. The rear wall is built vertically and the front wall is corbeled or splayed out to form the angle back to the flue. Various configurations can be made for the ash dump; if there is space below, the dump can be installed in the bottom of the firebox. It can also be built into the rear wall to the outside of the room. In some instances when no access can be had to an exterior wall or to the fireplace floor, the dump becomes a pan that must be emptied through the firebox opening.

It is most important in fireplace design that a hearth of noncombustible material be provided for approximately 18 inches in front of the firebox. A material such as quarry tile, brick, slate, flagstone, or similar masonry materials is a common choice. One other factor that must be seriously considered is the amount of heat generated. This heat must be prevented from superheating any adjacent wood framing, and starting a fire. Various fire codes prohibit direct contact between the fireplace construction and the framing members. Usually a 2-inch air space must be allowed between the two. In some instances this air may be filled with a noncombustible insulating material. The masonry construction of the chimney offers some insulation, but the wood members will still be warmed by the tremendous heat in the firebox.

Various specialty fireplaces are available, particularly in the more contemporary styles. They include a hooded type of fireplace screen, but the basic masonry construction is still provided even though the hood is merely a decorative element. No matter what the system, no matter what the motif or type of fireplace, the client is not going to be satisfied if the fireplace operates poorly. If the flue is too small, the damper throat too narrow, the chimney too low, and other exterior conditions inhibit the proper flow of air around the top of the chimney, the draft will not evacuate the smoke from the chamber. Freestanding fireplaces or open-backed fireplaces tend to allow smoke into the room, and it becomes more important that room drafts be prevented by the installation of glass sides or screens. Freestanding fireplaces present another sort of problem: there is usually no masonry enclosure [for these are packaged units] unless it is properly designed by the architect.

Steel fireplace boxes can be covered with masonry or other material to provide ducting for warm and cool air, the warm air being produced by the fireplace and the cool being returned to assist in combustion. These are stock units and all sizing is done by the manufacturers.

The main point is that numerous systems and numerous fireplace styles are available, all of which must be carefully detailed. Moreover, the manufacturer's data must be incorporated to make sure that the fireplace will operate.

In the same vein, stair building is a highly specialized trade. A great variety is available: wood, steel, aluminum, open tread, open riser, closed riser, decorative, and utilitarian, but a few basic principles apply to all. Here, again, a team of factory experts will be better equipped than the architect to supply complete detailing. The overall design criteria can be shown by the architect, but it may be wise to allow the actual completion of the detailing and construction to be done by the workers in the factory.

In most instances the architect will demand, in the specifications, that the stairs carry a certain load; for example, 100 pounds per square inch. These calculations can be made by the manufacturer and checked by the structural engineer.

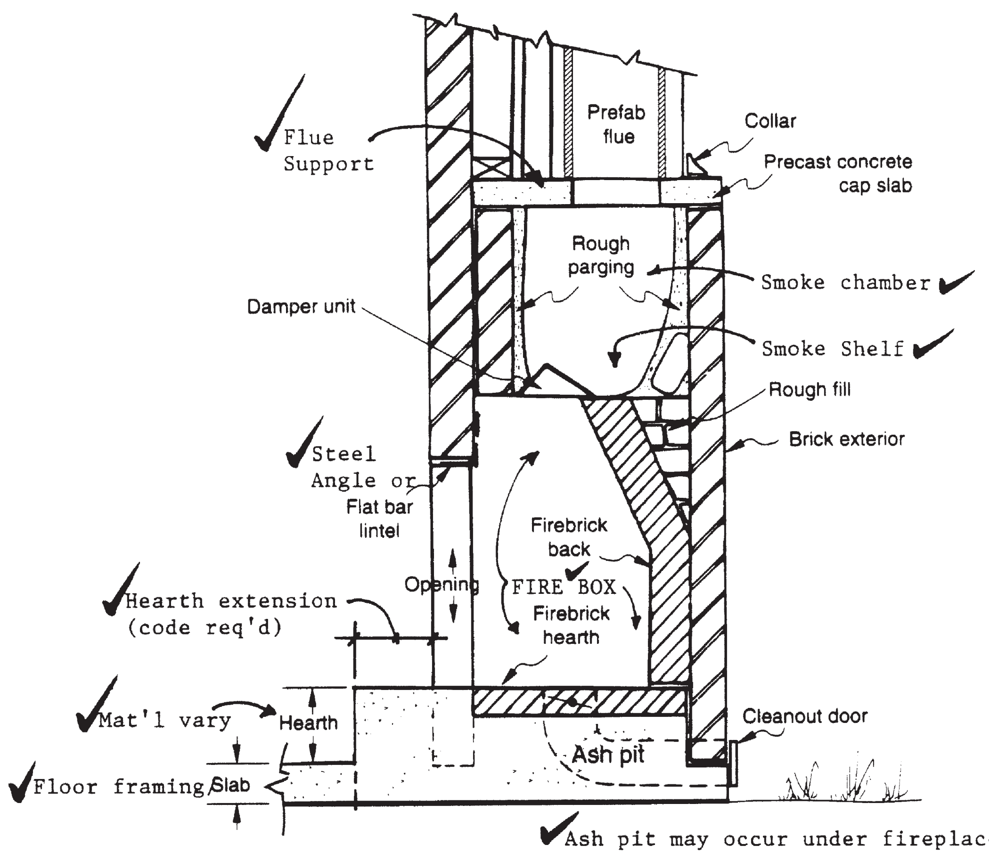
Most important to the young draftsman is the layout of the stairs and a knowledge of the various types. Stair design depends on the amount of space expendable for vertical access. Stairs are really sometimes a necessary evil. If at all possible, a minimum area should be used. In decorative or monumental types the reverse is true. The idea of stairs primarily for public use is that they be safe and comfortable. Often stairs that look easy to climb, such as those with low risers, will have wide treads that make the normal rhythm of ascent or descent impossible, and become difficult to climb.

An established proportion of the riser to the tread must be followed. Over the years, risers have fallen within a range of 7 to 7 1/2 inches in height, a comfortable rise, although in some instances service stairs [not for public use] employ 8-inch risers. For public use the 7 to 7 1/2 inch riser is a must, in conjunction with which most coding agencies will demand some relation between the height of the riser and the depth of the tread. There are three basic formulas:

- One riser plus one tread should be 17 to 171/2 inches.
- Two risers and one tread should be between 24 and 25 inches.
- One riser multiplied by one tread should be between 70 and 75 inches.

Therefore, if we choose a 7-inch riser, we will automatically go to a 10- or 10 1/2-inch effective tread width. The effective tread does not include the nosing or overhang of the tread. Again, some treads are as narrow as 9 inches for utility stairs, and some have gone to 12 inches and more for the monumental. The stair angle is usually between 30 and 35 degrees. As the chart shows, any radical departure from this norm is more like a ladder and anything less than 30 degrees resembles a ramp. Many codes prohibit fewer than three risers in a run of stairs. Similarly, they prohibit more than 18 risers in any run unbroken by a landing. This prevents the public, particularly the aged or handicapped, from having to work at climbing a set of long stairs. Here, at least, in every 18 risers there is a place to rest before undertaking the next run. One-and two-step risers are extremely dangerous. Many injuries are caused because people are unaware of them, and many lawsuits have resulted. If the designer finds a situation in which one or two risers are needed, another means of making that level change should be investigated.

The layout of the stairs begins with a calculation of the number of risers and treads. The first dimension to be determined is the floor-to-floor. The number of risers can be determined by dividing by the 7-inch riser. We often find that a fractional answer is the consequence; for example, an 8-foot ceiling plus a floor construction of 11 inches and a 2 X 10 joist, adds 9½ inches, plus 2 layers of 3-inch flooring, for 1½ inches, when divided by 7 produces a quotient of something around 15.25



Since fireplaces can vary so widely in size and style, this detail is merely a matrix to show the points in fireplace construction that need to be correctly addressed. There are relationships [height to width of fire box opening, for example] that is crucial and need correct sizing for the fireplace to function.

inches. Of course, it is impossible to produce a quarter of a riser, and either 16 risers at a height lower than 7 inches or 14 risers with something more than 7 inches in each rise must be provided.

Once the number of risers is determined the number of treads is established, for there is always one less tread than riser. By going through the proportioning formulas we can see what the width of the treads should be.

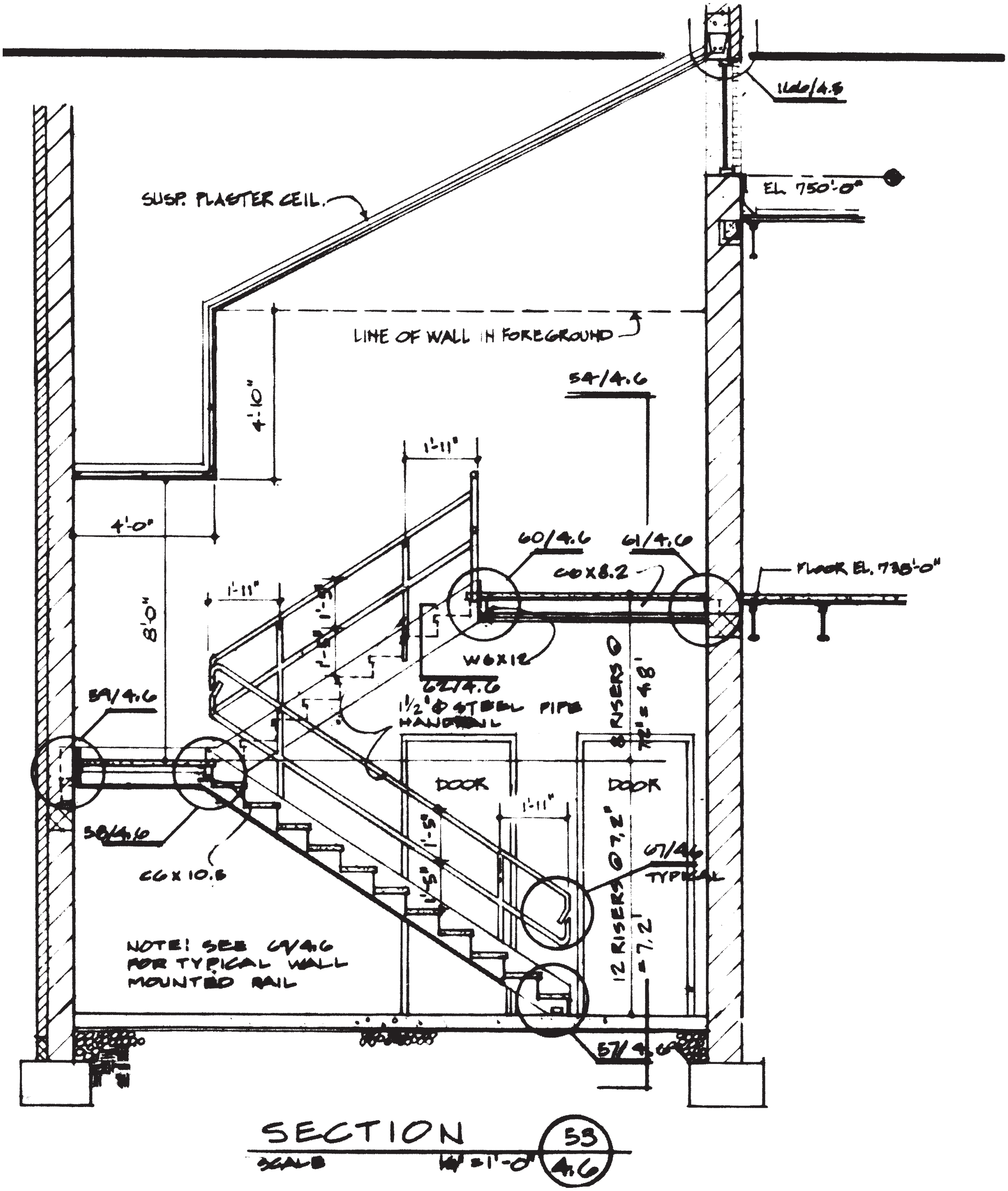
Because of the odd fractional dimensions for risers, it is difficult to scale the drawing when trying to produce a detail of the stair profile. The best means is to scale the floor-to-floor height and draw in the lines. Then take the number of risers; for example, 14. Any of the architectural scales can be used. By placing zero on one floor line and a multiple of the number of risers on the other [14, 28, or 42] the space between the two floor lines is then divided into the proper number of spaces equal to the number of risers. By knowing the number of treads and their width, the run [total of tread widths] can be calculated and established by two vertical lines equal to the total run. This total can be properly divided into the correct number of risers just as the treads were determined. With the production of the grid the stair profile can be developed and the details added as necessary. Although the basic layout does not change, there is a requirement of 6 feet 8 inches to 7 feet of headroom between the stairs and the construction above as one walks up or down the stairs. This headroom can locate the header in the floor framing and the sloped ceiling over the stairs. Whether they are concrete, steel, concrete-filled pans, or wood, the layout system is the same. The detailing becomes different in the actual construction, not in the configuration of the stairs.

Many helpful booklets have been published about the various methods of stair construction. Concrete stairs, for instance, are basically slabs that span from one floor to another, with a triangular-shaped riser-tread profile added to form the stairs. All the accouterments of landings and railings are easily added, depending on the demands of the building.

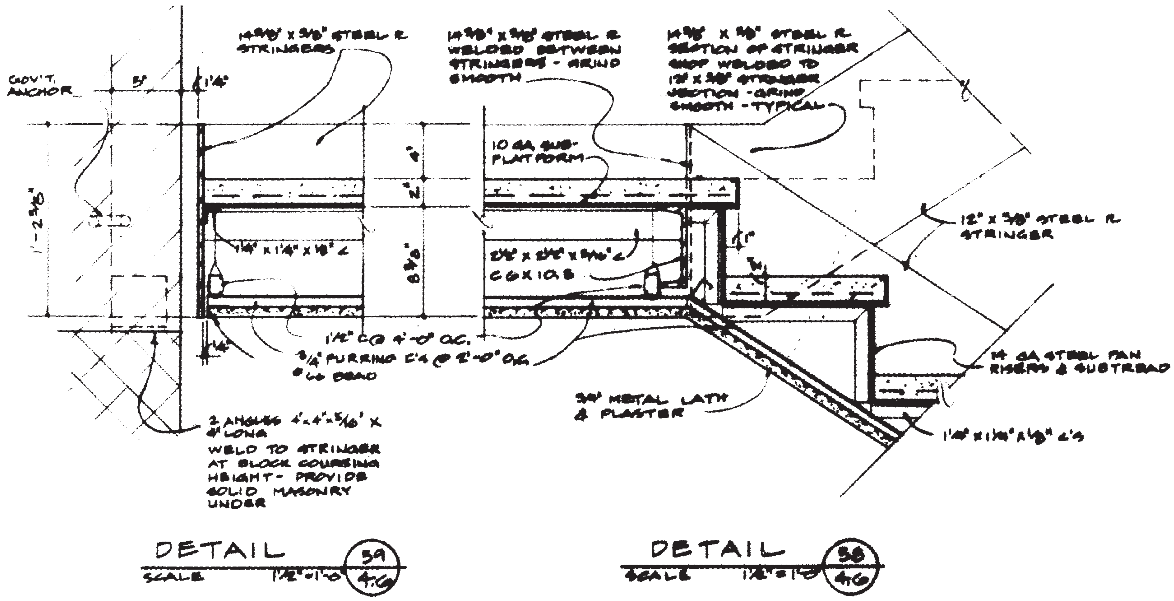
Stairways are also classified in the codes by width, type, and construction. Egress from a building is most important. In an emergency situation, the building should be evacuated in the most direct and efficient manner possible. T he stairs should be easily negotiated; there should be handrails, and the stairs should be "easy" so that one person or a group of persons will have no trouble leaving the building in an emergency. Stairs should ordinarily be kept to a minimum size. In some cases, however, they must be oversized because of the number of persons in the building. Winders [risers and treads placed diagonally at a turn] are prohibited because it is easily seen that the winder-tread near the inside becomes too narrow to function as a step. It is dangerous and can cause serious harm.

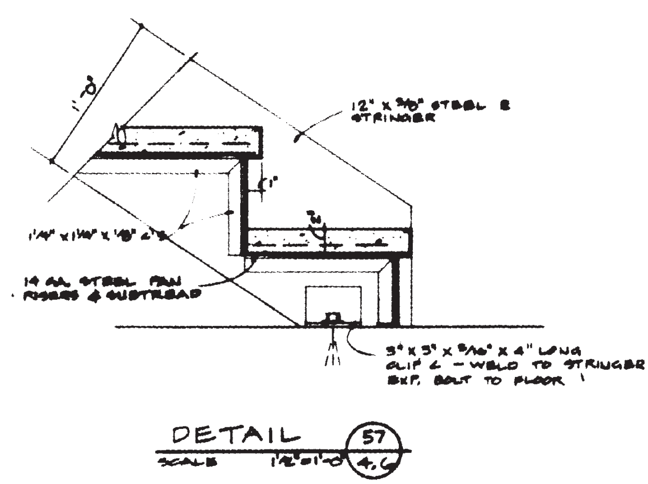
The overall concept, the basic layout of the stairs, is similar to that of the fireplace. We do not necessarily have to detail every single connection or even every item in the construction of the stairs. The architect must be so familiar with the layout, codes, and requirements of the building that he or she can determine what the stairs must do and how they must serve. Architectural detail can be added to them to make them whatever the architect wants them to be. In most instances the final shop drawings and construction of the stairs will be left to the fabricators.

CHECKLIST: STAIRS	
1.	Check building requirements.
2.	Check required loading, dimensions, and clearances.
3.	Material indications, width of tread, number of risers, height of risers, direction of travel, handrails and trim, grade elevations of landings [and floor or levels served], structural coordination, and features of the stairs, railing anchorage, and general stair construction.
4.	Extra attention should be given to the following for exterior stairs: pitch of tread [to drain water], side walls and buttresses, ramps, tread finish [nonslip], watertight handrail anchors, tight jointing for veneered stairs [stone-on concrete, etc.].

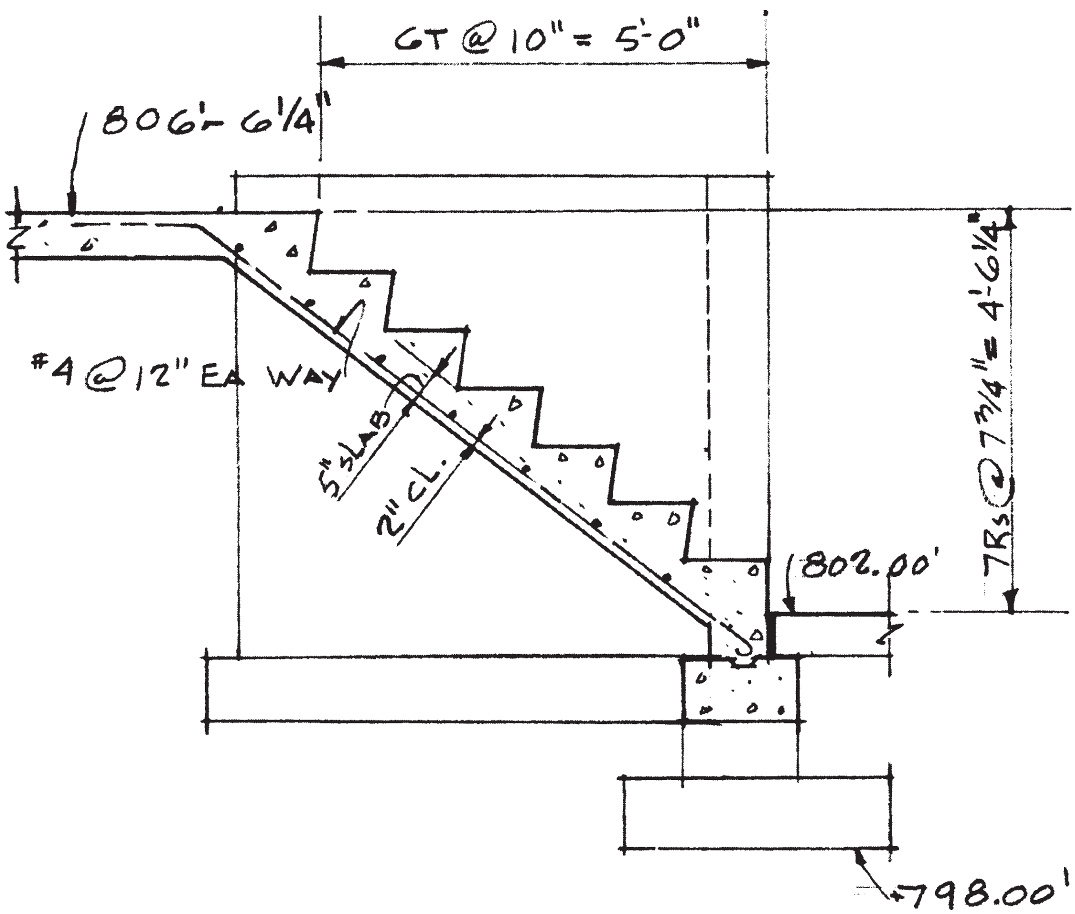


This is an example of the drawing of a stairway within the stairwell. Basically the construction [steel, wood, concrete] could be changed but the information shown here would still be needed to allow proper fabrication of the stair and railings.





Shown here are typical metal pan stairs. The meal frame is set in place and the treads are filled with concrete. This detail shows the construction of the stairs in larger scale to show more detail and to provide more information.



• SECTION 'F—F' • SCALE : 3/8" = 1'-0" •

(STAIR AT SOUTH EAST CORNER)

In manner similar to the previous details, this is a section through a concrete stair, with the pertinent information required to construct it. In this case, it is the form work [removable] which provides the "container" for the concrete. When the forms are removed the star must be self-supporting and structurally sound.

BUILDING [ENVIRONMENTAL CONTROL] SYSTEMS

In addition to architectural drawings, every project needs a number of environmental systems [plumbing, heating and ventilating, air-conditioning, and electrical], added to which are the life-safety systems [sprinklers, alarms, detectors, and others of a mechanical nature; e.g., telephones and pneumatic tubes]. The sequence in which these drawings are done has a different orientation than the architectural drawings.

In these systems, drawings show the building, and the various room areas, as shells in which the various environmental system equipment and devices are located. The complete array of systems must be included and fully delineated. The outline of the building and rooms are shown lightly, so they can be differentiated from the systems work. They still must be reproducible and readable. In the past, the building lines were drawn on the backs of sheets and were known as masks, ghosts, or backups. In this way, any erasure on the front of the sheet would not necessitate redrawing the building. Today many offices use halftone prints or photographic methods, which screen out the intensity of the building lines. Now, of course, the building lines can be most easily varied in weight and intensity, via CAD settings.

As a rule no building openings [doors, windows, etc.] were shown, since the systems being shown are usually located in the plenum space above the ceilings and the openings below. Mechanical designers should be fully aware of these and similar features, but they usually have no direct bearing on the layout of the systems.

Basically, mechanical systems show a schematic layout. More often than not a particular waste line in a plumbing drawing or a conduit in an electrical drawing will not be built in the exact position shown. This is not to say that the installation is wrong or that it should be changed, although some inspectors may view it that way. It is a matter of fitting the system together and of running the lines to facilitate not only that system but to prevent conflict with others. The latter is an especially knotty problem on any construction job. There must be a tremendous amount of coordination between the mechanical trades, and good mechanical drawings will to a large degree remove all sources of friction. If the engineers and designers who produce these drawings are aware of one another's responsibilities, they will not plan a light fixture for the same location as an air diffuser. This coordination is usually rather hard to come by even in the same office and much more so in dealing with several consultants.

The plumbing drawings are produced primarily in a single line con text-basically a centerline. A number of symbols are entered in the lines for proper identification, to show the vertical risers and vents as well as the horizontal runs, the interconnections of the fixtures, and, most important of all, where the pipe sizes change. The schematic drawing will not contain every fitting or every length of pipe, for this is left to the person in the field. Locations and interconnections are the crux of the plumbing drawings, shown in the plan for each floor. Even if there is only a single floor drain, there must be a plan to show its connection with the building drainage. The plumber must also be informed of the architectural features; he or she cannot run a pipe past a window opening. The plumber must be concerned with the materials used in the walls as well as their thicknesses. A 4-inch cast iron plumbing line cannot be hidden in a 4-inch cast iron partition. The 4-inch partition built of wood studs is smaller than the nominal 4 inches. The pipe itself has a bell-shaped fitting at one end that is larger than 4 inches. The plumbing engineer must work hand in hand with the architect to produce drawings and construction details that are workable.

Along with the plan the plumbing drawings have schematic isometric drawings that show the risers in the third dimension and also the location of all the fixtures.

In heating, ventilating and air-conditioning work the system is a little more complicated. Although used in some cases, a single line drawing [where one line represents a duct of any size] is not sufficient in all cases. More often than not a double line drawing [accurately showing the width of the ducts] will be needed to show the full configuration of the ductwork, and the relationship between the ducts and other features of the work [piping, light fixtures, structural elements, vertical risers and penetrations, etc.]. The double line drawing may appear to be more complex, but it provides a much clearer display of actual sizes and relationships. This is especially important to the installers. Usually, piping can use just single line drawing, since pipe diameters are generally small, as compared to some ducts. The double line drawing can display any type of reduction fittings, any turns in the runs and outlets; it can show the various diffusers and grilles and their capacities.

Here again the designer must consider the building openings. It is far better to center a diffusing grille above a door than to allow it to be off-center. In a paneled conference room, the duct outlet will look better centered on a panel or joint than in a haphazard position. Duct work can become intricate. In some buildings, it is not uncommon to find ducts that are 60 to 68 inches wide, depending on the necessary volumes of air. Ducts must reach from the air-handling machinery to each room that requires air, either heated or cooled. If other systems that supply heating [hot water, steam, or electric] are present, they must also be laid out to show the appliances in the areas to be heated. Here again, the mechanical systems should utilize dark line weights. There can be some tone in the line work, but the building lines should be in halftones. The mechanical trades must be cognizant of the overall configuration, materials, and layout while working with them. All drawings are done to scale so that the project may be seen in complete context and no one will be fooled into thinking that there is more area available above the ceiling than exists.

Mechanical systems, the two-duct system in particular in which air is not only supplied but returned through ducts, can become extremely complicated. These ducts must cross each other, and depth becomes a critical matter. Diagrammatic drawings will show the dampers, thermostats, and other controls. There may also be schedules of equipment; air-handling units, distributors, diffusers, and exhaust fans. Also to be incorporated in the architectural layout of the floor plans are areas in which the ducts can rise vertically [duct spaces, shafts, chases, and recesses]. This can sometimes be a problem: to provide sufficient space so that any chases or recesses involved can contain a large amount of mechanical equipment.

Drawings of the electrical ways follow the other types closely. Here the scaling of the drawing may be neglected; fixtures are seldom laid out and dimensioned individually, but the number and general layout must be shown. This allows for variance in the field. It is important to note that electrical contractors may attempt to scale the drawings, a practice that is to be discouraged as much as possible. The contractor should be warned that the layout must in general follow the drawings; the specifics must be worked out to meet field conditions. Fixtures are usually circuited together with -an arrow pointing in the direction of the lighting panel that supplies power; this is called a "home run," and is entirely schematic. The curvilinear pattern of lines merely shows where connections are to be made. The actual conduit is not shown, but the location of switches, wall devices, fixtures, and other electrical appliances is given. Because of the complexity of these systems many offices have been separating lighting from power drawings; lighting fixtures and other appurtenances are laid out on one sheet, the various types of outlets on another. This separation provides simpler drawings that are more easily read. Here, again, we have details: meter and panel setups and different types of circuits [emergency lighting and alarm systems].

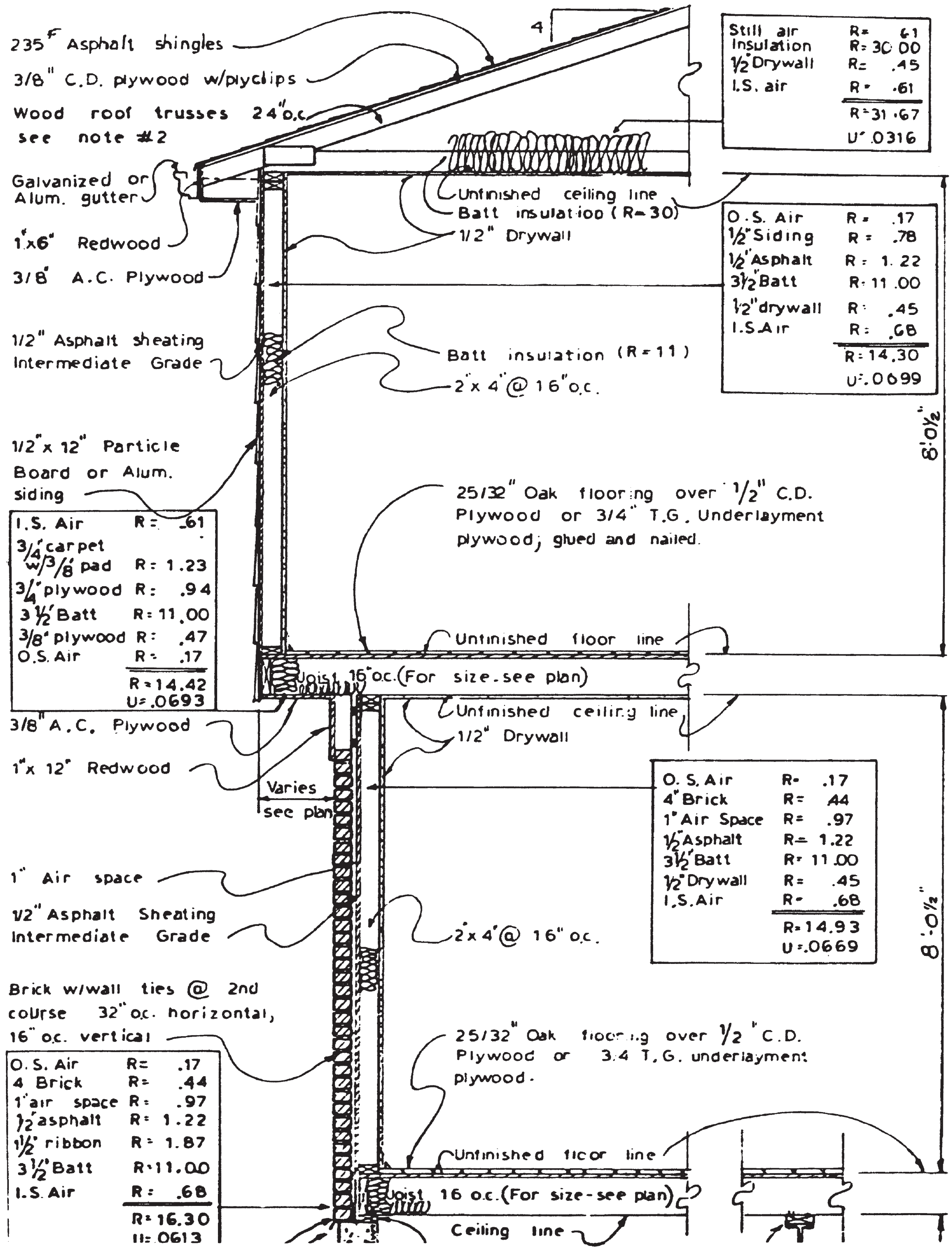
Imposition of the energy conservation codes has required the various engineering disciplines to submit data about their systems which heretofore was retained in their office calculations. These codes document the ratings and efficiencies of the equipment and the total energy requirements of the entire system. Many have taken the approach that most of these data can be placed on the drawings, although others utilize the specification booklet or even separate submittals.

When utilizing the drawings, it is essential that the data be complete, legible, accurate, and very well referenced. Much of the data can be placed close to the feature being explained, whereas other information can be scheduled elsewhere. Some professionals have incorporated separate sheets designed wholly for energy code provisions. Whatever the motif, the information should follow the "clear, concise, and complete" criteria of all work on the drawings.

The mechanical engineer's approach to drawings is entirely different in orientation, method, and impact than that of the architect. It is most important that there be a high degree of line differentiation between the architectural features and those of the mechanical systems; it is not satisfactory to interpret a wall line as the edge of a piece of equipment or the run of a conduit.

Mechanical drawings contain a vast number of symbols; it is much easier to use a symbol to indicate a minute piece of equipment, perhaps 4″ x 4″ junction box, than to try to draw it at small scale. The whole idea is to show principles; certain items must appear in certain places. The exact details must be worked out by the people in the field, although much of their equipment will not need' detailing. An air-handling unit is designed by the manufacturer, and it becomes a matter of assembling the pieces at the project in the proper sequence with the proper connections. A light fixture is manufactured and wired in a certain way and remains only to be wired into the building system. If there are particular features of the architect's work, such as a light cove, it is important that they be detailed by the mechanical trade.

Cooperation between the architect's project leader and the mechanical engineer should be complete in order that each can meet the other's requirements for a thorough job. Mechanical drawings in a large measure become complicated. In the last 15 years, the cost of mechanical systems has increased from about 33 percent of the total cost for a project to approximately 50 percent. The drawings have become more in-



Basically this drawing s a wall section, but it has-been utilized for environmental analysis. Energy codes are in effect in almost all jurisdictions and such calculations are required to ensure compliance with the code requirements for construction that is energy saving.

volved because at this point more equipment is being used, as reflected in the amount spent on the mechanical systems.

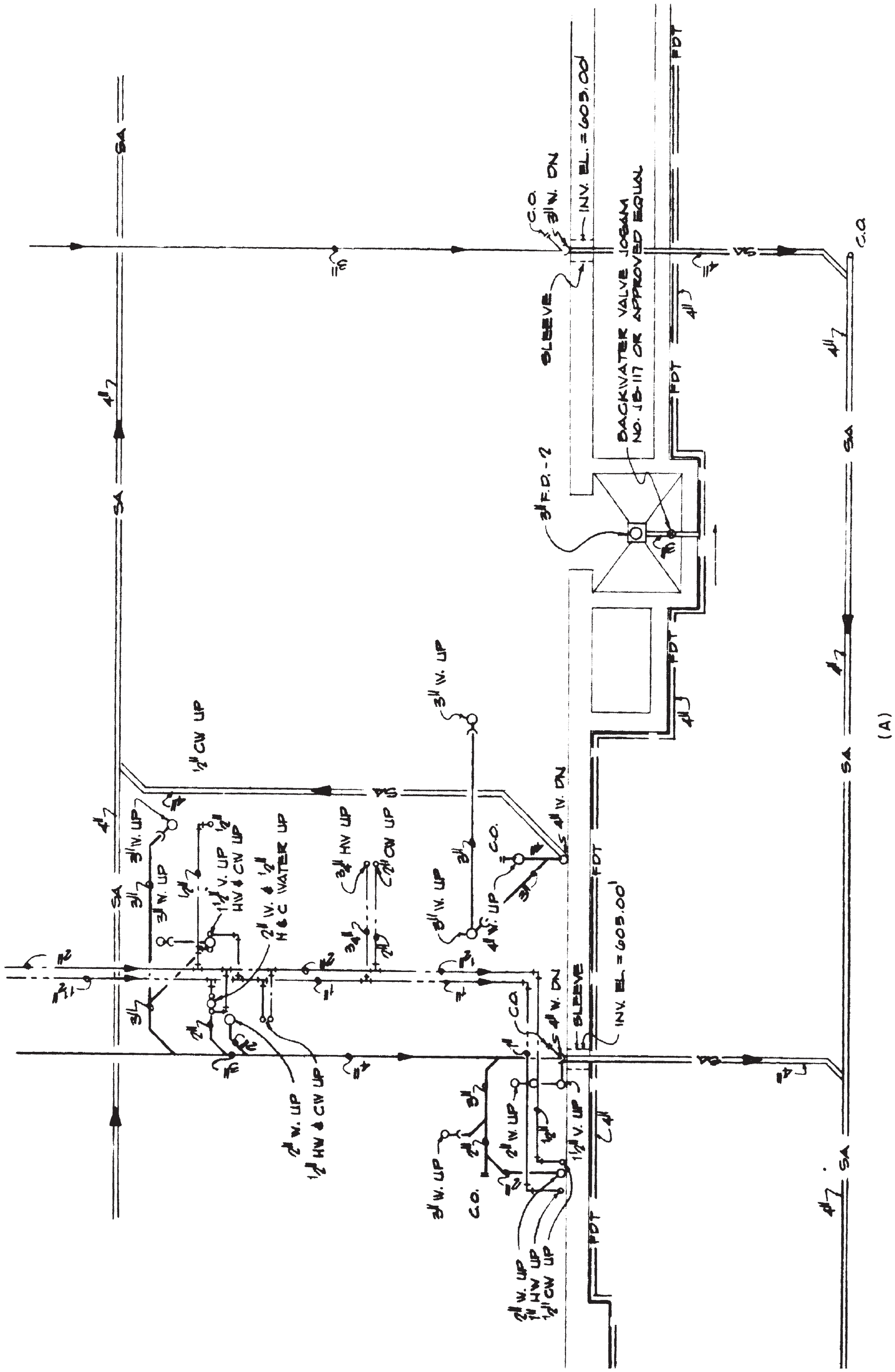
Therefore, the drawings must be complete, just as complete as the architect's drawings; the impact on the pocketbook is just as important. If not done correctly, costs can escalate. No matter how the drawings look, the systems must work. Good drawings go far in ensuring a good installation. It is most important that the architect's project leader, as head of the design team and selector of the consulting engineers, monitor the drawings that are being done. The same criteria that hold for the architectural drawings should be applied to the mechanical drawings: good, crisp line work and neat, precise lettering done with well-sharpened leads against a straightedge. Many engineers today are field workers who have become involved in design. For the most part they are well trained in the mechanical systems, knowing what they must do and how to put them together, but it is also important that they produce workable drawings. This is not to downgrade the engineering profession, but often in their haste engineers place speed above the overall high quality that the drawings require and end by casting a bad light on the entire set of working drawings.

It must be remembered that the architect has a contract with the owner; the engineer has not. The engineer's contract is with the architect. Control must be exercised so that no one's reputation can be hurt by a poor performance.

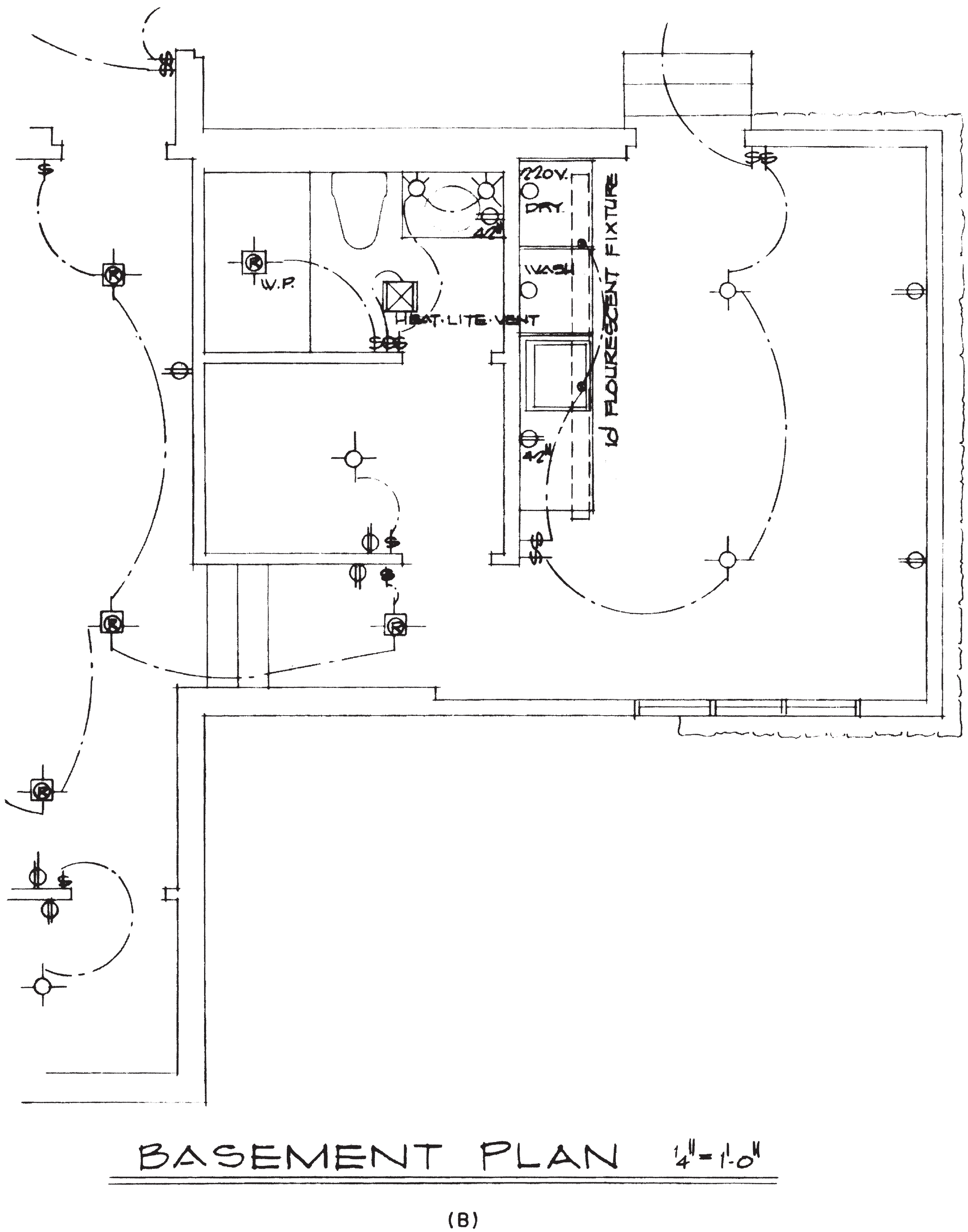
ITEMS FREQUENTLY OVERLOOKED AND LEFT UNCOORDINATED

1. Ensure combustion air for fuel-burning appliances.
2. Establish walls of sufficient thickness to provide space for pipes, pipe chases, hose cabinets, or electric panels.
3. Provide lights and power receptacles in the pits of elevators and dumbwaiters; provide ladders also.
4. Provide electric outlets in attics as required by code.
5. Architectural drawings should locate hose cabinets, electric panels, standpipes, hose bibbs, and so on.
6. Provide fresh air, through mechanical ventilation, for toilet rooms and janitors' closets.
7. Locate all access panels on architectural drawings.
8. Establish and provide street numbers at front entrance.
9. Provide mail drop or box; also, door and/or night bells.
10. Check height of receptacles and thermostats with fixtures, counters, cabinets, and other built-ins.
11. Ensure proper installation of fire alarm systerns and boxes.
12. Ensure proper posting of all areas requiring same.
13. Provide properly for waste receptacle or dumpster.
14. Ensure proper installation of emergency lighting system.
15. Check drawings with all other disciplines for proper coordination as often as possible; prevent errors from reaching the field.

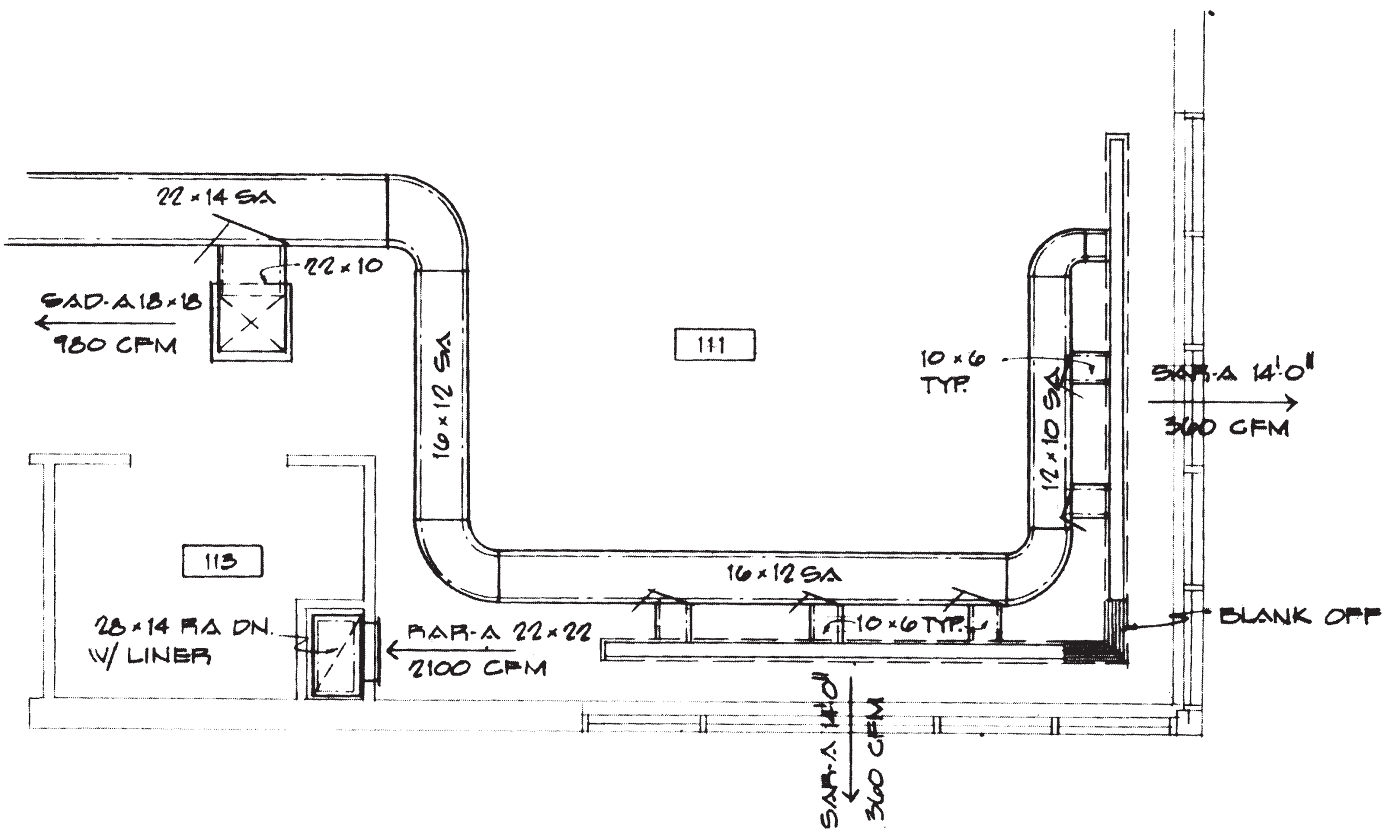
Although not all-inclusive, this is an interesting list of items that are all too often overlooked on the drawings and thus may not be included in the contract.



Example of a plumbing layout in a portion of a building.



This is an example of a an electrical system to be installed in a basement. Note all of the symbols used to represent various features.



11. Ensure proper installation of fire alarm systems and boxes.
12. Ensure proper posting of all areas requiring same.
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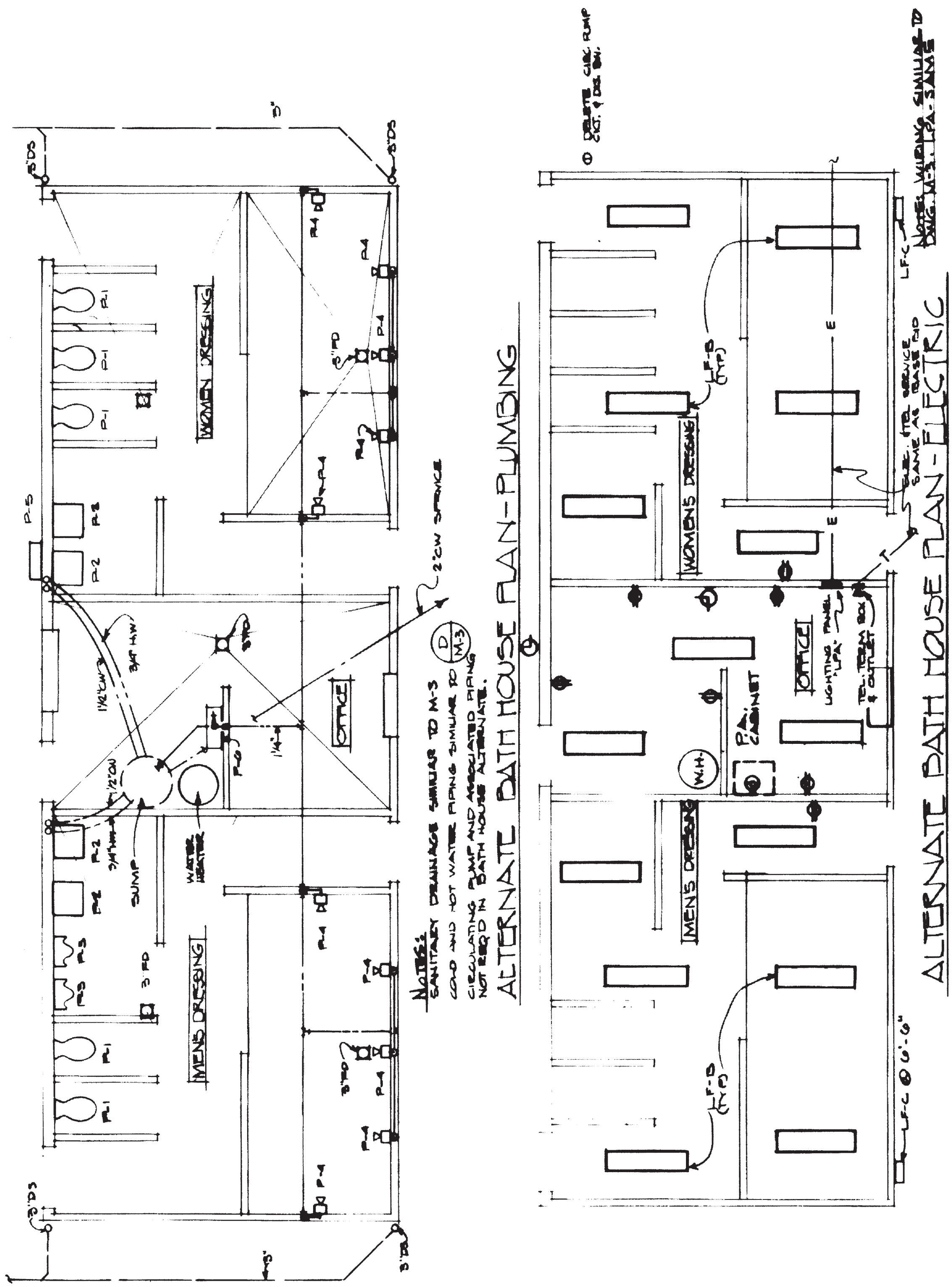
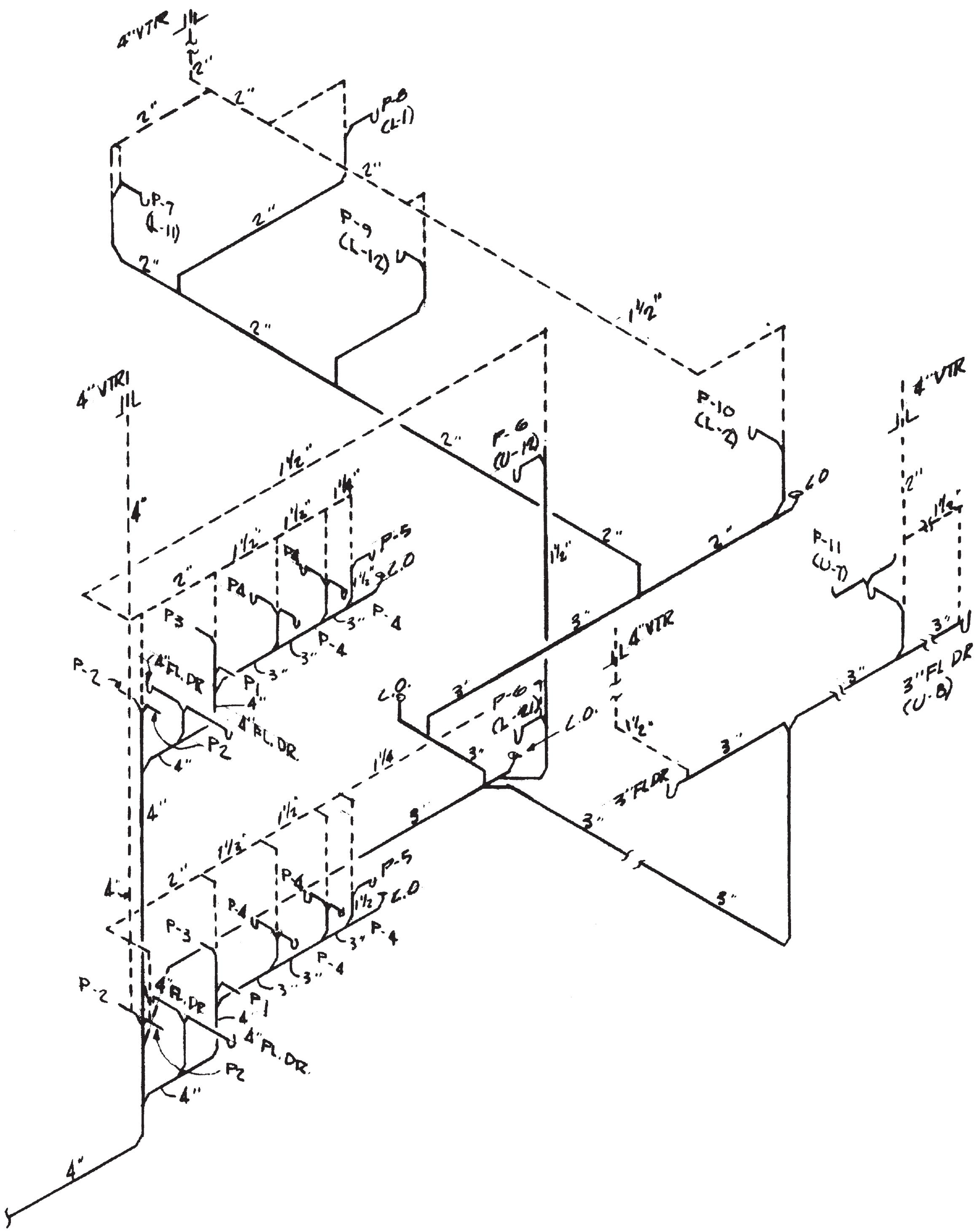
Although not all-inclusive, this is an interesting list of items that are all too often overlooked on the drawings and thus may not be included in the contract.

This a portion of ductwork to be installed, showing the various shapes in the duct work and other equipment and features required.

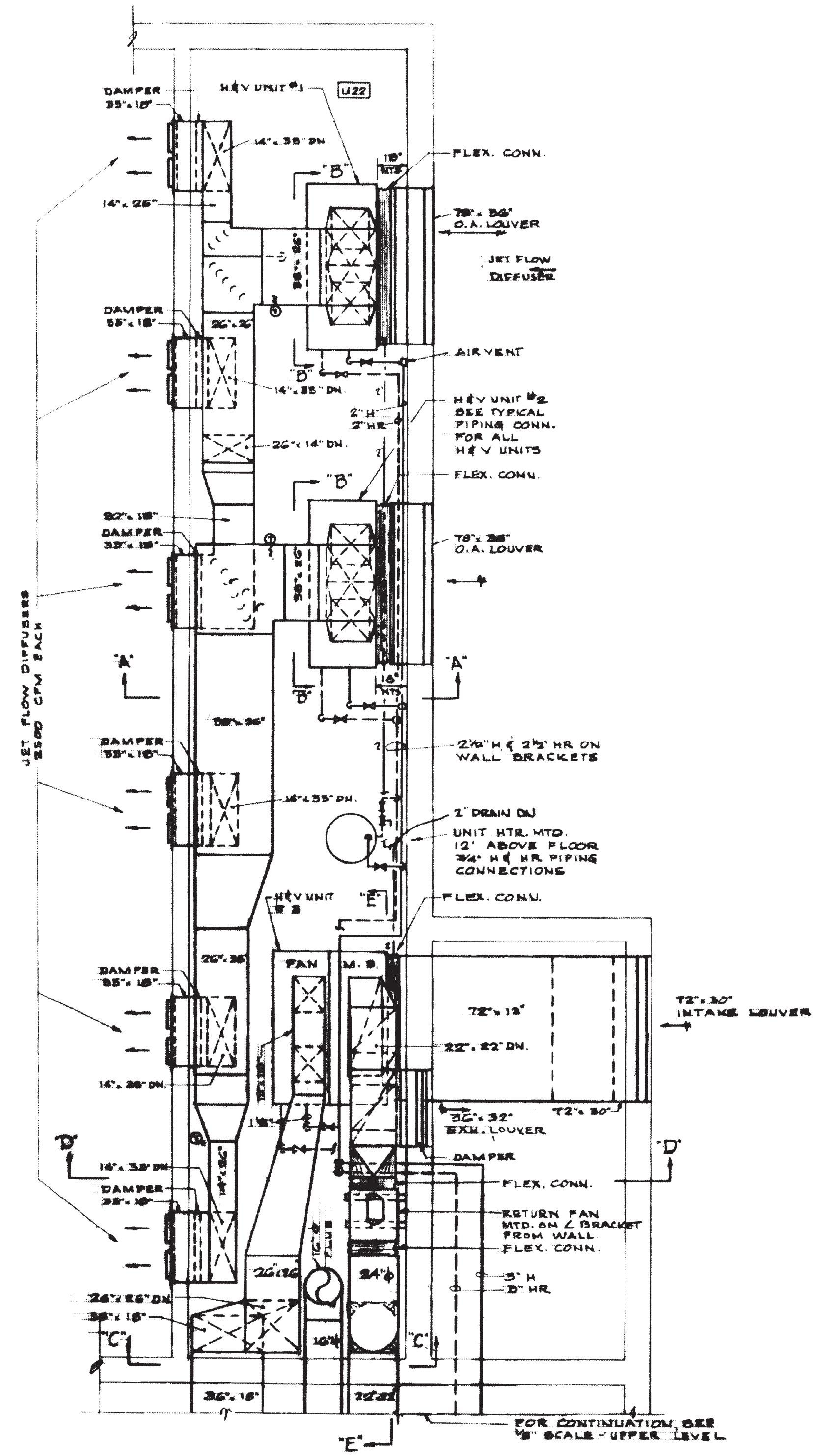


Two drawings for a small building. The upper is the layout of the plumbing work required; while the lower displays the lighting and electrical system Note in each how the building walls are in a lighter line weight so they are not confused with the work required.



PLUMBING ISOMETRIC
NOT TO SCALE

It is common practice to use isometric projection for displaying the overall plumbing system. This allows showing the various locations of fixtures, offsets pipe sizing and other features of the system.



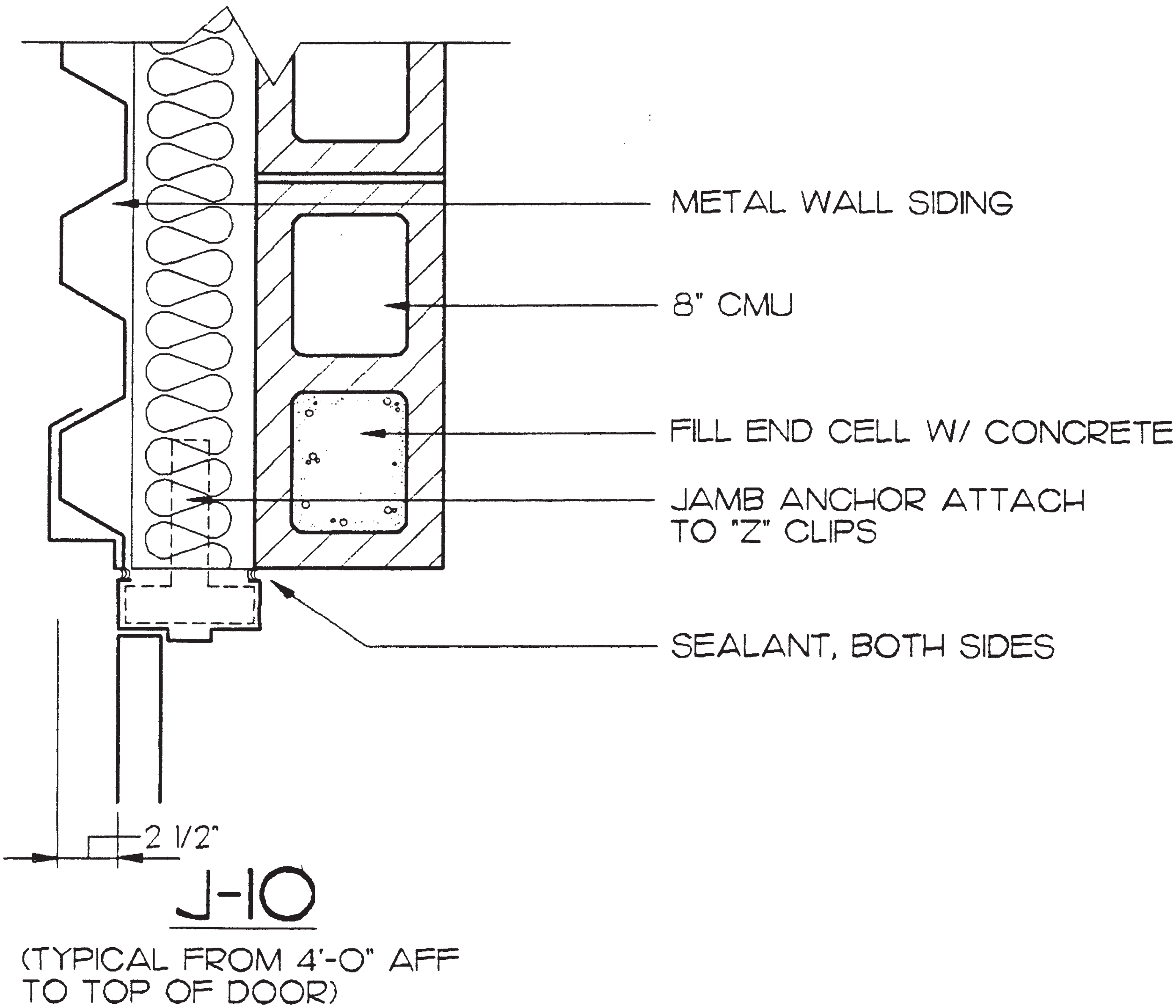
EQUIPMENT ROOM PLAN - U-22

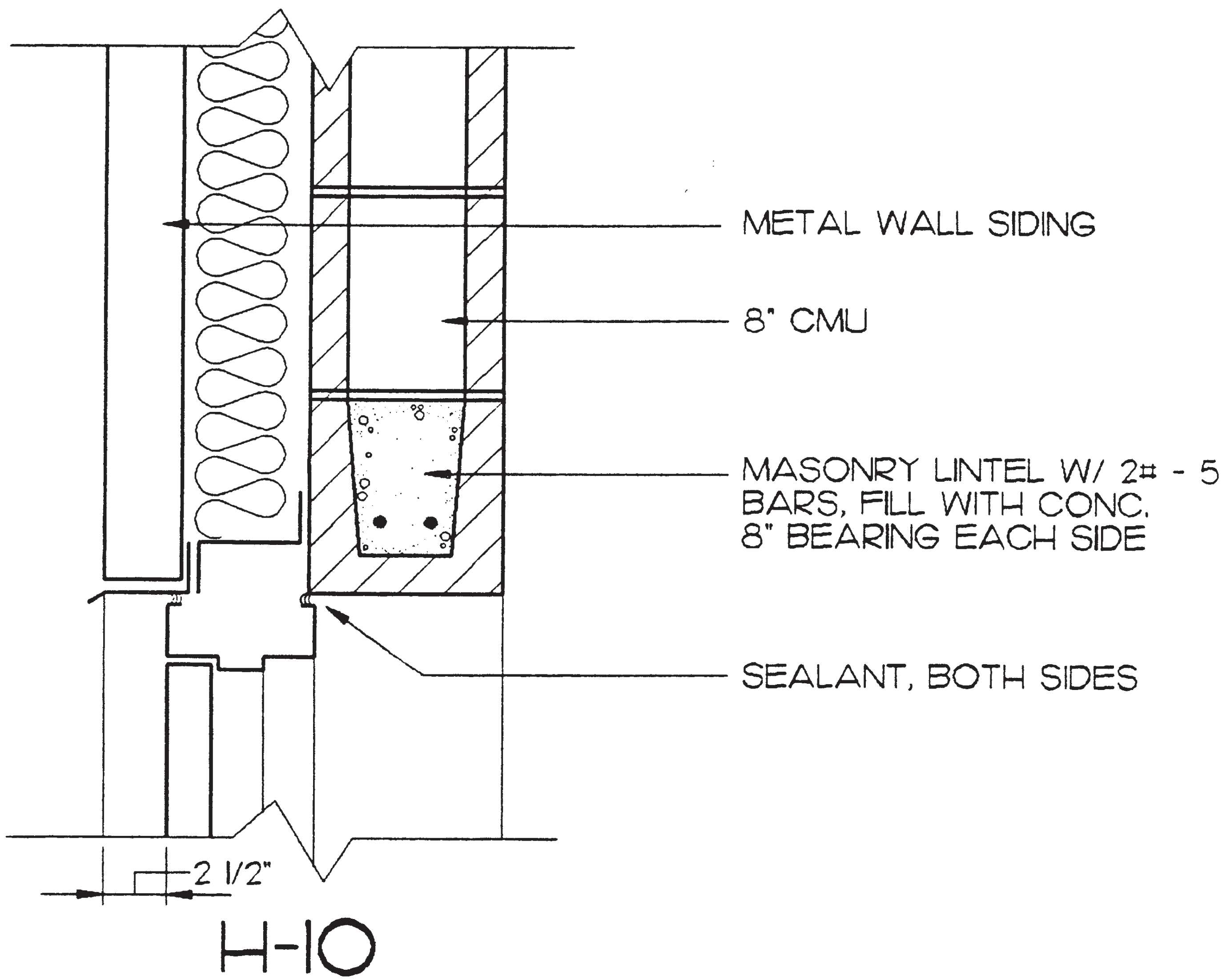
This is the plan view of an air handling system installed in the mezzanine level of a gymnasium. It shows the units themselves the duct work and the outlets that deliver air into the rooms. This is typical of such system – they usually require a good deal of space, but can be planned and accommodated into the overall building plan without being intrusive.

CASE STUDIES IN DETAILING

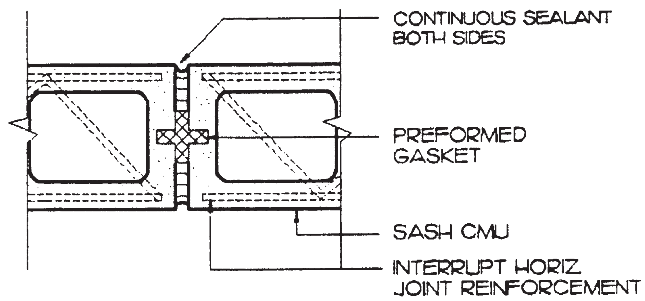
It seems appropriate at this juncture to provide a contrast between the details in the preceding chapters [mostly produced by manual drafting] and CAD-produced drawings. Freehand detailing also provides another point of comparison. Much of what is contained immediately following can be reviewed and applied to the manual drafting. Points discussed are also valid for all types of drawings.

The following is a collection of details produced by computer-assisted drafting [CAD]. They are all valid details that were used on projects. However, they were selected as examples because of the common presentation problems they contain and their instructive value. We are grateful to the people who graciously allowed this use of their work. All of these details were done when the operators were just beginning their CAD work; of course, through experience their work has been modified and greatly improved.

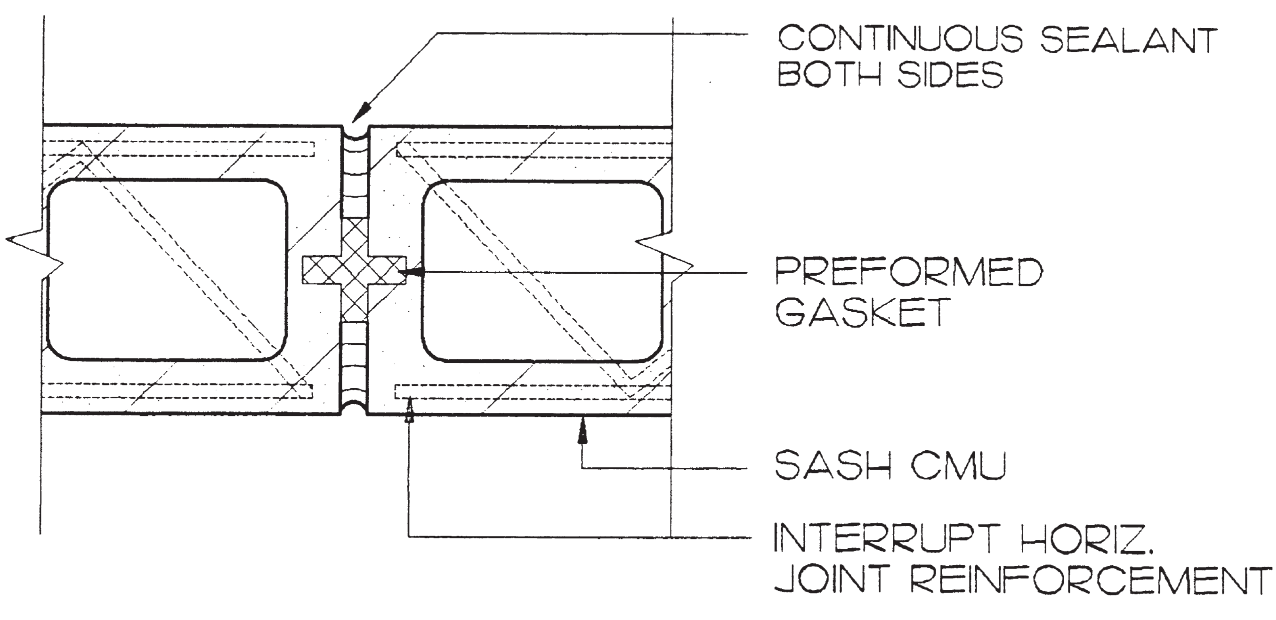

METAL WALL SIDING
8" CMU
FILL END CELL W/ CONCRETE
JAMB ANCHOR ATTACH
TO "Z" CLIPS
SEALANT, BOTH SIDES
2 1/2"
J-10
(TYPICAL FROM 4'-0" AFF
TO TOP OF DOOR)



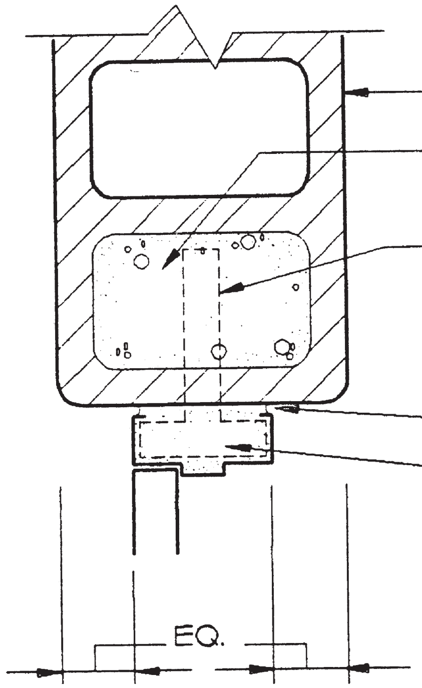
A pair of CAD details that note work around a door opening. Decent line work except the metal door frame, siding, closure pieces and flashing pieces should be heavier [to indicate metal thickness], also there is no indication of how the door frame is anchored to the wall in H-10. Some vital notes are missing.



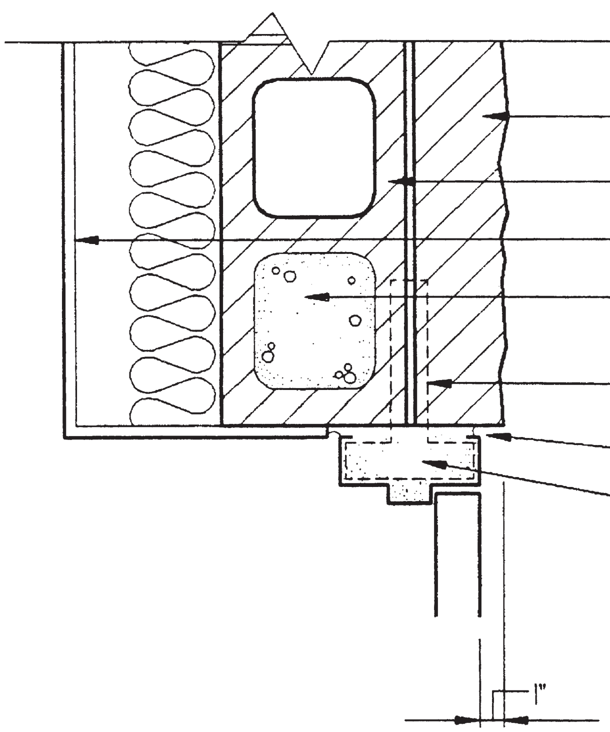
INTERIOR VERTICAL
CONTROL JOINT



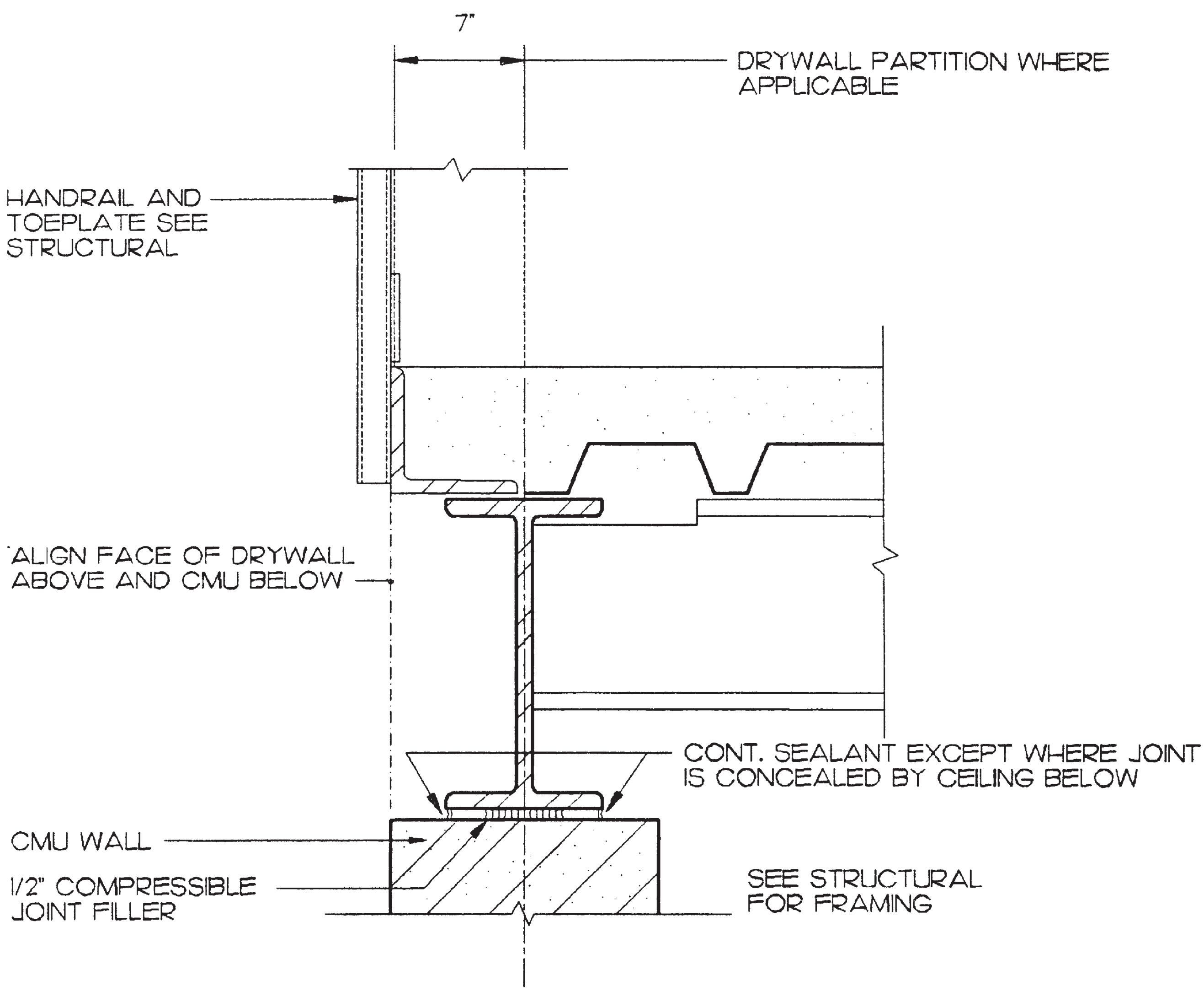
The same detail at different scales- compare the readability of material symbols, Note how the change in scale was also carried into the size of the lettering [a very necessary change]. The preformed gasket should be in darker line since it is "cut" in section, as is the CMU.

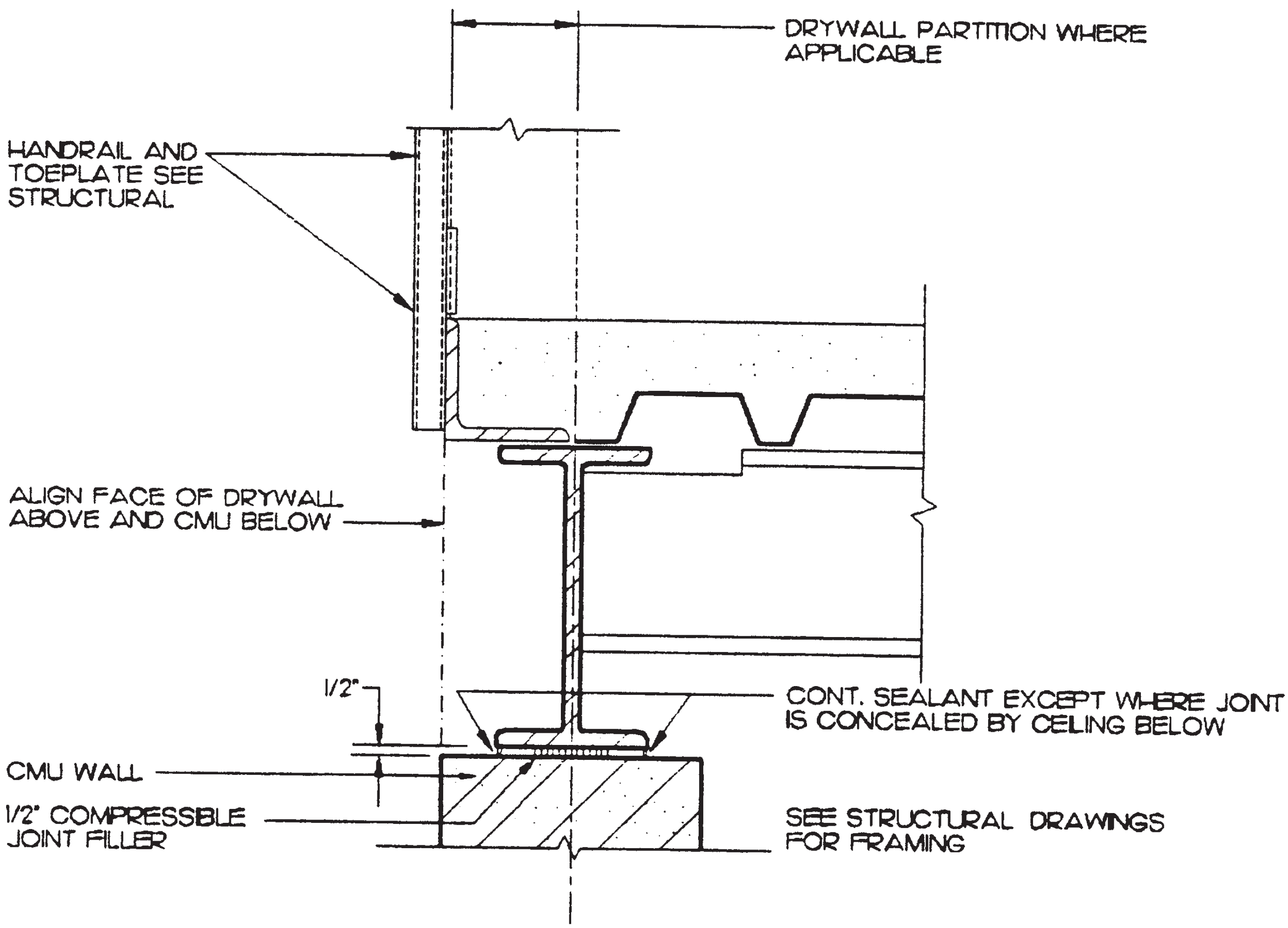


What changes are needed in this detail?

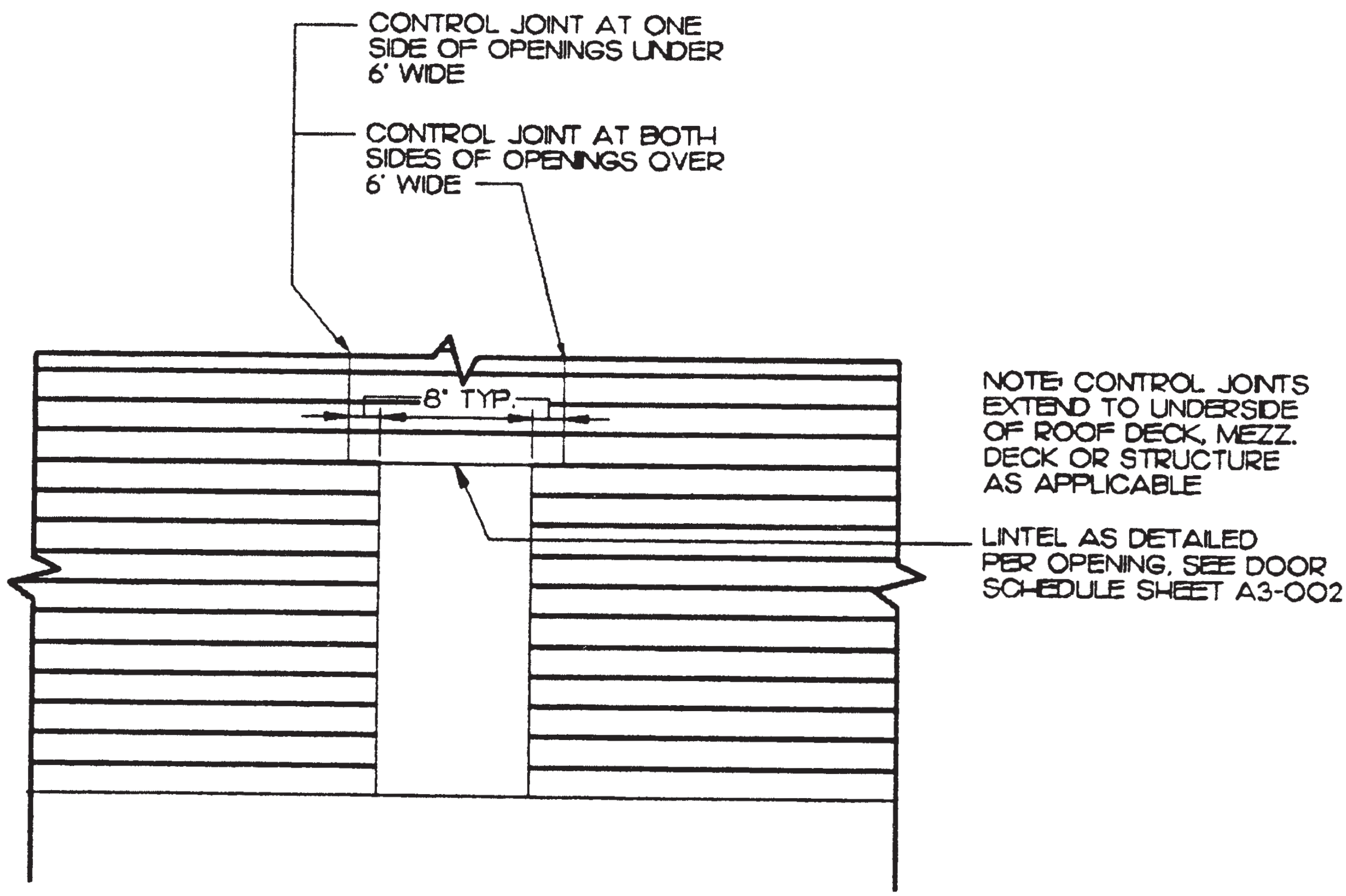


This detail is a little inconsistent. Note the difference in the liner panel lines [where adjacent to the CMU is the correct way since both materials are cut]. Metal products should be darker [note how dark the joint between CMU and split-faced CMU reads [and this is not all that important].

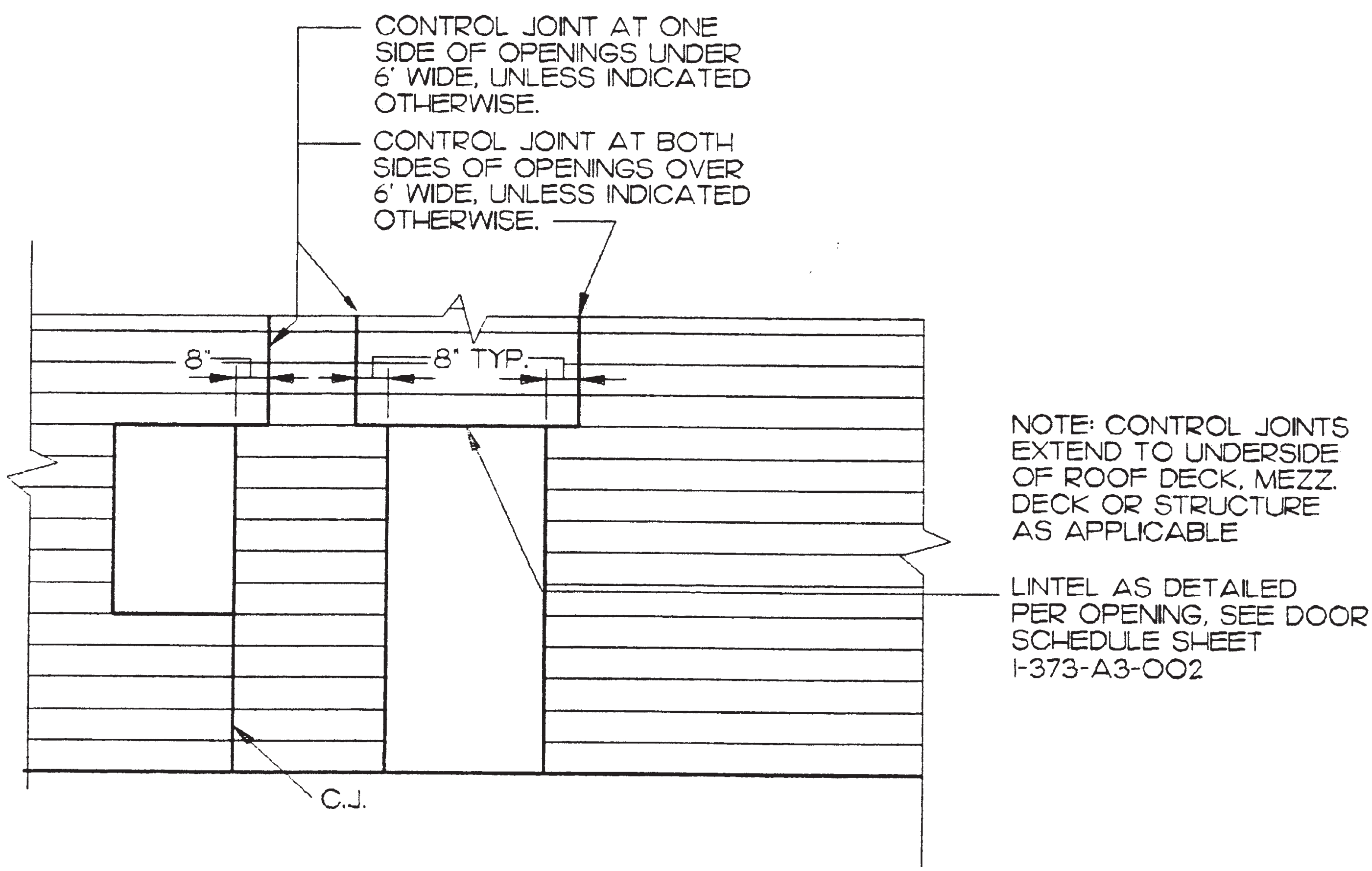

7"
DRYWALL PARTITION WHERE APPLICABLE
HANDRAIL AND TOEPLATE SEE STRUCTURAL
ALIGN FACE OF DRYWALL ABOVE AND CMU BELOW
CONT. SEALANT EXCEPT WHERE JOINT IS CONCEALED BY CEILING BELOW
CMU WALL
1/2" COMPRESSIBLE JOINT FILLER
SEE STRUCTURAL FOR FRAMING



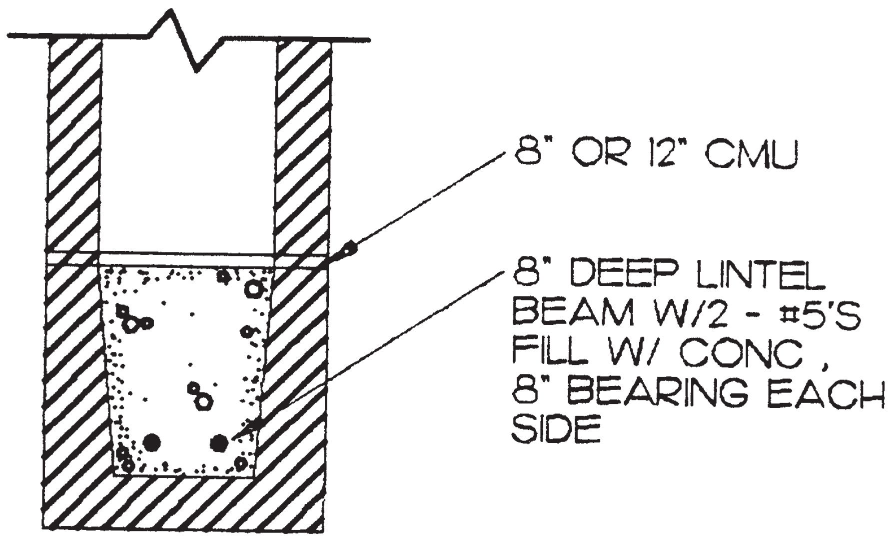
Another pair of details with differing scales. Note how difficult it is to read the work under the beam on the smaller scale drawing. Crucial notes are missing; where? If we consider the angle and the concrete slab to be continuous, how should their line work be changed, if at all?



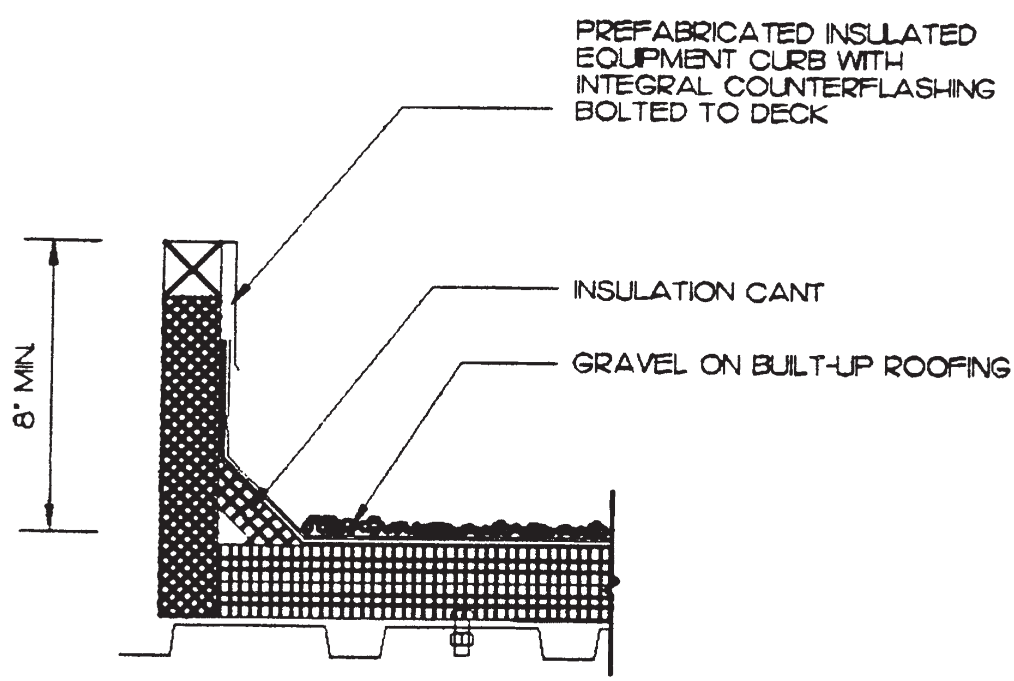
CONTROL JOINT
AT WALL OPENING



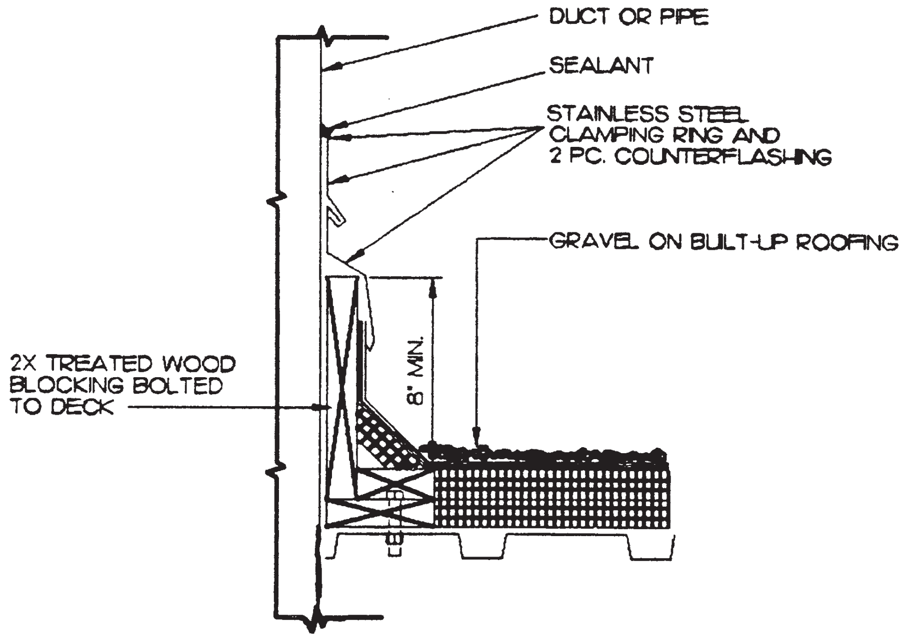
Essentially the same detail with slight scale changes. But notice how the larger uses line work in a better fashion [makes for a more readable drawing] and portrays the important work [control joints] much better. The heavy line work [course joints] in the CMU is wrong and distracts, in the smaller drawing and literally hides the important work.



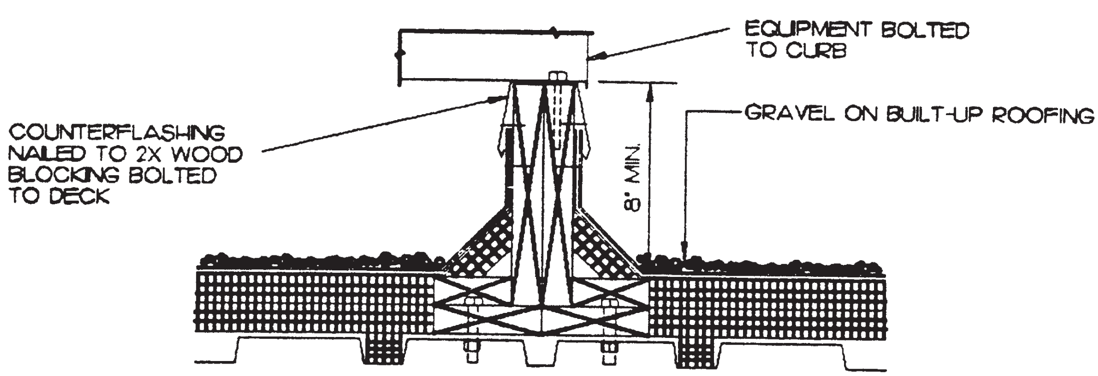
Wrong approach! The CMU and lintel are the important items and should be depicted in the heavy line work – not the material symbol!



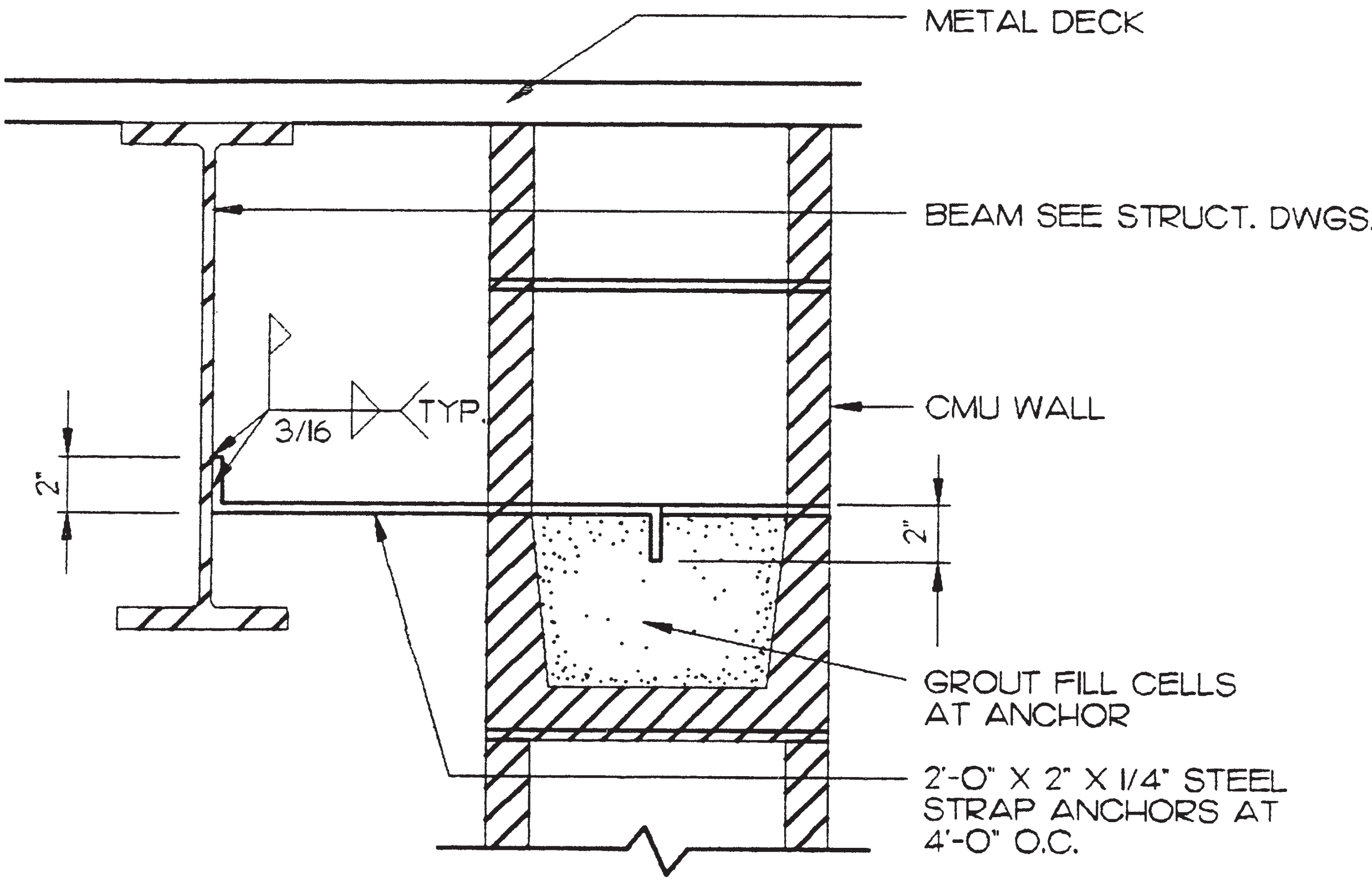
A detail done backwards! Obviously a detail at this scale is overwhelmed by the dark line work. In addition, the whole concept is wrong in that the darkest lines are merely material symbols – perhaps some of the least important information on the drawing. Metal thickness and the principles for work "cut" in section should be applied, with an overall eye toward readability.



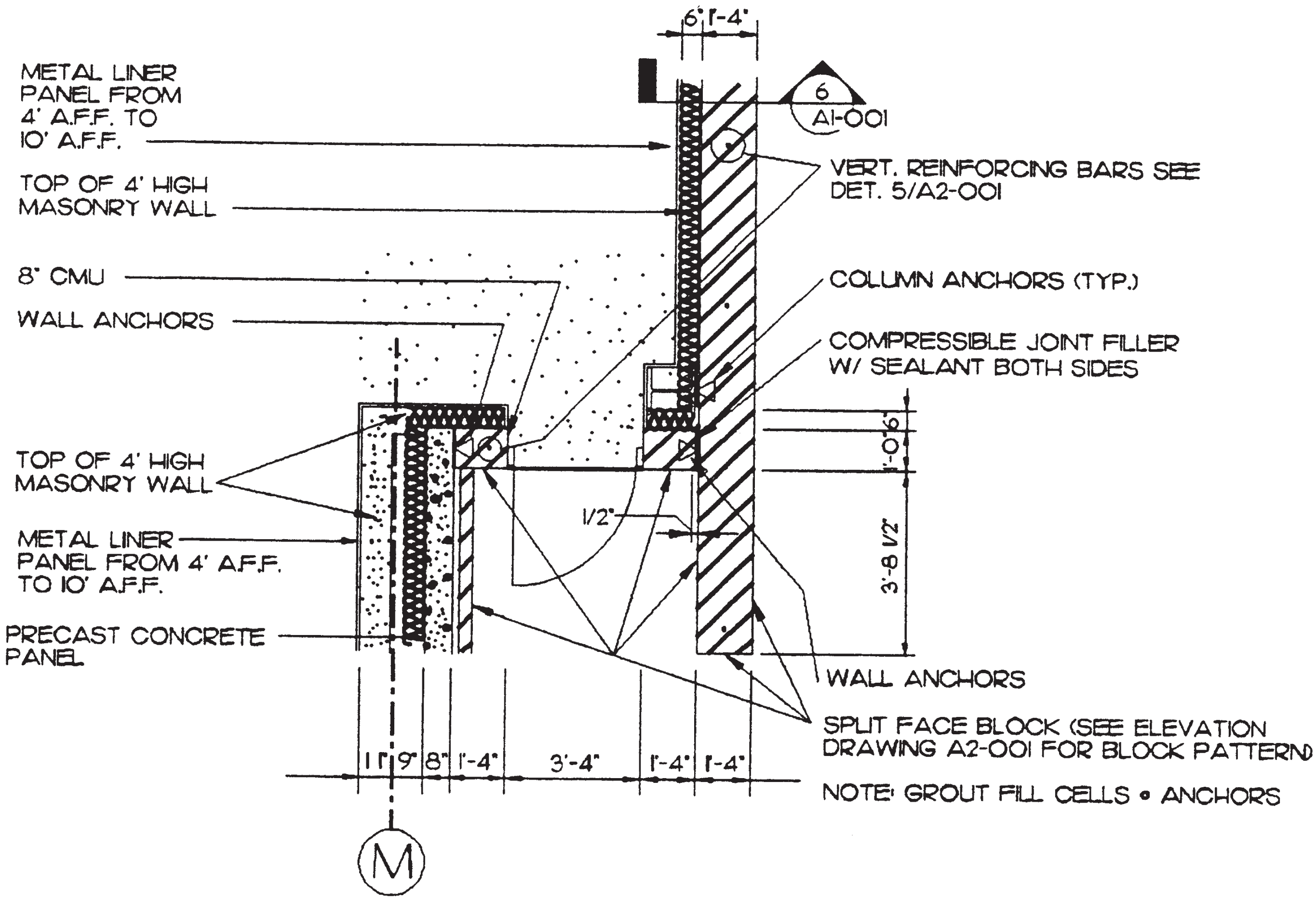
Another example of wrong line work. Here things are even more obvious; the 2x blocking has a light outline, but a heavy symbol-backwards. The various break lines are a mystery, as to why they exist and what is readily cut.



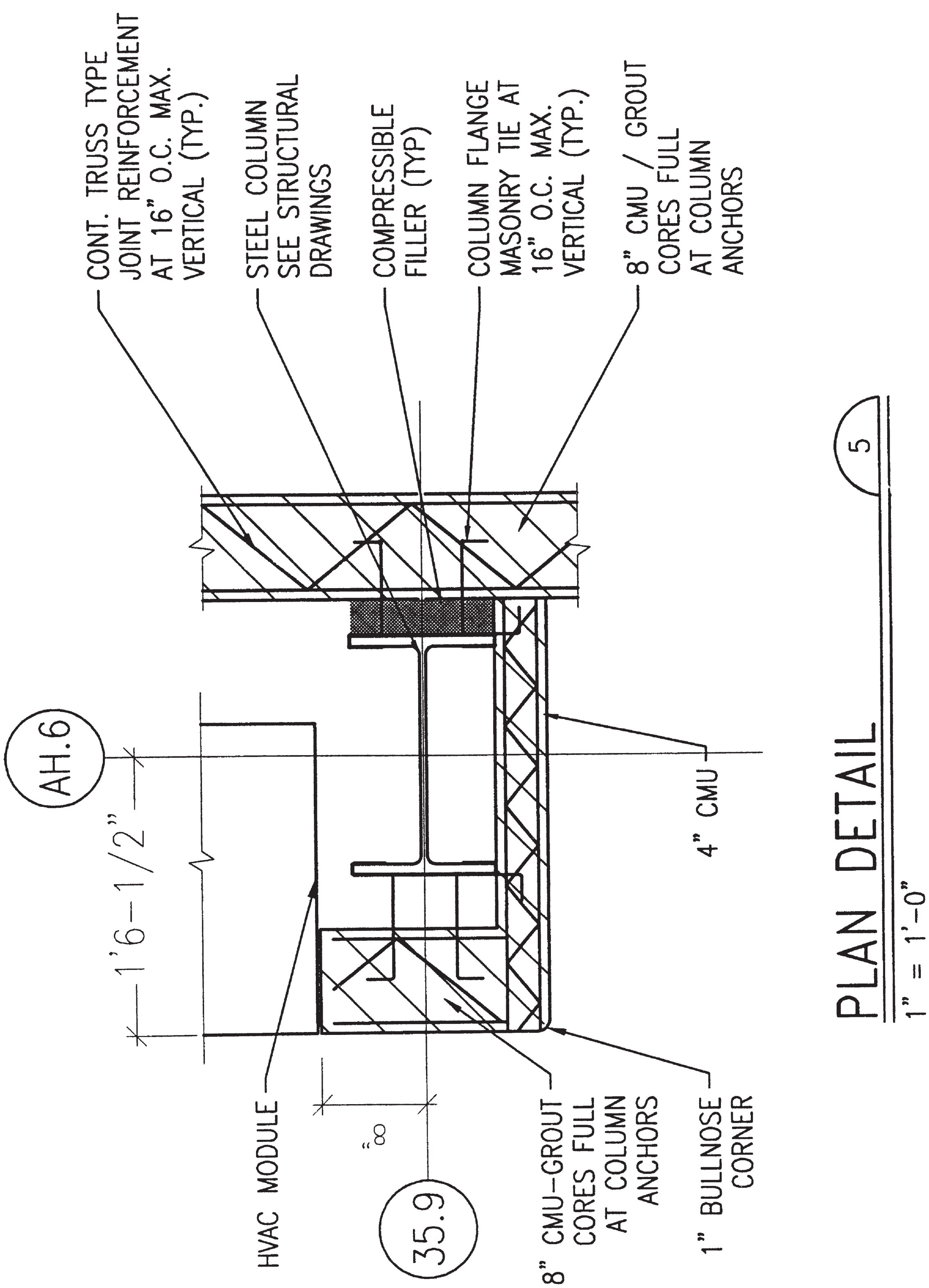
Yet another "backwards" detail.



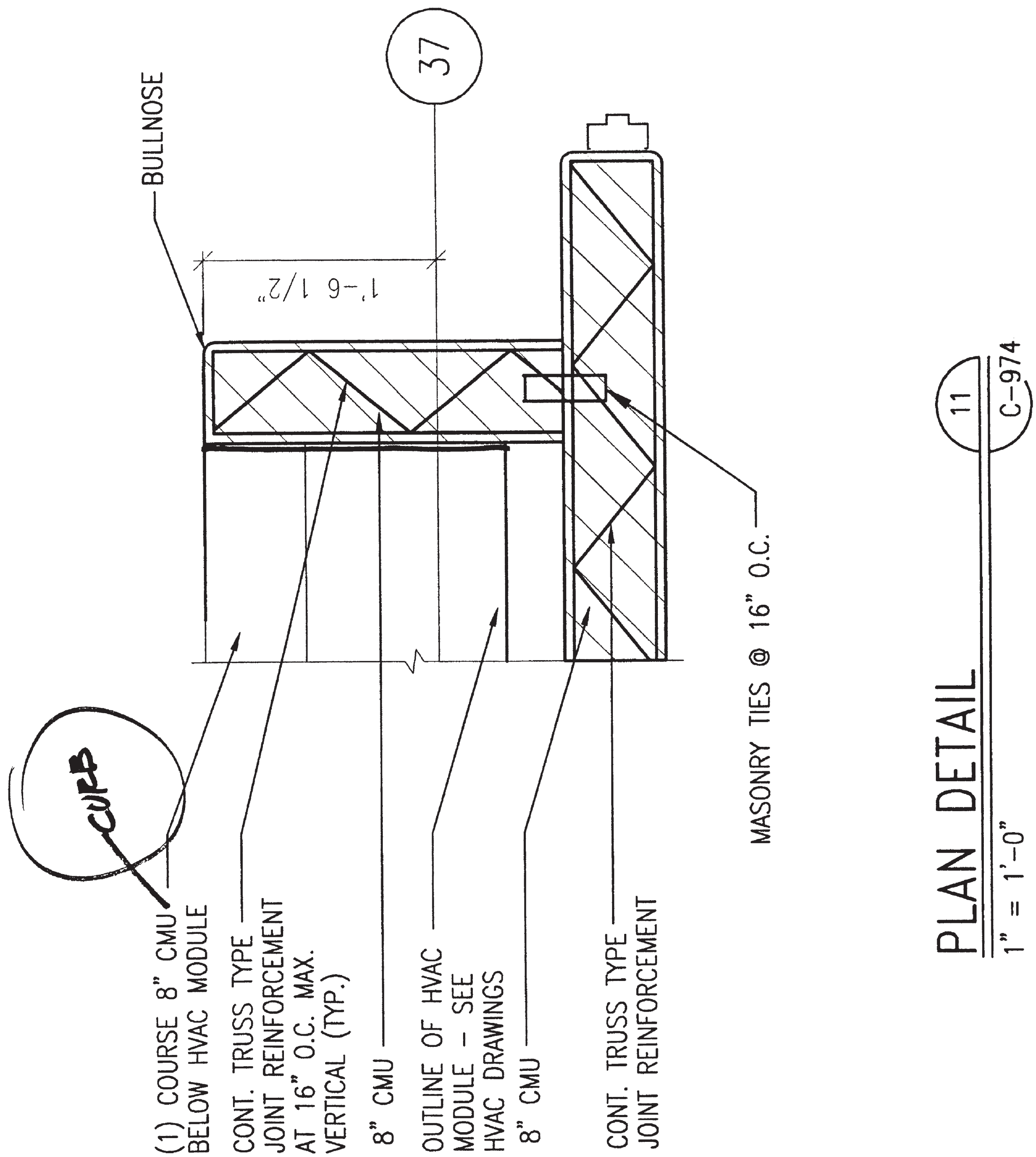
This detail is a mixture of line work. Again the material symbols are improper as compared to the edges of the CMU and the steel beam, course lines in the CMU should be lighter and one line of the metal deck should be heavier to show the material thickness.



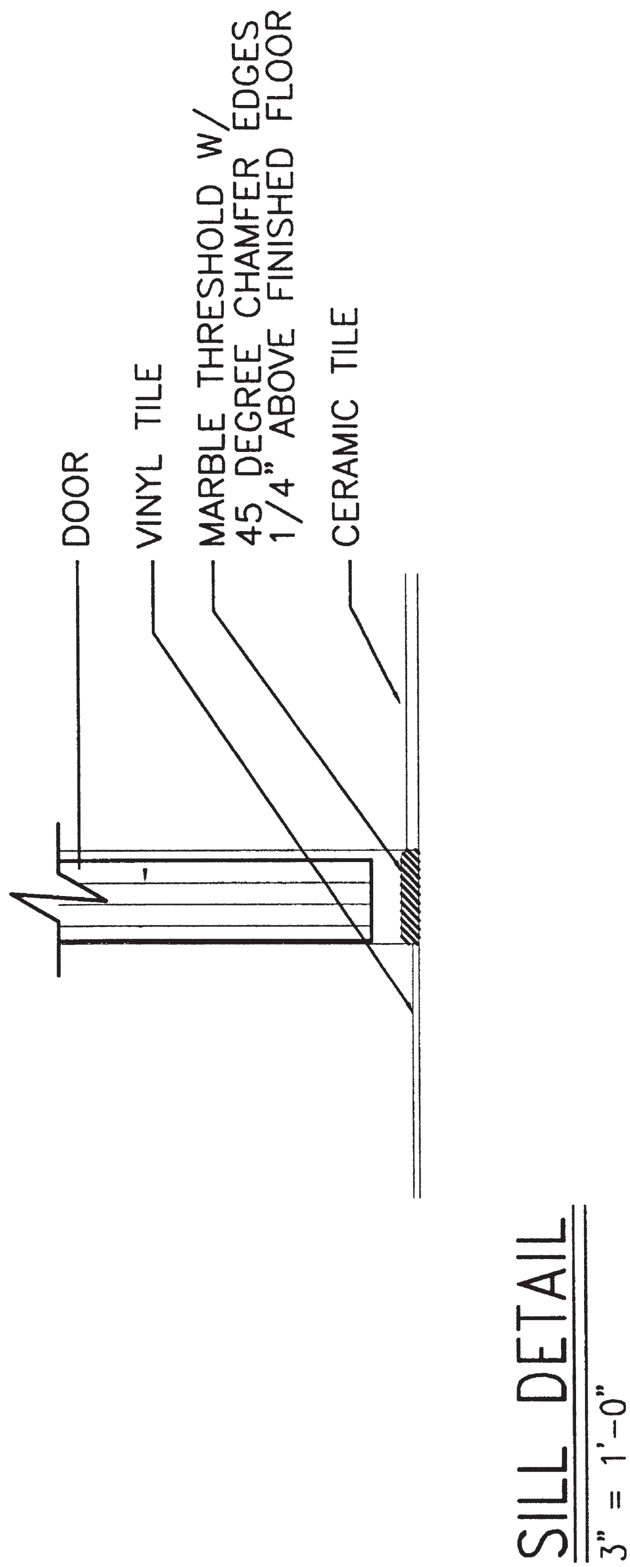
This is the plan view that suffers because of small scale and several different details that need to be more openly shown.
Note the "spider web" of leader lines and the length of some.
Of course, the material outlines are weakened by the too dark symbols.



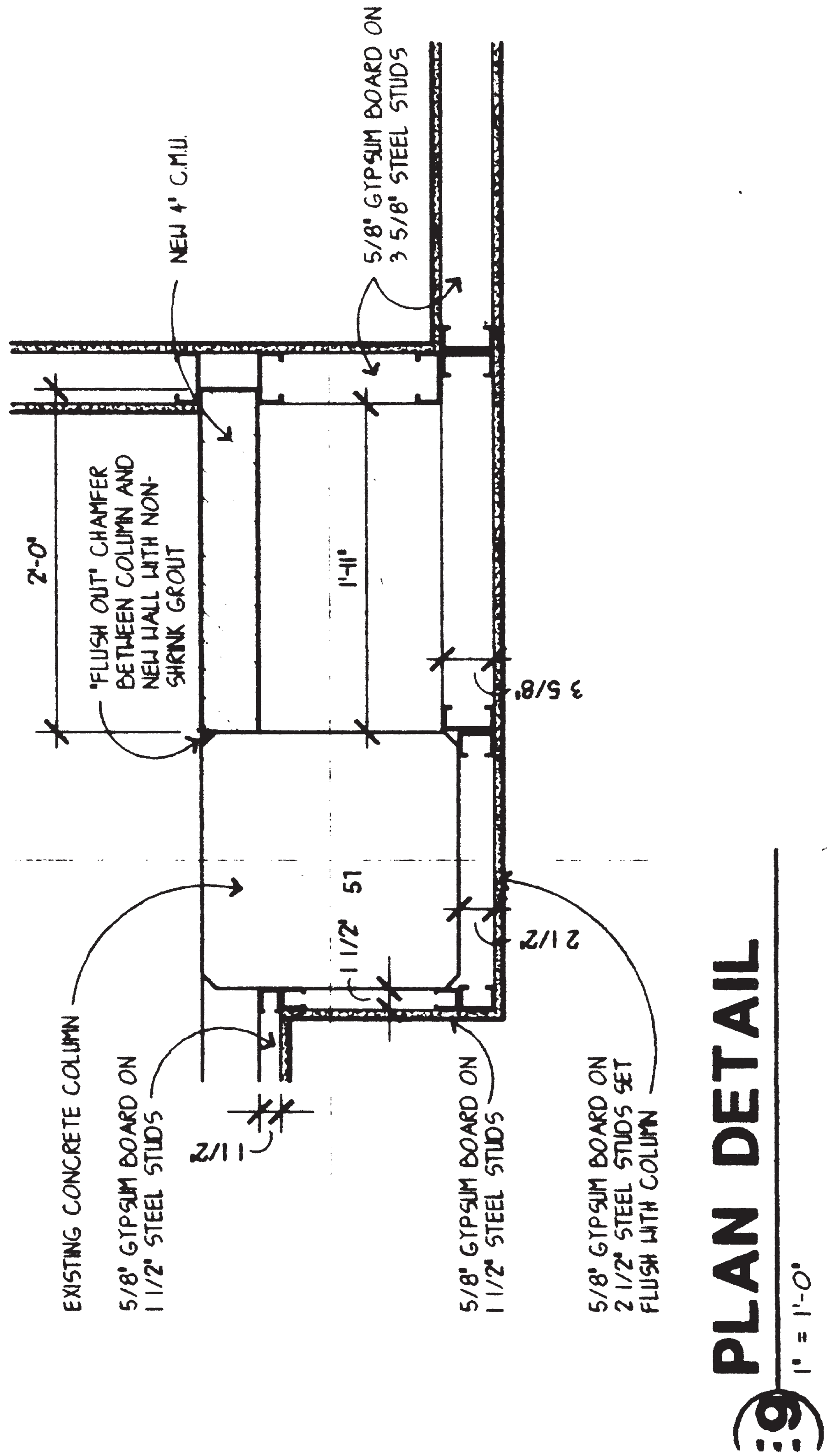
In this example, too many lines are in the same line weight, object edge outlines, reinforcement, anchors, etc. Te object lines [CMU, steel column] should be darkest, reinforcement and anchors lighter [but not the same as the material symbols].



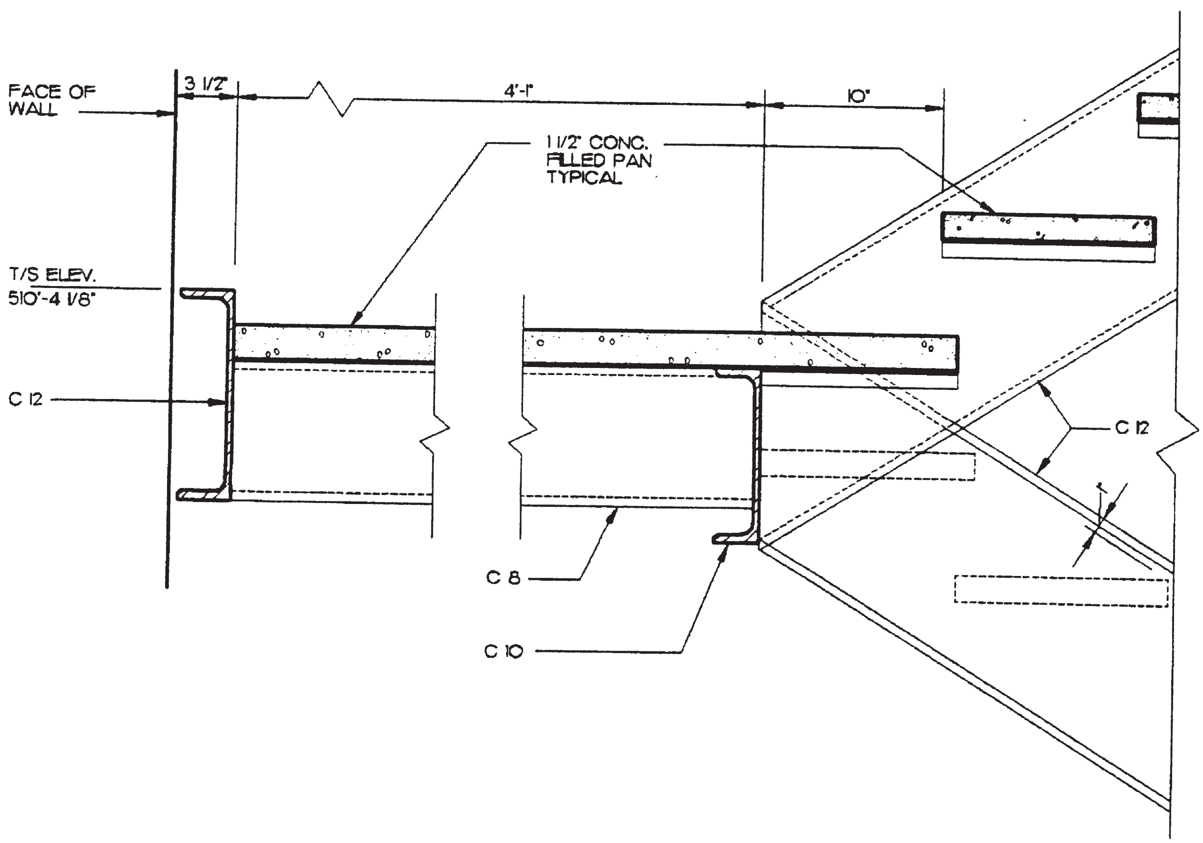
This detail is similar to the previous one, but here the column centerline should use the standard centerline designation; the door frame needs to be darker [for metal thickness and as a primary feature]. Note conflict at top leader and the dimension line.



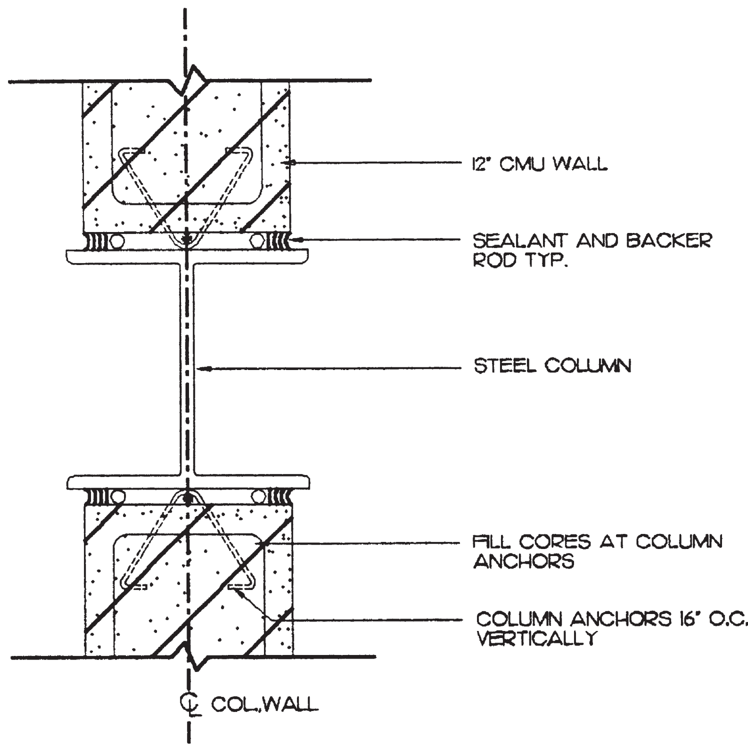
The threshold is NOT the primary issue here [and should not be in the darkest line]. The floor line needs to be darkened, along with the ceramic tile. Proper material symbols need to be used. Note leader lines with no distinct terminal point [arrowheads, etc. needed].



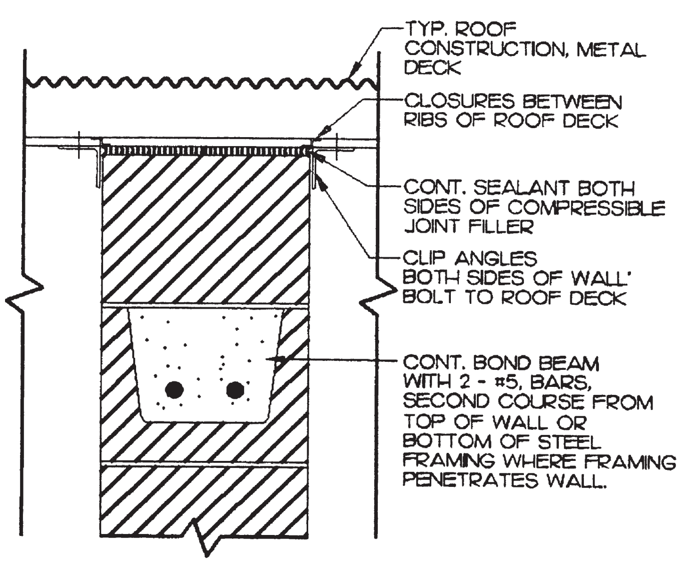
In this detail there needs to be a more definite distinction between new and existing work; this needs to be done by varying line weights, with new work being the darker. Also, the note "flush out" is inappropriate. Better worded as, "Fill camber to align with column and new wall". Variation in the readability and weight of materials symbols is notable.



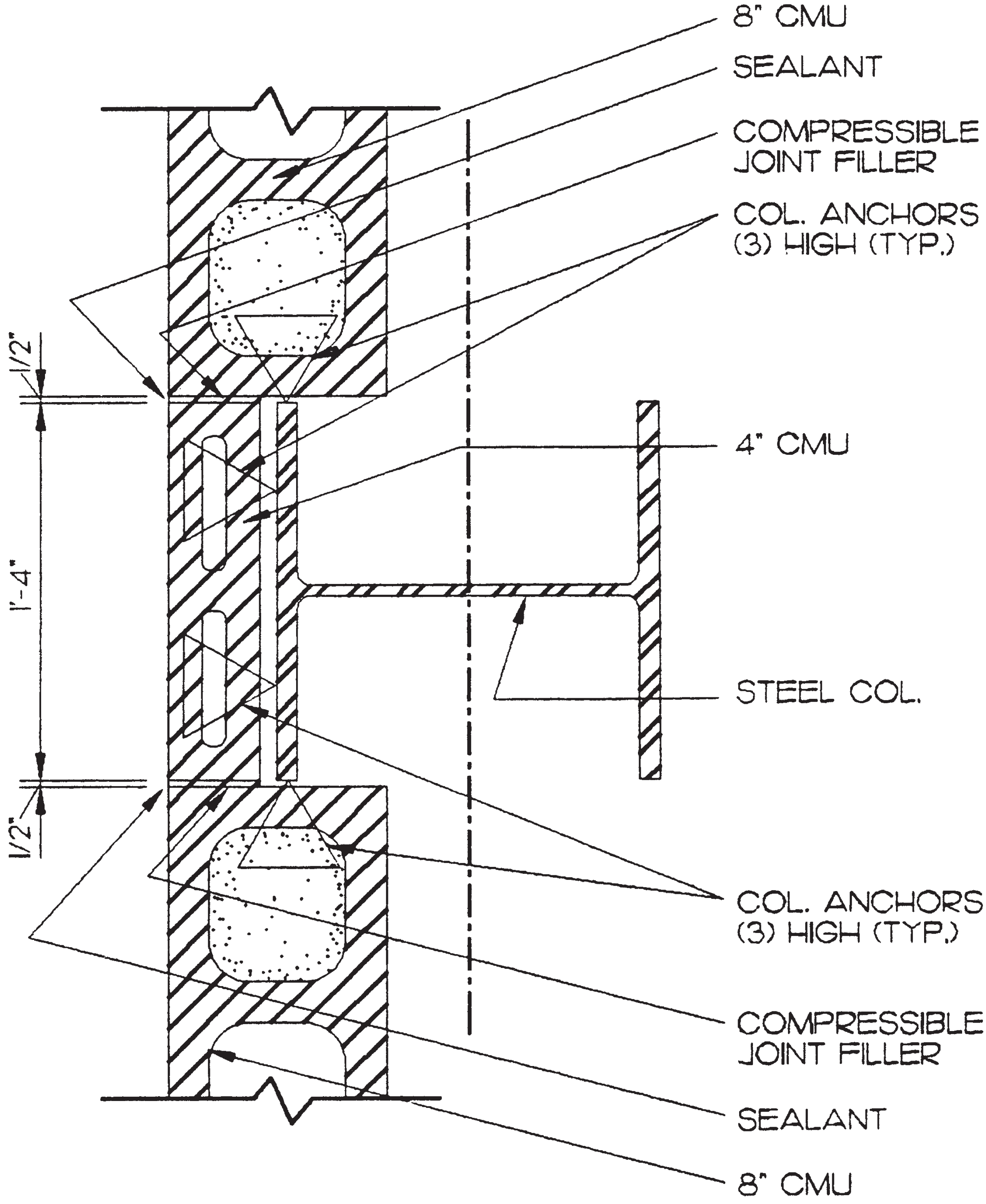
A reasonably well executed detail; decent line work. Care needs to be taken that items such as the tread and landing pans are shown in the same line weight [since they are made of the same material thickness]. What else would you do to touch-up and improve even this god detail?



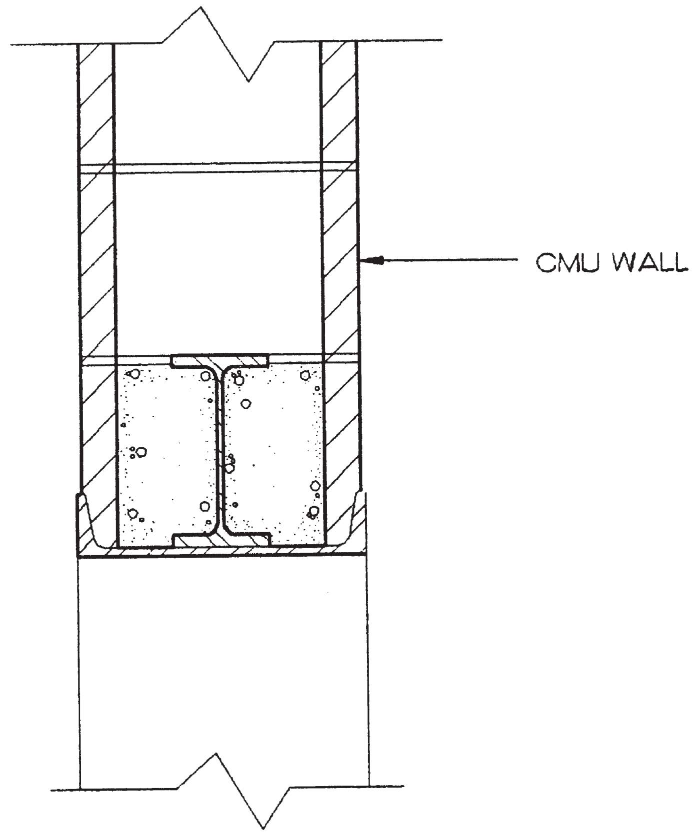
Can you identify what the dark diagonal lines are meant to show? Horizontal masonry joint reinforcing? Material symbol for concrete masonry units? A bad idea? Also, what there [3] other things would you do to improve this detail?



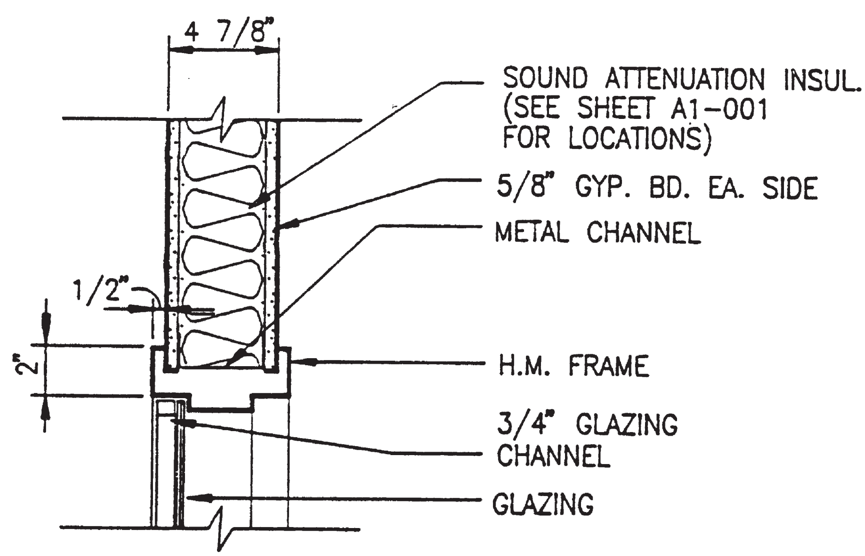
A detail badly hurt by small scale, bad lines [objects, and material symbols], useless break lines and easy readability!



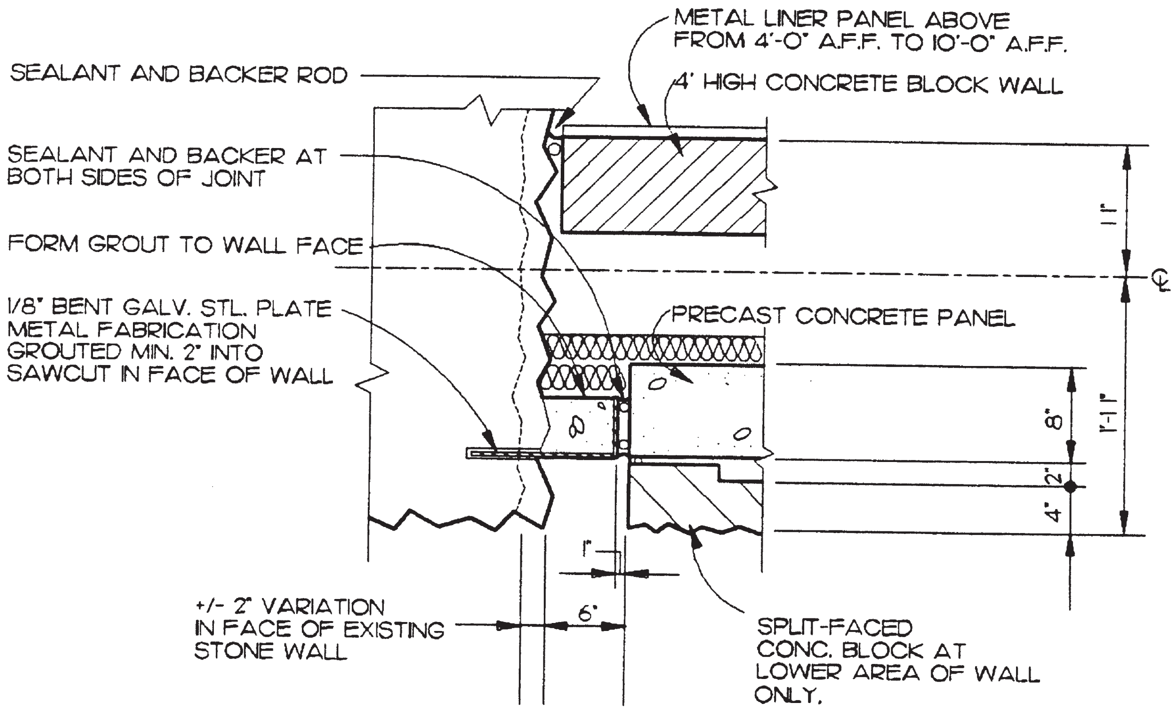
Can you identify at least 5 errors in this detail? More than 5?



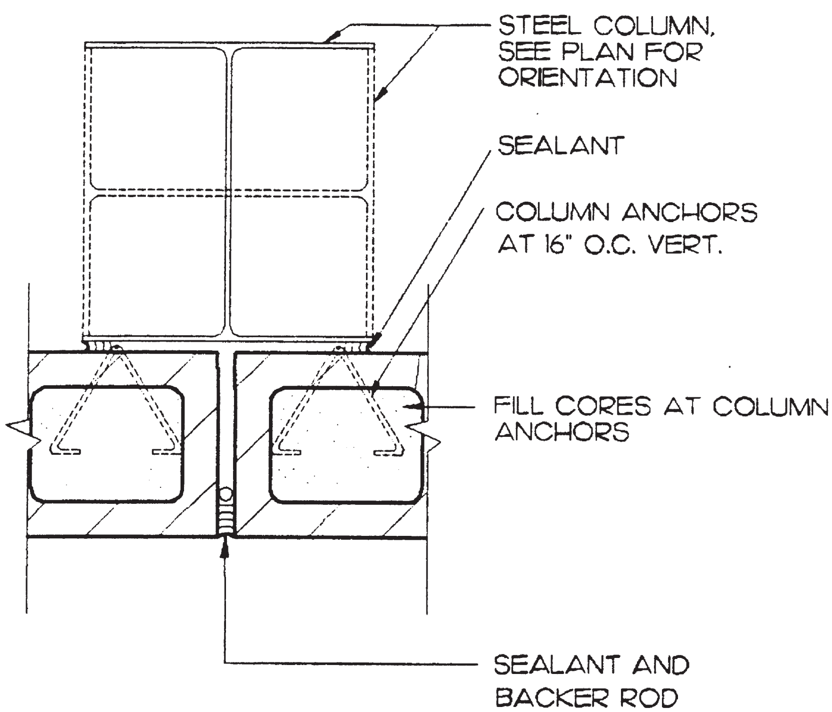
Note the inconsistent line work for items that are cut by the section.



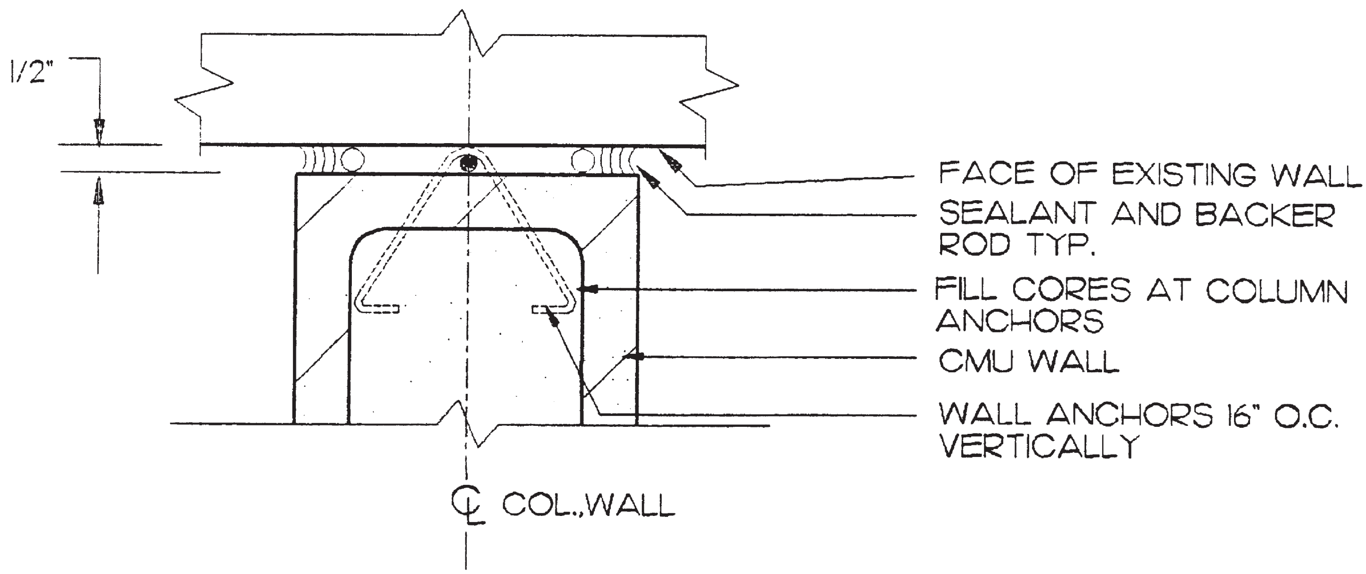
A good detail – if anything the outer lines of the gypsum board could be slightly lighter [so they don't appear exactly the same as the metal door frame].



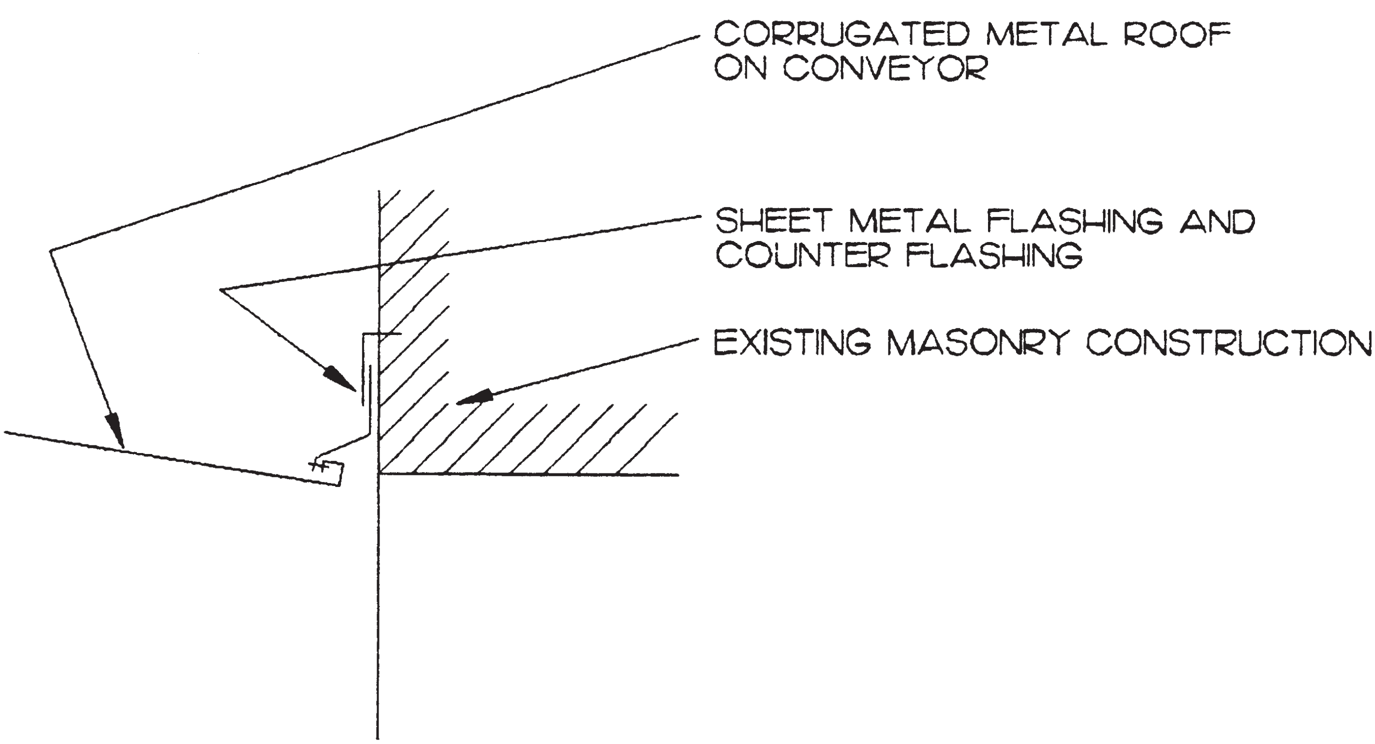
A little inconsistent in the line work between new and existing work — new should be darker.



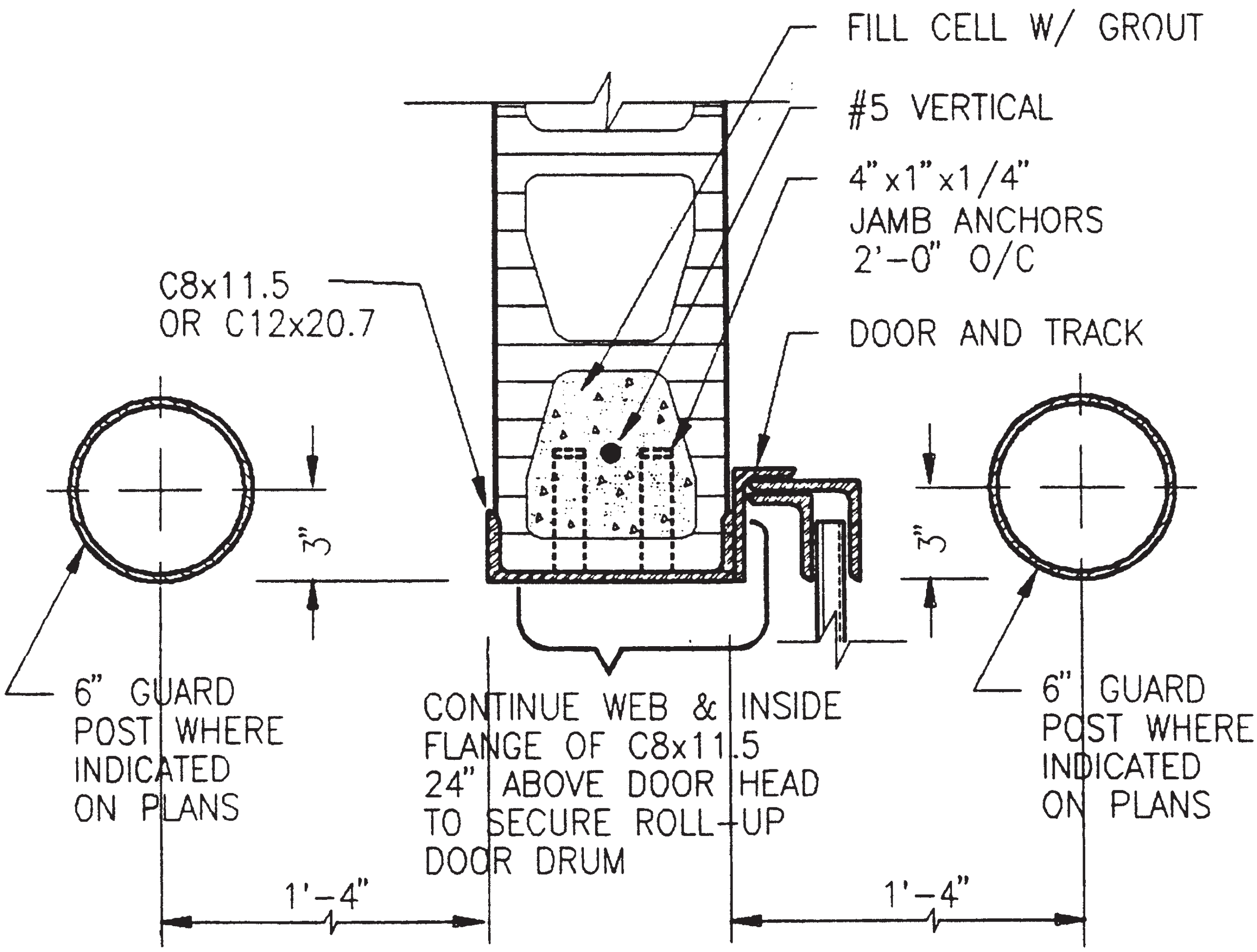
A good detail [column could be darker]. The concept here may be faulty. While trying to show that the column could be oriented either way, some confusion may easily occur; it may be better to show it one way and use a note to indicate that it may be [per plan] different in other locations. Also, if the “dotted” column is in place, how do you attach the column anchors shown?



How can this detail be made better?



If the three [3] metal items are of different thickness, can you [and how do you?] show that on this detail?
How does the wall material influence what you do?



A detail handled rather well; any ideas for changes or improvements?

SUMMARY/EPILOGUE

It seems both appropriate and desirable to summarize some of the information that has been discussed previously. An attempt to do this, at least in part, follows.

These are simply more thoughts about working drawing preparation. The suggestion is to use these frequently, whether for specific problems or simply to reorient yourself to your proper perspective for producing working drawings. Underline or highlight those items that interest you or seem to give you new and better direction and perspective.

- No matter your current station in life [graduate, degreed, bachelor, associate, master, registered, co-op, or designer/operator], the success of the project you are working on depends directly on how much you care.
- Caring has a direct impact on the project and its cost. For example, if you show a detail requiring work that is not normally done or is not normally done as you show it, the cost of the project will go up. Simply because there is a question as to what will be required if you insist on your own way, the added cost is justified to your client's detriment.
- You have to care about each line-what it does and doesn't do and, more important, what it is supposed to do. So, too, with each note, work, and dimension. Be aware and sensitive to conditions: Does the door open into a brick wall? Why is a door opening "hatched"? Do your dimensions add up to overalls? Do things look neat, controlled, and orderly? Be careful to avoid misspellings.
- Don't be misled by the words "architectural practice." The work of the profession is as serious as the "practice of medicine." While practice in some contexts indicates less than a fully committed effort, or something less than serous, here it means the real, actual, and dedicated work of the professionals. In plain language, giving a damn counts! Blowing things off, forgetting, "sloughing off," glossing over, and simply not understanding [and being too proud to ask] doesn't cut it. If you are charged with making changes noted on a check set, make absolutely sure that you make all of the changes and in a correct manner.
- Never consider any assignment or work on documents to be menial; the project architect knows what must be done and is looking to you to help, assist, aid, and contribute in a positive manner to their completion.
- It is your job to do the work assigned to you in the most complete, well-depicted, well-coordinated, and absolutely pertinent manner. Slopping something together is indefensible, especially with the resources and people around you who can help.
- Thinking does not hurt, but gives you a world of pride and makes you a valued employee.
- There is no such thing as a "dumb" question – ask, ask, ask! [It's only dumb to think there is a dumb question!] If you believe you have a possible solution, bring it along, but be sure to ask, ask, ask.
- You run, control, and think for the computer aided drafting [CAD] system – you!
- From now on, consider CAD as nothing more than your valuable production tool. It is exactly that – a tool – it does no more than a pencil. OK, so it's faster, but that in itself is meaningless if content, intent, and clarity are not present.
- CAD is a marvelous but inanimate machine. It cannot even turn itself on without you or a timing gadget. It doesn't know what to do, when, or where; all it knows is what you tell it. Tell it foolishness, it produces foolishness – who then is at fault? It doesn't know how to correct your mistakes, or how to do something you failed to do.
- By the same token, CAD has great capabilities, granted, but there is nothing that says you have to use all of them, or all of anyone of them. CAD will insert brick symbology until the cows come home-you give it the extent and the command for the symbol and wow! look at all those bricks! But have you – and CAD – contributed anything of value to the project?
- In none of this do we consider you dumb or inadequate; you are merely unprepared and inexperienced. There is no way to overcome this except by getting field and office knowledge and guidance; by asking questions and advice; by seeking to better yourself through reading and educational courses that increase your insight to construction.
- The Intern Development Program [IDP] proves, outrightly, that architecture schools are not teaching everything they should or could within the time you spend with them. You have to engage in on-the-job-training [OJT], and you will add to your knowledge and career status by asking and finding out from others who have been "bloodied" and have also learned from those before them.
- There is a great deal to learn, but don't fear this – it comes

in steps or stages, and each project will add something to your personal storehouse of details, concepts, approaches, and solutions.

- If it doesn't look right, it probably isn't!
- In the bygone days, every so often each day we looked at our drawings upside down; you'll be amazed at how easy it is to spot errors when you do this.
- Look at the drawings through half-closed eyes, and you'll see line work that is too light for proper readability and reproduction.
- Remember, a line has a beginning and an ending – it goes "from" somewhere "to" somewhere.
- Check and coordinate everything, no matter how small. If each of us "makes sure," we'll do a much better job, quicker, and at less cost.
- You will make mistakes! But make them in the office where they are easily changed. Don't let things slide, hoping they will be caught or remedied in the field – only "bad" things happen that way.
- Keep control. Only you can make things happen, including making the CAD machine do something. This means using the best information and the best technique[s] to get the project documented.
- Don't be afraid to use resources. Most of what we use is shown or pictured somewhere; we use a lot of standard materials or systems. Look them up in reference books, other project drawings, Sweet's Catalogs, product reference manuals. Just be sure the drawings or details you use apply completely to your work. Nothing is more distracting than a detail no one can figure out or place in the job. If you need information, talk to your supervisor and suggest that the product representative be called or a catalog sent for.

HELPFUL HINTS

1. All lettering in notes is the same size, style, and case. Titles are always larger than notes.
2. Turn on all layers, to ensure that notes, etc., do not [1] overlap each other or [2] overlap portions of the drawing.
3. Titles, section markers, door marks, wall-type designators, targets, and all other such symbols should be uniform and the same size in all locations. Door marks should always be within the door opening [move other "stuff" to miss them].
4. Dimension two thin, adjacent materials like this:
5. Run dimension lines through a wall or partition like this [CAD likes to dimension just to the face of the wall, leaving a gap]:
6. Run a line of dimensions between the column centerlines. Locate walls, partitions, and other landmarks [corners, bulkheads, etc.] from the nearest column centerline. Column centerlines are just that-long dash, dot or dash, then long dash, at close intervals and continuous through the drawing, both ways.
7. Dimension lines that cross match lines require a definite termination, either to a column centerline or to a wall, with a note showing the distance from the terminus to the landmark on the other side of the match line. Do not dimension to the match line, as this is an invisible line that is not located on-site [it is merely a drafting technique!].
8. Don't use match lines in wall sections. Think of wall sections as a series of details aligned one over the other. If the full height of a wall cannot be shown on the sheet, delete portions of the wall that just show repetitive construction [example: a brick wall] by using pairs of break lines [and keep them small too] through the width of the wall. Then merely space the detail work above and below the break lines closer together. Do, however, make every attempt to show the very top and the very bottom of the wall.
9. Reflected ceiling plans should show walls only, and with the same line weight for both new and existing; do not show door openings, etc. [remember that these drawings are the views we would see if we looked down at the floor and it was mirrored].
10. Do not dimension borders of ceiling tiles [rooms can vary in size and alignment, so a border may be altogether different from what you show]. Note spaces with no ceilings as "exposed structure," not "open"; "unfinished" spaces should be shown as unfinished.
11. In laying out a ceiling grid start at the geometric center of the room with an intersection of four panels, or with a panel centered both ways.
12. Delete North arrows from section and detail sheets; use them on plan sheets only.
13. Be aware of the need to vary line weight: new and existing work, work to be removed, materials that are "cut" in section. This adds readability to the drawings and makes things much clearer.
14. Do not rely on or "allow" auto-dimensioning to produce and control your dimensions [remember who is in control]. Architectural drawings are not dimensioned down to 1/16 and usually not even to I/S. CAD may want to do this, and some engineers tend to do it as well, but our work is too variable and there is no need for such precision in view of the normal variation in our materials and systems. If a dimension is critical or necessary, mark it "Hold"; if you are aware of a dimension that may vary several inches, add ± to the number dimension. When changes are made late in production, using "NTS" [not to scale] is permitted.

15. When adding hatching and use other material symbols, on both plans and elevations, do this work only in relatively small areas, not throughout entire walls. Usually it is helpful to add such indicators at opening jambs, repaired work, offsets, corners, and the like.
16. Use a "detail call out" only where a specific and unique location is involved. For example, not every bollard needs a "bubble," but can be noted as "See Detail 12345," or "Typical bollard." Where other typical [same item repeated], continuous, or wide-ranging work is done, use notes, not a call out.
17. Even though they may repeat each other, use a separate set of notes for each drawing/detail; don't use one set with merely two sets of leader lines pointing to the two drawings.
18. Moreover, ensure that the same note for the same work, but on different drawings, says things identically. Do not include a lot of specification information on your drawing notes [this includes material information, installation methods, etc.].
19. Do some preliminary planning about sheet layout; never allow leader lines to cross ["linear spaghetti" will result]; locate notes close to the point of application; leader lines should touch the work, not merely point to or "aim at" it.
20. Never use such large lettering that the drawing or object is obscured or made to "disappear." Just as in cartoons and comics, words should be used to aid and explain the drawing.
21. Be extra careful that you never transpose or otherwise "mess up" a model number or other pertinent information. Don't misspell.
22. Periodically, ask yourself [and be as objective as you can] whether you have enough information on the drawing that you could build the work. Be careful not to assume something in your head that is not on the drawing[s].
23. By the way, assume nothing!
24. Never let any of the following thoughts enter your mind: I guess that's OK; oh, that'll be all right; Who cares? No one will notice! Who knows? Let 'em work it out in the field; it doesn't make any difference what I put down.
25. Be very wary of detailing or requiring work that you do not fully understand; your concept may be not only faulty, but unbuildable; here, only experience is the remedy.
26. You've heard of the "honor system" at the military academies; there is one in architecture too, and in document production. Precious little time is available, in any office, for a complete and comprehensive review of every document, detail, and so on. What you do or don't do may be overlooked.
27. You are, or will be, a professional, and with that comes the need to meet a standard of care [note: care], which means doing the right thing, for the right reason, at the right time. Oddly enough, the standard of care that affects you is part of the legal network that surrounds you.
28. And, not to frighten you, but in this world today, you could find yourself in a witness chair in a court explaining why you drew what you did. Don't be caught having "I thought that would be OK" as your only defense. Litigation is a nasty process [I hope you never engage it!], whose sole purpose is to point fingers and establish responsibility. Following set procedures and working within the standard of care are of utmost importance.
29. Another important aspect to your professional OJT and education is your ability to understand the need to be flexible. Every office has an office standards manual, the ground rules about how the office does things or wants things done. Everything we do here is not necessarily the same way it is done by other offices.
30. A basic understanding of why something is done is far more important than how or under what symbol it appears. We can best serve you, personally and professionally, by giving you some insight into this process.
31. It is very important, for your development, to think for yourself. However, understand that you cannot do this isolated from your colleagues and supervisors. What you put on the documents "commits" your firm. Therefore, take the initiative, do things, think, research, seek answers, ask questions, but at the same time keep referencing back, and keep your supervisors informed. None of us knows every way to do everything; some of us have the experience to know, a little better, what works best and what won't work – you need to gain this information through your career.
32. A lot of this is "heavy stuff," but try not to be discouraged or frightened. We all like to enjoy our work. Your satisfaction and ultimate success as a professional lies in doing things well, properly, and once!

Welcome to the profession – have a long, wondrous, fruitful, and satisfying career

We are what we repeatedly do. Excellence, then, is not an act; it is a habit.

- Aristotle

APPENDIX A
TRADE ORGANIZATIONS
[Standards generating Organizations Governing Authorities]

Following is a list of associations who serve a very limited group of people or manufacturers or a specific product line. The scope of their work lies within very distinct limits, but the information they have and can provided within those limits is most helpful, very detailed to design professionals. Each is a valued resource within their narrow area of expertise.

Because of the massive amount of information required for any project, design professionals often utilize technical information and reference standards contained in publications produced by various organizations. Trade associations, standards generating organizations, and governing authorities are invaluable sources of technical information, literature, and audio/visual aids. Their documents are highly reliable, detailed, and wide-ranging. The information is product specific, complete, and in depth. It includes design, fabrication, processing, production, and installation data, along with pertinent [but general] details applicable to the products. There is no attempt to provide project specific details – that being the task of the project personnel.

These documents are generally categorized as "Reference Standards." The data are promotional in nature, not directed toward sales, but toward understanding, and the correct use and implementation of the products involved.

Usually, there is far more information than required, in that the testing and manufacturing procedures may be noted. Many items are provided gratis, but ask for catalog and applicable price list for available items and complete ordering information. In lieu of repeating all of the necessary information on the drawings or in the specifications, professionals usually use a system of referring to the required materials, often using acronyms or abbreviations to represent the full names of the organizations involved.

Following is a partial list of many such organizations; numerous other organizations exist that are not listed. The organizations are subject to change, in name, address, telephone number, and internet addresses. Those listed below are believed to be accurate as of the date of production of this book. To verify or update information readers are advised to consult one of the following:

Encyclopedia of Associations,
published by Gale Research Company.

National Trade and Professional Associations of the United States and Canada and Labor Unions,
published by Columbia Books, Washington, DC.

ARCAT,
published by The Architect's Catalog, Inc.,
Fairfield, CT.

Sources of Information section of The Directory,
published by the Sweet's Group of McGraw- Hill Construction Information Group

Architectural Graphics Standards, 10th ed.,
manual published by John Wiley and Sons, Inc., New York, NY [Also, most larger public libraries have a directory service [free], for locating local addresses, etc.

AA	Aluminum Association, Inc. [The] www.aluminum.org
AAADM	American Association of Automatic Door Manufacturers www.aaadm.com
AABC	Associated Air Balance Council www.aabchq.com
AAMA	American Architectural Manufacturers Association www.aamanet.org
AASHTO	American Association of State Highway and Transportation Officials www.transportation.org
AATCC	American Association of Textile Chemists and Colorists www.aatcc.org
ABAA	Air Barrier Association of America www.airbarrier.org
ABMA	American Bearing Manufacturers Association www.abma-dc.org

ACI	American Concrete Institute www.concrete.org
ACPA	American Concrete Pipe Association www.concrete-pipe.org
AEIC	Association of Edison Illuminating Companies, Inc. [The]; www.aeic.org
AF&PA	American Forest & Paper Association www.afandpa.org
AGA	American Gas Association www.aga.org
AGC	Associated General Contractors of America [The] www.agc.org
AHA	American Hardboard Association [Now part of CPA]
AHAM	Association of Home Appliance Manufacturers www.aham.org
AI	Asphalt Institute www.asphaltinstitute.org
AIA	American Institute of Architects [The] www.aia.org
AISC	American Institute of Steel Construction www.aisc.org
AISI	American Iron and Steel Institute www.steel.org
AITC	American Institute of Timber Construction www.aitc-glulam.org
ALCA	Associated Landscape Contractors of America [Now PLANET - Professional Landcare Network]
ALSC	American Lumber Standard Committee, Incorporated; www.alsc.org
AMCA	Air Movement and Control Association International, Inc. www.amca.org
ANSI	American National Standards Institute www.ansi.org
AOSA	Association of Official Seed Analysts, Inc. www.aosaseed.com
APA	Architectural Precast Association www.archprecast.org
APA	APA - The Engineered Wood Association www.apawood.org
APA EWS	APA - The Engineered Wood Association Engineered Wood Systems [See APA - The Engineered Wood Association]
API	American Petroleum Institute www.api.org
ARI	Air-Conditioning & Refrigeration Institute www.ari.org
ARMA	Asphalt Roofing Manufacturers Association www.asphaltroofing.org
ASA	Acoustical Society of America www.asa@aip.org
ASCE	American Society of Civil Engineers www.asce.org
ASCE/SEI	American Society of Civil Engineers/Structural Engineering Institute [See ASCE]
ASHRAE	American Society of Heating, Refrigerating and Air-Conditioning Engineers www.ashrae.org
ASME	ASME International [American Society of Mechanical Engineers International]; www.asme.org
ASSE	American Society of Sanitary Engineering www.asse-plumbing.org

ASTM	ASTM International [American Society for Testing and Materials International] www.astm.org
AWCI	Association of the Wall and Ceiling Industry www.awci.org
AWCMA	American Window Covering Manufacturers Association [Now WCMA]
AWI	Architectural Woodwork Institute www.awinet.org
AWPA	American Wood Protection Association [Formerly: American Wood Preservers' Association]; www.awpa.com
AWS	American Welding Society www.aws.org
AWWA	American Water Works Association www.awwa.org
BHMA	Builders Hardware Manufacturers Association www.buildershardware.com
BIA	Brick Industry Association [The] www.bia.org
BICSI	BICSI, Inc. [Building Industry Consulting Service International, Inc.] www.bicsi.org
BIFMA	BIFMA International [Business and Institutional Furniture Manufacturer's Association International]; www.bifma.com
BISSC	Baking Industry Sanitation Standards Committee; www.bissc.org
BWF	Badminton World Federation [Formerly: IBF - International Badminton Federation]; www.internationalbadminton.org
CCC	Carpet Cushion Council www.carpetcushion.org
CDA	Copper Development Association www.copper.org
CEA	Canadian Electricity Association www.canelect.ca
CEA	Consumer Electronics Association www.ce.org
CFFA	Chemical Fabrics & Film Association, Inc. www.chemicalfabricsandfilm.com
CGA	Compressed Gas Association www.cganet.com
CIMA	Cellulose Insulation Manufacturers Association www.cellulose.org
CISCA	Ceilings & Interior Systems Construction Association www.cisca.org
CISPI	Cast Iron Soil Pipe Institute www.cispi.org
CLFMI	Chain Link Fence Manufacturers Institute www.chainlinkinfo.org
CRRC	Cool Roof Rating Council www.coolroofs.org
CPA	Composite Panel Association www.pbmdf.com
CPPA	Corrugated Polyethylene Pipe Association www.cppa-info.org
CRI	Carpet and Rug Institute [The] www.carpet-rug.com
CRSI	Concrete Reinforcing Steel Institute www.crsi.org
CSA	CSA International [Formerly: IAS - International Approval Services] www.csa-international.org
CSI	Cast Stone Institute; www.caststone.org
CSI	Construction Specifications Institute [The] www.csinet.org
CSSB	Cedar Shake & Shingle Bureau www.cedarbureau.org
CTI	Cooling Technology Institute [Formerly: Cooling Tower Institute] www.cti.org
DHI	Door and Hardware Institute www.dhi.org
EIA	Electronic Industries Alliance www.eia.org
EIMA	EIFS Industry Members Association www.eima.com

EJCDC	Engineers Joint Contract Documents Committee www.ejdc.org
EJMA	Expansion Joint Manufacturers Association, Inc. www.ejma.org
ESD	ESD Association [Electrostatic Discharge Association] www.esda.org
ETL SEMCO	Intertek ETL SEMCO [Formerly: ITS - Intertek Testing Service NA] www.intertek.com
FIBA	Federation Internationale de Basketball [The International Basketball Federation]; www.fiba.com
FIVB	Federation Internationale de Volleyball [The International Volleyball Federation]; www.fivb.ch
FM	Approvals FM Approvals LLC www.fmglobal.com
FM Global	FM Global [Formerly: FMG - FM Global] www.fmglobal.com
FMRC	Factory Mutual Research; [Now FM Global]
FRSA	Florida Roofing, Sheet Metal & Air Conditioning Contractors Association, Inc.; www.floridaroof.com
FSA	Fluid Sealing Association www.fluidsealing.com
FSC	Forest Stewardship Council www.fsc.org
GA	Gypsum Association www.gypsum.org
GANA	Glass Association of North America www.glasswebsite.com
GRI	[Part of GSI]
GS	Green Seal www.greenseal.org
GSI	Geosynthetic Institute www.geosynthetic-institute.org
HI	Hydraulic Institute www.pumps.org
HI	Hydronics Institute www.gamanet.org
HMMA	Hollow Metal Manufacturers Association [Part of NAAMM]
HPVA	Hardwood Plywood & Veneer Association www.hpva.org
HPW	H. P. White Laboratory, Inc. www.hpwhite.com
IAS	International Approval Services [Now CSA International]
IBF	International Badminton Federation [Now BWF]
ICEA	Insulated Cable Engineers Association, Inc. www.icea.net
ICRI	International Concrete Repair Institute, Inc. www.icri.org
IEC	International Electro-technical Commission www.iec.ch
IEEE	Institute of Electrical and Electronics Engineers, Inc. [The]; www.ieee.org
IESNA	Illuminating Engineering Society of North America www.iesna.org
IEST	Institute of Environmental Sciences and Technology www.iest.org
IGCC	Insulating Glass Certification Council www.igcc.org
IGMA	Insulating Glass Manufacturers Alliance www.igmaonline.org
ILI	Indiana Limestone Institute of America, Inc. www.iliai.com
IMI	International Masonry Institute www.imiweb.org
ISO	International Organization for Standardization www.iso.ch Available from ANSI www.ansi.org

ISSFA	International Solid Surface Fabricators Association www.issfa.net	
ITS	Intertek Testing Service NA [Now ETL SEMCO]	
ITU	International Telecommunication Union www.itu.int/home	
KCMA	Kitchen Cabinet Manufacturers Association www.kcma.org	
LGSEA	Light Gauge Steel Engineers Association www.lgsea.com	
LMA	Laminating Materials Association [Now part of CPA]	
LPI	Lightning Protection Institute www.lightning.org	
MBMA	Metal Building Manufacturers Association www.mbma.com	
MFMA	Maple Flooring Manufacturers Association, Inc. www.maplefloor.org	
MFMA	Metal Framing Manufacturers Association, Inc. www.metalframingmfg.org	
MH	Material Handling [Now MHIA]	
MHIA	Material Handling Industry of America www.mhia.org	
MIA	Marble Institute of America www.marble-institute.com	
MPI	Master Painters Institute www.paintinfo.com	
MSS	Manufacturers Standardization Society of The Valve and Fittings Industry Inc.; www.mss-hq.com	
NAAMM	National Association of Architectural Metal Manufacturers www.naamm.org	
NACE	NACE International [National Association of Corrosion Engineers International]; www.nace.org	
NADCA	National Air Duct Cleaners Association www.nadca.com	
NAGWS	National Association for Girls and Women in Sport www.aahperd.org/nagws/	
NAIMA	North American Insulation Manufacturers Association; www.naima.org	
NBGQA	National Building Granite Quarries Association, Inc. www.nbgqa.com	
NCAA	National Collegiate Athletic Association [The] www.ncaa.org	
NCMA	National Concrete Masonry Association www.ncma.org	
NCPI	National Clay Pipe Institute www.ncpi.org	
NCTA	National Cable & Telecommunications Association www.ncta.com	
NEBB	National Environmental Balancing Bureau www.nebb.org	
NECA	National Electrical Contractors Association www.necanet.org	
NeLMA	Northeastern Lumber Manufacturers' Association www.nelma.org	
NEMA	National Electrical Manufacturers Association www.nema.org	
NETA	InterNational Electrical Testing Association www.netaworld.org	
NFHS	National Federation of State High School Associations www.nfhs.org	
NFPA	NFPA International [Formerly National Fire Protection Association] www.nfpa.org	
NFRC	National Fenestration Rating Council www.nfrc.org	
NGA	National Glass Association www.glass.org	
NHLA	National Hardwood Lumber Association www.natlhardwood.org	

NLGA	National Lumber Grades Authority www.nlga.org	
NOFMA	NOFMA: The Wood Flooring Manufacturers Association [Formerly: National Oak Flooring Manufacturers Association] www.nofma.com	
NOMMA	National Ornamental & Miscellaneous Metals Association www.nomma.org	
NRCA	National Roofing Contractors Association www.nrca.net	
NRMCA	National Ready Mixed Concrete Association www.nrmca.org	
NSF	NSF International [National Sanitation Foundation International] www.nsf.org	
NSSGA	National Stone, Sand & Gravel Association www.nssga.org	
NTMA	National Terrazzo & Mosaic Association, Inc. [The] www.ntma.com	
NTRMA	National Tile Roofing Manufacturers Association [Now TRI]	
NWWDA	National Wood Window and Door Association [Now WDMA]	
OPL	Omega Point Laboratories, Inc. [Now ITS]	
PCI	Precast/Prestressed Concrete Institute www.pci.org	
PDCA	Painting & Decorating Contractors of America www.pdca.com	
PDI	Plumbing & Drainage Institute www.pdionline.org	
PGI	PVC Geomembrane Institute http://pgi-tp.ce.uiuc.edu	
PLANET	Professional Landcare Network [Formerly: ACLA – Associated Landscape Contractors of America]; www.landcarenetwork.org	
PTI	Post-Tensioning Institute www.post-tensioning.org	
RCSC	Research Council on Structural Connections www.boltcouncil.org	
RFCI	Resilient Floor Covering Institute www.rfci.com	
RIS	Redwood Inspection Service www.redwoodinspection.com	
SAE	SAE International www.sae.org	
SDI	Steel Deck Institute www.sdi.org	
SDI	Steel Door Institute www.steeldoor.org	
SEFA	Scientific Equipment and Furniture Association www.sefalabs.com	
SEI/ASCE	Structural Engineering Institute/American Society of Civil Engineers [See ASCE]	
SFA	Steel Framing Alliance www.steelframingqalliance.com	
SGCC	Safety Glazing Certification Council www.sgcc.org	
SIA	Security Industry Association www.siaonline.org	
SIGMA	Sealed Insulating Glass Manufacturers Association [Now IGMA]	
SJI	Steel Joist Institute www.steeljoist.org	
SMA	Screen Manufacturers Association www.smacentral.org	
SMACNA	Sheet Metal and Air Conditioning Contractors' National Association; www.smacna.org	
SMPTE	Society of Motion Picture and Television Engineers www.smpte.org	
SPFA	Spray Polyurethane Foam Alliance [Formerly: SPI/SPFD - The Society of the Plastics Industry, Inc.; Spray Polyurethane Foam Division] www.sprayfoam.org	
SPIB	Southern Pine Inspection Bureau [The] www.spib.org	

SPRI Single Ply Roofing Industry
www.spri.org

SSINA Specialty Steel Industry of North America
www.ssina.com

SSMA Steel Stud Manufacturing Association
www.ssma.com

SSPC SSPC: The Society for Protective Coatings
www.sspc.org

STI Steel Tank Institute
www.steeltank.com

SWI Steel Window Institute
www.steelwindows.com

SWRI Sealant, Waterproofing, & Restoration Institute
www.swrionline.org

TCNA Tile Council of North America, Inc. [Formerly Tile Council of America, Inc. [TCA]; www.tileusa.com

TIA/EIA Telecommunications Industry Association/Electronic Industries Alliance; www.tiaonline.org

TMS The Masonry Society
www.masonrysociety.org

TPI Truss Plate Institute, Inc.
www.tpinst.org

TPI Turfgrass Producers International
www.turfgrasssod.org

TRI Tile Roofing Institute
www.tileroofing.org

UL Underwriters Laboratories Inc
www.ul.com

UNI Uni-Bell PVC Pipe Association
www.uni-bell.org

USAV USA Volleyball
www.usavolleyball.org

USGBC U.S. Green Building Council
www.usgbc.org

USITT United States Institute for Theatre Technology, Inc.
www.usitt.org

WASTEC Waste Equipment Technology Association
www.wastec.org

WCLIB West Coast Lumber Inspection Bureau
www.wclib.org

WCMA Window Covering Manufacturers Association
www.wcmanet.org

WCSC Window Covering Safety Council [Formerly: WCMA - Window Covering Manufacturers Association]; www.windowcoverings.org

WDMA Window & Door Manufacturers Association [Formerly: NWWDA - National Wood Window and Door Association]; www.wdma.com

WI Woodwork Institute [Formerly: WIC - Woodwork Institute of California]; www.wicnet.org

WIC Woodwork Institute of California [Now WI]

WMMPA Wood Moulding & Millwork Producers Association
www.wmmpa.com

WSRCA Western States Roofing Contractors Association
www.wsrca.com

WWPA Western Wood Products Association
www.wwpa.org

CODE AGENCIES:

IAPMO International Association of Plumbing and Mechanical Officials
www.iapmo.org

ICC International Code Council [Contact for information about former model code agencies [BOCA, ICBO and SBBCI] and now International family of codes]; www.iccsafe.org

ICC-ES ICC Evaluation Service, Inc
www.icc-es.org

UNITED STATES FEDERAL GOVERNMENT AGENCIES:

CE Army Corps of Engineers
www.usace.army.mil

CPSC Consumer Product Safety Commission
www.cpsc.gov

DOC	Department of Commerce www.commerce.gov
DOD	Department of Defense http://dodssp.daps.dla.mil
DOE	Department of Energy www.energy.gov
EPA	Environmental Protection Agency www.epa.gov
FAA	Federal Aviation Administration www.faa.gov
FCC	Federal Communications Commission www.fcc.gov
FDA	Food and Drug Administration www.fda.gov
GSA	General Services Administration www.gsa.gov
HUD	Department of Housing and Urban Development www.hud.gov
LBL	Lawrence Berkeley National Laboratory www.lbl.gov
NCHRP	National Cooperative Highway Research Program [See TRB]
NIST	National Institute of Standards and Technology www.nist.gov
OSHA	Occupational Safety & Health Administration www.osha.gov
PBS	Public Buildings Service [See GSA]
PHS	Office of Public Health and Science www.osophs.dhhs.gov/ophs
RUS	Rural Utilities Service [See USDA]
SD	State Department www.state.gov
TRB	Transportation Research Board http://gulliver.trb.org
USDA	Department of Agriculture www.usda.gov
USPS	Postal Service www.usps.com
ADAAG	Americans with Disabilities Act [ADA]; Architectural Barriers Act [ABA]; Accessibility Guidelines for Buildings and Facilities Available from U.S. Access Board; www.access-board.gov
CFR	Code of Federal Regulations [Available from Government Printing Office]; www.gpoaccess.gov/cfr/index.html
DOD	Department of Defense Military Specifications and Standards [Available from Department of Defense Single Stock Point] http://dodssp.daps.dla.mil
DSCC	Defense Supply Center Columbus [See FS]
FED-STD	Federal Standard [See FS]
FS	Federal Specification [Available from Department of Defense Single Stock Point]; http://dodssp.daps.dla.mil [Available from Defense Standardization Program] www.dps.dla.mil [Available from General Services Administration] www.gsa.gov [Available from National Institute of Building Sciences] www.wbdg.org/ccb
FTMS	Federal Test Method Standard [See FS]
MIL	[See MILSPEC]
MIL-STD	[See MILSPEC]
MILSPEC	Military Specification and Standards [Available from Department of Defense Single Stock Point]; http://dodssp.daps.dla.mil
UFAS	Uniform Federal Accessibility Standards [Available from Access Board] www.access-board.gov

APPENDIX B
CONSTRUCTION ORGANIZATIONS
(Standards generating Organizations Governing Authorities)

- Academy of Certified Hazardous Materials Managers
- Accessible Design for the Blind
- Accessibility Equipment Manufacturers Assoc.
- Acoustical Society of America (ASA)
- Adaptive Environments
- Adhesive and Sealant Council
- Affordable Comfort
- Air Barrier Association of America
- Air Conditioning and Refrigeration Institute (ARI)
- Air Conditioning Contractors of America (ACCA)
- Air Diffusion Council (ADC)
- Air Infiltration and Ventilation Centre
- Air Movement and Control Association International (AMCA)
- Alliance to Save Energy
- Alliance for Fire and Smoke Containment and Control
- Alliance for Flexible Polyurethane Foam
- Alliance for Polyurethane Industry
- Aluminum Anodizers Council
- Aluminum Association Inc.
- Aluminum Extruders Council
- American Academy of Environmental Engineers
- American Arbitration Association (AAA)
- American Architectural Foundation
- American Architectural Manufacturers Association (AAMA)
- American Association for Laboratory Accreditation
- American Association of Automatic Door Manufacturers
- American Association of Botanical Gardens and Arboreta
- American Association of Engineering Societies
- American Association of State Highway and Transportation Officials (AASHTO)
- American Backflow Prevention Association
- American Boiler Manufacturers Association
- American Coal Ash Association
- American Concrete Contractors Association
- American Concrete Institute
- American Concrete Pavement Association
- American Concrete Pipe Association
- American Concrete Pressure Pipe Association
- American Concrete Pumping Association
- American Congress on Surveying and Mapping
- American Construction Inspectors Association
- American Consulting Engineers Council
- American Correctional Association
- American Council for Construction Education
- American Design Drafting Association – a premier organization for designers, drafters
- American Electroplaters and Surface Finishers
- American Fence Association
- American Fiberboard Association
- American Fire Sprinkler Association
- American Floorcovering Alliance
- American Forest and Paper Association
- American Forest Foundation
- American Foundry Society
- American Galvanizers Association
- American Gas Association
- American Hardware Manufacturers Association
- American Hardwood Export Council
- American Institute for International Steel
- American Institute of Architects
- American Institute of Architecture Students
- American Institute of Building Design –
- American Institute of Construction
- American Institute of Steel Construction (AISC)
- American Institute of Timber Construction
- American Iron and Steel Institute
- American Lighting Association
- American Lumber Standard Committee
- American National Standards Institute (ANSI)
- American Nursery and Landscape Association
- American Planning Association
- American Public Transportation Association
- American Public Works Association
- American Railroad Engineering and Maintenance-of-Way Association
- American Road and Transportation Builders Association
- American Rolling Door Institute
- American Seed Trade Association
- American Segmental Bridge Association
- American Shotcrete Association
- American Shutter Systems Association
- American Society for Engineering Education
- American Society for Nondestructive Testing
- American Society of Civil Engineers
- American Society of Concrete Contractors
- American Society of Consulting Arborists
- American Society of Furniture Designers
- American Society of Golf Course Architects

- American Society of Heating, Refrigeration and Air-Conditioning Engineers
- American Society of Healthcare Engineering
- American Society of Higher Education Facility Officers
- American Society of Home Inspectors
- American Society of Interior Designers
- American Society of Irrigation Consultants
- American Society of Landscape Architects
- American Society of Mechanical Engineers
- American Society of Plumbing Engineers
- American Society of Professional Estimators
- American Society of Safety Engineers
- American Society of Sanitary Engineering
- American Society of Theatre Consultants
- American Soil and Foundation Engineers
- American Solar Energy Society
- American Sports Builders Association
- American Subcontractors Association
- American Supply Association
- American Tree Farm System
- American Underground Construction Association
- American Walnut Manufacturers Association
- American Water Works Association
- American Welding Society
- American Wind Energy Association
- American Wire Producers Association
- American Wood Council
- American Wood-Preservers' Association
- American Zinc Association
- Amusement Industry Manufacturers & Suppliers
- APA - Engineered Wood Association
- Appalachian Hardwood Manufacturers
- Appraisal Institute
- Architectural Engineering Institute
- Architectural Precast Association
- Architectural Woodwork Institute
- Architectural Woodwork Manufacturers Assoc. of Canada
- Art Glass Association
- ASCR International - Association of Specialists
- ASIS International
- Asphalt Emulsion Manufacturers Association
- Asphalt Institute
- Asphalt Pavement Alliance
- Asphalt Recycling and Reclaiming Association
- Asphalt Roofing Manufacturers Association
- Associated Air Balance Council
- Associated Builders and Contractors
- Associated Construction Distributors International
- Associated Equipment Distributors
- Associated Floor Covering Contractors
- Associated General Contractors
- Associated Locksmiths of America
- Associated Schools of Construction
- Association for Bridge Construction and Design
- Association for Computer Aided Design in Architecture
- Association for Contract Textiles
- Association for Facilities Engineering
- Association for Preservation Technology
- Association for the Advancement of Cost Engineering
- Association for Women in Architecture
- Association of Asphalt Paving Technologist
- Association of Collegiate Schools of Architecture
- Association of Equipment Manufacturers
- Association of Energy Engineers
- Association of Energy Services Professionals
- Association of Home Appliance Manufacturers
- Association of Licensed Architects
- Association of Nonwoven Fabrics Industry
- Association of Professional Landscape Designers
- Association of Rotational Molders
- Association of State Floodplain Managers
- Association of Walls and Ceiling Industries
- ASTM International
- ATHENA Sustainable Materials Institute
- Audio Engineering Society
- Autoclaved Aerated Concrete Producers Association
- Automatic Fire Alarm Association
- Automotive Lift Institute
- BACnet Manufacturers Association
- Barre Granite Association
- Bath Enclosures Manufacturers Association
- BC Wood
- Blow-in-Blanket Contractors Association
- Brick Industry Association
- British Columbia Forest Information
- Builders Hardware Manufacturer Association
- Building Codes Assistance Project
- Building Commissioning Association
- Building Futures Council
- Building Owners and Managers Association
- Building Owners and Managers Institute
- Building Stone Institute
- Business and Institutional Furniture Manufacturer's Association
- Cable Tray Institute
- California Building Industry Association
- California Forest Products Commission
- California Industry Research Board
- California Manufactured Housing Inst.
- California Precast Concrete Pipe Association
- California Redwood Association
- Canadian Alarm and Security Association
- Canadian Carpet Institute
- Canadian Design Build Institute

- Canadian Hardwood Plywood & Veneer
- Canadian Institute of Plumbing and Heating
- Canadian Institute of Quantity Surveyors
- Canadian Institute of Steel Construction
- Canadian Plywood Association
- Canadian Precast / Prestressed Concrete Institute
- Canadian Restaurant & Foodservices Association
- Canadian Roofing Contractors' Association
- Canadian Sheet Steel Building Institute
- Canadian Society of Landscape Architects
- Canadian Solar Industries Association
- Canadian Standards Association
- Canadian Steel Producers Association
- Canadian Stone Association
- Canadian Window and Door Manufacturers Assoc.
- Canadian Wood Council
- Carpet and Rug Institute
- Carpet Cushion Council
- Cast Iron Soil Pipe Institute
- Cast Stone Institute .
- Cedar Shake & Shingle Bureau
- CEDIA
- Ceilings & Interior Systems Construction Association (CISCA)
- Cellulose Insulation Manufacturers Association
- Cement Association of Canada
- Center for Energy Efficiency and Renewable Energy
- Center for the Built Environment
- Center for Health Design
- Ceramic Glazed Masonry Institute
- Ceramic Tile Distributors Association
- Ceramic Tile Institute of America Inc.
- Certified Floor Covering Installers Assoc.
- Chain Link Fence Manufacturers Institute
- Chimney Safety Institute of America
- Collaborative for High Performance Schools
- Color Guild International
- Color Marketing Group
- Commercial Food Equipment Service Association
- Commercial Windows Initiative
- Composite Panel Association
- Compressed Air and Gas Institute
- Compressed Gas Association
- Concrete Anchor Manufacturer's Association
- Concrete Corrosion Inhibitors Association
- Concrete Countertop Institute
- Concrete Foundations Association
- Concrete Masonry Association of California & Nevada
- Concrete Reinforcing Steel Institute
- Concrete Sawing and Drilling Association
- Construction Estimating Institute
- Construction Financial Management Association
- Construction Industry Institute
- Construction Innovation Forum
- Construction Institute
- Construction Management Association of America
- Construction Materials Recycling Association
- Construction Owners Association of America
- Construction Science Research Foundation
- Construction Specification Institute
- Construction Specifications Canada
- Construction Writers Association
- Consumer Electronics Association
- Continental Automated Buildings Assoc.
- Conveyor Equipment Manufacturers Association
- Cool Metal Roofing Coalition
- Cool Roof Rating Council
- Cooling Technology Institute
- Copper Development Association
- Council for Masonry Research
- Council of Educational Facility Planners International
- Council of Forest Industries
- Council of Landscape Reg. Boards
- CSA America
- Daylighting Collaborative
- Decorative Plumbing & Hardware Industry
- Deep Foundations Institute
- Design Build Institute of America
- Design Management Institute
- Dietary Managers Assn.
- Door and Access Systems Manufacturers Association
- Door and Hardware Institute
- Dry Stone Conservancy
- Floodplain Management Association
- Floor Covering Installation Contractors Association
- Floor Installation Association of North America
- Foodservice Consultant's Society International
- Forest Products Society
- Forest Stewardship Council
- The Forest Guild
- Forest World
- Forging Industry Association
- Forest Certification Resource Center
- Forintek Canada Corp.
- Foundation for Design Integrity
- Foundation for Interior Design Education Research
- Galvalume Sheet Metal Roofing
- Gas Appliance Manufacturers Association
- Gas Technology Institute
- Geosynthetic Institute
- Geosynthetic Materials Association
- Geothermal Energy Association
- Geothermal Heat Pump Consortium
- Geothermal Resources Council

- Glass Association of North America
- Glass Packaging Institute
- Golf Course Builders Association of America
- Green Roofs for Healthy Cities
- Green Seal
- Greenguard Environmental Institute
- Gypsum Association
- Hardwood Manufacturers Association
- Hardwood Plywood & Veneer Association
- Health Facility Institute
- Hearth, Patio and Barbecue Association
- Heat Exchange Institute
- Heating, Air-conditioning & Refrigeration Distributors International
- Heating Refrigeration & Air Conditioning Institute of Canada
- Hollow Metal Manufacturer's Association
- Home Fire Sprinkler Coaltion
- Home Furnishings International Association
- Home Ventilating Institute
- Human Factors and Ergonomics Society
- Hydraulic Institute
- Illuminating Engineering Society of North America
- Independent Electrical Contractors Assoc.
- Independent Office Products and Furniture Dealers Association
- Indiana Limestone Institute of America
- Industrial Fabric Association International
- Industrial Fasteners Institute
- Industrial Perforators Association
- Innovative Pavement Research Foundation
- Institution of Fire Engineers
- Insulated Cable Engineers Association
- Insulating Concrete Form Association
- Insulating Glass Certification Council
- Insulating Glass Manufacturers Alliance
- Insulation Contractors Association of America
- Integrated Building & Construction Solutions
- International Hurricane Protection Assoc.
- Institute of Clean Air Companies
- Institute of Electrical and Electronic Engineers
- Institute of Heating and Air Conditioning Industries Inc.
- Institute of Noise Control Engineering (INCE/USA)
- Institute of Store Planners
- Institute of Transportation Engineers
- Interior Design Educators Council
- Interlocking Concrete Pavement Institute
- International Association of Amusement Parks and Attractions
- International Association of Assembly Managers
- International Association of Electrical Inspectors
- International Association of Foundation Drilling
- International Association of Lighting Designers
- International Association of Lighting Management Cos.
- International Association of Plumbing and Mechanical Officials (IAPMO)
- International Association of Professional Security Consultants
- International Association of Structural Movers
- International Basketball Federation
- International Cast Polymer Association
- International Code Council
- International Communications Industries Association
- International Concrete Repair Institute
- International Dark Sky Association
- International Door Association
- International Electrical Testing Association (NETA)
- International Erosion Control Association
- International Facility Management Association
- International Firestop Council
- International Furnishings & Design Association
- International Groundsource Heat Pump Association
- International Institute for Lath & Plaster
- International Institute of Ammonia Refrigeration
- International Interior Design Association
- International Lead Zinc Research Organization
- International Masonry Institute
- International Parking Institute
- International Play Equipment Manufacturers Association
- International Safety Equipment Association
- International Sign Association
- International Slurry Surfacing Association
- International Society of Arboriculture
- International Society of Explosives Engineers
- International Solid Surface Fabricators Assoc.
- International Tropical Timber Organization
- International Wholesale Furniture Association
- International Window Cleaning Association
- International Window Film Association
- International Wood Products Association
- International Zinc Association
- Irrigation Association
- Joint Commission on Accreditation of Health Care Organizations
- Kitchen Cabinet Manufacturers Association
- Lean Construction
- Light Gauge Steel Engineers Association
- Light Right Consortium
- Lighting Controls Association
- Lighting Research Center
- Lightning Protection Institute
- Lightning Safety Alliance
- LonMark Interoperability Association
- National Construction Law Center

- National Corrugated Steel Pipe Association
- National Council of Acoustical Consultants
- National Council of Architectural Registration Boards
- National Council of Structural Engineers Associations
- National Council on Qualifications for the Lighting Professions
- National Council on Radiation Protection and Measurement
- National Electrical Contractors Association
- National Electrical Manufacturers Association
- National Elevator Industry
- National Environmental Balancing Bureau
- National Federation of State High School Associations
- National Fenestration Rating Council
- NFPA, International, Inc. [formerly National Fire Protection Association]
- National Fire Sprinkler Association
- National Fireplace Institute
- National Floor Safety Institute
- National Frame Builders Association
- National Glass Association
- National Ground Water Association
- National Guild of Professional Paperhangers
- National Hardwood Lumber Association
- National Home Furnishings Association
- National Institute of Building Sciences
- National Institute of Certified Floor-Covering Inspectors
- National Institute of Steel Detailing
- National Insulation Association
- National Joint Apprenticeship and Training Committee
- National Kitchen & Bath Association
- National Lighting Bureau
- National Lightning Safety Institute
- National Lime Association
- National Lumber Grades Authority
- National Multi Housing Council
- National One Coat Stucco Association
- National Onsite Wastewater Recycling Association
- National Ornamental and Misc. Metals Association
- National Paint and Coatings Association
- National Parking Association
- National Pavement Contractors Association
- National Pest Management Association
- National Precast Concrete Association
- National Ready Mix Concrete Association
- National Restaurant Association
- National Roof Deck Contractors Association
- National Roofing Contractors Association
- National Rural Water Association
- National Sash and Door Jobbers Association
- National School Plant Management Association
- National School Supply and Equipment Association
- National Slag Association
- National Preservation Institute
- National Slate Association
- National Society of Black Engineers
- National Society of Professional Engineers
- National Spa and Pool Institute
- National Standards Systems Network
- National Stone, Sand and Gravel Assoc.
- National Sunroom Association
- National Systems Contractors Association
- National Terrazzo & Mosaic Association
- National Tile Contractors Association
- National Training Center for Stone & Masonry Trades
- National Trust for Historical Preservation
- National Utility Contractors Association
- National Wood Flooring Association
- Natural Stone Council
- Network of Executive Women in Hospitality
- Nickel Development Institute
- NOFMA - Wood Flooring Manufacturers Assoc.
- Non-Ferrous Founders Association
- North American Association of Food Equipment Manufacturers
- North American Association of Mirror Manufacturers
- North American Building Material Distribution Association
- North American Insulation Manufacturers Association
- North American Society for Trenchless Technology
- North American Wholesale Lumber Association
- Northeastern Lumber Manufacturers Association
- Northwest Wall and Ceiling Bureau
- NSF International
- Office Furniture Dealers Alliance
- Operative Plasterers' and Cement Masons' International Association
- Paint and Coatings Resource Center
- Paint Quality Institute
- Painting and Decorating Contractors of America
- Partnership for Advancing Technology
- Perlite Institute Inc.
- Petroleum Equipment Institute
- Pile Driving Contractors Association
- Pipe Fabrication Institute
- Plastic Lumber Trade Association
- Plastic Pipe and Fittings Association
- Plastics Pipe Institute
- Plumbing and Drainage Institute
- Plumbing Heating Cooling Contractors Association
- Plumbing Manufacturers Institute
- Polyisocyanurate Insulation Manufacturers Association
- Porcelain Enamel Institute
- Portland Cement Association

- Post-Tensioning Institute
- Powder Actuated Tool Manufacturers' Institute
- Powder Coating Institute
- Power & Communication Contractors Association
- Precast/Prestressed Concrete Institute
- Preservation Trades Network
- Professional Awning Manufacturers Association
- Professional Construction Estimators Association
- Professional Grounds Management Society
- Professional Landcare Network
- Professional Women in Construction
- Project Management Institute
- Protective Glazing Council
- Radiant Panel Association
- Redwood Inspection Service
- Reflective Insulation Manufacturer's Association
- Reflective Roof Coatings Institute
- Refrigeration Service Engineers Society
- Research Council on Structural Connections
- Residential Fire Safety Institute
- Resilient Floor Covering Institute
- Roof Coatings Manufacturers Association
- Roof Consultants Institute
- Royal Architectural Institute of Canada
- Safety Glazing Certification Council
- Scaffold Industry Association
- Scaffolding, Shoring & Forming Institute
- Scientific Equipment and Furniture Association
- Screen Manufacturer's Association
- Sealant Waterproofing and Restoration Institute
- Security Hardware Distributors Association
- Security Industry Association
- Sheet Metal and Air Conditioning Contractors National Association
- Siding and Window Dealers Association of Canada
- Silica Fume Association
- Single Ply Roofing Institute
- Slag Cement Association
- Slate Discover Center
- Smart Wood
- Society for Environmental Graphic Design
- Society for Marketing Professional Services
- Society of American Registered Architects
- Society of Architectural Historians (SAH)
- Society of Building Science Educators
- Society of Design Administration
- Society of Fire Protection Engineers
- Society of Glass and Ceramic Decorators
- Society of Hispanic Professional Engineers
- Society of Municipal Arborists
- Society of Women Engineers
- Society of Wood Science and Technology
- Soil and Water Conservation Service
- Soil Science Society of America
- Solar Energy Industries Association
- Solar Energy Society of Canada
- Solar Rating and Certification Corporation
- Southeastern Lumber Manufacturers Association
- Southern Cypress Manufacturers Association
- Southern Forest Products Association
- Southern Pine Council
- Southern Pine Inspection Bureau
- Southwest Research Institute
- Spancrete Manufacturers' Association
- Specialty Steel Industry of North America
- Specialty Tools and Fasteners Distributors Association
- Specifications Consultants in Independent Practice
- Spiral Duct Manufacturers Association
- Sports Turf Managers Association
- Spray Polyurethane Foam Alliance
- SSPC - Society for Protective Coatings
- Stained Glass Association of America
- Stairway Manufacturers' Association
- Standards Engineering Society
- Steel Deck Institute
- Steel Door Institute
- Steel Erectors Association of America
- Steel Framing Alliance
- Steel Joist Institute
- Steel Manufacturers Association
- Steel Plate Fabricators Association
- Steel Recycling Institute
- Steel Stud Manufacturers Association
- Steel Tank Institute
- Steel Truss and Component Association
- Steel Tube Institute of North America
- Steel Window Institute
- The Stone Foundation
- Stucco Manufacturers Association
- Structural Board Association
- Structural Building Components Council
- Structural Component Distributors Association
- Structural Engineering Institute
- Structural Engineers Association
- Structural Engineers of California
- Structural Insulated Panel Association
- Submersible Waste Water Pump Association
- Sump and Sewage Pump Manufacturers Association
- Surety Information Office
- Sustainable Building Information Centre
- Sustainable Buildings Industry Council (SBIC)
- Sustainable Foresty Initative
- Telecommunications Industry Association
- Terrazzo Tile and Marble Association of Canada

- Testing, Adjusting and Balancing Bureau
- Textile Society of America
- Themed Entertainment Association
- Tile Contractors Association of America
- Tile Council of North America
- Tile Roofing Institute
- Tilt-Up Concrete Association
- Timber Frame Business Council
- Timber Framers Guild
- Tree Care Industry Association
- Tropical Forest Foundation
- Truss Plate Institute
- Tube & Pipe Association, Intl.
- Turfgrass Producers International
- Uni-Bell PVC Pipe Association
- United States Sign Council
- Urban Land Institute
- US Composting Council
- US Fuel Cell Council
- US Green Building Council
- Used Building Materials Association
- Valve Manufacturers Association
- Vent-Free Gas Products Alliance
- Vibration Isolation and Seismic Control Manufacturers Association
- Vinyl Institute
- Vinyl Siding Institute
- Wallcoverings Association
- Walnut Council International Office
- Water Environment Federation
- Water Quality Association
- West Coast Lumber Inspection Bureau
- Western Hardwood Association
- Western Red Cedar Lumber Association (WRCLA)
- Western States Clay Products Association
- Western States Roofing Contractors Association
- Western Wall and Ceiling Contractors Association
- Western Wood Preservers Institute
- Western Wood Products Association
- Window and Door Manufacturers Association
- Window Coverings Association of America
- The Wire Association International
- Wire Reinforcement Institute
- Wood Component Manufacturers Association
- Wood Moulding and Millwork Producers Association
- Wood Products Manufacturers Association
- Woodtruss Council of America
- Woodwork Institute
- World Energy Efficiency Association
- World Floor Covering Association
- World Green Building Council
- Woven Wire Products Association

ADDITIONAL READING

The following publications are suggested as sources of additional and ancillary information of value to the readers of this book

CONSTRUCTING ARCHITECTURE,
by Ralph W. Liebing;
John Wiley & Sons, Hackensack, NJ; 2007

ARCHITECT? A CANDID GUIDE TO THE PROFESSION,
by Roger K. Lewis,
MIT Press, Cambridge, MA; 2001

ARCHITECTURE: THE STORY OF A PRACTICE,
by Dana Cuff [1992]

ARCHITECTURAL PRACTICE: A CRITICAL VIEW,
by Robert Gutman [1997]

**BECOMING AN ARCHITECT:
A GUIDE TO CAREERS IN DESIGN,**
by Lee W. Waldrep [2009]

CAREERS IN ARCHITECTURE,
2nd edition, by Blythe Camenson [2009]

**MARKETING AND COMMUNICATION
FOR ARCHITECTS: A HANDBOOK**,
by Edgar Haupt and Manuel Kubitza [2002]

The following books, for the most part provide different perspectives and added insight into the process of detailing-- ***they are not directly competitive*** *and do not present the same type of information and illustration:*

Architectural Detailing: Function Constructibility Aesthetics,
2nd Edition, by Edward Allen and Patrick Rand [2007]

Handbook of Detailing: Graphic Anatomy of Construction,
by Ralph W. Liebing [2009]

The Professional Practice of Architectural Working Drawings,
by Richard M. Linde,
Osamu A. Wakita [November 1994]

A Manual of Construction Documentation: An Illustrated Guide to Preparing Construction Drawings,
by Glenn E. Wiggins [May 1989]

Working Drawings Handbook,
by Keith Styles

Architect's Handbook of Construction Detailing,
by David Kent Ballast

**Architectural Working Drawings:
Residential and Commercial Buildings**,
by William Perkins Spence

Uniform Drawing Format Manual: New CADD and Drafting Standards for Building Design and Working Drawings,
by Fred Stitt

**Handbook of Architectural Details
for Commercial Buildings**,
by Joseph De Chiara

Construction Details for Commercial Buildings,
by Glen Wiggins

Architectural Graphics Standards,
10th Edition, by Ramsey and Sleeper [also several volumes are specific to various areas of work – site, interior, etc.]

Building Construction Illustrated,
4th Edition, by Francis Ching

Guide to Contract Documents,
3rd Edition, by William Poage

Fundamentals of Building Construction Methods and Materials, by Edward Allen

**Time Saving Techniques for
Architectural Construction Drawings**,
by FredNashed

Architectural Quality Control: An Illustrated Guide,
by Fred Nashed

Construction Graphics,
by Keith A. Bisharat

Time Savers Standards, [several volumes in series –
per Site Planning, Building Types and Building materials]

Traditional Construction Patterns:
Design and Detail Rules-of-Thumb,
by Stephen Mouzon and Susan Henderson
[Paperback – Jan 26, 2004]

Architectural Elements:
Traditional Construction Details on CD-ROM [single-user],
by Stephen A. Mouzon
[Hardcover - Oct 20, 2000]

GLOSSARY OF CONSTRUCTION TERMS

This glossary has been compiled to be as comprehensive as possible for students in Architectural, Engineering, and Construction Technology programs. It is NOT, however, complete in that each construction phase, system, trade, and material has its own "jargon" and nomenclature; in many cases definitions, too. These number in the tens of thousands. Therefore, it is impossible to know and list them all; it is, however, well to become familiar with them as the need arises - always expanding the list. [Also, there is a need to caution that often things are called by familiar names which are not accurate – for example, it is plastic laminate, not Formica; it is concrete not cement; it is steel not iron, etc.]

The following is a short list of resources and references that may provide the definition of terms being sought by the student. Be advised that the latest editions should be verified with the publishers;

THE CONSTRUCTION DICTIONARY, 9th ed.
Greater Phoenix Chapter
National Association of Women in Construction
P.O. Box 6142, Phoenix, AZ 85005

DICTIONARY OF ARCHITECTURE AND CONSTRUCTION, 2d. ed.
by Cyril M. Harris
ISBN 0-07-026756-1
Published by McGraw-Hill Book Company

BUILDING NEWS CONSTRUCTION DICTIONARY ILLUSTRATED, 2000 Ed.
ISBN 1557013268
Published by ENR/BNI Books
1221 Avenue of the Americas

CONSTRUCTION GLOSSARY, 2d. ed.
by J.S. Stein
ISBN 0-471-56933-X
Published by John Wiley and Sons, Inc.

MEANS ILLUSTRATED CONSTRUCTION DICTIONARY
ISBN 0-87629-218-X
Published by R.S. Means Co., Inc.
100 Construction Plaza
P.O. Box 800, Kingston, MA 02364

A VISUAL DICTIONARY OF ARCHITECTURE
By Francis D.K. Ching
ISBN D-28451-3
Published by John Wiley and Sons, Inc.

A

A/C - An abbreviation for air conditioner or air conditioning.

A/C Circuit - [Alternating Current] The flow of current through a conductor first in one direction then in reverse. It is used exclusively in residential and commercial wiring because it provides greater flexibility in voltage selection and simplicity of equipment design.

A/C Condenser - The outside fan unit of the Air Conditioning system. It removes the heat from

A/C Disconnect - The main electrical ON-OFF switch near the A/C Condenser.

A/E - Architect/Engineer - the design professional hired by the owner to provide design and design-related services; a firm with personnel and expertise in both professions.

Above Grade - The portion of a building that is above ground level [see Grade].

Abrasives - Substances rubbed on wood to smooth the surface/ Flint; garnet, aluminum oxide, and silicon carbide are common abrasives; also, used in stair nosings, for non-slip surfaces; can be "seeded" into flat concrete surfaces and stair treads also for non-slip purposes.

ABS Pipe - ABS is abbreviation for Acrylonitrile Butadiene Styrene; type of plastic pipe frequently used in plumbing and drainage work. Black in color and usually in the form of Schedule 40 pipe.

Abut - To be immediately adjacent to, and touching on a side or end.

Accelerator - Any material added to stucco, plaster or mortar, which speeds up the natural set.

Access Floor - Raised floor system consisting of relatively small (24" square] individually removable panels, mounted on isolated pedestal supports, beneath which wiring, ductwork, cabling and other services may be installed; also called "computer floor" or "pedestal floor"

Access panel - Cover or door, of various sizes for openings provided to reach plumbing or other system, in/behind walls, floors, or ceilings; usually primed steel or stainless steel.

Accessories - Trim pieces, reinforcement, anchors and other similar devices that aid and enhance various material installations; vary in type but available for drywall, plaster, masonry, concrete, etc.

ACM – Aluminum composite material; usually sheet material for facings, etc. with aluminum face sheets laminated to various backing materials.

Acoustic Materials - Composition board installed on ceilings or walls for the purpose of reducing sound reflection [or echo]; board is generally the same as that used for ordinary insulating purposes, or can be specially manufactured material for added acoustic capabilities; acoustical tile for ceilings is often perforated or fissured to increase the area of sound-absorbing surface; may be boards, batts, blocks, foam, spray-on, panel, sheets, pads or tile materials.

Acoustic[al] - Pertains to sound. In some buildings, it is necessary to include sound control, i.e., acoustical treatment; generally smooth flat surfaces reflect sound; a soft, porous surface will absorb it. The finished surfaces of ceilings and walls are designed according to the need for acoustical treatment; floors may also be treated as well as doors, windows and mechanical systems.

Acre - A unit of land measurement equal to 43,500 square feet.

Activity - (1) A scheduling term (2) The smallest work unit within a project; the basic building block of a project. [see Project]

Actual dimension - Size of boards or lumber, distinguished from "nominal dimensions"; term "2x4" is nominal, while 1-1/2" x 3-1/2" is the actual size, which is that existing after machining, sanding and preparing the lumber.

ADA - The Americans with Disabilities Act which gives civil rights protection to individuals with disabilities similar to those provided to individuals on the basis of race, color, sex, national origin, age, and religion. It guarantees equal opportunity for individuals with disabilities in public accommodations, employment, transportation, State and local government services, and telecommunications; in construction, basically provides for full accessibility [barrier removal] for handicapped persons throughout various facilities in buildings and businesses; also contains minimum spacing, clearance requirements, and other physical protection.

Adapter - Fitting which makes transition between pipes and ducts which are not of the same size, or otherwise made to fit together.

Addendum [Addenda] - An addendum is generally issued by the owner to the contractor during the bidding process and as such, addenda are intended to become part of the contract documents when the construction contract is executed; written information [with drawings if necessary] adding to, clarifying or modifying bidding documents.

Adhesion - The property of a coating or sealant to bond to the surface to which it is applied.

Adhesive - A natural or synthetic material, generally in paste or liquid form, used to fasten or surface-attach material together; glues, cements, pastes, and mucilage are examples to install floor tile, fabricate plastic laminate-covered work, build up laminated structural members, or otherwise attach work items together.

Adhesive Failure - Loss of bond; or a coating or sealant from the surface to which it is applied.

Admixture - A substance other than Portland cement, water and aggregates included in a concrete mixture, for the purpose of altering one or more properties of the concrete; aids setting, finishing, or wearing of the concrete.

Aerator- The round, screened screw-on tip/nozzle of a sink spout. It mixes water and air for a smooth flow.

Aggregate - Hard, inert material, such as sand, water-worn gravel, slag and crushed stone, used as filler material combined with Portland cement and water to produce concrete; must be properly cleaned and well graded as required; also used alone as porous fill, substrate, or surfacing material; in a wide range of sizes that is used to surface built-up roofs.

AIA - The American Institute of Architects; a professional organization of registered architects; provides various membership services, documents, lobbying efforts, government interface, information education, and other professional services; national organization with regional/local chapters

Air-Dried Lumber - Lumber that has been piled and stored in outdoor yards or sheds for any length of time [in lieu of drying in a kiln]. For the United States as a whole, the minimum moisture content of thoroughly air-dried lumber is 12 to 15 percent and the average is somewhat higher. In the South, air-dried lumber may be no lower than 19 percent.

Air Duct - Formed conduit which carries conditioned air to rooms from an airhandling unit or furnace, and back again; varies in size and shape [rectangular, round]; usually sheet metal or fiberglass.

Air-entrained Concrete - Concrete suffused with tiny air bubbles, making it more workable and better able to withstand frost.

Air Filters - Adhesive filters made of metal or various fibers that are coated with adhesive liquid to which the particles of lint and dust adhere. These filters will remove as much as 90 % of the dirt if they do not become clogged. The more common filters are of the throwaway or disposable type.

Air Infiltration - The amount of air leaking in and out of a building through cracks in walls, windows and doors.

Air Lock - Enclosure between sets of entrance doors to create a transition space; a vestibule, overheated to prevent flow of cold air into building; can be ceilingless, but duplicates entrance doors layout.

Air Space - A space or void in a wall or other enclosed part of a building between structural members.

Airway - A space between roof insulation and roof sheathing for movement of air.

Alligatoring - A condition of paint or aged asphalt which produces a pattern of cracks resembling an alligator hide, brought about by the loss of volatile oils and the oxidation caused by solar radiation. Coarse checking pattern characterized by a slipping of the new paint coating over the old coating to the extent that the old coating can be seen through the fissures; is ultimately the result of the limited tolerance of paint or asphalt to thermal expansion or contraction; also a malady which occurs when roofing is deteriorating.

Alterations - (1) A term used to describe remodeling or renovations involving partial construction work performed within an existing structure (2) Remodeling without a building addition.

Anchor - Any of a number of devices/fasteners [usually metal] used to mechanically attach one item or material to another of the same or different qualities or composition. Anchor Bolts - Bolts, placed/imbedded in concrete with threaded portion exposed, which fasten column base plates, sills, girders or other members to concrete or masonry such as bolts used to anchor sills to masonry foundation; bolts to secure a wooden sill plate to concrete, or masonry floor or wall in wood frame construction.

Angle [steel] - A section of rolled structural steel bent to form a 90 degree angle; may have equal or unequal legs; identified by the symbol "L"; used in miscellaneous ways or as part of structural frames-- lintels to span openings and support masonry at the openings. In brick veneer, they are used to secure the veneer to the foundation. Also known as "shelf angle".

Approved - Term used to indicate acceptance of condition, material, system, or other work or procedure; reflects action by design professional or other authorized party, but does not relieve basic responsibility of party seeking such approval, as written in other binding documents and provisions

Apron - 1) The flat, vertical part of the inside trim of a window. It is placed against the wall directly beneath the window sill [stool]. 2) Also, concrete slab at the approach to a driveway or garage.

Arch - A curved structure that will support itself and the weight of wall above the opening, by mutual pressure.

Architect - Person trained in design and construction and registered by the state, who prepares architectural designs to meet the owner's requirements, and associated construction documents and observes construction of various types of building projects for a variety of types of structures.

Architect-Engineer [A/E] - An individual or firm offering professional services as both architect and engineer.

Architect's Scale - Three-sided "ruler" with two different scales on each side – one reads in one direction and is twice the other [e.g., 1/4-inch and 1/8-inch]; also can be beveled, two-sided versions.

Architectural Design – Process of assembling and developing stated project requirements, regulatory concerns and conceptual design principles into a coordinated program and associated sketches and drwaings which depict the proposed project.

Architectural Drawing - Part of a set [series] of drawings created and compiled to depict the desired design configuration and details for the general construction of a project; does not address structural or building service systems; also, singly, a line drawing showing plan and/or elevation views of the proposed building for the purpose of showing the overall appearance of the building.

Areaway [wells] – 1) Concrete or metal barriers walls installed around a subgrade window to hold back the earth and allow light into a basement; also called "areaway". 2) An open subsurface space adjacent to a building used to admit light or air or as a means of access to a basement.

Ashlar - Squared and dressed stones used as a masonry wall facing; also, short upright wood pieces extending from the attic floor to the rafters forming a dwarf wall.

Asphalt - A mineral pitch insoluble in water and used extensively in building materials for waterproofing, roof coverings, shingles, floor tile, paints, and paving; A dark brown to black, highly viscous, hydrocarbon produced from the residue left after the distillation of petroleum. Asphalt is used on roofs and highways as a waterproofing agent. Most native asphalt is a residue from evaporated petroleum. It is insoluble in water but soluble in gave. line when heated. Used widely in building for waterproofing roof coverings of many types, exterior wall coverings, flooring tile, and the like.

Asphalt Expansion Joint Material - A composition strip of felt and asphalt material made to specified thickness and used to take up the expansion in concrete floor and sidewalks; in large part has given way to foam plastic material. [also see, Expansion joint material]

Asphalt Roofing - On a flat surface the roofing is composed of alternate layers of roofing felt and hot-applied asphalt [called built-up roof]. [Asphalt is the most widely used material for covering roofs because it possesses the characteristics needed for protection against weather and is easily applied, at a relatively inexpensive cost]

Asphalt Shingles - Composition roof shingles made from asphalt impregnated felt covered with mineral granules, reinforced with strands of fiberglass; available in several weights.

Assemblies - Portions of a building in combination; for example, a roof/ceiling assembly, or a ceiling/floor assembly, where different materials are combined, installed, and interfaced to form protectives, and other aspects of construction for an entire building.

ASTM - Abbreviation for the organization, ASTM, International [formerly the American Society for Testing and Materials], an organization dedicated to developing and establishing the testing and standardization of building materials.

Astragal - A molding, attached to one of a pair of swinging doors, against which the other door strikes. French doors use this as the stop; trim piece that covers a joint between doors.

Attic - The accessible space located between the top of the ceiling and the underside of the sloped roof; usually accessed through a ceiling opening in the hallway or garage of a home.

Attic Ventilators - Fans or turbines in the roof or in gables for the purpose of moving air to circulate it through the attic; in houses, screened opening] provided to ventilate an attic space. They are located in the soffit area as inlet ventilators and in the gable end or along the ridge as outlet ventilators. They can also consist of powerdriven fans used as an exhaust system. [See also Louver.]

Auger - In carpentry, a wood-boring tool used by a carpenter to bore holes; also large diameter screw-type tool to bore holes in earth for caissons

Awning - Shading device mounted above a window; usually canvas or metal, with some plastic

Awning window - A window unit that is hinged near the top so the bottom opens outward; can be single or multiple sections.

B

Back Nailing - The practice of nailing roofing felts to the deck under the overlap, in addition to hot mopping, to prevent slippage of felts.

Backer Rod - A flexible, compressible polyethylene or polyurethane foam rope or strip of plastic foam or similar material tightly wedged into a joint to limit the depth to which sealant can be applied; in glazing, a material installed under compression and used to control sealant joint depth, provide a surface for sealant tooling, serve as a bond breaker to prevent three-sided adhesion, and provide an hour-glass contour of the finished bead.

Backfill - Coarse earth or granular material used to fill in and build up the ground level around the foundation wall to provide a slope for drainage away from the foundation wall; (1) filling in any previously excavated area, i.e., The replacement of excavated earth into a trench around and against a basement foundation …

Backing - Added framing installed to allow secure installation of surface applied items, such as handrail brackets, towel bars, cabinets, countertops, shelving, lavatories, etc.

Backsplash - The raised or vertical lip/trim piece along the back and side edges of a countertop to close the joint at the wall; at a vanitory, to prevent water from running down the backs of the cabinets.

Backup - A material, usually not in view, which acts as a support, filler, or rigidity reinforcement for another material [example- concrete masonry units act as "back-up" to face brick].

Baffle - 1) Acoustical pads or panel to absorb sound, hung or attached to walls; 2) vanes in air ducts to divert flow of air; 3) any other device/material to preclude transfer of heat, sound, etc.

Balcony - A deck projecting from the wall of a building above ground or at floor level.

Ballast - 1) A heavy material [usually gravel or stone] installed over a roof membrane to prevent wind uplift and to shield the membrane from sunlight, and aids water evaporation. 2) Also, an electrical component in some fixtures to limit flow of electricity.

Balloon Framing - In carpentry, the lightest and most economical form of wood frame construction; system of light-wood or house framing characterized by the studding extending in continuous lengths from the foundation sill to the roof plate; not widely used because it requires applied fire blocking and a let-in ribbon for the second floor framing; utilizes long pieces of lumber, not readily available; also called Eastern Framing.

Balusters - Usually small vertical posts/members supporting a handrail in a railing used between a top rail and the stair treads or a bottom rail; more commonly known as banister spindles

Balustrade - A series of small vertical members [balusters], used between a top rail, and sometimes bottom rail, used on the edge of stair treads, balconies, and porches.

Bar - Small rolled or drawn steel shape, round, square or rectangular in cross section; a deformed steel shape used for reinforcing concrete.

Bar Joists - Structural steel framing units made from bar- and rod-shaped steel and other light weight members, for supporting moderate roof and floor loads; also known as "open-web steel joists", or "steel lumber".

Barge Board - A decorative board covering the projecting rafter [fly rafter] of the gable end. At the cornice, this member is a facie board.

Barrel Vault [Roof] - A roof design, which in cross section is an arched segment of a cylinder, lying horizontally, and that spans like an arch.

Barrier-Free Design - Providing layout and design that provides accessible route for all persons to all functions within a building, as noted; meet requirements of the Americans with Disabilities Act [ADA] regulations and local codes. etc.

Base - 1) The bottom part of any unit on which the entire thing rests; 2) can be a separate concrete pad under equipment; 3) A board placed against the wall around a room next to the floor to finish properly between floor and wall; 4) slang for "baseboard".

Baseboard - Interior wall trim at the floor line to cover the joint between wall and floor materials; strip of wood placed along the base of a wall or column to protect the finish from damage by shoe.

Base Cabinet[s] - The lower, floor mounted cabinets that support the work – or countertop, in offices, laboratories, kitchens or other work areas.

Base Flashing - The upturned edge of the watertight membrane formed at a roof termination point by the extension of the felts vertically over the cant strip and up the wall for a varying distance where they are secured with mechanical fasteners.

Base Molding - Molding used to trim the upper edge of interior baseboard.

Base Plate - A steel plate forming the bottom or base of a steel column; usually larger than the column to disperse the imposed load, to allow proper anchorage to the bearing surface.

Base Ply - An asphalt-saturated and/or coated felt installed as the first ply with 4 inch laps in a built-up roof system under the following felts which can be installed in a shingle-like fashion.

Base Shoe - Molding used next to the floor on interior base board. Sometimes called a carpet strip.

Bat - A half-brick [see Cull]

Batt - Strip of faced, or unfaced fiberglass insulation sized to fit snugly between framing members.

Batten - Narrow strips of wood or other material used to cover joints in sheets of wall materials or as decorative vertical members over plywood or wide boards.

Batten Plate - A formed piece of metal designed to cover the joint between two lengths of metal edge.

Batter Board - A pair of horizontal boards, set at 90 degrees to each other, nailed to posts set outside the corners of a building excavation, used to indicate the desired level, and serve as a fastening place for stretched cords used to mark building corners, and foundation lines during construction; to show the outlines of other building features and walls. Also, can indicate the proper level or grade elevation.

Batt Insulation - Strips of flexible blanket-like, or roll of insulating material [usually faced or unfaced fiberglass] used for thermal or sound insulation by being installed between framing members in walls, floors and/or ceilings.

Bay Window - Any fixed window space projecting outward from the walls of a building, either square or polygonal in plan.

Bead - In glazing, an applied sealant in a joint irrespective of the method of application, such as caulking bead, glazing bead, etc. Also a molding or stop used to hold glass or panels in position.

Beam - Structural support member [steel, concrete, lumber] transversely supporting a load that transfers weight from one location to another--- A structural member that is normally subject to bending loads, and is usually a horizontal member carrying vertical loads [an exception to this is a purlin]; three types are-

1. Continuous beam – has more than two points of support.
2. Cantilevered beam – supported at only one end, and restrained against rotation and deflection by design and connection.
3. Simple beam – freely supported at both ends.

Beam pocket - A slot or recess left in a wall in which the end of a beam or joist is placed for bearing [support].

Bearing Partition - A partition that supports any vertical load in addition to its own weight.

Bearing Plate - Steel plate set on grout bed [non-shrinking] under the end of a beam or other structural member; distributes the load carried on the member over a greater area of the wall; may also be a "pad" made of a block of plastic or synthetic rubber which cushions point at which members meet.

Bearing Wall - A wall that supports any vertical load in addition to its own weight; wall or partition that supports all or part of the floors, roofs, or ceilings, in a building; partition that carries the floor joists and other partitions above it.

Bed joint - A horizontal mortar joint in brick or other masonry walls.

Bed Molding - A molding in an angle, as between the over hanging cornice, or eaves, of a building and

Bed or Bedding - In glazing, the bead compound or sealant applied between a light of glass or panel and the stationary stop or sight bar of the sash or frame. It is usually the first bead of compound or sealant to be applied when setting glass or panels.

Bed Rock - Unweathered [never exposed to air and light], and undisturbed solid stratum of rock; excellent bearing surface for foundation systems.

Below Grade - Element of item that occurs beneath the top of the earth [grade]; may be a portion of a building that is below ground level.

Bench Mark [B.M.] - A fixed point used as the basis for computing elevation grades; identified by marks or symbols on stone, metal or other durable surveying items/matter, permanently affixed in the ground and from which differences of elevation are measured; also referred to as a "datum", or "datum point".

Bent Glass - Flat glass that has been shaped while hot into curved shapes.

Berm [earth] - A low, artificially made mound of earth which adds height and depth to a flat landscape; often used in rock gardens, landscaped with rocks and plants. Also used against buildings to help insulate the walls [usually installed up to sill of windows].

Bevel [cut] - The angle of the front edge of a door usually from 1/8" to 2".

Bevel Siding [or Lap Siding] - A type of finish siding used on the exterior of a house. It is usually manufactured by re-sawing a dry, squared, surfaced board, diagonally, to produce two wedge-shaped pieces; used as horizontal siding in a lapped pattern. This siding varies in butt thickness from ½ to ¾ inch and in widths up to 12 inches. Normally used over some type of sheathing.

Bi-fold doors - Doors panel hinged in the middle and fixed at the jamb; panels fold and slide to the jamb; ideal for achieving maximum opening.

Bi-pass doors - Track- mounted doors which slide by each other.

Bitumen - Any of various mixtures of hydrocarbons occurring naturally or obtained through the distillation of coal or petroleum. [See Coat Tar Pitch and Asphalt]

Bituminous Concrete - An asphaltic compound with small aggregate mixed in thick liquid asphalt, which hardens into a paving surface after being heated, spread and rolled; also, called "blacktop".

Blanket - Term referring to long rolls of fiberglass insulation, which are subsequent cut into batts.

Bleaching - A method of lightening the color of wood by applying chemicals.

Bleeding - A migration of a liquid to the surface of a component or into/onto an adjacent material; seeping of a stain or lower coat through the top coat, spoiling the appearance of the top coat.

Blend - Mixture of two or more elements to produce a different product: as of two pigments, to obtain a desired color in paint.

Blind Nailing - Nailing driven in such a way that the nail heads are not visible on the face of the work – usually at the tongue of matched boards for flooring, so the groove of the adjoining board conceals the nail head.

Blind Stop - A rectangular molding, usually 3/4 by 1-3/8 inches or more in width, used in the assembly of a window frame. Serves as a stop for storm and screen or combination windows and to resist air infiltration.

Blister - An enclosed raised spot evident on the surface of a building; Cloudy or milky-looking raised spots on finished surfaces. They are mainly caused by the expansion of trapped air, water vapor, moisture or other gases.

Blocking - Various wood members sized and cut to shape and used as fillers, backing, or nailing strips; Also, method of bonding two adjoining or intersecting walls not built at the same time.

Board Foot [Measure] - In carpentry, a system for specifying a quantity of lumber; one unit is one board foot, the equivalent of a board 12″ x 12″ and 1 inch thick.

Boards - Yard lumber less than 2 inches thick and 2 or more inches wide.

Bollard - Short stanchion used to inhibit vehicle access, to direct pedestrian traffic, and/or as decorative [and illuminated] markers [not part of a sign system]; also used as bumpers to protect building, fire hydrants, and similar features; also called "pipe guards".

Bolster - A short horizontal timber or steel beam on top of a column to support and decrease the span of beams or girders. Bond - 1) The fusing together of materials through chemical action.

Bond Beam - Continuous, reinforced concrete block course in or around the top of masonry walls used to stabilize the walls.

Bond Breaker - A chemical coating, tape, or inert sheet divider to prevent adhesion of one material to another; primarily used in sealant joints to prevent sealant from adhering to backer rood.

Bond Plaster - In addition to gypsum, bond plaster contains 2-5 % lime by weight and chemical additives which improve the bond with dense non-porous surfaces such as concrete. It is used as a base coat.

Bottom chord - The lowest or bottom horizontal or angled member in a truss.

Bottom or sole plate - Bottom framing member of a wall, usually either 2x4 or 2x6; plate is nailed to the bottom of the studs and to the floor joist or sheathing below it.

Bow - Distortion [curve, bend, warping] or other deviation from flatness in glass or wood so it is no longer flat.

Box sill - Wood frame sill construction where a header joist is nailed, vertically, across the ends of floor joists closing off the voids between joists; ensures proper joist spacing and stability; vertical board also called a "band board".

Brace - An inclined piece of framing lumber applied to wall or floor to stifled the structure. Often used on walls as temporary bracing until framing has been completed.

Braced Framing - Supported framework of a house, especially at the corners; diagonal or let-in braces [wood or metal] form a triangular shape to make the frame rigid and solid; plywood sheets at corners provide the same function.

Bracing - Auxiliary members in framing that are used to make the major structural members more rigid; ties and rods used for supporting and strengthening various parts of a building used for lateral stability for columns and beams.

Bracket - A brace extending from a wall to support a weight, such as a shelf.

Brad - A small, fine finishing nail with a small head.

Brick - Masonry unit[s] composed of clay or shale with added ingredients and shaped into various size units; formed into a rectangular prism while soft, then burned or fired in a kiln; can have voids or recessed panel to reduce weight and increase bond to mortar; many types of brick, face brick being most familiar [can be exposed; many colors, textures and sizes]; also backup material; also a fire brick used for fire boxes in fireplaces; many colors available and a range of size for differing visual effects. Available in several grades, as follows:

Grade MW - Moderate Weather grade of brick for moderate resistance to freezing used, for example, in planters.

Grade NW - No Weather brick intended for use as a back-up or interior masonry.

Grade SW - Severe Weather grade of brick intended for use where high resistance to freezing is desired-Commonly called "Face Brick".

Brick ledge - Foundation feature, usually a continuous notch in the top outer corner, where the brick wythe is set, so the brick runs passed the face of the foundation wall.

Brick Mold - Standard wood molding used as outside casing around doors and windows; covers joint between window unit and adjacent wall.

Brick [wall] tie - Corrugated metal strip [approx. 1″w x 6-8″ long] nailed to wall framing, bent and inserted into the mortar joints of brick veneer.

Brick Veneer - Single wythe [thickness] of brick facing applied over wood frame construction, or masonry other than brick; this facing is non-structural, and must be fastened to the framing or structural backup material for stability.

Bridging - 1) Method of bracing floor joists to distribute the weight over more than one joist; joins joists to act as a diaphragm unit and not individually; prevent displacement and wracking; usually two wood (1″ thick] or light metal pieces crisscrossed between joists are inserted in a diagonal position between the floor joists at midspan to act both as tension and compression members for the purpose of bracing the joists a spreading the action of loads.; also can be wood stock same size as joists and is called "solid bridging"; must be installed continuously from end wall to end wall.

Broom finish - A slightly roughened, slip-resistant texture created by running a stiff broom across fresh concrete; commonly used on sidewalks.

Browncoat - The coat of plaster directly beneath the finish coat. In three-coat work, the brown is the second coat.

BTU - British Thermal Unit - The amount of heat energy required to raise the temperature of one pound of water through a change of one degree Fahrenheit [F].

Buck - Often used in reference to the assembly of rough frame opening members. Door bucks used in reference to metal door frame.

Buildability – Extent to which a design facilitates the construction of a building in accord with overall requirements for the project; collection of techniques and methods to ease construction.

Builder-grade - A trade term meaning a product of average quality normally found in production-built housing.

Building - (1) To form by combining materials or parts (2) A structure enclosed within a roof and within exterior walls housing, shelter, enclosure, business, and support of individuals, animals, their activities, or real property of any kind.

Building Brick - Brick for building purposes not especially treated for texture or color, formerly called "common brick." It is stronger than face brick.

Building Codes - Laws, ordinance, regulations and other legal requirements adopted by local governing jurisdictions to establish minimum acceptable safety standards for all types of construction; set safe building practices and procedures. The codes generally encompass structural, electrical, plumbing, and mechanical remodeling and new construction. Usually a building permit is required prior to the start of construction, and inspections are required during construction, to confirm compliance with the local codes.

Building Code Official - Department Head or chief of building regulations department; often a registered design Professional, and also certified as code official by state or code organizations. [see Building Inspector]

Building Envelope - (1) The waterproof elements of a building which enclose conditioned spaces through which thermal energy may be transferred to or from the exterior. (2) The outer structure of the building. [sometimes referred to as "Building Shell"]

Building Inspector - A qualified government representative authorized to inspect construction in progress for compliance with applicable building codes, regulations and ordinances; works for the Building Code Official [see]; often certified by state or code organizations.

Building Line - Lines established and marked off by a surveyor which denote the exterior faces of a proposed building; used by trades-persons as guidelines; surveyors get their information from the plans, specifications and official records; building line is generally extended and marked on batter boards placed about 6 feet outside the corners/lines of the building excavation.

Building Paper - Heavy sheet material [e.g., papers, felts, etc.] used between sheathing and siding/facing for insulation and wind-breaking purposes; four types – 1) red rosin paper; 2) sisal paper; 3) plain asphalt felt paper [tar paper], and 4) plastic sheeting.

Building Permit - A written document issued by the appropriate governmental agency, to owner or contractor, prior to the start of construction on a specific project in accordance with drawings and specifications approved by the governmental authority; indicates proper review for compliance with various regulations; must be kept posted in a conspicuous place on the site until the job is completed and passed by the building inspector.

Built-Up Roof - A roof covering composed of 3 to 5 alternate layers [plies] of building [roofing] felt and laminated with hot liquid asphalt, coal tar or pitch, with a final surfacing of gravel or crushed slag; generally laid on a low slope or comparatively level roof.

Bull float - A large, rectangular, long handled float used for smoothing a large slab of concrete; can reach across or into the center of the slab. A tool used to finish and flatten a slab. After screeding, the first stage in the final finish of concrete, smoothes and levels hills and voids left after screeding. Sometimes substituted for darbying. A large flat or tool usually of wood, aluminum or magnesium with a handle.

Bullnose - A radius or rounded corner on ceramic tile, CMUs, and drywall [using a metal trim piece]

Butt - Common type of door hinge that allows the edge of a door to butt into the jamb of the frame.

Butt Glazing - The installation of glass products where the vertical glass edges have butted vertical joints and no mullions or structural supporting mullions; joints are sealed with silicone sealant; used on interior or exterior for clean, sleek range of glass without struts.

Butt Joint - Joint The junction of two members in a square-cut joint, end-to-end, or side-to-side [edge-to-edge].

Butterfly Roof - A roof assembly, which pitches sharply from either side toward the center.

Buttering - In glazing, application of sealant or compound to the flat surface of some member before placing the member in position, such as the buttering of a removable stop before fastening the stop in place.

Butyl - Type of non-curing and non-skinning sealant made from butylene. Usually used for internal applications.

C

Cabinet - Shop or job-built unit for kitchens or office uses; often combination of drawers and shelves; can be wall-hung, or floor mounted.

Caisson - A deep shaft drilled into ground down to adequate bearing soil, then filled with concrete; used to support a column or to provide other structural foundation.

Callout - A note on a drawing with a leader line to the feature, location, material or work item involved.

Camber - A slight upward arch placed in a beam or girder to counteract deflection caused by loading.

Canopy - An overhanging roof.

Cant Strip - A board or strip installed on an angle at the intersection of the roof deck and a wall, curb, or other penetrating item to prevent bends and/or cracking of the roofing membrane at the intersection of the roof deck and wall used to avoid sharp right angles when the roof covering is installed; used with a base flashing to minimize breaking of the roofing felts.

Cantilever - A projecting beam or other structure supported at one end, only.

Cap - Upper/top trim or closure member of a column, pilaster, door cornice, molding or the like. The upper member of a column, pilaster, door cornice, molding, and the like.

Cap flashing - Portion of flashing attached to vertical surface to forestall water from migrating behind the base flashing.

Cap Sheets - In roofing, one to four plies of felt bonded and top coated with bitumen that is laid over an existing roof as a treatment for defective roofs.

Carriage - Center diagonal supporting member under and for stair treads; usually a 2″ plank or steel member[s]; formed or notched to receive treads and risers; runs parallel to the stringers

Casement Window - A side-hinged window that opens outward by a crank device or push-bar; units of wood or metal sash, which may be opened by means of hinges affixed to the vertical edges.

Casework - Manufactured, or custom-built cabinetry, including shelves, cabinets [base and/or wall], countertops, and ancillary equipment; can be metal, wood, laminate covered, etc.

Casing - Trim/molding of various widths and thicknesses used to trim door and window openings at the jambs; also trim to finish a wall opening.

Cast-In-Place [Concrete] - Current and proper term for the placing of concrete into its forms on the job site; also called "site-cast"; replaces the word "pour" which has negative connotations relating to a watery mix inappropriate for construction use.

Catch basin - Commonly, the drain in the curb or gutter of a street; in a stream or watercourse, a depression designed to hold water

Caulk - [v] The application of sealant to a joint, crack or crevice. [n] A compound used for sealing that has minimum joint movement capability; sometimes called low performance sealant.

Caulking - A waterproof adhesive filler material used to seal seams, cracks, and various types of joints between materials, or building parts; must remain flexible, non-drying and non-sagging; also see Sealants.

Cavity Wall - A masonry wall made of two or more wythes of masonry units joined with ties, but having an air space between them.

Cellulose Insulation - Ground up newspaper that is treated with a fire retardant.

Cement, Portland [Types] - Portland cement is a finely ground, gray, powdery material which when mixed with water will harden; used with aggregate of various sizes in concrete and mortar; formed by crushing burned limestone clinkers [unburned material]; is available in a variety of types;

Type I Normal - is a general purpose cement suitable for practically all uses.

Type II Moderate - is used where precaution against moderate sulfate attack is important.

Type III High Early Strength - is used when high strengths are desired at very early periods

Type IV Low Heat - is a special cement for use where the amount and rate of heat generated during curing must be kept to a minimum; is intended in large masses of concrete such as dams.

Type V Sulfate Resisting - is a special cement intended for use only in construction exposed to severe sulfate action, such as western states having soils of high alkali content.

Cementitious - Attribute of inorganic substances that have cementing properties.

Centerline - Actual or imaginary line through the exact center of an object.

Center-to-Center - Measuring distance from centerline to centerline of similar, adjacent units; term meaning "on center", as in the spacing of joists, studding, or other structural parts.

Ceramic tile - Thin hand- or machine-made clay tile to act as facing or flooring where water or spillage is a problem; bathrooms, shower rooms, entries

Chain - Metal tape used by surveyors for measuring; unit of measure equal to 66 feet.

Chair Rail - Horizontal strip of wall molding installed at proper height and protruding enough to prevent top of chair backs from touching, scraping or marring the wall [see wainscoting]; In storefront, window wall, or curtain wall systems, a chair rail is an aluminum extrusion applied horizontally to the inside of the system 3 feet from the floor to create a barrier in floor-to-ceiling glazing applications.

Chairs - Metal, heavy wire, or plastic supports to hold reinforcing steel in place during placing of concrete in forms; allows concrete to surround bars, and provide proper [required] clear cover of concrete between bars and face of concrete member; available in single or multiple bar sizes, and in varying heights.

Chamfer - A beveled surface cut on the corner of a material; prevent chipped corners.

Channel Glazing - The installation of glass products into U-shaped glazing channels. The channels may have fixed stops; however, at least one glazing stop on one edge must be removable.

Channel - Structural section, steel or aluminum, shaped like a rectangle, but with one long side missing; "C"-shaped.

Chase - In masonry a recess or channel cut or built in the face of a wall to allow space for receiving pipes, conduits, etc.; also a recess in any wall to provide space for pipes and ducts, etc.

Checking - Fissures that appear with age in many exterior paint coatings, at first superficial, but which in time may penetrate entirely through the coating. It produces a pattern of surface cracks running in irregular lines. When found in the top pour of an asphalt built-up roof, checking is the preliminary stage of alligatoring.

Checkrails - Meeting rails sufficiently thicker than a window to fill the opening between the top and bottom sash made by the parting stop in the frame of double-hung windows. They are usually beveled.

Chimney - A vertical shaft for drawing smoke from a heating unit, fireplace, or incinerator, and venting it to the outside.

Chip board - Wood panels manufactured with small wood chips and glue; also called, Oriented Strand Board [OSB] and wafer board

Chord - Usually refers to uppermost [top chord] or lowermost [bottom chord] in a truss; also, a line drawn through a circle other than a diameter or radius.

Circuit Breaker - Simple switch-like device which automatically opens a circuit when the rated current is exceeded as in the case of a short circuit.

Cladding - Any of several materials or systems used as exterior wall enclosures for buildings; siding, metal

Claim - A formal notice sent by a contractor to an owner asserting the fact that the terms of the contract have been breached and compensation is being sought by the contractor from the owner.

Clapboard - Type of siding which consists of narrow boards, usually thicker at one edge than the other.

Clear Dimension/Opening - Designation used to indicate the direct, unobstructed distance between opposing inside faces of an opening, frame, room, columns, etc.

Cleat - A wedge-shaped piece [usually of metal] which serves as a support or check. A strip fastened across something to give strength or hold something in position.

Clerestory - Portion of a building or room that extends above the adjoining roof, usually with glazing for light and ventilation.

Close-grained wood - Woods with narrow, inconspicuous annual rings; term sometimes used for wood having small, closely spaced pores.

Closer - Finish door hardware device which automatically pushes the door closed.

CMU - Abbreviation for concrete masonry unit [see]

Coal Tar Pitch - A bituminous material, which is a by-product from the coking of coal. It is used as the waterproofing material for tar and gravel built-up roofing.

Coarse-grained wood - Wood with wide, conspicuous annual rings indicating considerable difference between springwood and summerwood growth; term used for woods with large pores such as oak, ash, chestnut, and walnut.

Coating - A layer of any liquid product, of various compostitions, spread over a surface for protection.

Coating/topping - Relatively thin material, such as paint, epoxy, etc. applied to surfaces for protection and/or decoration; topping is usually applied to floors to smooth irregularities, or to provide better wearing surface.

Codes - Variety of prevailing regulations, ordinances or statutory requirements set forth by governmental agencies associated with building construction practices and owner occupancy, adopted and administered for the protection of various aspects of public health, life safety and welfare.

Cold Applied - Products that can be applied without heating. These are in contrast to products which need to be heated to be applied.

Cold Patch - In roofing, a roof repair done with cold-applied material.

Collar - In roofing, a conical metal cap flashing used in conjunction with vent pipes or stacks usually located several inches above the plane of the roof, for the purpose of shedding water away from the base of the vent.

Collar beam - Horizontal member installed between opposing roof rafters about 1/3 of the way down from the ridge; to stiffen roof framing and prevent spreading of rafters when loaded.

Column - In architecture: A perpendicular supporting member, circular or rectangular in section, usually consisting of a base, shaft, and capital. In engineering: A vertical structural compression member which supports loads acting in the direction of its longitudinal axis; can also be purely decorative.

Combination Doors or Windows - Combination doors or windows used over regular openings. They provide winter insulation and summer protection and often have self storing or removable glass and screen inserts. This eliminates the need for handling a different unit each season.

Commissioning - The process at or near construction completion when a facility is put into use to see if it functions as designed. Usually applied to manufacturing type projects, and similar to Beneficial Occupancy in the commercial sector.

Common Bond - Brick laid in a pattern consisting of five (5) courses of stretchers, followed by one (1) "bonding" course of headers [tied to the backup wythe].

Common nail - Large diameter nail, with head, for rough framing; size indicated by "d", or penny designation [for example, 16-penny nail]

Common Rafter - Rafter extending from the top of the wall to the roof ridge.

Compatible - Two or more substances, which can be mixed or blended without separating, reacting, or affecting either material adversely.

Component - A part, member, unit or module of an assembly or building which is built or manufactured before being delivery to the project site for installation.

Composite Board - An insulation board, which has two different insulation types laminated together in 2 or 3 layers.

Composite Wall - A masonry wall that incorporates two or more different types of masonry units, such as clay brick, and concrete masonry units [CMUs].

Compound - A chemical formulation of ingredients used to produce a caulking, elastomeric joint sealant, etc.

Concave Joint - A mortar joint tooled and compacted into a curved, indented profile which sheds water.

Concealed Installations – Materials or equipment installed and subsequently covered by ceiling, wall or floor surfaces, or other enclosure to render it "out of view" and not readily visible.

Concrete - A thick, pasty [but "plastic/formable"] mixture of Portland cement, sand, gravel, and water; can be formed into any shape which it retains when hardened and cured; mixes may be varied in proportioning, for strength, and other attributes or features,. e.g., 1 part cement, 2 1/2 parts sand, 5 parts coarse aggregate; an appropriate ratio of water produces a mix used for foundations, walls, abutments, piers, etc.

Concrete Block - Common term for masonry units of varying shapes and sizes, produced with concrete [see Concrete Masonry Units].

Concrete Brick - A solid concrete masonry unit the same size and proportions as a modular clay brick.

Concrete Cylinder Test - A compression test where wet [fresh from the delivery truck] samples of concrete are carefully placed in special cylinders, 6 inches in diameter and 12 inches high; cylinder is filled 1/3 full and concrete is then compacted by rodding, 25 strokes, with a bar; this is repeated at 2/3 full, and full. Two, or more such cylinders are prepared, some to be tested at 7 days and the remainder at 28 days after preparation; shells are stripped off and the concrete cylinders are lab-tested, in a hydraulic press that measures the pressure required to crush the cylinders to breakage; this determines the compressive strength of concrete, most commonly specified as 3,000 psi at 28 days.

Concrete Masonry Unit [CMU] - Units of hardened concrete formed to varying profiles, sizes, and strengths, some solid, others with hollow cores [voids]; designed to be laid in same manner as brick or stone to form walls, partitions, etc. [commonly called "concrete block"]

Concrete, Plain - Concrete either without reinforcement, or reinforced only for shrinkage or temperature changes.

Concrete Slump Test - A test run on the job site to determine the plasticity of concrete. A sample of fresh concrete is placed in a cone-shaped container, 12″ high. Concrete is compacted with 25 rod strokes at 1/3, 2/3, and completely full. The container is then slowly lifted; the concrete will "slump" as the form is removed. The flattened concrete is then measured to ascertain how much lower than the 12″ original height remains, i.e., how much the concrete has "slumped" down from the 12″ cylinder height. This "slump" will be specified and the actual test results note the acceptability of the concrete [for use in the project]. This test is completely site-accomplished. Usually a slump of 3-5 inches is required or acceptable; it varies as required to meet the various job conditions.

Conduit - General term for an feature that carries or conveys some other substance.

Conduit, Electrical - Pipe-like tubing, usually metal or plastic, in which wire is installed for electrical service.

Conifer [coniferous] - A tree with needles in lieu of leaves that bears cones [pine for example]; also called "evergreen"]

Construct - To assemble and combine construction materials and methods to make a structure.

Construction Administration - Administrative activities associated with handling of contracts, such as (1) invitation to bid, (2) bid evaluation, (3) award of contract, (4) contract implementation, (5) measurement of work completed, and (6) computation of payments. It also includes monitoring contract relationship, addressing related problems, incorporating necessary changes or modifications in the contract, ensuring both parties meet or exceed each other's expectations, and actively interacting with the contractor to achieve the contract's objective[s].

Construction Documents - Complete array of all drawings, specifications, addenda, change order, field instructions, bulletins, directives associated with a specific construction project. These documents delineate and graphically represent the physical construction requirements established by the A/E. [also, see Contract Documents]

Construction Phase - The fifth and final phase of the architect's basics services, which includes the architect's general administration [G&A] of the construction contract.

Construction Schedule - A graphic, tabular or narrative representation or depiction of the construction portion of the project-delivery process, showing activities and duration in sequential order.

Construction Specifications Institute [CSI] - Professional organization active in overall specification development, writing, production, and ancillary activities; established the original uniform 16-Division format which is standard and widely used today as the uniform basis for specifications and Project Manuals; provides information for upgrading of specifications content and production; adjusting to 50-Division format (2004) to meet need for more space specific to trades and professions, to clarity requirements, and provide for future additions

Construction Support- Activities, other than administrative tasks, that aid and facilitate the process of construction. Tasks, services, actions, etc. that are not directly project related or specific, but which impact, assist, and service the physical construction of the project.

Contour Line[s] - Lines on a survey plat, site plan, or topographic map which connect points of like [same] grade elevation, referenced to above/below sea level or other appropriate datum point[s].

Contract - (1) An agreement for goods and/or services between two or more parties, especially one that is written and enforceable by law (2) The writing or document containing such an agreement.

Contract Administration - The contractual duties and responsibilities of the A/E, contractor or CM during the construction phase of a specific project for generally overseeing the actual construction and servicing the interactive provisions in the contract for construction. See Construction Administration.

Contract Bond - A written form of security from a surety company, on behalf of an acceptable prime or main contractor or subcontractor, guaranteeing complete execution of the contract and all supplemental agreements pertaining thereto and for the payment of all legal debts pertaining to the construction of the project.

Contract Documents - A term used to represent all executed agreements between the owner and contractor, any general, supplementary or other contract conditions, the drawings and specifications, all bidding documents less bidding information plus pre-award addenda issued prior to execution of the contract and post-award Change Orders, and any other items specifically stipulated as being included in the contract documents, which collectively form the contract between the contractor and the owner.

Contract Document Phase - The third phase of the architect's basic services wherein the architect prepares working drawings, specifications and bidding information. Depending on the architects scope of services the architect may also assist the owner in the preparation of bidding forms, the conditions of the contract and the form of agreement between the owner and contractor: phase of design for an architectural project when documents for construction are completed and bidding documents formulated.

Contract Document Review - A review of Bid and/or Contract Documents on a continuing basis, or at short intervals during the pre-construction phase, to preclude errors, ambiguities, and omissions.

Contractor - A properly licensed individual of company that contracts to perform a defined scope of work on a construction project and agrees to furnish labor, materials, equipment and associated services to perform the work as specified for a specified price; there are various types of contractors:

- *General:* responsible for execution, supervision and overall coordination of a project, and may also perform some of the individual construction tasks; not licensed to perform specialty trade work and hires special contractors for such tasks as plumbing, HVAC, electrical, etc.
- *Remodeling:* general who confines work projects to remodeling or renovation work exclusively
- *Sub contractor/Specialty contractor* is one who performs a limited amount of project work, usually in a special material or system.

Contractor's Option - A written provision in the contract documents giving the contractor the option of selecting certain specified materials, methods or systems without changing in the

Control Joint - An intentional, linear discontinuity which accommodates movement in a structure or component, designed to form a plane of weakness where cracking can occur in response to various forces so as to minimize or eliminate cracking elsewhere in the structure.

Coordinator - A person designated to assist a Control CM, Project Manager, or Level 2 Manager in executing the CM format.

Cope - Cutting one piece of material to allow connection to another, with a tight fit, such as removing the top and bottom flange of the end[s] of a metal I-beam, to fit within, and bolted to, the web of another I-beam in a "T" arrangement

Coped joint - Cutting and fitting woodwork to an irregular profile/surface [see scribing].

Coping - Cap or top covering of a masonry or other wall to close off the wall from moisture, etc. can be cut stone, formed metal, brick, or pre-cast concrete.

Corbel - To build one or more courses of brick or stone, which extend beyond the face of the unit below or the wall in order to form a support for timber, or other member.

Core - A small section cut from any material to show internal composition.

Corner bead - A section of lightweight sheet metal angle used to shape and reinforce outside corners in drywall placed on outside corners of drywall before applying drywall 'mud'.

Corner Boards - Used as trim for the external corners of a house or other frame structure against which the ends of the siding are finished.

Corner Braces - Diagonal braces at the corners of frame structure designed to stiffen and strengthen the wall.

Cornerite - Product name for metal-mesh lath cut into strips and bent to a right angle. Used in interior corners of walls and ceilings on lath to prevent cracks in plastering.

Cornice - A horizontal projecting [overhanging] course on the exterior of a building, usually at the base of the parapet. In residential construction, the Overhang of a pit hed roof at the cave line, usually consisting of a fascia board, a soffit for a closed cornice, and appropriate moldings.

Cornice Return - That portion of the cornice that returns on the gable end of a house.

Corrosion - The deterioration of metal by chemical or electrochemical reaction resulting from exposure to weathering, moisture, chemicals or other agents or media.

Corrugated - Formed into a fluted, rippled, or ribbed profile; folded or shaped into parallel ridges or furrows so as to form a symmetrically wavy surface.

Counter Flashing - The formed metal secured to a wall, curb, or roof top unit to cover and protect the upper edge of a base flashing and its associated fasteners. Flashing that usually is installed downward over base or other flashing that rises from a surface [roof, etc.] to prevent entry of moisture

Coupling - In plumbing, a short collar with only inside threads at each end, for receiving the ends of two pipes which are to be fitted and joined together. A right/left coupling is one used to join 2 gas pipes in limited space.

Course - A single layer of brick or stone or other building material, or units such as brick, concrete block, shingles,

Cove base - Trim piece applied to walls, and resting on floor; radius bottom allows easier cleaning and more sanitary condition; flexible strip of vinyl, rubber, or plastic

Cove Molding - A molding with a concave face used as trim or to finish interior corners.

Crawl Space - A shallow open area between the floor of a building and the ground, normally enclosed by the foundation wall; space beneath a house or structure that lacks a basement, but which allows access to utilities; may also refer to the space in an attic that is too low to walk in, but high enough to crawl through or store in.

Crazing - A series of hairline cracks in the surface of weathered materials, having a web-like appearance. Also, hairline cracks in pre-finished metals caused by bending or forming. [see brake metal]

Cricket - A small drainage-diverting roof structure of single or double slope placed at the junction of larger surfaces that meet at an angle, such as above a chimney; also called a "saddle".

Cripple - Framing member that is cut off and used at less than full length [stud beneath a window sill, for example]

Cross-Bridging - Diagonal bracing between adjacent floor joists, placed near the center of the joist span to prevent joists from twisting; often lines of diagonal bracing placed in "X" fashion between floor joists.

Cross-Hatching – Indications, on working drawing sections, that indicate materials that have been cut by the cutting plane of the view; material symbols for example, to distinguish one from the adjacent. Can be solid infill on smaller scale or presentation drawings to simply identify the walls.

Crown Molding - A molding used on cornice or wherever an interior angle is to be covered especially at the roof and at wall/ceiling intersections

CSI - Abbreviation for the Construction Specification Institute [see]

Cubic Foot - Measure of volume that has three- 12″ dimensions- width, height and depth; contains 1,728 cubic inches (12″x 12″x 12″].

Cubic Yard - Measure of volume that is 3 feet on each side- width, depth, and height; contains 27 cubic feet

Cul-de-sac - A street or roadway with no outlet, but provided with a circular turn-around for vehicles.

Cull - Material [especially boards or brick] rejected for use because of mars, imperfections, defects, or of substandard grade; also pieces of brick broken or cut off from full unit, and unusable

Culvert - Round, corrugated drain pipe of various sizes as required, installed in a drainage course [ditch, stream] to allow water flow under an improvement like a road or street; commonly 15″ or 18″ in diameter installed beneath a driveway, parallel to and near the street.

Cupola - Small, decorative monitor or dome structure built on a roof of a building; often placed over an attached garage, at the peak of a gable roof; may be utilized for outside air intake for ventilation purposes.

Cupping - A type of warping that causes boards to curl up at their edges.

Curb - 1) Linear edging, raised or partially concealed around pave areas, at walks, around other areas; 2) also, a raised box installed around roof openings for passage of equipment, piping, devices, and the watertight mounting of same; 3) short wall or masonry built above the level of the roof that provides a means of flashing the deck equipment.

Curing - The slow chemical process that takes place in concrete after it is placed, in which mortar and concrete harden and as it attains its load-bearing strength over a period of time. The length of time is dependent upon the type of cement, mix proportion, required strength, size and shape of the concrete section, weather and future exposure conditions. The period may be 3 weeks or longer for lean concrete mixtures used in structures such as dams or it may be only a few days for richer mixes. Favorable curing temperatures range from 50 to 70 degrees F. Design strength is achieved in 28 days.

Curtain Wall - A thin, non-load bearing wall, supported by the structural steel or concrete frame of the building independent of the wall below; an exterior "skin"; Also a metal [most often aluminum] framing system on the face of a building containing vision glass panels and spandrel panels made of glass, aluminum, or other material.

Cutback - In roofing, basic asphalt or tar which has been "cut back" with solvents and oils so that the material become fluid.

Cut-in Brace - Nominal 2-inch-thick members, usually 2 by 4's, cut in between each stud diagonally.

Cut Off - A piece of roofing membrane consisting of one or more narrow plies of felt usually moped in hot to seal the edge of insulation at the end of a day's work. Cut Stone - Decorative, natural stone of various types, cut to given sizes and shapes [ashlar veneers, sills and copings, for example], but not including thin paving or facing sections.

D

d. - Designation of nail size [See Penny].

Dado - A rectangular groove or cut made across the width of a board, panel or plank intended to receive edge of connecting board or panel. In interior decoration, a special type of wall treatment.

Dampproofing - Layer of impervious material, spread or sprayed on walls usually, to prevent moisture from passingthrough concrete, masonry or stone surfaces to repel water, the main purpose of which is to prevent the coated surface from absorbing rain water while still permitting moisture vapor to escape from the structure. [Moisture readily penetrates coatings of this type.] "Dampproofing" generally applies to surfaces exposed to moisture; "waterproofing generally applies to surfaces exposed to standing water, and water with head pressure.

Datum [point] - An established, known, and fixed reference point from which grade elevations can be measured [See Bench Mark].

Dead Bolt - Finish hardware device for securing exterior doors; sliding square-ended bolt moveable by use of key or thumb-turn

Dead Load - The constant, design-weight/load on a structure imposed its own weight and any permanent fixtures attached above or below; the weight of the materials of which it is built, and other fixed loads.

Decay - Disintegration of wood or other substance through the action of fungi.

Decibel - Unit used to measure the relative intensity or loudness of sound; higher numbers indicate greater sound.

Deciduous - Trees which lose their leaves annually.

Deck - 1) "Deck" is also commonly used to refer to the above-ground floors in multi-level parking garage; 2) An elevated platform or exterior floor, similar to a concrete slab, patio, or porch; usually wood and extends out from building wall; usually slightly elevated above ground surface; also fluted metal sheets used as support for floors and roofs.

Deck Paint - An exterior enamel or stain with a high degree of resistance to mechanical wear, designed for use on such surfaces as porch floors.

Deflect - To bend or deform under weight.

Deflection - Amount of sag at the center of a horizontal structural member [between supports] when subjected to a load; amount of bending movement of any part of a structural member perpendicular to the axis of the member under an applied load.

Delamination - Separation of layers or plies of a built-up unit [e.g., plywood, laminate on underlayment]due to failure of adhesive

Demising Walls - The boundaries that separate your space from your neighbors' and from the public corridor.

Density - The mass of substance in a unit volume. When expressed in the metric system, it is numerically equal to the specific gravity of the same substance.

Dentil - An ornamental trim of repetitive, tooth-like blocks

Design - 1) The overall concept and configuration of a project developed to meet stated needs, desires and goals of the client; drawn showing the plans, elevations, sections, details and other features necessary for the construction of a new structure [as used by architect, the term "plan" denotes a horizontal projection; "elevation" applies to vertical exterior views. 2) A graphical representation consisting of plan views, interior and exterior elevations, sections, and other drawings and details to depict the goal or purpose for a building or other structure.

Design Professional - Term applied to one responsible for creation of a design scheme or concept for a portion of a building project; in particular, a properly registered architect or engineer.

Detail - (1) An individual part or item (2) A graphical scale representation, e.g., a drawing at a larger scale, of construction parts or items showing materials, composition and dimensions in a limited area of the project construction; type of sectional drawing showing special, in-depth information about a particular portion of the construction; usually drawn at larger scale than other views to show all construction required.

Dimension Lumber - Yard or framing lumber that is 2 inches thick [but less than 5″] and from 4 to 12 inches wide; includes joists, rafters, studding, planks, and small timbers.

Direct Nailing - To nail perpendicular to the initial surface or to the junction of the pieces joined. Also termed face nailing.

Directed - Term which reflects action[s] of design professional or other authorized party; used in same manner as "requested", "authorized", selected", "approved", "required" and "permitted".

Distortion - Alteration of viewed images caused by variations in glass flatness or inhomogeneous portions within the glass. An inherent characteristic of heat-treated glass.

Door operator - Commonly a garage door opener, but also there are systems for the automatic operation of doors, which necessitate no human physical effort.

Door stop [bumper] - Floor or wall mounted device to prevent further opening of door; also wood strip of form on door frames against which the door closes.

Doorjamb - The vertical sides of the surrounding case into which and out of which a door closes and opens. It consists of two upright pieces, called side jambs, located under and attached to the horizontal head section.

Dormer - A rooftop projection built out from and above a sloping roof to provide greater headroom inside; opening in a sloping roof, the framing of which projects out to form a vertical wall suitable for windows or other openings.

Double Glazing - In general, any use of two lights of glass, separated by an air space, within an opening, to improve insulation against heat transfer and/or sound transmission. In insulating glass units the air between the glass sheets is thoroughly dried and the space is sealed, eliminating possible condensation and providing superior insulating properties; also called "insulating glass".

Double Header - Two or more structural members joined together for added strength; also, the shorter framing, of two members, to create an opening in structural framing.

Double Plate - when two layers of 2 x 4's are placed on top of studs in framing a wall.

Double Strength - In float glass, approximately 1/8″ (3 mm.] thick.

Double Tee - Refers usually to a pre-cast roof deck panel poured with two fins in its underside to impart flexural rigidity.

Double-hung Window - A window unit having a top and bottom sash, each capable of moving up and down, independently, bypassing each other.

Dowel - 1) Wood peg, "stick", or pin which fits into holes in abutting pieces to prevent slipping; 2) in concrete a re-bar extending from a member which permits attachment of other reinforcing in adjacent members, yet to be installed.

Downspout - A tube or pipe of plastic or sheet metal, for carrying rainwater from the roof gutter to the ground, or to a sewer connection; also called a "leader", or "conductor".

Drain [Footing] Tile - A perforated, corrugated plastic or clay pipe laid around the bottom of the foundation wall usually aside the footing] and used to drain excess water away from the foundation. It prevents ground water from seeping through the foundation wall. Sometimes called "foundation" or "perimeter" drain.

Drainage - Flow or removal of water.

Drawing - A graphical depiction of work to be performed to construct a project; conveys information as to construction, configuration, etc., with appropriate notations; each drawing addresses specific work, and usually there will be a set of drawings for a project.

Drawing Detail - A drawing done at a large scale, which shows a limited area of work – the fit of a door frame jamb into the adjacent wall, for example. Numerous views which provide increased amounts of information, relationships and construction items which cannot be easily shown on other types of drawings.

Drawings - (1) A term used to represent that portion of the contract documents that graphically illustrates the design, location, geometry and dimensions of the components and elements contained in a specific project in sufficient detail to facilitate construction. (2) A line drawing.

Dressed and Matched [Tongued & Grooved] - Boards or planks machined in such a matter that there is a groove on one edge and a corresponding tongue on the other.

Dressed Size Lumber - Actual size of lumber after shrinking from green dimension, and after machining and surfacing for pattern and construction use.

Drip - (a) A member of a cornice or other horizontal exterior finish course that has a projection beyond the other parts for throwing off water. (b) A groove in the underside of a sill or drip cap to cause water to drop off on the outer edge instead of drawing back and running down the face of the building.

Drip Cap - A molding placed on the exterior top side of a door or window frame to cause water to drip beyond the outside of the frame.

Drip Edge - A device designed to prevent water from running back or under an overhang.

Drop Siding - Usually ¾ inch thick and 6 and 8 inches wide with tongued-an grooved or shiplap edges.

Dry Glazing - Also called compression glazing, a term used to describe various means of sealing monolithic and insulating glass in the supporting framing system with synthetic rubber and other elastomeric gasket materials.

Dry Seal - Accomplishment of weather seal between glass and sash by use of strips or gaskets of Neoprene, EPDM, silicone or other flexible material. A dry seal may not be completely watertight.

Dry Sheet - A ply mechanically attached to wood or gypsum decks to prevent asphalt or pitch from penetrating the deck and leaking into the building below.

Dry-In - To make a building waterproof.

Drywall - Construction system that uses gypsum board used to cover the framing with taping, coating, and finishing to make the interior walls and ceilings of a building. Drywall is also used as a verb to refer to installation process. See Gypsum board, Wallboard.

Drywall "mud" - Common term for joint compound; substance used to fill/cover/hide seams and nail/screw heads in finished gypsum board walls.

Dry-Wall Construction - A type of panelized interior wall construction in which the interior wall finish is applied in a dry condition, generally in the form of sheet materials or wood paneling as contrasted to "wet" plaster; usually referred to as "gypsum board, wall board, or plasterboard"; sheets of material are applied to a stud framework with threaded nails or screws.

Drywall Hammer - A special hammer used for nailing up gypsum board. It is also known as an ax or hatchet. Edges should be smooth and the corners rounded off. The head has a convex round & checkered head.

Drywall Nail - Nails used for hanging regular drywall that is to be taped and finished later must have adequate holding power and a head design that does not cut the face paper. They must also be of the proper depth to provide exactly 1 inch penetration into the framing member. Nails commonly used are chemically-etched and are designed with a cupped head.

Duct - A round or rectangular "tube" used to move air either from exhaust or intake, and for distributing warm air from the heating plant to rooms, or air from a conditioning device or as cold air returns; usually sheet metal or fiberglass; The installation is referred to as "duct work".

Dumbwaiter - An elevator with a maximum footage of not more than 9 sq. ft. floor area; not more than 4" headroom and a maximum capacity of 500 lbs. used for carrying materials only.

E

Earth-sheltered Building - A structure which is totally or partially underground [commonly, one face or elevation is exposed]; uses soil coverings to reduce heat loss [or gain].

Easement - Designated, and legally documented area of property where right or privilege, granted by the property owner, to another party that entitles the user to a specific, exclusive, but limited use of the property noted [access example; running of a utility line]

Eave - The projecting lower edges of a roof overhanging the side walls of the building, or the lower edge of the part of a roof that overhangs a wall.

Edge Clearance - Nominal spacing between the edge of the glass product and the bottom of the glazing pocket [channel].

Edge Grain [vertical] - Edge-grain lumber has been sawed parallel to the pith of the log and approximately at right angles to the growth rings; i.e., the rings form an angle of 45° or more with the surface of the piece.

Edge Metal - A term relating to brake or extruded metal around the perimeter of a roof.

Efflorescence - Undesirable chalky white stains on masonry walls created by water leeching soluble salts out of concrete or mortar and depositing them on the surface. Also used as the name for these deposits.

EIFS [Exterior Insulating and Finish System] - Exterior wall cladding system consisting primarily of polystyrene foam board with a textured acrylic finish material, usually a polymer, used as an exterior finishing material applied over insulation foam; stucco-like coating in several colors which conforms to any profile cut and constructed in the foam backing; adds thermal performance and decreases air infiltration.

Elastomer - An elastic rubber-like substance, such as natural or synthetic rubber.

Elastomeric - Of or pertaining to any of the numerous flexible membranes that contain rubber or plastic.

Elevation - 1) A side of a building; 2) Building drawing that shows vertical dimensions; 3) also the height of a point in reference to sea level; sometimes called "grade elevation"

Emulsion - In roofing, a coating consisting of asphalt and fillers suspended in water.

Encase - To fully enclose, such a totally covering an underground electrical conduit with concrete-- top, bottom and sides.

End Dams - Internal flashing [dam] that prevents water from moving laterally within a curtain wall or window wall system.

End Lap - The amount or location of overlap at the end of a roll of roofing felts in the application.

Engineer [Professional] - Person trained and registered [by the state] to professionally engage in work of one of the areas of the engineering discipline; e.g. civil, structural, electrical, mechanical [HVAC, plumbing]; also referred to as a "design professional"; many types of engineers are not construction related.

Engineered Fill - Earth compacted by machine, in such a way that it has predictable physical properties, based on field and laboratory tests; produced using specified, supervised installation procedures.

English Bond - Pattern in brickwork consisting of alternate courses of headers and stretchers.

Entrance [Assembly] - Complex of construction, usually involving tubular wall framing [see Storefront

EPDM - Ethylene Propylene Diene Monomer. A single-ply roofing membrane consisting of synthetic rubber; usually 45 or 60 mils. Application can be ballasted, fully adhered or mechanically attached.

Erect - To raise, construct a building frame; generally applied to prefabricated materials, such as structural steel, as they are installed on the job site.

Erector - The subcontractor who raises, connects, and accurately sets [plumb and level] a building frame from fabricated steel or pre-cast concrete members. **Escutcheon** - Door hardware trim piece which surrounds and accommodates the knob and keyhole.

Ethics - Principles, rules or standards of performance for professionals set by the organization or association to which the professional belongs or is associated by the public trust; guidelines for performance of professional services and duties.

Excavate - Dig the basement and or all areas that will need footings/foundations below ground.

Excavation - A cavity, hole or pit in the earth surface produced by digging and removing the earth in preparation for construction.

Exit - Egress facility whereby one may leave or "exit" a building; made up of exit access [corridors, etc. enroute to exit], the exit itself [enclosed fire-rated area], and the exit discharge.

Expanded metal lath - Thin sheet of metal with punched slits and then stretched to transform it into a diamond-shaped grid; used lath for plaster applications.

Expansion Bolt - A combination of a bolt and a sleeve used when an ordinary bolt is unsuitable; sleeve is inserted in pre-drilled hole, bolt is then inserted and turned to expand a "V" shaped piece into the sleeve and forces sleeve to become wider at bottom; tightened until assembly is firmly anchored in material.

Expansion Joint - 1) Joint in walls, floors other materials to permit and take up expansion caused by temperature changes without damage to surrounding surfaces; 2) a bituminous fiber strip used to separate blocks or units of concrete to prevent cracking due to expansion as a result of temperature changes. Also used on concrete slabs.

Expansion shield - Any of several types of inserts into wall materials to receive fasteners, i.e., a screw can be.

Expansive soil - Earth that swells and contracts depending on the amount of water present.

Exposed Aggregate Finish - Concrete surface in which the top of the aggregate [usually "pea gravel"] is exposed; can be used in walks, or wall panels.

Exposed Installations – Materials or equipment, which is readily visible, within its location, without the removal or opening of any door, panel, or removal of any other cover or enclosure.

Extended Services - Dissimilar services included in a contract to be performed over and above those that are included as the principal services of the contract; applicable to design professionals, construction managers, etc.

Exterior – Area, space, or portion of project beyond the outer face of the structure or building; "outside"; direct opposite of "interior" [see]

Exterior Glazed - Glazing infills set from the exterior of the building.

Exterior plywood - Plywood with plies bonded together using exterior or wate proof adhesive; renders plywood more dampness resistant.

Exterior Stop - The molding or bead that holds the light or panel in place when it is on the exterior side of the lite or panel.

Exterior Wall – Outer wall of building or structure, which separates open air space from inside of building.

Extras - Common term for additional work requested of a contractor which was not included in the original contract; billed separately; may or may not impact time of completion of project.

Extrusion - An item formed by forcing a base metal [frequently aluminum] or plastic, at a malleable temperature, through a die to achieve a desired shape.

Eyebrow - A flat, normally concrete, projection which protrudes horizontally from a building wall; Eyebrows are generally located above windows.

F

Fabricator - Company that prepares, fashions, adapts standard materials or members [such as structural steel] for erection and installation to specific project conditions by cutting, fitting, punching, coping, and otherwise making ready for specific installations.

Facade - The face or front elevation of a building. Frequently, in architectural terms an artificial or decorative effort.

Face Brick - Brick of higher quality, and made specifically for exposure to weather; usually hard-burned and frostproof; available in large array of colors, textures, sizes, and combinations; brick made especially for exterior use with special consideration of color, texture and size, and used as a facing on a building.

Face Glazing - A system having a triangular bead of compound applied with a putty knife, after bedding, setting, and clipping the glazing infill in place on a rabetted sash.

Face nailing - To nail perpendicular to the surface, or to the junction of the pieces joined; also termed "direct nailing".

Facing - Any material attached to the outer portion of a wall and used as a finished surface.

Factor of Safety - Ratio of ultimate strength of material to maximum permissible stress in use; unused capacity can be from two to five times or more that required.

Falsework - Temporary work that does not form a part of the final structure; concrete forms and scaffolding for example.

Fascia - The horizontal member on the edge of a roof or overhang; closes off ends of rafters/trusses and is backing for gutter; flat board, band, or face, used sometimes by itself but usually in combination with moldings, often located at the outer face of the cornice. Any cover board or framed metal assembly at the edge or eaves of a flat, sloping, or overhanging roof, which is placed in a vertical position to protect the edge of the roof assembly.

Fast Track Construction - The process of designing portions of a project while potions already designed are under construction. A method of project management which involves a continuous design-construction Operation, where project work is carried on while drawings are being finished; as drawings are finalized they are Incrementally released for construction [construction lags drawing production]; overall program reduces total time for design/construction sequence.

Fasteners - A general term covering a wide variety of metal devices, such as nails, bolts, screws, etc., which may be used for mechanically securing various components of a building.

Felt - A very general term used to describe composition of paper impregnated with asphalt used as underlayment for roof shingles, and in other ways as a building paper, roofing ply sheets; consisting of a mat of organic or inorganic fibers unsaturated, impregnated or coated with asphalt.

Fenestration - Arrangement, pattern and sizing of any glass panels, windows, doors, curtain wall or skylight units in exterior walls of buildings.

Ferrous - Refers to objects made of or partially made of iron, such as ferrous pipe.

Fiberglass - Glass spun into fine threads, and made into batting which is used as an insulation material; can also be pressed into rigid board insulation; and used for forms for, and can be fashioned into intricate shapes.

Field measure - Taking actual dimensions and sizes, during the construction work to ensure

Fill - A build-up land area/formation of new material such as clean sand, gravel, or loose earth used to bring a sub-grade up to desired level around a building, in a trench, etc.; [see Engineered Fill]

Fillet - A narrow concave strip connecting two surfaces that meet at an angle; adds both strength and beauty by avoiding sharp angles.

Fillet Bead - Caulking or sealant placed in such a manner that it forms an angle between the materials being caulked.

Fillet weld - Triangular shaped weld at the inside intersection of two metal surfaces set at right angles.

Finger joint - A series of matched V-grooves, and "teeth" cut in the ends of wood members to interconnect and fit them together to make longer pieces.

Finish - 1) In hardware, metal fastenings on cabinets which are usually exposed such as hinges and locks. 2) Final, exposed surface texture of coating on a surface [paint, covering, etc.].

Finish Carpentry - 1) Carpentry work which will be exposed to view in the final project; casing of openings, running trim [base, chair rail, crown molds, etc.] bookshelves, paneling, and so forth. 2)The hanging of all interior doors, installation of door molding, base molding, chair rail, built in shelves, etc. [compare with Rough Carpentry].

Finish Coat - The last coat applied in plastering intended as a base for further decorating or as a final decorative surface. Finish coat usually consists of calcified gypsum, lime and sometimes an aggregate. Some may require the addition of lime or sand on the job. The three basic methods of applying it are (1) trowel (2) flat and (3) spray.

Finish Floor [covering] - The floor material exposed to view as differentiated from the sub-floor, which is the load bearing floor material beneath.

Finished Grade - Final, top level of earth/ground around a building; any surface which has been cut to or built to the elevation indicated for that point. Surface elevation of lawn, driveway or other improved surfaces after completion of grading operations.

Finish Hardware - Devices and features which allow installation and operation of doors; in particular, knobs, rosettes, escutcheons, push/pull plates, closers, hinges, etc., which are exposed and which have decorative finishes; also called "door hardware". [see Rough Hardware for comparison].

Finish Lumber - Good quality lumber used to form surfaces that will be finished [often in natural finish] and exposed to view.

Finish plaster - Final or white coat of plaster Finished – 1) Completed; all required work is finalized, in-place, with nothing else required: 2) Material or equipment to which a decorative or protective material has been applied as a final decoration or protection [example, coat of paint, resilient flooring].

Finished Spaces – Rooms or areas, which in their final construction state, will have finishes or finished materials on the walls, floors, and ceilings.

Fire Cut - An angled cut made on the end of a joist or wood beam [where inserted into a masonry wall] to permit the member to rotate and drop away if burned through.

Fire Protection System - An interconnected system of devices and equipment installed throughout a structure [or in specific hazardous areas] to detect a fire, activate an alarm, suppress or control a fire, or any combination thereof; fire alarm systems, sprinkler systems, and smoke detectors are examples.

Fire-Rated - Description of materials that has been tested for resistance to the passage of fire; doors, for example and materials for use in fire separation and other walls required to fire resistant.

Fire-Rated Doors - Doors designed to resist the passage of fire from one side to the other; constructed to match those tested in standard fire tests, and subsequently awarded an hourly rating and verification label; also called "labeled doors".

Fire-Rating - The comparative resistance of a material to failure, as stated in hours, when subjected to fire testing; ratings are standardized by fire underwriters [the Uderwriters' Laboratories/UL for example], who publish full data on tests, results, and material performance.

Fire Retardant Chemical - A chemical or preparation of chemicals used to reduce flammability or to retard spread of flame.

Fire Wall - Any special wall designed and constructed to remain in place, despite collapse of structure on either or both sides of the wall, to stop the spread and passage of fire from one portion of a building to another for extended period of time [up to 4 hours]; built to prevent the spread of fire in a building; such walls of solid masonry or concrete generally sub-divide a building and run from their own foundations to two or more feet above the plane of the roof.

Firebrick - A refractory brick that is especially hard and heat resistant; for use in fireplace fire boxes, and as smoke stack linings.

Fireproofing - Material to protect portions of buildings, primarily structural members against fire; can be stiff material [brick, concrete, tile, gypsum], or flexible [spray-on, wraps, paints].

Fire-Resistant - Basically, incombustible; slow to be damaged by fire; forming a barrier to the passage of fire.

Fire-Resistive - In the absence of a specific ruling by the authority having jurisdiction, applies to materials for construction not combustible in the temperatures of ordinary fires and that will withstand such fires without serious impairment of their usefulness for at least 1 hour.

Fire-Separation Wall/Partition - Fire-rated wall required by building codes to separate two areas of a building, into separate fire areas, as a deterrent to the spread of fire.

Fire-Stop - Any of a variety of material, even wood, placed in a solid, tight closure of a concealed space to prevent the rapid spread of fire and smoke through such a space. In a frame wall, this will usually consist of 2 by 4 cross blocking between studs; used to block the passage of flames or air currents upward, or across and in concealed building parts; includes draft-stops.

Fire-Stopping System - Installation of a tested combination of fire-resistant wraps, packing, collars, inserts, and sealants in annular areas around various penetrations in walls and floors, to preclude the passage of fire and smoke.

Fishplate - A wood or plywood piece used to fasten the ends of two members together at a butt joint with nails or bolts. Sometimes used at the junction of opposite rafters near the ridge line.

Fixed Window - Unit of glass mounted in an inoperable frame, mounted in a wall opening.

Flagstone [Flagging or Flags] - Flat stones, of various sizes and from 1 to 4 inches thick, used for rustic walks, steps, floors, and the like.

Flake - 1) scale-like particle. 2) To lose bond from a surface in small thin pieces. Sometimes a paint film "flakes".

Flange - Horizontal bottom and top portions of an I-beam, wide-flange beam, or channel member.

Flash Point - The critical temperature at which a material will ignite.

Flashing - Weatherproof material [sheet metal, or rubberized plastic] installed between roof sheathing [or wall sheathing] and the finish materials to ensure joints, openings, and connections in roofs and walls are watertight; used in roof valleys, at dormers, chimneys, and other vertical penetrations through roofs; Typically, sheet metal or a similar material is used in roof and wall construction to protect a building from water seepage; also at window, and door openings; usually covered, at least in part, by finished material such as siding or roofing so water is directed away from the areas in which leaks could occur.

Flat Glass - A general term that describes float glass, sheet, glass, plate glass, and rolled glass.

Flat Grain - Flat-grain lumber has been sawed parallel to the pith of the log and approximately tangent to the growth rings, i.e., the rings form an angle of less than 45° with the surface of the piece.

Flat Paint - An interior paint that contains a high proportion of pigment and dries to a flat or lusterless finish.

Flat Seam - A seam at the junction of sheet metal roof components that has been bent at the plane of the roof.

Flat-Slab Construction - Type of reinforced concrete floor/roof construction having no beams, girders of joists below the underside; requires thick slabs, moderate spans, and special reinforcement at columns.

Flat work - Common term for large, horizontal concrete features such as floors, driveways, sidewalks, etc.

Flexible Metal Conduit – Conduit similar to armored cable in appearance but does not have the pre-inserted conductors.

Float Glass - Glass formed on a bath of molten tin. The surface in contact with the tin is known as the tin surface or tin side. The top surface is known as the atmosphere surface or air side.

Floor Plan - Horizontal sectional view, "cut through" a proposed building/structure, approximately 4 feet above floor line, and showing the basic layout of building or addition, which includes placement of walls, windows and doors as well as dimensions; includes all features, layout, configuration, and details of the design and construction; most important source of information for other contract documents.

Floor Plate - See Floor Plan.

Flue - The space or passage in a chimney through which smoke, gas, or fumes ascend. Each passage is called a flue, which together with any others and the surrounding masonry make up the chimney; each fuel burning appliance requires its own flue.

Flue Lining - Special, high-temperature fire clay or terra-cotta pipe, round or square, usually made in all ordinary flue sizes and in 2-3 foot lengths; used for inner lining of chimneys with brick or masonry work surrounding; runs from above the smoke chamber to the top of the chimney and several inches above top.

Flush Door - A door with two flat faces [no panels] and resembles a "slab"; can have a hollow or solid core; can have glass or louvered openings; can be fire-rated.

Flush Glazing - [Pocket Glazing] The setting of a light of glass or panel into a four-sided sash or frame opening containing a recessed "U" shaped channel without removable stops on three sides of the sash or frame and one channel with a removable stop along the fourth side.

Fly Rafters - End rafters of the gable overhang supported by roof sheathing and lookouts.

Folded Seam - In sheet metal work, a joint between sheets of metal wherein the edges of the sheets are crimped together and folded flat.

Foot Print - The imposed outline of a building or series of structures on a plot plan; area of land covered by buildings. See Floor Plan.

Footings - Lowest part of a foundation system for a structure, generally of reinforced concrete; spread out flat to distribute the imposed load of the wall, column, grade beam, chimney, foundation wall or other feature it supports, over sufficient area of earth to provide stability; wide pours of cement reinforced with re-bar [reinforcing bar] that support foundation walls pillars, or posts. Footings are part of the foundation and are usually poured before the foundation walls.

Foundation damp/waterproofing - Asphaltic mastic or special sheet materials applied to outer face of foundation walls, to prevent leakage or water or dampness into or through the wall; system used needs to be consistent with conditions anticipated [waterproofing being a far more imposing and expensive system].

Form Tie - Mesh, strap or heavy wire/rod used to hold wall forms in place, but of proper length to provide specified width; spaced at intervals over the entire area of forms, as necessary.

Form[work] - Temporary framing, basically, a "mold" into which concrete is placed; serves to give shape to cast-in-place concrete, and to support it and keep it moist as it cures; built of wood, plywood, or metal for holding and shaping concrete.

Foundation - The supporting portion of a structure below the first floor construction, or below grade, including the footings; lowest portion of structure, fully or partially below grade; substructure of building, consisting of foundation system [walls, grade beams, etc.] and supports [caissons, footings, etc.].

Foundation Drain - Piping or tile installed around the perimeter of a foundation wall [before backfill] and collects and diverts ground water away from the foundation. Generally, it runs to daylight or into a sump pit inside the home, and a sump pump is sometimes inserted into the pit to discharge any accumulation of water.

Frame Construction - A type of construction in which the structural parts are wood or depend upon a wood frame for support. In codes, if masonry veneer is applied to the exterior walls, the classification of this type of construction is usually unchanged.

Frame/Framing - The skeletal structural system [beams, columns, studs, etc.] of a building; rough lumber, steel or concrete frame including floors, roofs and partitions; in light wood framing there are "Platform" and "Balloon" systems.

Framing anchors - Variety of metal devices for connecting framing members together, in wood construction; plates, strips, angles, straps, etc.

Frieze - In house construction a horizontal member connecting the top of the siding with the soffit of the cornice.

FRP - Fiberglass reinforced plastic used for various shapes, doors and frames, grating sections, etc.

Frost heave - Movement or upheaval of ground surface due to the expansion of water in the ground below, when there is alternate freezing and thawing of water in soil; can cause cracks in concrete.

Frost Line - Lowest depth at which the ground will freeze; varies greatly by location and is listed in local building codes, since bottom of building footings must be placed well below this line; depth varies in different parts of the country; footings should be placed below this depth to prevent frost-heave movement which effects the building stability …

Fully Tempered Glass - Flat or bent glass that has been heat-treated to a high surface and/or edge compression to meet the requirements of ASTM C 1048, kind FT. Fully tempered glass, if broken, will fracture into many small pieces [dice] which are more or less cubical. Fully tempered glass is approximately four times stronger than annealed glass of the same thickness when exposed to uniform static pressure loads.

Fully-Adhered - A roof membrane fully adhered or attached over the entire surface area.

Fungi [wood] - Microscopic plants that live in damp wood and cause mold, stain, and decay.

Fungicide - A chemical that is poisonous to fungi.

Furnace - A heating system that uses the principle of thermal convection. When air is heated, it rises and as the air cools it settles. Ducts are installed to carry the hot air from the top of the furnace to the rooms. Other ducts, called cold air returns, return the cooler air back to the furnace.

Furnish - Means to "supply, and deliver to the job site, ready for unloading, unpacking, assembly, installation, and similar operations"; see "Install", and "Provide".

Furring - Narrow strips of wood or other material [metal channels] attached to a surface to provide an even, level, true to line, and plumb plane for attachment of finish wall or ceiling materials; provides some added insulation space.

Furr Out – To apply/install furring.

G

Gable - The end of a building where the roof slopes on only two sides as distinguished from the front or rear side. The triangular end of an exterior wall from the level of the eaves to the ridge of a double-sloped roof. In house construction, the portion of the roof above the eave line of a double-sloped roof.

Gable End - An end wall having a gable.

Galvanize - To coat steel members or sheets by dipping them into molten zinc after cleaning; to provide added protection against rusting.

Gambrel Roof - A type of roof which has its slope broken by an obtuse angle, so that the lower slope is steeper than the upper slope. A double sloped roof having two pitches.

Gang-nail plate - Steel plate with nail holes, or punched out "nails" applied to one or both sides of truss joints, to connect truss members together; placed in press after fasteners are installed.

Gaskets - pre-formed shapes, such as strips, grommets, etc., of rubber or rubber-like composition, used to fill and seal a joint or opening either alone or in conjunction with a supplemental application of a sealant.

Gauge - An outdated [but still widely used] uniform standard of measure for wire diameters, and thickness of sheet metal, plates, etc. [now use actual thickness sizes]; also a measure of other materials in regard to spacing or thickness.

Gauge Board - [Spot Board] Board used to carry grout needed to patch small jobs.

General Contractor [GC] - [or Prime Contractor] A contractor responsible for all facets of construction of a building or renovation; properly licensed individual or company having "primary" responsibility for the work; contracts to build a building, or a part of it for another party; hires, oversees and coordinates other contractors called sub-contractors, who perform specific specialized work on projects; often performs concrete and carpentry work in addition to general project supervision; GC can perform work with its own contractors or can perform the project work as an independent contractor, providing services to owners through the use of subcontractors when using the general contracting system. In the latter case, the GC is referred to as "Paper Contractor".

Girder - Larger of principle structural members of wood, steel, or concrete used to support concentrated loads at isolated points along its length, e.g., at the bearing points of a series of supported beams; used to support concentrated loads at isolated points along its length, usually made of steel or wood.

Girt-Horizontal strut which runs between structural members to brace the structure; also to provide for attachment of siding, cladding and other features to the building frame.

Glass - A hard, brittle substance, usually transparent, made by fusing silicates under high temperatures with soda, lime, etc.; also, variations which are translucent or even opaque [usually through an applied coating process].

Glass Block - Hollow masonry units made of glass; usually square, and made of diffused or molded glass; Translucent to permit passage of light, but not clear vision.

Glazing – [v] A generic term used to describe fitting/placing glass or other similar materials [acrylic plastic, for example] into windows and doors, or tubular grid curtain wall systems; the process of installing an infill material into a prepared opening in windows, door panels, partitions, etc. [n] an infill material such as glass, panels, etc.

Glazing Bead - In glazing, a strip surrounding the edge of the glass in a window or door which holds the glass in place.

Glazing Channel - In glazing, a three-sided, U-shaped sash detail into which a glass product is installed and retained.

Glazing Compound - Mastic, similar to sealants, of various formulations to bed lights of glass in their frames.

Glue-Laminated [Glu-Lam] Timber - Timbers, large beams, and rigid frames [arches] built-up from a large number of small strip [laminations] of wood, glued together; used where solid wood timbers are not available for the loads and spans involved.

Government Anchor - V-shaped anchor, with open ends turned outward; usually 1/2″ round bar, used to secure steel beams and joists to masonry walls which support them.

Grade - 1) construction/building trade term used in referring to the ground level around the building; 2) lumber term to denote the quality and classification of the pieces related to their adaptability for different uses; 3) the slope or gradient of a roof, piece of land, ramp, etc.

Grade Beam - Concrete foundation [wall] formed into a beam configuration [by pattern of reinforcement], which spans across isolated footings, piles, or caissons spaced at intervals; used where soil bearing pressure is inadequate for continuous support.

Grade of Wood - Designation given, after visual inspection, to indicate quality of manufactured lumber.

Gradient - Inclination or slope of a road, piping, ramp, ground level, etc.

Grain - In wood, the direction, size, arrangement, appearance, or quality of the longitudinal axes of wood fibers, or the figure formed by the fibers.

Granite - Fine to medium-coarse grained, Igneous rock with visible crystals of quartz and feldspar; dense, and water-resistant; can be used in thin panels, as stepping stones, or as thick pavers.

Granules - The mineral particles of a graded size which are embedded in the asphalt coating of shingles and roofing.

Gravel - Naturally rounded or mechanically crushed stones ranging in size from 1/4-inch to 1-1/2 inches; often used in sub-base, and surfacing for roads, paths, gardens, roofs, and as filler aggregate in concrete, or porous fills [for drainage] under slabs and around foundations; loose fragments of rock used for surfacing built-up roofs, in sizes varying from 1/8″ to 1 3/4″.

Gravel Stop - Metal [usually] strip or piece formed with a vertical lip used to retain the gravel on the roof surface around the edge of a built-up roof; can be enlarged to act as the fascia also.

Grid - (1) the assembly of main and cross tee members which form the support for a suspended ceiling; ceiling panels are fitted into or lay on the flanges of the tees; (2) Cross-pattern of centerlines of structural columns in a framing system, formed in both directions to define center points.

Grillage - System of steel beams set closely side-by -side, then crossed at 90 degrees by another set of beams. heavy support for large columns, located on top of footing.

Ground System - The connection of current-carrying neutral wire to the grounding terminal in the main switch which in turn is connected to a water pipe. The neutral wire is called the ground wire.

Ground-Faced Concrete Masonry Units [GFCMU] - Special concrete masonry units [CMU] made with variegated natural aggregates and with the faces ground to expose this aggregate; subsequently coated with an acrylic to accentuate the aggregate and seal the facing; ASTM units, generally produced in sizes same as other CMUs, plus special shapes as may be required for corners, coursing or special effects.

Grounds - Narrow strips of wood nailed to walls as guides for plastering, and as nailing base for interior trim; used around openings, at the floor line to strike off plaster, sub-jambs at interior doorways. They provide a level plaster line for installation of casing and other trim.

Grout or Grouting - (1) Mortar-like material made of such consistency [by adding water] that it will just flow into the joints and cavities of the masonry work and fill them solid; (2) material of non-shrinking, but plastic consistency used and placed as a spacer or shim to provide solid bearing [under column base plates for example]

Gun-Grade Sealant - A thickened liquid or mastic sealant material formulated in a degree of viscosity suitable for application by being extruded under pressure through the nozzle of a caulking gun.

Gunite - A spray applied, construction material composed of cement, sand or crushed slag and water mixed together and forced through piping and a spray nozzle/gun by pneumatic pressure onto metal mesh form work; used in the construction of swimming pools, artificial rock formations.

Gusset Plate - Plywood or metal plate used to overlay adjacent/intersecting members in a truss joint to connect and strengthen the joint; plate[s] is nailed, screwed, or bolted in place.

Gutter - (1) A U-shaped trough, along roof line of buildings, of metal or plastic to receive and carry off various types of drainage, including rain water; usually non-sanitary drainage; (2) flat areas out from street curb for drainage.

Gutter Strap - Metal bands used to support the gutter.

Guy Wire - A strong steel wire or cable strung from an anchor on the roof to any tall slender projection for the purpose of support.

Gypsum [Wall] Board - Sheet material having a gypsum core laminated between layers of heavy paper [exposed face is manila in color; the back [concealed] face is gray]; available in varying thickness, edge treatments, finishes [some pre-finished] and fire-ratings; overall usually 4'x8',10', or 12'; also called "drywall", "plaster-board", and "gyp board" [see each].

Gypsum backer board - Board specifically manufactured to be located behind finish gypsum board in multi-layer drywall installations; can be water/moisture resistant for backing of ceramic tile installations; also called, "W/R", "Backer", or "Green" board.

Gypsum Board ["Gyp" board] - See Drywall and/or gypsum wall board.

Gypsum Keene Cement - Material used to obtain a smooth finish coat of plaster, for use over gypsum plastic base coats only and in areas not subject to moisture. It is the hardest plaster.

Gypsum plaster - Powered gypsum material combined with water and other ingredients to form a creamy applied coating that dries to a hard finish, i.e., plaster; can be applied in two, three or veneer coat systems; called "wet wall" as opposed to the drywall designation for panelized gypsum.

H

Hanger - Wire, rod or bar [or other shape required for loading] suspended from roof or other structural members used to support and carry piping, balconies, ru ways, etc.; stirrup-like drop support attached to wall to carry ends of beam; wire is used to hang a suspended ceiling grid system.

Hardware - A wide variety of items, in both rough and finished form, which provide various functions such as attachment, operation, etc. for doors and other features; also, can be applied to some accessories. see Rough Hardware, and Finish Hardware for further distinction.

Hardwood - Wood cut from broad-leaved trees, or trees that lose their leaves annually; examples include oak, maple, walnut, and birch; utilized in a number of construction and architectural items, primarily as finish carpentry.

Hatch - An opening in a deck; floor or roof. The usual purpose is to provide access from inside the building.

H-Beam - Another less-used name or designation for steel beam shapes; most often refers to an I-beam used as a column- "H-Column"; See I-Beam, and Wide-Flange.

H-clips - Small metal devices in shape of "H" that fit between edges of plywood panels to stiffen the joints; used primarily on roof decking.

H-column - Term commonly applied to columns which are steel I- or Wide Flange sections.

Head - 1) The top of a frame at a door, window or other opening; 2) also, a standing depth of water which exerts downward pressure.

Header - 1) Framing members over windows, doors, or other openings;.2) Doubled members installed perpendicular to trimmer joists on each end of openings for stairs, chimneys, or other features for attachment of joists cut short to allow the opening; also wood lintels; 3) A beam placed perpendicular to joists and to which joists are nailed in framing for chimney, stairway, or other opening; 4) A wood lintel; 5) in masonry, units laid on the large flat face with small end exposed.

Head Room - Vertical clear space in a doorway, or in the height between a stair tread and the ceiling overhead.

Hearth - The inner [actual floor of firebox] or outer floor of a fireplace, usually made of brick, tile, or stone; also, incombustible floor or covering extension in front of a fireplace.

Heartwood - The wood extending from the pith to the sapwood, the cells of which no longer participate in the life processes of the tree.

Heat Strengthened Glass - Flat or bent glass that has been heat-treated to a specific surface and/or edge compression range to meet the requirements of ASTM C 1048, kind HS. Heat-strengthened glass is approximately two times as strong as annealed glass of the same thickness when exposed to uniform static pressure loads. Heat-strengthened glass is not considered safety glass and will not completely dice as will fully tempered glass.

Heel Bead - Sealant applied at the base of a channel, after setting the light or panel and before the removable stop is installed, one of its purposes being to prevent leakage past the stop.

Hidden work - Work performed which cannot be viewed in full which completed; e.g., underpining, where back side cannot be viewed; risky work since final result is not viewable for evaluation.

High-Early Cement - Portland cement sold as Type III; sets up to its full strength faster than other types.

High-Strength [Tension] Bolts - Steel bolts designed to be tightened, with calibrated wrenches, to high tensile strength; used as a substitute for conventional rivets in steel frame construction.

Hip - The external angle formed by the meeting of two sloping sides of a roof.

Hip Rafter - A rafter that forms the intersection of an external roof angle.

Hip Roof - A roof that rises by inclined planes from all four sides of a building.

Hoistway - A vertical shaft or access way for the travel of one or more elevators.

Hollow Core Door - Door consisting of two wood veneer panels separated by a light weight core [grid, paper egg-crate, strips] installed to reinforce and stabilize the faces; solid wood framing members for stiles and rails.

Hollow Metal - Refers to doors and door frames fabricated from light-gauge carbon steel of various types. Similar work fabricated from stainless steel and other material usually identified by the material involved.

Honeycomb - (1) Areas in a foundation wall where the aggregate [gravel] is visible – Rough condition in concrete where voids are created in the surface and to some depth of the member; gravel is exposed and appears like "popcorn"; indicates poor mixing and consolidation of the concrete-- a dry, stiff mix with inadequate water. Honeycombing can usually be remedied by applying a thin layer of grout or other cement product over the affected area. (2) Method by which concrete is poured and not puddled or vibrated, allowing the edges to have voids or holes after the forms are removed.

Hopper Window - Window with sash hinged or pivoted at the sill, and opens by tilting the top of the sash inward.

Horizontal masonry reinforcing - Long lengths of ladder- or truss-like configuration of heavy wires, laid in masonry joints, and extending from face to face of wall [slightly recessed from faces]; ties multi-wythe walls together so they act in unison..

Hose Bibb - A water faucet made for the threaded attachment of a hose; exterior bibbs should be frostproof.

House Wrap - A tough fabric-like material that lets moisture to pass through, but stops air from passing; installed To encase the entire building, from sill to eave under the siding or facing; for energy efficiency.

Hurricane clip - Metal strap devices nailed to roof rafters and trusses, tying them to the top plate of the wall framing; also similar devices used to connect wall sill framing to foundations.

HVAC - Acronym for Heating Ventilation and Air Conditioning.

Hydraulic Elevator - An elevator where liquid is pumped under pressure directly into a cylinder by a pump driven by an electric motor without an accumulator between the pump and cylinder; piston in cylinder raises and lowers elevator car.

I

I-Beam - Rolled structural steel sections, of various sizes, with a cross section resembling the letter "I". [often called "H-beam" when used as a column It is used for various spans as support for smaller joists or over wide wall openings, such as a double garage door, when wall and roof loads are imposed on the opening; usually higher than it is wide; can be made of wood in similar profile; used for larger spans across openings, etc.

IBC- International Building Code - Code, with companion documents, first published in 2000; intention is for it to replace the three model codes used, but no longer promulgated in the U.S.; compilation of the model codes and fashioned so it is usable worldwide.

ICC- International Code Council - Organization for promulgation of the IBC, its distribution, revision and marketing worldwide; formed by and has three U.S. model code organizations as its major component/members.

I-joist - Wood framing members [joists and rafters] formed with solid vertical webs [plywood] inserted into top and bottom members of dimensioned lumber; lighter and cheaper than solid wood members.

Improvements - Improvements can be in the form of new construction or remodel work; alterations and additions to property which tend to increase value; buildings, utilities, streets, etc. in wood, glass, masonry, plaster, drywall, tile, brick, concrete, metal and other materials, and various types and configurations of construction.

Incombustible material - Material of various formulations which will not ignite or actively support combustion in a surrounding temperature of 1200 degrees F, during exposure of 5 minutes; will not melt when temperature is maintained at 900 degrees F for at least 5 minutes.

Incompatibility - Descriptive of two or more materials which are not suitable to be used together.

Indicated - Term refers to graphic representations, notes, or schedules on the drawings, or to paragraphs and schedules in the specifications; used to help locate references and information in manner similar to "shown", "noted", "scheduled", and "specified".

Infiltration - The process by which air leaks into a building. In either case, heat loss results. To find the infiltration heating load factor [HLF], the formula to account for the extra BTU's needed to heat the infiltrated air is.

Inner Ply - Material or core located between two layers of material [such as roofing felts] that have been laminated together.

INR - [Impact Noise Rating]. A single figure rating which provides an estimate of the impact sound insulating performance of a floor-ceiling assembly.

Insert - Devices, made of jute fibers compressed into a tubular form, lead, plastic; many sizes, lengths, etc., which are embedded in or surrounded by other material, concrete for example; exposed face creates an opening or anchorage for bolts, fasteners, other anchors, etc. which are then firmly held in place by the surrounding material.

Inside Drain - In roofing, a drain positioned on a roof at some location other than the perimeter. It drains surface water inside the building through closed pipes to a drainage system.

Inspection - (1) The act of inspecting [viewing, observing, or monitoring in a critical manner]. (2) An official examination or review of the work completed or in progress to determine its compliance with contract requirements.

Install - On site operations of "unloading, unpacking, assembling, erection, placing, locating, anchoring, applying, working to dimension, connecting, testing, finishing, curing, protecting, cleaning" and similar activities for proper and complete use/operation of area, equipment, appliance, surface, or item.

Insulating Board - Material, in rigid board form of various sizes and thickness, for insulating purposes; usually manufactured from vegetable fibers, or synthetic chemicals, and pressed or caused to "foam" into finished profile.

Insulating Concrete - Concrete with vermiculite added to produce lightweight concrete, with insulating properties, used for subfloor and roof fills.

Insulating Glass Unit – Two or more lights of glass separated by air spaces [for insulation purposes] and hermetically sealed to form a single-framed unit with an air space between each light.

Insulation - (1) A variety of materials designed and manufactured for protection from heat or cold, protection against fire, or reduction of sound transmission; usually paper, composition board, fiberglass, mineral/wood fiber wools, foam products are good insulators [poor conductors]; produced as pliable batts and blankets, rigid boards, or loose particles; any material which slows down or retards the flow or transfer of heat. Building insulation types are classified according to form as loose fill, flexible, rigid, reflective, and foamed-in-place. All types are rated according to their ability to resist heat flow [R-Value]. (2) In electrical contracting, rubber, thermoplastic, or asbestos wire covering. The thickness of insulation varies with wire size and type of material, application or other code limitations.

Insulation Board - A rigid structural building board made of coarse wood or cane fiber in ½- and 25/32-inch thickness It can be obtained in various size sheets, in various densities, and with several treatments.

Insulation Fasteners - Any of several specialized mechanical fasteners designed to hold insulation down to a steel or a nailable deck.

Interior – Within or "inside" of structure or building; direct opposite of "exterior" [see]; internal, confined and enclosed space within the exterior walls of the building; occupiable space usually with conditioned air source and artificial lighting.

Interior Finish - Term applied to the total effect produced by the inside finishing of a building; includes not only the material used, but the fashion of their installation and decoration; term used to represent the visible elements, materials and applications applied to cover the interior framed areas, or materials of walls and ceilings.

Interior Glazed - Glazing units or panels set in place from the interior of the building.

Interior Trim - General term for all finish moldings, casings, baseboards, cornices and other applied running and isolated trim pieces inside a building; installed by finish carpenters for fine fitting, finishing and decorative expression.

Interlayer - In glazing, any material used to bond two lights of glass and/or plastic together to form a laminate.

Intumescent Coating - Paint, mastic, or fireproofing substance that expands, when heated, to form a stable, foam-like, insulating char, when exposed to fire; and acts as an insulating agent [against the fire] for surfaces to which it is applied.

Isolated footing - Structural footing which stands alone in open area; primarily a footing for a column.

J

Jack rafter - Rafters cut to fit between the outside wall and a hip rafter, or the ridge and a valley rafter; rafter that spans the distance from the wall plate to a hip, or from a valley to a ridge. - A rafter that spans the distance from the wall plate to a hip, or from a valley to a ridge.

Jalousie - Type of window consisting of a number of long, narrow horizontally hinged glass panels, which operate in unison- out-swinging; can be used in doors, or a isolated window units.

Jamb - Sides of an opening; frame or lining mounted on the sides of a rough opening for installation of a door or window; also, sides members of windows, doors, or openings.

J-Channel/Bead/Mold - Metal trim piece, with unequal legs, applied to exposed edge [cut or uncut] of gypsum wallboard to provide a better finished edge appearance.

Joinery - General woodworking term used to describe creation of the joints where members/units are connected together, better execution of joints for better quality wood-joint construction; carefully done.

Joint - Line, point, or position where two items meet, adjoin, or intersect each other; in masonry, the layer of mortar between the horizontal courses of units [tooled to raked, flush, weeping, concave, tooled, "V", etc. shape]; The interfacing space between the adjacent surfaces of two members or components joined and held together by nails, glue, cement, mortar, or other means.

Joint compound - Pre-mixed gypsum-based material with the consistency of thick slurry used to fill the seams, and fastener depressions in drywall construction; also called "mud".

Joint filler material - Various material [asphalt impregnated felt, foam plastics, expandables, bellows, metal, synthetics] which are installed to fill the joints, and maintain closure during the flexing movement of the joint; to exclude air, water, fire, etc.

Joist - One of a series of parallel smaller framing members, usually 2 inches in thickness [wood], used to support floor and ceiling loads, and supported in turn by larger beams, girders, or bearing walls; also applicable to steel and concrete framing.

Joist hanger - One of a variety of metal framing anchors/devices shaped like a "U" used to connect two joists or joist and beam at right or other angles, to each other.

Junior Beam - Lightweight rolled structural steel sections similar to but smaller than an I-beam; used for short spans and light loads, bracing, etc.

K

Keene's Cement - A white finish plaster that produces a very hard, and extremely durable, moisture resistant wall surface; Because of its density, it excels for use in bathrooms and kitchens and is also used extensively for the finish coat in auditoriums, public buildings, and other places where walls may be subjected to unusually high trafic,hard wear or abuse; see veneer plaster and gypsum backing board.

Keeper - Metal plate set into doorframe, which retains the latch bolt of the door; holds door in closed position.

Kerf - Void created by the width of a saw blade as it cuts into wood surface, forming a groove or slot.

Key[way] - 1) Slot or deep groove formed in the top of concrete footings or other members, to receive concrete from adjoining members when placed; e.g., foundation wall concrete will fill slot; 2) hardware device for unlocking a lock and the slot into which the key is placed for its function.

Kicker - Diagonal brace, in concrete formwork for example, used to prevent side of form from springing out of alignment.

Kick Hole - A defect frequently found in perimeter flashings arising from being stepped on or kicked. A small fracture of the base flashing in the area of the cant.

Kick Plate - Brass, stainless steel, or plastic laminate plate fastened to the lower portion of a door to protect it from damage.

Kiln Dried Lumber - Artificially [oven] dried lumber; a method that produces lumber, because of the controlled conditions, superior to the more common air-dried product; lumber dried in this manner has a moisture content of 6 to 12 percent. Common varieties of softwood lumber, such as framing lumber are dried to a somewhat higher moisture content.

Kip [K] - A unit of measure equal to 1,000 pounds; used to simplify structural calculations; e.g., a 9,000 pound load is said to be "9 kips" in magnitude.

Kneehold - Open area in cabinet or casework which allows person to sit at countertop with legs/knees in the recess under the top.

Kneewall - Short [usually 48" high] and often non-bearing; wall that extends from floor of an attic to the underside of the rafters.

Knife-Grade - Compound formulated in a degree of firmness suitable for application with a putty knife such as used for face glazing and other sealant applications.

Knocked-down [KD] - Unassembled construction unit requiring assembly after delivery to the job site.

Knot - Natural defect in lumber, where a branch or limb of a tree was located, that appears on the edge or face of the piece; weakens lumber [depending on size and location of knot]; should be located on top in framing members, and are prohibited in scaffolding planks.

Knurled - Having a surface texture of with striations or a grid of small knobs, or beads, as a nail which may have a surface for greater holding power; also texture on metal to allow better gripping as in door hardware for elderly or handicapped persons.

Kraft Paper - Strong, heavy, water-resistant, brown paper made of sulfate pulp, used for protection of surfaces, such as finished floors, and also in composition materials [egg-crate grid in door cores. for example].

Kynar Coating - Architectural coating that is UV stable and suitable for exterior use on aluminum and other metal surfaces.

L

Lag Screw - Large diameter wood screw with hexagonal or square head for turning/tightening with a wrench.

Lally Column - A steel pipe column, with or without concrete/sand fill; used for loads up to moderate sizes, including residential floor loads.

Laminate - (1) To form a product by bonding together two or more layers of materials. (2) Also, the product so formed, such as plastic laminate [brand name example is Formica].

Laminated Glass - Two or more lights of glass permanently bonded together with one or more inter-layers.

Laminated Wood - Beams, arches, and other members formed by pressure gluing multiple thin layers or strips [laminations] together to form the shapes and size desired/required; substitute for solid wood members due to limited availability of same [see Glue-Laminated].

Landing - A platform, usually level, between flights of stairs, at changes in stair direction, or at the termination of a flight of stairs; also applicable to ramps; required to be placed on each side of door by building code.

Lap - To extend one material partially over another; the distance so extended.

Latch [bolt] - Spring-loaded metal cylinder/bar which moves horizontally and extends beyond the edge of a door; retracts and then engages the keeper for positive closure.

Lateral Bracing - Diagonal or other bracing in structural systems to counteract wind pressures, other loads, and to stabilize the framing overall.

Latex Caulk - A low-range sealant formulated of synthetic latex material; used on interior primarily; paintable.

Lath - A building material of wood, metal, gypsum, or insulating board that is secured to the framing on which plaster is applied; can be gypsum lath [solid or perforated], or metal lath, each providing a mechanical or chemical bond for the plaster.

Lattice - Framework of crossed wood or metal slats; lightweight, usually, but can be heavy where used as bracing in structures.

Lead - 1) A malleable metal once extensively used for flashings; 2) Professionally, the discipline head for a project work effort [e.g., Lead architect].

Leader - Vertical pipe--[see downspout -- that carriers rain water drainage from roof gutter to ground or storm sewer.

Lean-To Roof - The sloping roof of a building addition having its rafters or supports pitched against and supported by the adjoining wall of a building.

Ledger strip - A strip of lumber nailed along the bottom of the side of a beam or girder on which other supporting members [joists, for example] rest.

Let-in Brace - Nominal 1 inch-thick boards fitted into notched studs diagonally, so face of brace and studs are in same plane.

Level - 1) on a perfectly flat, horizontal line or plane; 2) tool used by workers to determine such level plane or line; 3) surveyor's instrument, similar to or a function of a transit, for establishing grade elevations; 4) term often used in place of floor, as in "4th Level".

Leveling Rod - A rod with graduated marks for measuring heights or vertical distances between given points and the line of sight of a leveling instrument, held by a survey crew member in a vertical position; usually made with telescoping sections for extreme height perhaps to 20 feet; also called a "Philadelphia Rod".

Lift Slab - System of construction where the various floor slabs are poured at ground level, and then subsequently lifted into proper position by hydraulic jacks, working simultaneously at each column; cast-in, steel collars are welded to steel columns to hold slabs in place.

Light - A single pane of glass or space in a window sash for a single pane of glass.

Light Steel Framing [LSF] - Construction method utilizing light gauge (20-25 gauge] sheet steel members for the framing of a structure; also called cold-formed metal [steel] framing.

"Like new" - Term applied to remedial work of modification or repair of existing work; replacement not required but care is required to make condition as noted.

Limestone - A fine to coarse-grained sedimentary rock; often used as ashlar or flagstone because it splits easily, limestone also serves as the preferred rock for constructing rock gardens; also good material for fashioning "cut stone" trim, such as copings, sills, etc.

Linear feet - Measure of length expressed in feet.

Linear measure - Measurement along a straight line.

Lintel - A horizontal structural member [wood, steel, concrete, stone, etc.] placed horizontally across the top of an opening [door, window, etc.], to support the wall above.

Liquid-Applied Membrane - Generally applied to cast-in-place concrete surfaces in one or more coats to provide fully-adhered waterproof membranes which conform to all contours.

Lite - see Light

Live Load - Loads produced by use and occupancy of the building or other structure and do not include construction or environmental loads such as wind load, snow load, ice load, rain load, seismic load, or dead load; includes all furniture, persons, and other movable loads not included as a permanent part of the structure.

Load - Weight imposed on buildings and structures by various elements, both natural and manmade; weight that must be properly and adequately supported by the building frame to prevent collapse or other failure.

Load-bearing Wall - Wall designed to support the weight [load] imposed on it from walls and structural members.

Loader - Self-propelled, wheeled or tracked, possibly articulated machine with "bucket" attachment for engaging and lifting loads, such as earth, or gravel; as opposed to the "pushing" action of the bulldozer.

Lockset - Complete complement of door hardware including the lock, knobs, trim, screws, and strike plates; also, "latchset" which is the same but with no locking function.

Lookout - Framing extension, bracket or cantilever member which supports the overhead portion of a roof; also provides backing for soffit material; usually cocealed from view.

Loose Laid - In roofing, a membrane "laid loosely", without being adhered or otherwise fastened to the roof deck; system held in place by heavy ballast material; minimizes fastener holes in roofing system.

Lot - A parcel of land with boundaries determined by the county [or other local jurisdiction; part of the metes and bounds, and other land identification systems.

Louver - Unit with slanted slats of wood, plastic, or metal, used to permit air circulation [ventilation] but to exclude rain, and direct sunlight, or vision. See also Attic ventilators.

Lumber - The product of the sawmill and planing mill not further manufactured other than by sawing, re-sawing, and passing lengthwise through a standard planing machine, crosscutting to length, and matching and grading. 1" stock is sawed to 1" thickness then finished [planed] to final size of 3/4", 5/4" stock finishes out to 1" thickness, and 2"x stock finishes out to 1 1/2"; also referred to as "dimensioned lumber".

M

Mansard Roof - A roof style of steeply sloped sides sloping upward by inclined planes from all four sides of a building down from a flat top sections across the majority of the building area;. The sloping roofs on all four sides have two pitches, the lower pitch usually very steep and the upper pitch less steep; sides usually overhand walls below. Italian origin, popularized in France.

Mantel - The shelf mounted on a chimney, above a fireplace. Also used in referring to the decorative trim around a fireplace opening.

Manufactured Housing/Homes - Updated term for housing units totally factory-fabricated, with some portions unitized; built on a transportable chassis, which is not removable; should be equated to, and is another name for trailer-like construction [see mobile housing]; not controlled by local building codes and regulations [compare to Modular Home].

Manufactured Wood - Wood products such as a truss, beam, glu-lam, micro-lam or joist which is manufactured out of smaller wood pieces and glued or mechanically fastened to form a larger piece. Often used to create a stronger member which may use less wood. See also Oriented Strand Board.

Manufacturer - Organization, company, or person who designs, invents, formulates, makes or otherwise produces various products, including those for construction purposes, which are then provided to project via distributors, vendors, or suppliers.

Manufacturer's Instruction - The written installation and/or maintenance instructions which are developed by the manufacturer of a product and which provide useful information about product, its handling and installation; very important for proper use and installation and may have to be followed in order to maintain the product warrantee; often used to supplement and substitute for extensive specifications text.

Marble - A fine-grained metamorphic rock that is strong and weather-resistant; more often used in indoor than outdoor paving and walls because of its cost and its slipperiness when wet; grain can vary greatly in intensity as well as in a variety of colors, depending on the source.

Mason - A construction professional who builds masonry work using brick, stone, or concrete units.

Masonry - General term applied to construction formed with stone, brick, concrete, hollow-tile, concrete block, gypsum block, or other similar building units or materials or a combination of the same, bonded together with mortar to form a wall, pier, buttress, or similar mass; sometimes called "unit masonry".

Masonry Cement - Factory-blended mixture of Portland cement and admixtures specially designed to increase the workability of mortar; usually better than site mixing, due to control available at plant.

Masonry Unit - A brick, stone, concrete masonry unit, glass block, or hollow clay tile intended to be laid in courses and embedded in mortar.

Masonry Veneer - A single wythe, non-load bearing facing installed over a structural frame, e.g., brick veneer applied to a wood frame house.

Mastic - A pasty material used as a cement [as for setting tile] or a protective coating [as for thermal insulation or waterproofing]; Heavy-consistency compound that may remain adhesive and pliable with age. Is typically an adhesive or other coating material used for attachment, dampproofing, etc.

Matched Lumber - Lumber that is dressed and shaped on one edge in a grooved pattern and on the other in a tongued pattern.

Medium Dense Overlay - Plywood product with special paper facing laminated to panel; excellent weather-resistance for signs, etc.; readily paintable; called "MDO".

Meeting Attendance Form - A form consisting of three columns [individuals name, individuals title, and company the individual represents]. This form is given to all persons attending any meeting. Each person attending the meeting will fill in their respective information. The date of the meeting should be included for reference.

Member - Individual element of structure such as a beam, girder, column, joist, piece of decking, stud, truss chord, brace, etc.

Membrane - 1) Sheet or mastic material which is impervious to water or water vapor. 2) A generic term relating to a variety of sheet goods used for certain built-up roofing repairs and application.

Membrane roof - Roof covering consisting of a heavy, single ply of waterproof sheeting; usually a rubberized or other synthetic material such as EPDM, APP or PVC; alternative to multi-ply built-up roofing.

Metal Edge - Brake metal or metal extrusions which are secured at the perimeter of the roof to form a weather-tight seal.

Metal Lath - Expanded steel mesh created by slitting sheet steel and pulling it out until it forms a grid; used primarily for and provides an excellent plaster base due to mechanical "keying" of plaster around mesh wires.

Metal Wall Ties - Strips of corrugated sheet metal, usually galvanized, used to anchor [tie] brick veneer construction to the structural frame behind.

Micro-lam - Manufactured structural wood members, made using layers of 1-1/2" material laminated together; usually have higher strength than sawn lumber.

Mil - Unit of measure [thickness] for very thin sheets, and for paint and coatings thickness; one thousandth part of an inch (1 mil = .001 inch, 1/1000].

Mil Thickness - Measurement, in mils, used to determine Dry Film Thickness of paint or coating; also, used for other thin materials to indicate thickness.

Millwork - General term for interior woodwork and trim, made of finished wood which is machined to profile, size and finish; manufactured in millwork plants and planning mills; It includes such items as inside and outside doors, window and doorframes, blinds, porch work, mantels, paneling, stairways, moldings, and interior trim. It normally does not include flooring, ceiling, or siding material; part of finished carpentry work, as opposed to rough carpentry [framing].

Mineral Spirits - A by-product of petroleum, clear in color, a solvent for asphalt coatings.

Mineral Wool - Type of batt insulation consisting of many fine threads of a wood by-product; also used for fireproofing and acoustical treatment; some types are called "safing" insulation.

Miter Joint - The joint of two pieces at an angle that bisects the joining angle. For example, the miter joint at the side and head casing at a door opening is made at a 45° angle.

Mobile Home - Outdated term [now called Manufactured Home] for trailer-like unit, totally factory built on a transportable but permanent chassis.

Modular home - A factory-built, transportable building unit designed to be used by itself or with other, similar units, and site installed on a permanent foundation; produced complete with structural floor system; built with standard-size materials, and complete modules [kitchens/ baths]; similar to manufactured housing, but requires some site construction; controlled by state regulations, and/or local building codes.

Moisture Barrier - Material, plastic or specially treated paper, that retards the passage of moisture or vapor into walls, and prevents condensation; see Vapor Barrier [Retarder].

Moisture Content of Wood - Weight of the water contained in the wood, usually expressed as a percentage of the weight of the oven dried wood.

Molding - Single strip/piece, or series of pieces of material cut, shaped, and finished with a distinctive profile, to serve as an ornament; can be made of various material – wood, stone, fiberglass, plaster, etc.; used for decorative purposes, e.g., door and window trim.

Monitor - A large structure rising above the surrounding roof planes, designed to give light and/or ventilation to the building interior.

Monolithic - Term used for concrete and other materials placed, or installed without joints; as one-piece, or a unit.

Mopping - In roofing, a layer of hot bitumen mopped between plies of roofing felt. Full mopping is the application of bitumen by mopping in such a manner that the surface being mopped is entirely coated with a reasonably uniform coating. Spot Mopping is the procedure of applying hot bitumen in a random fashion of small daubs, as compared to full mopping. Sprinkle mopping is a special application of installing insulation to the decks. It is done by dipping a roof mop into hot bitumen and sprinkling the material onto the deck. Strip Mopping is the application of bitumen in parallel bands.

Mortar - A mixture of masonry cement, sand and water, used by masons as the bonding agent between masonry units; the "joint material" in masonry.

Mortar Types - Type M is suitable for general use and is recommended specifically for masonry below grade and in contact with earth, such as foundations, retaining walls and walks. Type M is the strongest type. Type S is suitable for general use and is recommended where high resistance to lateral forces is required. Type N is suitable for general use in exposed masonry above grade and is recommended specifically for exterior walls subject to severe exposures. Type 0 is recommended for load-bearing walls of solid units where the compressive stresses do not exceed 100 lbs. per square inch and the masonry wall not be subjected to freezing and thawing in the presence of excessive moisture.

Mortise - 1) Recess fashioned in wood or metal to receive a recessed device; commonly used in finish door hardware installation, to reduce surface mounting of devices. 2) A slot cut into a board, plank, or timber, usually edgewise, to receive tenon of another board, plank, or timber to form a joint.

Mosaic - Small colored tile, glass, stone or similar material, regular or irregular in shape but arranged to produce a decorative surface; used on walls or floors.

Mud Sill - Bottom-most horizontal member of an exterior wall frame; rests on top of foundation; commonly called "sill plate".

Mullion - A vertical separating member, bar or divider in the frame between windows/doors units or other openings that supports and holds several such in a single frame, as in sections of a curtain wall.

Muntins - Small horizontal or vertical bars that divide the sash frame into smaller areas to receive an individual light of glass; can be made as a grid set in the sash frame; Muntins are smaller in dimensions and weight than mullions.

N

Nail-base Sheathing - Sheathing material, such as wood boards, panels, or plywood to which siding can be attached by nailing; such nailing is not provided by fiberboard, or plastic foam materials used as sheathing [primarily for better insulation].

Nailer - Wood member, shaped to fit, in any of several places used to provide a nailing base for other members or materials; for example, member secured to non-nailable decks and walls by bolts or other means, which provides a suitable backing onto which roof components may be mechanically fastened; called "blocking" in some locations.

Natural Finish - Transparent finish on wood using sealers, oils, varnishes and preservatives; grain of wood is still exposed, and is often enhance by the coating; finish which does not seriously alter the original color or grain of the natural wood. Natural finishes are usually provided by sealers, oils, varnishes, water-repellent preservatives, and other similar materials.

Neat Plaster - A base coat plaster which does not contain aggregates and is used where the addition of aggregates on the job is desired.

NEC - National Electric Code; Standard No. 70 promulgated and published by the National Fire Protection Association [NFPA] and widely adopted and used as regulations for electrical work of all types; modified versions used for residential construction.

Needling - Series of steel or wood beams [called "needle beams"] threaded through a bearing wall to support it while its foundation is underpinned.

Neoprene - A synthetic rubber having physical properties closely resembling those of natural rubber. It is made by polymerizing chloroprenes, and the latter is produced from acetylene and hydrogen chloride.

New - Unused condition, fresh from manufacture, production, or fabrication [unless specifically noted otherwise] of all materials, devices, equipment, units and systems for projects; this meets owner's expectations and payment is based on this principle.

Newel [Post] - Large termination post at the end or turns in stair hand- and guard rails to which the end of a stair railing or balustrade is fastened; Also, any post to which a railing or balustrade is fastened.

Nominal Size - Size of material before final working and dressing; not the actual size; as a 2x4 [nominal] is 1-1/2″ x 3-1/2″ in actual size.

Nonbearing Partition/Wall - Term used for space dividing partitions or other walls, which carry no imposed floor or roof load; wall supporting no load other than its own weight.

Non-Drying [Non-Curing] – A sealant that does not set up or cure. See Butyl.

Non-Sag - A sealant formulation having a consistency that will permit application in vertical joints without appreciable sagging or slumping. A performance characteristic which allows the sealant to be installed in a sloped or vertical joint application without appreciable sagging or slumping.

Non-Skinning - Descriptive of a product that does not form a surface skin.

Non-Staining - Characteristic of a compound that will not stain a surface.

Nosing - 1) The projecting edge of a molding or drip. Usually applied to the projecting molding on the edge of a stair tread which projects over the riser; any similar projection. (2) A term applied to the rounded edge of a board.

Notch - 1) A three-sided slot, groove, or opening cut into a piece of material, usually along an edge. 2) A crosswise rabbet at the end of a board.

Nozzle - The tubular tip of a caulking gun through which the compound is extruded.

NRC - Noise Reduction Coefficient; term denoting noise reducing efficiency of individual acoustical materials.

NSPE - National Society of Professional Engineers; professional association for registered engineers; national organization with regional/local chapters, and separate groups for different types of engineers [i.e., mechanical or civil engineers].

O

O.C. - "On Center". A measurement term meaning the distance between the center of one member to the center of the next adjacent member; studs rafters, joists, and the like in a building placed at 16 inches O.C. will be laid out so that there is 16 inches from the center of one to the center of the next.

O. G. [or ogee] - A molding with a profile in the form of a letter S; having the outline of a reversed curve. - A molding with a profile in the form of a letter S; having the outline of a reversed curve.

Oil-Canning - The term describing distortion of thin-gauge metal panels which are fastened in a manner restricting normal thermal movement.

On-Center [O.C.] - Method of indicating spacing of framing members or other items; measurement is from center of one object to the center of each of those adjacent; for example, "studs shall be 16″ o.c.".

Open Web [Steel] Joist - Prefabricated, light steel truss-like member with a welded lattice-like web; closely spaced for moderate spans; also called "bar joist" or "steel lumber".

Open-grained wood - Common term for woods with large pores such as oak, ash, chestnut, and walnut. Often preferred for decorative reasons; can be filled before finish. Also known as "coarse textured."

Orientation - 1) direction in which a building or structure faces; 2) relationship to a direction or bench mark/line; 3) relating contact drawings to the actual structure.

Oriented-Strand Board [OSB] - Newer engineered board that has the long axis of the strands of the wood chips aligned with the long dimension of the materials [such as the 8 foot measurement in a 4x8 sheet of OSB]; bonded together with an adhesive matrix under pressure; previously old "chip board" was not structural while OSB is structural just like plywood.

Outcropping - Bare rock formations exposed and protruding from the surrounding soil.

Outrigger - An extension of a rafter beyond the wall line. Usually a smaller member nailed to a larger rafter to form a cornice or roof overhang.

Overhang - Area or portion of upper story, building part or roof at the eave which extends horizontally beyond the vertical plane of the exterior walls of a building.

Oxidize - To combine with oxygen in the air.

P

Pad - 1) Extra usually isolated concrete slab installed on top of a floor slab, as the mounting surface for mechanical or other equipment; adds some strength, but merely provides a better, slightly elevated surface for mounting the unit[s]; 2) landing area outside a door; 3) material installed under carpeting to add foot comfort, sound isolation, and to prolong carpet life [also called padding].

Paint - A combination of colored pigments with suitable binders, vehicle, thinners or oils to provide opaque, decorative, wearable, and protective coatings.

Panel - (1) A large, thin sheet of lumber, plywood, or other material. (2) A thin board with all its edges inserted in a groove of a surrounding frame of thick material. (3) A section of floor, wall, ceiling, or roof, usually prefabricated and of large size, handled as a single unit in the operations of assembly and erection. (4) a thin flat piece of wood, ply. wood, or similar material, framed by stiles and rails as in a door or fitted into grooves of thicker material with molded edges for decorative wall treatment.

Panel Door - Door constructed with thin panels installed between solid rails and stiles [perimeter frame].

Paneling - Thin sheet material of composite, synthetic or wood composition which is used as a lining or interior wall finish; can be nailed or glued into place over various sub-surfaces.

Parapet Wall - That portion of a wall that extends above the top of the roof; usually in exterior walls, or interior fire walls.

Parging/Parge Coat - 1) A thin coat of Portland cement plaster used to smooth masonry walls. 2) A thin application of plaster, drywall compound for coating a wall.

Parquet floor - A floor made of a series of small panels or blocks [9-12 inches square] of flooring made with short pieces of hardwood laid in different design patterns, as opposed to long strip flooring.

Particleboard - A sheet material composed of compressed wood chips, flakes, or small wood particles such as sawdust, held together with special glues; non-structural.

Parting Stop or Strip - A small wood piece used in the side and head jambs of double-hung windows to separate upper and lower sash.

Parting stop or strip - A small wood piece used in the side and head jambs of double-hung windows to separate upper and lower sash.

Partition [wall] - An interior, full or part-high wall that subdivides space for directing traffic, separating or screening spaces one from another but plays no part in a building's structural integrity; non-bearing wall.

Party wall - Single wall common to two properties/ buildings owned by different owners; also common walls between row houses; straddles property line which separates two properties.

Patio - Paved, open area outside a house; also called a terrace, and can be a structure such as a deck.

Patterned Glass - On type of rolled glass having a pattern impressed on one or both sides. Used extensively for light control, bath enclosures and decorative glazing. Sometimes call "rolled," "figured" or "obscure" glass.

Pavers - Clay masonry [brick] made specifically for finish floor surfaces, walks, drives, and terraces, etc.' must be frostproof and serviceable for heavy traffic; also, pre-cast concrete slabs used to create a traffic surface.

Paving - Asphaltic/bituminous material [or composites], or concrete installed as ground surfacing/cover, or as a hardstand for vehicle access or parking; usually asphaltic concrete [blacktop] or cast-in-place concrete over a compacted gravel fill; can be light-duty or heavy duty depending on traffic requirements and construction.

Pea gravel - A fine grade of naturally rounded stones approximately 1/4 inch in diameter; used frequently as the porous fill under floor and other slabs; used in gravel gardens, as flooring for children's play areas, as top finish in exposed aggregate sidewalks/slabs.

Penny - As applied to nails, it originally indicated the price per hundred. The term now series as a measure of nail length and is abbreviated by the letter d.

Penthouse - [not the magazine!] A relatively small structure/enclosure, usually roof mounted, to enclose mechanical and/or elevator equipment, without taking up valuable interior floor space.

Perimeter drain - Continuous line of 3" or 4" perforated plastic pipe or field tile that goes around the perimeter [either inside or outside]of foundation wall to drain off ground water or seepage; drains to open area, or basin/drain and may require a sump pump for draining.

Perlite - An aggregate formed by heating and expanding siliceous volcanic glass.

Perm - A measure of water vapor movement through a material [grains per square foot per hour per inch of mercury difference in vapor pressure].

Permanent Set - The amount by which a material fails to return to its original dimensions after being deformed by an applied force or load.

Permeability- A measure of the ease with which water penetrates a material.

Phased Construction - A unitized approach to constructing a facility by designing and constructing separate project elements. Each element is a complete project in itself.

Pier - Vertical structural member, usually rectangular in horizontal cross section, usually of concrete or masonry; used to support other structural members; also, short foundation columns, between window/door openings, and mass masonry supports such as for bridges, gates and girders.

Pigment - A powdered solid substance which when finely ground gives color, as in paint, enamel, dye, or lacquer.

Pilaster - Rectangular pier engaged in a wall, for the purpose of strengthening it; also can be decorative, or act as a beam support [expanded bearing area at the wall].

Pile [Piling] - Long concrete, wood or steel member driven into the ground to act as a below-grade column to support the building; used to carry building load to sufficient bearing soil.

Pitch - (a) The incline slope of a roof or the ratio of the total rise to the total width of a house, i.e., an 8-foot rise and 24-foot width is a one-third pitch roof. Roof slope is expressed in the inches of rise per foot of run. (b) A term frequently used to designate coal tar pitch.

Pitch Pocket - An opening extending parallel to the annual rings of growth, that usually contains, or has contained, either solid or liquid pitch.

Pith - The small, soft core at the original center of a tree around which wood formation takes place.

Place[ing] [concrete] - More appropriate term for locating concrete in a project; as opposed to "pour[ing]"; see Pour.

Plan - (1) A line drawing [by floor] representing the horizontal geometrical section of the walls of a building. The section [a horizontal plane] is taken at an elevation to include the relative positions of the walls, partitions, windows, doors, chimneys, columns, pilasters, etc. (2) A plan can be thought of as cutting a horizontal section through a building at an eye level elevation.

Plank - 1) A wide board, usually more than 1" thick; especially, one laid with its wide dimension horizontal and used as a bearing surface; 2) flooring section which is wider than regular strip flooring.

Plans - A term used to represent all drawings including sections and details; and any supplemental drawings for complete execution of a specific project. These graphic representations show the location, geometry, and dimensions of a project or its elements in sufficient detail to facilitate construction; See Blue Prints.

Plaster - A cementitious material, usually mixture of lime, sand, and water, applied to gypsum or metal lath or masonry surfaces; formed of a gypsum or Portland cement mixture; applied in paste form, which hardens into a hard smooth surface [or other finish desired]; used for outside and inside wall surfaces [often called "wet wall" as opposed to "drywall"].

Plaster Grounds - Strips of wood used as guides or strike off edges around window and door openings.

"Plastic" concrete - Concrete that has not set or hardened, and can still be worked, moved, shaped; phrase has nothing to do with content of concrete.

Plastic Laminate - Composite material made from compressing Kraft paper into phenolic resin layers to form a decorative material; usually has a melamine exposed [decorated] surface; used for covering doors, countertops, wall paneling, cabinets, etc.

Plat - 1) Drawing or plat of a parcel or parcels of land based on and giving its legal description, and other survey data indicating the block numbers; the location, boundary lines, dimensions and number of each lot; and the location and names of the existing and planned streets.; 2) may be filed as an official record of the land via map of a geographical area as recorded by the county.

Plate - Horizontal members at top [doubled] and bottom of stud walls [sole plate]; also, refers to bearing, top and base plates for structural steel members; examples – Sill plate: a horizontal member anchored to a masonry wall. Sole plate: bottom horizontal member of a frame wall. Top plate: top horizontal member of a frame wall supporting ceiling joists, rafters, or other members.

Plate Glass - Glass of high optical quality produced by grinding and polishing both faces of the glass sheet; glass with parallel faces and minimal distortion.

Plate Line - The top horizontal line of a building wall upon which the roof rests.

Platform Framing [Construction] - System of light-wood framing where floor joists of each story rest on the top plates of the story below but framed independently [upper story rests on flooring decking applied to top of first floor ceiling joists], or on the foundation sill for the first story, and the bearing walls and partitions rest on the subfloor of each story. [Usually one story constitutes a platform.]; also, called "western framing"; See and contrast with Balloon Framing.

Plenum - [or Plenum Chamber] Chamber or container for moving air under a slight positive pressure to which one or more ducts are connected.

Plot - Lot, parcel, or other piece of land [real estate] with specific dimensions; potential building/construction site.

Plot Plan - An overhead, "bird's eye" view showing how a building sits on the building lot, typically showing setbacks [how far the building must sit from the road], easements, rights of way, and drainage; See Site Plan, and Survey.

Plough/Plow - To cut a groove, lengthwise, in a board or plank.

Plumb - Exactly perpendicular; vertical; straight up and down; a plumb line is created when a weight ["plumb bob"] is tied on a cord and held vertically.

Ply - A term to denote a single layer in a built up material or system; e.g. one layer of roofing in a built-up system, 1 layer of wood veneer in a built-up plywood panel, or in any finished piece of such material.

Plywood - Engineered wood panel, of many varieties and types, composed of a number of thin veneers bonded together, glued under pressure; Adjoining plies are usually laid with grains at right angles to each other, and almost always an odd number of plies are used; normally 4 feet wide by 8 feet although longer lengths are available; has various face finishes and can be used as a finish or rough material.

Poché - The infill color, pattern or material symbol within walls in architectural working drawings. [see cross-hatching].

Pocket [Channel] - A three-sided, U-shaped opening in a sash or frame to receive glazing infill. Contrasted to a rabbet, which is a two-sided, L-shaped sections as with face glazed window sash.

Pointing - The process where joints between masonry units, brick, etc., are filled with mortar.

Polished Wired Glass - Wired glass that has been ground and polished on both surfaces.

Polybutylene pipe - A modern type of flexible plastic pipe used for the distribution of potable water in a building.

Polymer - A substance consisting of large molecules which have been formed from smaller molecules of similar make-up.

Polysulfide Sealant - Polysulfide liquid polymer sealant which is mercaptan terminated, long chain aliphatic polymers containing disulfide linkages. They can be converted to rubbers at room temperature without shrinkage upon addition of a curing agent.

Polyurethane finish - A clear finish used for coating stained wood to provide it with protection and shine. It is durable and highly resistant to water.

Polyurethane Sealant - An organic compound formed by reaction of a glycol with and polyisocyanurate.

Polyvinyl Chloride [PVC] - Polymer formed by polymerization of vinyl chloride monomer. Sometimes called vinyl. Polyvinyl Chloride [PVC] A type of plastic formulation. Thin, flexible sheets of PVC plastic are used for vapor barriers, pond liners. Rigid PVC plastic pipe is used for plumbing, storm drainage, and water supply lines.

Ponding - A condition where water stands on a roof for prolonged periods due to poor drainage and/or deflection of the deck.

Pop Rivets - Fasteners used to join pieces of metal that are installed by either compressed- air-assisted or hand-operated guns. Unique in that they are installed from one side of the work.

Pop-Out - See stucco pop-out.

Pores - Wood cells of comparatively large diameter that have open ends and are set one above the other to form continuous tubes. The openings of the vessels on the surface of a piece of wood are referred to as pores.

Porosity - The density of substance and its capacity to pass liquids.

Portico - A covered entrance to a house, usually supported by decorative columns.

Portland Cement - Gray colored, finely powdered limestone material [crushed and pulverized] made from burning compounds of lime, silica, and alumina; used to coat and bond the aggregate together in concrete and mortar.

Post - A vertical member of wood, steel, concrete or other material that transfers weight from the top of the post to whatever the post is resting on; a column: a timber set on end to support a wall, girder, or other structural member.

Post & Beam Construction - Most common type of wall framing, using posts which carry horizontal beams on which joists are supported. It allows for fewer bearing partitions, & less material; system uses widely spaced posts and beams as the frame; plank decking applied transversely across the beams for stability and roof structure; a wood version of a rigid frame, in concept.

Potain - Name of French inventor, who designed first tower crane [single-masted, top-slewing] in 1928; known for large load capacity, and long reach [see Tower Crane].

Pot-Life - The time interval following the addition of an accelerator before chemically curing material will become too viscous to apply satisfactorily. See Shelf Life.

Pour - Outdated term, meaning to place concrete, casting concrete in place without interruption; not used, today, because of negative impression of a thin, watery inadequate substance.

Power - The energy rate, usually measured in watts. Power equals voltage times amps. or W = E x 1. The heavier the flow of amps at a given supply, the higher the rate at which energy is being supplied and used.

Pre-Bid Shopping - Negotiations between prime contractors [buyers] and trade contractors [sellers] to obtain lower prices prior to submitting prime contract proposals to owners.

Pre-cast Concrete - The shaping of structural members in a factory, then transported and installed in a building; includes concrete joists, beams, tee-slabs, as well as non-structural terrazzo, stair treads and risers, and miscellaneous trim, such as copings, sills, etc.

Pre-construction Meeting - Meeting convened to bring all parties to a project together to discuss mutual and project related topics, prior to actual start of construction; valuable to creating a good project atmosphere, and commonality of understanding on all aspects of the project.

Pre-construction Phase - All required phases prior to the start of construction.

Pre-Construction Planning - A team-building process used for the purpose of establishing below market dollar budget, overall project scheduling and design criteria; also identification and selection of the most feasible planning, design and construction team.

Precut - Cutting wood stock to exact dimensions at a mill, yard, or job site, before using/installation; for standardizing building components and minimizing errors.

Pre-Design Phase - The phase prior to the start of design where feasibility studies are done and conceptual project cost estimates are prepared.

Prefabrication - Building sections, or component parts of a building in a factory, or on-site, and installed/assembled as a whole on the job site; see Modular Housing.

Preservative - Any substance that, for a reasonable length of time, is effective in preventing the development and action of wood-destroying rot, fungi, borers of various kinds, insects that cause deterioration in wood. And similar destructive agents when the wood has been properly coated or impregnated with it.

Pre-Shimed Tape Sealant – A sealant having a pre-formed shape containing solids or discrete particles that limit its deformation under compression.

Pressed wood products - A group of materials used in construction that are made from wood veneers, particles, or fibers bonded with an adhesive under heat and pressure; hardboard, for example.

Pressure-Treated Lumber - Lumber that is treated in such a way that the sealer is forced into the pores of the wood; Lumber that has been impregnated with chemicals/preservatives under pressure, for the purpose of retarding rot, decay, vermin, and/or fire.

Primer - (1) A material of relatively thin consistency applied to a surface for the purpose of creating a more secure bonding surface and to form a barrier to prevent migration of components, (2) The first coat of paint in a paint job that consists of two or more coats, (c) the paint used for such a first coat, used to provide good adhesion to the work being covered, and a good base for the finish coats.

Priming - Sealing of a porous surface so that compounds will not stain, lose elasticity, shrink excessively, etc. because of loss of oil or vehicle into the surround.

Product Data - Detailed information provided by material and equipment suppliers demonstrating that the item provided meets the requirements of the contract documents.

Professional Engineer - A professional firm and/or individual who is professionally trained and engaged in an engineering discipline.

Professional Services - Services provided by a professional, in the legal sense of the word, or by an individual or firm whose competence can be measured against an established standard of care.

Professionalism - Essentially; considerate, courteous, ethical behavior when dealing or communicating with others on a construction project.

Program - 1) Written list of needs and requirements, and regulatory obligations, set out by the owner [and law] for a specific project; 2) An ordered list of events to take place or procedures to be followed for a specific project.

Project - A word used to represent the overall scope of work being performed to complete a specific construction job.

Project Delivery System - A variety of contractual arrangements open to choice of owners, which create differing arrangements for the project team, sets specific responsibilities, and forms a general pattern for the conduct of the project.

Project Manager - A qualified individual or firm authorized by the owner to be directly responsible for the day-to-day management and administration, and for coordinating time, equipment, money, tasks and people for all or specified portions of a specific project.

Project Manual - A organized book setting forth the bidding requirements, conditions of the contract and the technical work specifications for a specific project that documents and augments the drawings. The Project Manual contains the General Conditions, Supplementary and Special Conditions, the Form of Contract, Addenda, Change Orders, Bidding Information and Proposal Forms as appropriate, and the Technical Specifications.

Project Representative - Qualified person authorized by owner and assigned to project [part- or full-time] to assist in administration of contract[s] to protect the owner's interest; may be owner's employee, or duly authorized employee of design professional, or both.

Project Site - Specific tract of land, lot or portion thereof which is dedicated to the project and its construction; the Physical location where a structure or group of structures was, or is to be located, i.e., a construction site.

Projection - In roofing, any object or equipment which pierces the roof membrane.

Protection Board - In roofing, heavy asphalt impregnated boards which are laid over bituminous coatings to protect against mechanical injury.

Public Sector - The domain where owners fund projects with monies that come in whole or in part from taxes.

Pulls - A knob or other form attached to the front of a drawer by which the drawer can be opened.

Punch List - A trade term referring to the document resulting from the process of inspecting, and listing completed work, to determine where there is need for correcting deficiencies and making minor adjustments at the end of the job; list prepared by the owner or his/her authorized representative of items of work requiring immediate corrective or completion action by the contractor.

Purlins - Smaller horizontal structural member spanning between rafters, beams or trusses to support a roof deck; in slope glazing, purlins are the horizontal framing members.

Push Stick - In hardware, a tool used when cutting a short board on a table saw.

Putty - A soft, pliable type of compound, having nearly the consistency of dough, usually made of whiting and boiled linseed oil, beaten or kneaded to the consistency of dough, and used in sealing glass in sash, filling small holes and crevices in wood, and for similar purposes.

PVC pipe - Pipe made form Polyvinyl Chloride plastic material; see.

PVDF - Architectural coating. See Kynar Coating.

Q

Qualified - An individual or firm with a recognized credentials, degree, certificate, or professional standing; or who by extensive knowledge, training and experience, has successfully demonstrated his/her abilities to identify and solve or resolve problems associated with a specific subject matter or project type.

Quality - The value levels of material and equipment selected by the A/E. Conformance to the technical specifications during construction.

Quality Assurance [QA] - The procedure established by the Project Team to inject and extract the level of quality designated by the owner.

Quality Control [QC] - That part of the Quality Assurance procedure that determines if specified quality is attained.

Quality Engineering - That part of the Quality Assurance procedure where the required level of quality is accurately inserted into the construction documents by the A/E.

Quarry Tile - Unglazed, machine-made tile used for floors with sanitary require-

ments and open to wet conditions; usually red or tan color, and 6″x6″.
Quarter Round - A small molding with a cross section profile of a quarter circle.
Quarter Sawn - Lumber, usually flooring or veneer, that has been sawn so that the medullar rays showing on end grain are nearly perpendicular to the face.
Quarter-sawn Grain - Another term for edge grain.
Questionable Practices - Practices, standard or otherwise, that are not totally productive or are unfriendly or unfair to those parties that the practices interface.
Quoins - Large squared stone pieces, or slightly projected panels of brick, set in the corners of masonry walls for decorative purposes.
Quotes - Foreshortened or slang term for quotations which cite firm prices for work or material given by contractors and suppliers for labor and materials.

R

"R" value - A measure of a materials [incl. insulation] resistance to the passage of heat; high R value denoted better insulating "power" it has-- e.g., typical new home's walls are usually insulated with 4" of batt insulation with an R value of R-13, and a ceiling insulation of R-30.
R.F.I. - (1) An abbreviation for Request for Information. (2) A written request from a contractor to the owner or architect for clarification or information about the contract documents following contract award.
Rabbet - A rectangular longitudinal groove cut in the corner edge of a board or plank; also, L-shaped groove cut into the edge of a board to receive the edge of another board and form a corner joint.
Radial - Extending out from the center, as the rays in a tree.
Radial Saw - A circular saw which hangs from a horizontal arm or beam and slides back and forth. The arm pivots from side to side to allow for angle cuts and bevels. When sawing finish plywood, the good side should face up as the saw cuts on the down stroke.
Radiant Heating - (1) A method of heating consisting of a forced hot water system with pipes placed in the floor, wall, or ceiling. (2) A method of heating with electrically heated panels.
Radiation - Any heated surface loses heat to cooler surrounding space or surfaces through radiation. The earth receives its heat from the sun by radiation. The heat rays are turned into heat as they strike an object which will absorb some or all of the heat transmitted.
Radiator - A heating unit which is supplied heat through a hot water system.
Radon - A colorless, odorless, radioactive gas that comes from the natural breakdown of uranium in soil, rock, and water; can create adverse conditions where it seeps into buildings.
Rafter - One of a series of slopped/inclined structural roof members running from the wall to the ridge or top of roof; designed to support the roof deck, roofing and other loading; such rafters for a flat roof are called "joists"; common rafter is one which runs square with the plate and extends to the ridge. A hip rafter extends from the outside angle of the plate towards the apex of the roof. They are 2" deeper or wider than common rafters. A valley rafter extends from an inside angle of the plates toward the ridge of the house.
Rafter cuts - A trade term for the angle cut s on rafters to fit into framing system when stick-building a roofing system.
Raggle Block - A specially designed masonry block having a slot or opening into which the top edge of the roof flashing is inserted and anchored.
Rail - The horizontal top, bottom, and center framing pieces of panel doors or of asash. Also the upper and lower members extending over or between posts of a balustrade or staircase extending from one vertical support, such as a post, to another.
Raised grain - A roughened condition of the surface of dressed lumber in which the hard summerwood is raised above the softer springwood but not torn loose from it.
Rake - (a) Trim members that run parallel to the roof slope and form the finish between the wall and a gable roof extension. (b) An incline or slope, as in a pitched roof, or the angle of slope of a roof rafter, or the inclined portion of a cornice.
Ramp - A sloped surface for walking, or rolling equipment for easier access, between floor levels, than stairs; required as access under the ADA regulations for disabled persons; can be utilized with stairs.
Rankin - Thermometer scale on which unit of measurement equals the Fahrenheit degree.
Raw Linseed Oil - The crude product processed from flaxseed and usually without much subsequent treatment.
Raze - To demolish, remove, dismantle or wreck existing work, usually to provide place for new construction.
Ready-mix concrete - Concrete prepared at an off-site "batching plant" [where all ingredients are initially combined], and continuously mixed while transported in a truck from the plant to the site, so it is immediately ready for placement; also, called "transit mixed".
Rebar - Contracted term indicating "reinforcing bars" [rods/steel]; Reinforcing bar used to increase the tensile strength of concrete; see Reinforcing steel.
Record Drawings - A set of contract document drawings, marked up as construction proceeds to reflect changes made during the construction process, which show the exact location, geometry, and dimensions of all elements of the constructed project as installed. It is good practice to make As-Built Drawings by marking the changes on reproducible drawings such a mylar, vellum or sepias for the duplication purposes later.
Reflective Glass - Glass with a metallic coating to reduce solar heat gain.
Reflective Insulation - Sheet material with one or both sun faces of comparatively low heat emissivity, such as aluminum foil. When used in building construction the surfaces face air spaces, reducing the radiation across the air space.
Register - A fixture through which conditioned air flows. In a gravity heating system, it is located near the baseboard. In an air conditioning system, it is located close to the thermostat.
Reglet - A horizontal slot, formed or cut in a parapet or other masonry wall, into which the top edge of counter-flashing can be inserted and anchored. In glazing, a reglet is typically a pocket or keyway extruded into the framing for installing the glazing gaskets.
Reimbursable Expense - Charges to the owner covering costs for services that could not or intentionally were not quantified at the time the fee arrangement was made.
Reimbursable Expenses [or Costs] - Amounts expended for or on account of the project which, in accordance with the terms of the appropriate agreement, are to be reimbursed by the owner.
Reinforced Concrete - A composite material in which steel bars are encased in the concrete to reinforce its tensile strength using the best properties of each; material bonded together to act in unison with a combined capacity that exceeds that of either material alone; various designs utilize varying amounts of reinforcing. The steel consists of rebar or reinforcing bars varying from 3/8" to 2 1/4" in diameter and is installed before concrete is placed.
Reinforced Masonry - Masonry units, reinforcing steel, grout and/or mortar combined to act together to strengthen the masonry structure.

Reinforcing - Steel bars [rods] deformed with projecting ridges to ensure bonding, placed in concrete slabs, beams, and columns to add tensile strength; bars are bent or straight as required, and tied in shapes, grids or other configurations as required for concrete member; most are round, but some are square in cross section; diameter sizes vary from 3/8″ to 2-1/4″; cut to proper length, and bent to shapes required by structural designer, to strengthen concrete framing members.

Reinforcing mesh - Steel wires welded into a grid of 6 or 10 inch squares and embedded in concrete; ties concrete pads/slabs together to reduce cracking; also called simply "mesh", or "welded wire fabric" [see].

Relative Heat Gain - The amount of heat gain through a glass product taking into consideration the effects of solar heat gain [shading coefficient] and conductive heat gain [U-value].

Relative Humidity - The amount of water vapor in the atmosphere, expressed as a percentage of the maximum quantity that could be present at a given temperature. [The actual amount of water vapor that can be held in space increases with the temperature.]

Release of Lien - A written action properly executed by and individual or firm supplying labor, materials or professional services on a project which releases his mechanic's lien against the project property.

Relief valve - A type of valve designed to open if it senses excess pressure or temperature.

Remodeling - The practice of altering, upgrading, renovating, rehabilitating, and/or re-decorating existing conditions and adding new space to existing structures.

Re-sawing - Sawing lumber again after the first sawing; specifically, sawing into boards or dimension lumber.

Resident Architect - An architect permanently assigned at a job site who observes the construction work for the purpose of protecting the owner's interests during construction; also called project Representative.

Resident Engineer [RE] [inspector] - An individual permanently assigned at a job site for the purpose of representing the owner's interests during the construction phase, i.e., Owner's Rep.

Resilient flooring - Vinyl, vinyl-composition, rubber, cork, and other man-made floor coverings that are flexible yet provide a smooth surface; available in tile form [9x9 inches or 12x12 inches] and in sheets up to approx. 60″ wide; installed with an adhesive.

Resistance - The internal structure of wires even in the best conductors opposes the flow of electric current and converts some current into heat. This internal friction-like effect is called resistance and is measured in ohms. Resistance equals Voltage divided by Amperage.

Resorcinol Glue - A glue that is high in both wet and dry strength and resistant to high temperatures. It is used for gluing lumber or assembly joints that must withstand severe service conditions.

Retaining wall - A wall that holds earth in place nearly vertically; a retaining wall can either be mortared, dry stacked, or of poured concrete, masonry units, or wood timbers.

Return - 1) In heating and cooling systems, a vent that returns cold air to be warmed. In a hot air furnace system, it is located near an inside wall. 2) Change in direction of a molding, cornice, or other design feature, without breaking the continuity of the profile.

Reveal - Side of an opening for a window or door in a masonry or wood structure; margin to which the casing is set on the jamb for appearance, and to accommodate the door hinges.

RFP - The abbreviation for "Request for Proposal; The second request for uniform detailed information from prospective CM practitioners being screened for a project.

Ribbon [or Girt] - Horizontal wood member [called "girt" in steel] to support other members, or for attachment of wall Normally a 1- by 4-inch board let into the studs horizontally to support ceiling or second-floor joists.

Ridge/Ridge Board - The top edge of a roof where two slopes meet; also, the horizontal board between, and to which opposing rafters are attached, running the length of the roof structure.

Rigid Insulation - Another name for insulation materials in a stiff, high density board form, as opposed to pliable batts or blankets; commonly dense fiberglass or foam-type insulations.

Rigid Metal Conduit - This conduit resembles plumbing pipe, protecting wires from damage.

Rise - 1) In stairs, the vertical height of a single step, or a full flight of stairs; also, distance from one floor to the next for stair design is called "total rise"; 2) also, vertical height of a roof above the surrounding walls.

Riser - 1) In general, the vertical part of a stair step closing the spaces between the treads of stairways. 2) in plumbing, a vertical water supply line.

Roll Roofing - Roofing material, composed of fiber and satin rated with asphalt that is supplied in 36-inch wide rolls with 108 square feet of material. Weights are generally 45 to 90 pounds per roll.

Rolled section - Term applied to steel structural shapes [Is, wide-flanges, angles, channels, etc.] which are formed by rolling super-heated steel [blooms/billets] through successive rolls to form the final required shape.

Roll-Out - A loose term used to describe the rapid succession [completion] of similar projects over a given time period.

Romex - A nonmetallic sheathed cable consisting of two or more insulated conductors having an outer sheath of moisture resistant, nonmetallic material. The conductor insulation is rubber, neoprene, thermoplastic or a moisture resistant flame retardant fibrous material. There are two types: NM and NMC - described earlier.

Roof Sheathing - Boards, or sheet material fastened to the roof framing [rafters/trusses, etc.] and to which the shingles or other roof covering is attached; also, called "roof deck or decking".

Roof System - General term referring to the waterproof covering, roof insulation, vapor barrier, if used and roof deck as an assembly or entity.

Rough Carpentry - That work of the carpenter trade which is, for the most part, concealed, such as framing, blocking, furring, etc.; usually involves dimensioned lumber, and rough hardware.

Rough Hardware - All devices such as nails, screws, bolts, hangers, etc., which aid in the construction of the framing and rough construction of the project; also called "Builders' Hardware"; see Finish Hardware.

Rough Opening - Opening in framing around a window or door opening that has been sized to accept the finished units with allowances for fitting, shimming and leveling of the door or window units.

Rough Plumbing - All plumbing that should be done before the finish trades [drywall, painting, etc.], including all waste lines and supply water lines that are in the walls or framing of the building. See also: Plumbing, Sub Rough, and Finish Plumbing.

Rough-in - A trade term referring to the installation of underground or material to be concealed, prior to being enclosed in the stud walls, or under floors; examples would be for plumbing, heating, and electrical systems; the bulk of these systems must be installed before the wall coverings are applied, so this is considered roughin work. Also, the erection of the framing of the structure; portion of a system which does not include finishes and fixtures.

Rowlock - Laying brick on the long, narrow side, so the small ends are vertical in the face of the wall; a vertical header.

RPM - Revolutions per Minute.

Rubber Emulsion Paint - Paint, the vehicle of which consists of rubber or synthetic rubber dispersed in fine droplets in water.

Rubber-Tired Roller - A roller with rubber tires commonly used for compacting trimmed subgrade or aggregate base or clay type soils.

Run - [roofing] The horizontal distance between the eaves and the ridge of the roof, being half the span for a symmetrical gable roof [stairs]. The net horizontal distance of a flight of stairs; also, the horizontal distance from the top of the sidewall to the ridge of a roof.

Running Bond - Most commonly used brick coursing/bonding pattern consisting entirely of stretchers overlapping by 1/2 brick; i.e., vertical joints centered over brick below.

R-Value - The thermal resistance of a glazing system. The R-value is the reciprocal of the U-value. The higher the R value, the less heat is transmitted throughout the glazing material.

S

Saber Saw - a saw that cuts on the upstroke, good side of wood faces down.

Saddle - Two sloping surfaces meeting in a horizontal ridge, used between the back side of a chimney, or other vertical surface, and a sloping roof feature to divert water around the vertical surfaces. Also called a cricket.

Safety Report - The Occupational Safety and Health Act [OSHA] of 1970 clearly states the common goal of safe and healthful working conditions. A Safety Report is prepared following a regularly scheduled project safety inspection of the specific project.

Safing Insulation - Fire-resistant insulating material inserted into space between piping, ducts, curtain wall, conduit, beam, column, wall, floor, etc. where fire might pass through; packing behind fire penetration sealant used to close top of such openings and retard passage of fire and smoke.

Samples - Limited size, physical pieces and examples or prototypes and detailed information provided by material and equipment suppliers demonstrating that the item provided meets the requirements of the contract documents.

Sand Float Finish - Lime mixed with sand, resulting in a textured finish.

Sanding - To make smooth by rubbing sandpaper or similar abrasive over a surface before applying a finish.

Sandstone - A fine to coarse-grained sedimentary rock that splits easily; often used in the construction of garden walls and paths.

Sandwich Panel - Panel consisting of two outer faces of wood, metal, or concrete bonded to a core of insulating material.

Sanitary fitting - Any of several connectors linking drain-waste-vent lines and designed to direct wastes downward.

Sap - Most of the fluids in a tree. Certain secretions and excretions, such as oleoresin, are excepted.

Sapwood - The outer zone of wood, next to the bark. In the living tree it contains some living cells [the heartwood contains none], as well as dead and dying cells. In most species, it is lighter colored than the heartwood. In all species, it is lacking in decay resistance.

Sash - Individual movable panels of window frames surrounding the glass; a single light frame containing one or more lights of glass.

Saturated Felt - A felt which is impregnated with tar or asphalt.

Scaffold - A temporary structure or platform for workers to sit or stand on when working at a height above the floor or ground.

Scale - Use of proportional measurements, i.e., using a small increment of measure to represent one foot [usually]; also a drafting tool with markings at different intervals to permit measuring using different increments.

Scarf joint - A joint between two pieces of wood cut at an angle which allows them to be spliced and slide, one over the other, lengthwise without creating an open joint.

Schedule - A time-related plan for performing work or achieving an objective. 1) Written/graphic listing of various units of construction [doors, windows, toilet accessories, finish hardware, soil borings, room finishes, lintels, kitchen equipment, etc.], 2) activity to plan sequence or work, assignment of contractors, delivery of materials, etc. to meet stated completion date for project. Schedule 40 pipe - This is a rating for the thickness and strength of a pipe; it is the standard weight of plastic pipe used for residential drainage and vent plumbing systems.

Schedule of Values - (1) The breakdown of a lump sum price into sub-items and sub-costs for identifiable construction elements, which can be evaluated by examination for contractor progress payment purposes. (2) A statement furnished by the contractor to the architect or engineer reflecting the portions of the contract sum allotted for the various parts of the work and used as the basis for reviewing the contractor's applications for progress payments.

Schematic - A preliminary sketch or diagram representing the proposed intent of the designer.

Schematic Design Phase - The initial Design Phase on an architectural project: the first phase of the A/E design professional's basic services in which he/she consults with the owner to ascertain the requirements of the project and prepares schematic design studies consisting of drawings and other documents showing the scale, project components, and delineates the owner's needs in a general way for the owner's approval.

Scheme - (1) A chart, a diagram, or an outline of a system being proposed (2) An orderly combination of related construction systems and components for a specific project or purpose.

Scope of Work [SOW] - A written range of view or action; outlook; hence, room for the exercise of faculties or function; capacity for achievement; all in connection with a designated project.

Scotia - A hollow molding used as a part of a cornice, and often under the nosing of a stair tread.

Scratch Coat - The first coat of plaster, which is scratched to form a bond for the second coat.

Screed - The wood or metal straightedge or board used to strike off or level newly placed concrete immediately after it is placed, when doing concrete work. Screeds can be the leveling device used or the form work used to level or establish the level of the concrete. Screeds can be hand used or mechanical.

Screeding - Process of dragging a straight board across wet concrete to strike off excess concrete to achieve the desired thickness or grade elevation on the concrete.

Scribe - Fitting woodwork to an irregular surface or another section of wood trim by marking and cutting/coping wood or other materials so its edge matches the surface it butts up to, as the edge of a cabinet or paneling against a wall; in moldings, cutting the end of one piece to fit the molded face of the other at an interior angle to replace a miter joint.

Scupper - Opening through a wall for drainage of water from floor or roof into a downspout; requires careful and extensive flashing for watertight installation.

Scutch - A bricklayer's cutting tool used for dressing and trimming brick to a special shape. It resembles a small pick.

Scuttle - Opening and box-like unit with cover, in a ceiling or roof that provides access to an attic or roof.

Sealant - Thickened liquid, mastic, or paste substance, with adhesive qualities applied between components of a similar or dissimilar nature to provide an effective barrier against the passage of the elements; used to seal cracks, joints and porous surfaces; must adhere to surrounding material and permit expansion and contraction without rupture; many varieties, chemical compounds, types, colors and uses involved; may also be in tape or gasket form [see Caulking, and Gun-Grade Sealant].

Sealer - A finishing material, either clear or pigmented, that is usually applied directly over uncoated wood for the purpose of sealing the surface; also finish material [clear or pigmented] applied to reduce porosity or "dusting" of underlying material; e.g., concrete tends to create a dust as it dries.

Seasoning - Removing moisture from green wood in order to improve its serviceability.

Seismic Load - Added stresses/load on a structure caused by movement of the earth relative to that structure during an earthquake; varies by locale, and history of earthquake incidents; applicable to almost every project, if only to a limited degree; must be part of structural calculation and design for projects.

Select lumber - Lumber without knots or other deformities; it is the best lumber; in hardwood it refers to a specific grade.

Self-Healing - A term used to describe to a material which melts with the heat from the sun's rays, and seals over cracks that were earlier formed from other causes. Some waterproof membranes are self-healing.

Self-Leveling - A term used to describe a viscous material that is applied by pouring. In its uncured state, it spreads out evenly.

Selvage - The unsurfaced strip along a sheet of roll roofing which forms the under portion at the lap in the application of the roof covering.

Semigloss - Primarily a paint or enamel finish made with a slight insufficiency of nonvolatile vehicle so that its coating, when dry, has some luster but is not very glossy; can apply to other finished surfaces.

Separation - In concrete application, what happens to concrete when it is dropped directly with a flat chute causing the concrete to separate, usually occurring at a 1:2 slope.

Service Conductor - In electrical contracting, the supply conductors that extend from the street main or from the transformer to the service equipment.

Service Drop - In electrical contracting, the overhead service conductors from the last pole or other aerial support to and including the splices, if any, connecting to the service entrance conductors at the building.

Set - 1) The change in concrete and mortar from a plastic [semi-liquid] to a solid [hardened] state; 2) Assemblage of drawings created and compiled to depict a complete construction project.

Setback - A required minimum distance from the property line to the line/point where construction may begin; open area also called a "required yard" where no constructed features may occur; applied to each section of a property line; usually required by zoning regulations.

Setting Blocks - Generally rectangular cured extrusions of neoprene, EPDM, silicone, rubber or other suitable material on which the glass product bottom edge is placed to effectively support the weight of the glass.

Settlement - Shift in structure caused reduction/shrinkage of soil beneath the foundation; usually uneven in nature, and can cause cracking in the upper walls.

Shading Coefficient - The ratio of the solar heat gain through a specific glass product to the solar heat gain through a lite of 1/8″ (3mm] clear glass. Glass of 1/8″ (3mm] thickness is given a value of 1.0, therefore the shading coefficient of a glass product is calculated as follows:

Shake - A thick hand-split shingle, re-sawn to form two shakes; usually edge-grained.

Sheathing - The rough structural covering, usually wood boards, plywood, gypsum or wood fiber, used over studs or rafters of framed buildings as the first layer of outer covering; installed under the exposed finished material.

Sheathing Paper - A building material, generally paper or felt, used in wall and roof construction as a protection to retard the passage of air and sometimes moisture.

Shed Roof - A roof having only one slope or pitch, with only one set of rafters which fall from a higher to a lower wall.

Sheet metal - Flat rolled metal less than 1/4-incg [6,35mm] in thickness.

Sheet Metal Work - All components of a house employing sheet metal, such as flashing, gutters, and downspouts.

Shelf-Life - Used in the glazing and sealant business to refer to the length of time a product may be stored before beginning to lose its effectiveness. Manufacturers usually state the shelf life and the necessary storage conditions on the package.

Shellac - A transparent coating made by dissolving lac, a resinous secretion of the lac bug [a scale insect that thrives in tropical countries, especially India], in alcohol.

Shim - A thin, tapered piece of wood used for wedging purposes to create level or plumb surfaces on materials.

Shingles - A covering applied in overlapping layers, for the roof or sides of a building; covering of asphalt, wood, tile, slate, or other material cut to stock lengths, widths, and thicknesses, which are laid in a series of overlapping rows, as a roof covering on pitched roofs.

Shiplap Lumber - Boards that are edge-dressed to make a close rabbeted or lapped joint, so they fit into or overlap each other.

Shop drawings - Drawings produced by manufacturers or fabricators which show, exactly, how items or equipment will be constructed so they meet the requirements of the contract drawings; literally, instructions to the "shop" for production of the item; used as submittals to the design professional as verification of how work will be accomplished.

Shore "A" Hardness – Measure of firmness of a compound by means of a Durometer Hardness Gauge. [A hardness range of 20-25 is about the firmness of an art gum eraser. A hardness of about 90 is about the firmness of a rubber heel.]

Shoring - The placing of shores [upright braces] under formwork as temporary supports; also refers to the bracing or sheeting used to hold back an earth bank.

Shutter - Usually lightweight louvered or flush wood or non-wood frames in the form of doors located at each side of a window. Some are made to close over the window for protection; others are fastened to the wall as a decorative device.

Sidelight - Usually a tall and fairly narrow glass panel on either or both sides of a door.

Siding - The finish covering of the outside wall of a frame building, whether made of horizontal weatherboards, vertical boards with battens, shingles, or other material; boards, panels or other sections of material placed over the outside wall of a frame building and nailed to the sheathing. Although wood or plywood is generally used, composition board is also popular. Wood siding is made in several different patterns, as are vinyl and aluminum.

Sight Line - The line along the perimeter of glazing infills corresponding to the top edge of stationary and removable stops. The line to which sealants contacting the glazing infill are sometimes finished off.

Signage - Modern term for the entire coordinated system or pattern of signs used on, around and throughout a building, interrelated and color-coded or coordinated.

Silicone - A polymer used for high range sealants, roof membranes, and masonry water repellant.

Silicone Sealant - A sealant having as its chemical compound a backbone consisting of alternating silicon-oxygen atoms.

Sill - The lowest member of the frame of a structure, resting on the foundation and supporting the floor joists or the uprights of the wall. Also, the member forming the lower side of an opening, as a door sill. window sill. etc.

Sill Plate - The framing member anchored to the foundation wall upon which studs and other framing members will be attached. It is the bottom plate of your exterior walls.

Sill Sealer - A material placed between the top of the foundation wall and the sill plate. Usually a foam strip, the sill sealer helps make a better fit and eliminate water problems.

Sill Step - The first step coming directly off a building at the door openings.

Single Family Dwelling [SFD] - A house built for the purpose of a single family as opposed to multi families such as a duplex or apartment complex.

Single Ply - A descriptive term signifying a roof membrane composed of only one layer of material such as EPDM, Hypalon or PVC.

Single Tee - The name given to a type of precast concrete deck which has one stiffening rib integrally cast into slab to form a member in the shape of the letter "T".

Sisal Kraft paper - A heavy, strong paper reinforced with strands of sisal fibers. The strands of sisal are placed between two layers of paper stuck together with a coat of pitch. This paper has many uses around construction because of its toughness and durability.

Site - The land area or real estate place where a structure or group of structures was, or is to be located, i.e., a construction, project or job site.

Site-cast [Cast-In-Place] Concrete - Concrete placed and cured in its final position in a building.

Site conditions - A term used when describing the attributes of a construction site. Examples would be: level, sloping, rocky, wet, etc.

Site-constructed - Built on the job or project location.

Site plan - The drawing that shows the boundaries of the property, existing features [natural and man-made], the layout of the proposed building, its location, site utilities, and other proposed improvements, also called a "site improvement" or "plot" plan.

Site work - Refers to the preparation of a site for building construction [clearing, grading, excavating, trenching, utility service lines].

Sizing - (1) Working material to the desired size. (2) A coating of glue, shellac, or other material applied to a surface to prepare it for wall covering, paint or other finish; similar to a primer.

Sky Dome - A type of skylight exhibiting a characteristic translucent plastic domed top.

Skylight - A glazed panel [window] in a box-like unit built into a roof or ceiling; designed to admit light and is somewhat above the plane of the roof surface.

Slab - 1) Term generally used when referring to a concrete floor; concrete pavements and sidewalks are also concrete slabs; 2) also, a thick slice of stone or other masonry material.

Slab-on-Grade - 1) A concrete floor slab/surface lying upon, and supported directly by, the ground beneath; 2) A term for a type of construction in which wall footings are needed but little or no foundation wall is poured, and the floor slab "floats" inside the foundation [not supported on the walls].

Slack Time - The flexibility with non-critical jobs that allows their start dates to be adjusted without affecting the project completion date. [also referred to as Float].

Slag - A by-product of smelting ore such as iron, lead or copper. Also overburden/dropping from welding which may burn, melt, or discolor adjacent surfaces.

Slate - A dark gray stratified stone cut relatively thin and installed on pitched roofs in a shingle like fashion.

Sleeper - Usually, a wood member embedded in concrete, as in a floor, that serves to support and to fasten subfloor or flooring.

Sleeve[s] - Tube or section of pipe installed under the concrete driveway or sidewalk, or through walls and floors that are used later to run piping, wiring or other utility equipment/devices.

Slope - Incline or pitch of roof surface; relationship between rises and run of a roof; amount of gradient on any non-level surface.

Sloped Glazing - Any installation of glass that is at a slope of 15 degrees or more from vertical.

Slump - A measure of the stiffness or "wetness" of concrete; see Slump Test.

Slump-Test - Measures the consistency of a concrete mix or its stiffness; differential between top of concrete and 12" high, test cone [used to form concrete, then removed]; 3-inch slump is dryer and stiffer than a 5-inch slump. If the tests results are high, one likely cause would be too much water. Low slump-not enough water. The test is measured in inches.

Smoke chamber - he portion of a chimney flue located directly over the fireplace.

Soffit - The area below the eaves and overhangs. The underside where the roof overhangs the walls. Usually the underside of an overhanging cornice extending out from the plane of the building walls.

Soft Costs - Soft Costs are cost items in addition to the direct Construction Cost. Soft Costs generally include architectural and engineering, legal, permits and fees, financing fees, construction Interest and operating expenses, leasing and real estate commissions, advertising and promotion, and supervision.

Softening Point - The temperature at which a substance changes from a hard material to a softer and more viscous material.

Softwood - Wood produced from coniferous trees or trees that bear cone. Most commonly used are the pines, but also included such trees as fir, spruce, redwood, and cedar. The term has no reference to the actual hardness or softness of the wood. Soil boring - Holes created by driving a hollow tube into the subsurface soil for the purpose of investigating the load bearing and stability characteristics of the earth under a building; tube fills with soil, and then is extracted so soil samples can be examined.

Soil Cover [or Ground Cover] - A light covering of plastic film, roll roofing, or similar material used over the soil in crawl spaces of buildings to minimize moisture permeation of the area.

Soil Stack - A general term for the vertical main of a system of soil, waste, or vent piping.

Sole Plate - bottom horizontal member of a frame wall.

Solid Bridging - A solid member placed between adjacent floor joists near the center of the span to prevent joists from twisting; structural bridging may also be "X" shaped, or horizontal.

Solid core door - A flush door with solid stiles and rails and a solid infill material with no internal cavities.

Sonotube - Large, round cardboard tubes used as forms designed to hold wet concrete in place until it hardens; forms are then easily stripped or torn away; used to form concrete columns.

Sound attenuation - Sound proofing a wall or subfloor, generally with fiberglass insulation to reduce transmission of sound through the construction assembly [see STC].

Spacers [Shims] - Small blocks of neoprene, EPDM, silicone or other suitable material placed on each side of the glass product to provide glass centering, maintain uniform width of sealant bead and prevent excessive sealant distortion.

Spalling - The chipping or flaking of concrete, bricks, or other masonry where improper drainage or venting and freeze/thaw cycling exists.

Span - The clear, unencumbered horizontal distance between structural supports such as walls, columns, piers, joists, beams, girders, and trusses.

Spandrel - The wall area above a window; the panels of a wall located between vision areas of windows, which conceal structural columns, floors, and shear walls.

Special Conditions - (1) Amendments to the General Conditions that change standard requirements to unique requirements, appropriate for a specific project. (2) A section of the conditions of the contract, other than the General Conditions and Supplementary Conditions, which may be prepared for a particular project. (3) Specific clauses setting forth conditions or requirements peculiar to the project under consideration, and covering work or materials involved in the proposal and estimate, but not satisfactorily covered by the General Conditions. Special Consultants - Experts in highly specialized fields not inherent to an owner, A/E, or CM.

Specifications - A detailed, exact statement of particulars, especially statements prescribing the kinds and attributes of materials and methods, and quantitative and qualitative information pertaining to material, products, and equipment to be incorporated into a specific project. Detailed written instructions which, when clear and concise, explain each phase of work to be done, quality and level of workmanship required, and the general methods of installing and erecting the work; serve to complement, explain, and augment graphic information of working drawings. The most common arrangement for specifications substantially parallels the Construction Specification Institute [CSI] format.

Splash Block - A small pan or block, of pre-cast concrete, or plastic, laid with the top close to the ground surface to catch roof drainage from downspouts and to direct, divert or carry it away from the building foundation.

Splice - The joining of two members to form one piece by attaching plates or boards and fastening to each of the members [spanning across the joint].

Splitting - The formation of long cracks completely through a membrane. Splits are frequently associated with lack of allowance for expansion stresses. They can also be a result of deck deflection or change in deck direction.

Spread footing - A concrete footing larger than the structural member it supports constructed for the purpose of spreading the load over the bearing soil; used under piers, columns, and foundation walls.

Sprinklers - A fire protection systems whereby water, foam or other extinguishing agents are disbursed from overhead or sidewall heads [spraying devices] when activated by the heat from a fire; first line of defense to extinguish fires in early and limited stages.

Spud - [not a potato!] The removal of gravel or heavy accumulations of bitumen from roof membranes by means of chipping or scraping.

Square - 1) A unit of measure, e.g., 100 square feet, usually applied to roofing material. Generally roof area estimates are expressed in the number of squares of material required for application. Sidewall coverings are sometimes packed to cover 100 square feet and are sold on that basis. 2) Also indicates perpendicular, or at right [90 degree] angle.

Stack - The vertical pipe of a system of soil, waste or vent piping.

Stack Vent - Also called a waste vent or soil vent, it is the extension of a soil or waste stack above the highest horizontal drain connected to the stack.

Stain - A form of oil paint, very thin in consistency, intended for coloring wood with rough surfaces, such as shingles, without forming a coating of significant thickness or gloss.

Stair Carriage - Supporting member for stair treads. Usually a 2-inch plank notched to receive the treads; sometimes called a "rough horse."

Stair landing - A platform between flights of stairs or at the termination of a flight of stairs. Often used when stairs end, or change direction. Normally no less than 3 ft. X 3 ft. square.

Stair riser - The vertical member and distance from top of stair tread to top of next stair tread [and not to exceed dimension noted in building code, usually 7 to 7 ½"].

Stair stringer - Side supporting member for stair treads. Usually a 2 X 12 inch plank notched to receive the treads.

Stair well - A compartment extending vertically through a building, into which a stairway system is installed.

Standard Details - A detail drawing or illustration sufficiently complete and detailed, and generic enough for re-use on other projects with minimum or no changes.

Standard Dimension - A measurement unique to a specific manufactured item.

Standards of Professional Practice - A listing of minimum acceptable ethical principals and practices adopted by qualified and recognized professional organizations to guide their members in the conduct of specific professional practice.

Standing Seam - A type of joint often used on metal roofs.

Start Date - The date that an activity or project begins.

Start-Up - The period prior to owner occupancy when mechanical, electrical, and other systems are activated and the owner's operating and maintenance staff are instructed in their use.

Statement - A copy or summary of any account covering a stated period.

Static Decisions - Decisions that are made or can be made under the full influence of the project team's checks and balances.

Static Load - The total amount of permanent non moving weight that is applied to given surface areas.

Static Risks - Risks inherent tot he project-delivery process which occur or can occur by accident and have no opportunity for gain in the manner of their disposal.

Statute of Limitations - The period of time in which legal action must be brought for an alleged damage or injury. The period commences with the discovery of the alleged damage or injury; or in construction industry cases with completion of the work or services performed. Legal advise should be obtained.

STC [Sound Transmission Class] – The measure of an assembly's [comprised of various materials] ability to inhibit the transmission of sound through that assembly. A single number rating derived from individual transmission losses at specified test frequencies. It is used for interior walls, ceilings and floors.

Steel joist - A light, steel truss made from small bars, rods, or angles welded into rigid units; sometimes referred to as "steel lumber", or "bar joists".

Steel Trowel - Tool used for non-porous smooth finishes of concrete. It is a flat steel tool used to spread and smooth plaster, mortar or concrete. Pointing trowels are small enough to be used in places where larger trowels will not fit. The pointing trowel has a point. The common trowel has a rectangular blade attached to a handle. For smooth finish, use trowel when concrete begins to stiffen.

Step Flashing - Individual small pieces of metal flashing material used to flash around chimneys, dormers, and such projections along the slope of a roof. The individual pieces are overlapped and stepped up the vertical surface.

Stick built - A structure built without prefabricated parts. Also called conventional building.

Stile - The side frame members of a panel door or window [not the jamb].

Stipulated Sum Agreement - A written agreement in which a specific amount is set forth as the total payment for completing the contract.

STL [Sound Transmission Loss] – The reduction of the amount of sound energy passing through a wall, floor, roof, etc. It is related to the specific frequency at which it is measured and it is expressed in decibels. Also called "Transmission Loss".

Stool - A flat horizontal molding fitted over the lower rough framing at a window sill, between jambs and contacting the bottom rail of the lower sash; commonly called "window sill".

Storefront Construction - System of light aluminum tubular sections interconnected to form a network of glass frames, utilizing large glass panels; usually includes the entrance complex, and acts as both wall and fenestration.

Storm Door - A panel or sash door placed on the outside of an existing door to provide additional protection from the elements.

Storm Sewer [Drain] - A sewer, pipe or other features [natural or man-made] used to carry away rain-produced surface water drainage [but not sewage].

Storm Window - A glazed panel or sash placed on the inside or outside of an existing sash or window as additional protection against the elements.

Story - That space in a building from top of floor to top of floor next above.

Straightedge - Used to strike off the surface of a concrete slab using screeds and a straight piece of lumber or metal.

Strain - The percentage of elongation or compression of a material or portion of a material caused by an applied force.

Strap footing - Footing for two or more columns; columns so closely spaced, so it is easier to construct one common footing.

Striking Off - The operation of smoothing off excess compound or sealant at sight line when applying same around lites or panels.

String [or Stringer] - A timber or other support for cross members in floors or ceilings. In stairs, the support on which the stair treads rest; also stringboard.

String Line - A nylon line usually strung tightly between supports to indicate both direction and elevation, used in checking grades or deviations in slopes or rises. Used in landscaping to level the ground.

Strip Flooring - Finish flooring in the form of long, narrow, matched strips, or tongue and groove boards; wood or some synthetic materials.

Structural Design - A term used to represent the proportioning of structural members to carry loads in a building structure.

Structural Glazed [Clay] Tile - Hollow clay tile with glazed faces; used for constructing interior partitions where sanitation or cleanliness are concerns.

Structural Shapes - The "H", "I", "T" beams, angle, channel, and plate members for framing; steel, wood or concrete.

Structural Silicone Glazing – The use of a silicone sealant for the structural transfer of loads from the glass to its perimeter support system and retention of the glass in the opening.

Structural steel - May be pre-cast.

Structural Systems - The load bearing frame assembly of beams and columns on a foundation. The beams and columns are generally fabricated off site and assembled on site. Other systems such as non load bearing walls, floors, ceilings and roofs are generally constructed within and on the structural system.

Structural Tubes - Usually welded seam, hollow tubular steel sections, of various sizes used as light columns, struts and bracing; also, other structural and sometimes decorative installations; can be square or rectangular.

Structure - (1) Something constructed (2) Building or other unit/facility erected or constructed in accord with specific drawings and specifications.

Stucco - A type of exterior finish. Most commonly refers to an outside plaster made with Portland cement as its base. replaced by EIFS materials to some degree.

Stud - One of a series of wood or metal vertical structural members placed as supporting elements in walls and partitions, usually a piece of dimension lumber, 2 x 4 or 2 x 6, used in a series of spaced elements [commonly spaced 16 or 24-inches o.c.] to form the framework of a partition or wall.

Study and Report Phase - Principally applicable to engineering projects. Includes the investigation and determination of specific conditions and/or areas, activities or phases of the project and provides recommendations of design solutions to and owner's needs.

Sub - An abbreviation for Subcontractor.

Subcontract - A written form of agreement between the prime or main contractor and another contractor or supplier for the satisfactory performance of services or delivery or material as set forth in the plans and specifications for a specific project.

Subcontractor - A qualified subordinate contractor [individual or firm] who has a contract with the prime or main contractor. The subcontractor usually specializes in and agrees to do certain specific trade or skilled work on a building. Tile work, waterproofing plumbing, heating, electrical work, and other limited portions of construction work are sublet and perform by sub-contractors.

Subcontractor Bond - A written document from a subcontractor given to the prime or main contractor by the subcontractor guaranteeing performance of his/her contract and payment of all labor, materials, equipment and service bills associated with the subcontract agreement.

Subfloor - Carpentry term applied to flooring laid directly on the joists and serving as "temporary" decking during construction; Boards or plywood laid on joists over which a finish floor is to be installed; left in place when all rough construction work is completed, the finish floor is laid over the sub-floor.

Sub-grade - A fill or earth surface upon which concrete is placed; generally the area below the top of the earth surrounding a building.

Sublet - To subcontract all or a portion of a contracted amount.

Submittal[s] - Documents required, by project specifications, to be returned to the design professionals and contractors, by manufacturers, suppliers, and sub-contractors, showing and explaining, in precise terms, how fabrication and preparation of materials and systems will be done for the specific project; include shop drawings, product data, samples, certifications, etc.; professionals and contractors check and approve these documents when in accord with general design concept.

Sub-Rough - That part of a building's plumbing system that is done before the cement is poured.

Substantial Completion - The stage in the progress of the work when the work, or designated portion of the work, is sufficiently complete in accordance with the contract documents so that the owner can occupy or utilize the work for its intended use.

Substantial Completion Date - The date on which a contractor reaches a point of completion, when subsequent interfacing contractors can productively begin work or the owner can occupy the project, in whole or in part, without undo interference.

Substitution - A proposed replacement or alternate offered in lieu of and represented as being equivalent to a specified material or process; must be fully equivalent to that specified.

Substrate - A part or substance which lies below and supports another; rough material similar to underlayment, which is installed under or behind a finish material for added support and strength.

Substructure - The supporting part of a structure, i.e., foundation system, and portion of structure/building below grade line; lowest support for superstructure; visible only in small part.

Sub-subcontractor - An individual or contractor who has a written contract with a subcontractor to perform a portion of the work; for example, a carpet laying service hired by a carpet supplier.

Sub-surface Investigation - (1) A term used to represent an examination of soil conditions below the ground. (2) Investigations include soil borings and geotechnical laboratory tests for structural design purposes.

Successor - (1) One that succeeds another (2) A scheduled activity whose start depends on the completion of one or more predecessors.

Superintendent - A job title usually reserved for the administrative level person who supervises the work of an on-site contractor.

Superstructure - The highly visible, major mass of the building, above ground level and the sub-structure and foundation.

Supervision - (1) The act, process, or function of supervising construction materials, methods and processes for a specific project (2) Hands on field direction of the contracted work by a qualified individual of the contractor.

Supplemental Conditions - Supplements or modifies the standard clauses of the general conditions to accommodate specific project requirements [synonymous with Supplementary Conditions].

Supplementary Conditions - A written section of the contract documents supplementing and qualifying or modifying the contracts general conditions.

Supplier - An individual or firm who supplies and/or fabricates materials or equipment for a specific portion of a construction project but does not perform any labor on the project. [see manufacturer].

Surety Company or Surety - A properly licensed firm or corporation willing to execute a surety bond, or bonds, payable to the owner, securing the performance on a contract either in whole or in part; or securing payment for labor and materials.

Survey - A procedure which examines and investigates the attributes of land areas; reviews legal descriptions, records, utility services, topography, physical features [natural and man-made] and overall state of the land area; also, drawing produced to depict investigation of documents and field observations; made to scale, by a registered land surveyor, showing the lengths and directions of the boundary lines of the lot; the surrounding lots and streets; the position of the house and all exterior improvements such as walkways, driveways, decks and porticos within the lot; and any existing encroachments.

Suspended Ceiling - A ceiling system supported by hanging it, by wire and light channel framing, from the overhead structural framing; may be solid drywall, or a series of acoustical panels laid in a grid.

Swale - A broad, shallow ditch or depression in the ground, either occurring naturally, or excavated for the purpose of directing water runoff.

Synergism - Actions by two or more persons to achieve an end result that could not be achieved as well by one of the persons.

T

T & G - Tongue and groove; a protrusion full length on edge of one piece of material fits into a groove in the next adjacent piece.

T & M - (1) An abbreviation for a contracting method called Time and Materials (2) A written agreement between the owner and the contractor wherein payment is based on the contractor's actual cost for labor, equipment, materials, and services plus a fixed add-on amount to cover the contractor's overhead and profit.

Tail Beam - A relatively short beam or joist supported in a wall on one end and by a header at the other.

Take-off - Process of measuring and otherwise ascertaining quantities of various materials for estimating purposes; associated more with materials than with labor.

Taper - A gradual and uniform decrease in size, as of a round or rectangular piece or hole.

Taping - The process of covering the joints in drywall construction by applying joint tape over embedding compound in the process of joint treatment and filling over them with several coats of joint compound to produce a continuous smooth surface.

Team - The designated responsible project management of each trade contractor plus the Level 2 and Level 3 Managers of the owner, A/E, and CM, i.e., Project Team.

Tear-Off - In roofing, a term used to describe the complete removal of the built up roof membrane and insulation down to and exposing the roof deck.

Technical Inspection - Matching technical specification criteria with visual or mechanical tests on the project site, or in a remote location or laboratory, to ascertain conformance.

Technical Review - The critique of design solutions, or criteria used for design solutions, by a party other than the one providing the solutions or criteria, to determine adequacy and suitability of purpose.

Technical Specifications - Written criteria that augment the drawings pertaining to the technical construction of the project that cannot be conveniently included on the plans.

Tee - A pipe fitting, or pre-cast concrete member with a cross section resembling the letter T.

Tempered glass - Glass that has been cooled rapidly to produce surface tension. The result is a stronger-than-normal glass that shatters into relatively harmless cubical fragments when broken.

Template - A full-sized pattern from which structural or other work layouts are made. Templates may be of paper, cardboard, plywood, or metal.

Tenant's Rentable Square Feet - Usable square feet plus a percentage [the core factor] of the common areas on the floor, including hallways, bathrooms and telephone closets, and some main lobbies. Rentable square footage is the number on which a tenant's rent is usually based.

Tenant's Usable Square Feet - The square footage contained within the demising walls.

Tension - A stretching force; to stretch; a force that tends to pull apart.

Tenure - The duration, term, or length of time required by agreement or precedent for performance of services.

Termites - Insects that superficially resemble ants in size, general appearance, and habit of living in colonies; hence, they are frequently called "white ants." Subterranean termites establish themselves in buildings not by being carried in with lumber, but by entering from ground nests after the building has been constructed; they do attack and eat away wood members.

Termite Shield - A shield, usually of noncorrodible metal, placed in or on a foundation wall or other mass of masonry or around pipes to prevent passage of termites.

Terneplate - Sheet iron or steel coated with an alloy of about four parts lead to one part tin; primarily a roof covering.

Terra cotta - Ceramic material formed into masonry units – usually for decorative features.

Testing - Applying standard procedures to determine if prescribed technical criteria have been met in performance.

Testing Agencies - Entity, separate from any of the contractual parties on a project, engaged to perform inspections, tests, and analysis either at the site, in a laboratory or elsewhere; reports results to proper project party, and interprets results if required; may function to meet specifications, or to investigate problems which arise; building codes list some such agencies which are approved and acceptable due to impartiality, reliability, and past performance.

Texture Paint - One which may be manipulated by brush, trowel or other to give various patterns.

Thermal Insulation - Any material high in resistance to heat transmission that, when placed in the walls, ceiling, or floors of a structure, will reduce the rate of heat flow.

Thermal Movement - The measured amount of dimensional change that a material exhibits as it is warmed or cooled.

Thermal Shock - The stress built up by sudden and appreciable changes in temperature.

Thermoplastic Material - Solid material which is softened by increasing temperatures and hardened by decreasing temperatures.

Three-Phase - In electrical contracting, a wiring system consisting of 4 wires and used in industrial and commercial applications. This system is suitable for installations requiring large motors. It consists of three hot wires and one ground wire. The voltage in each hot wire is out of phase with the others by 1/3 of a cycle, as if produced by 3 different generators.

Threshold - A strip of wood or metal with beveled edges used over the joint between finish floor and the sill of exterior doors.

Thru-Wall Flashing - Flashing extended completely through a masonry wall. Designed and applied in combination with counter-flashings, to prevent water which may enter the wall above from proceeding downward in the wall or into the roof deck or roofing system.

THW - Moisture and heat resistant thermoplastic conductor. It is flame retardant, moisture and heat resistant and can be used in dry or wet locations.

Tie-In - In roofing, a term used to describe the joining of a new roof with the old.

Tile - A fired clay product that is thin in cross section as compared to a brick, either a thin, flat element [ceramic tile or quarry tile], a thin, curved element [roofing tile], or a hollow element with thin walls [flue tile, tile pipe, structural clay tile]; also a thin, flat element of another material, such as an acoustical ceiling unit or a resilient floor unit.

Tilt-up construction - A method of constructing walls, and sometimes floors, by pouring concrete or putting wooden walls together in flat panels. When complete, they are moved to the building site where they are tilted into permanent place; units can be site built and then raised [tilted] into place.

Timbers - Yard lumber 5 or more inches in least dimension. Includes beams, stringers, posts, caps, sills, girders, and purlins Construction lumber larger than 4″ x 6″ (102 x 152 mm] in cross section.

Time is of the Essence - A provision in a construction contract by the owner that punctual completion within the time limits or periods in the contract is a vital part of the contract performance and that failure to perform on time is a breach and the injured party is entitled to damages in the amount of loss sustained. e.g., "time is of the essence in the completion of the construction contract".

Time of Completion - The date or number of calendar or working days stated in the contract to substantially complete the work for a specific project.

Time-and-a-half - A term meaning any individuals normal billing hourly rate is increased by a multiple of 1.5 following predetermined normal working hours.

Timeline - A synonym for scheduling of activities in the context of time.

Timely Completion - Completing the work of the contract before the date required.

Timely Performance - Compliance with a time requirement.

Tinted Glass - Glass that is colored with various formulations of pigments, dyes, or other admixtures added to the basic glass batch that give the glass color as well as light and heat-reducing capabilities. The color extends throughout the thickness of the glass; also, glass to which colored coatings have been applied.

TI'S [Tenant Improvements] - TI'S is a term used to define the interior improvements of the project after the Building Envelope is complete. TI'S usually include finish floor coverings; ceilings; partitions; doors, frames, hardware; fire protection; HVAC consisting of branch distribution duct work, control boxes, and registers; electrical consisting of lighting, switches, power outlets, phone/data outlets, exit and energy lighting; window coverings; general conditions; and the general contractor's fee. The cost of tenant improvements are generally born by the tenant and the costs of tenant improvements will vary with every building, and with tenant requirements.

Toe Bead – Sealant applied at the intersection of the outboard glazing stop and the bottom of the glazing channel; must be sized to also provide a seal to the edge of the glass.

Toenailing - Driving a nail at a slant, usually about 45 degrees with the initial surface in order to permit it to penetrate into a second member; used to attach joists to plates, etc.

Toe space - Recessed area at the bottom of cabinets and casework which allows person to stand close to face of units with toes in the recessed area.

Toilet Room Accessories - Various items of equipment such as towel dispensers, soap dispensers, waste receptacles, sanitary napkin and seat dispensers, robe hooks, tissue holders, etc. for installation in restrooms.

Tongue & Groove - A continuous projection on the edge of a board that fits into a groove formed on another board; also called "T & G" [see].

Tooling - The operation of pressing in and striking a sealant in a joint to press the sealant against the sides of a joint and secure good adhesion; the finishing off of the surface of a sealant in a joint so that it is flush with the surface.

Top chord - The top sloped or horizontal member of a truss.

Top Mopping - The finished mopping of hot bitumen on a built-up roof.

Top Plate - Top horizontal member of a frame wall; wood member laid horizontally on top of the studs to tie them together and form a base for the framing above which may be a floor or a roof. Most often two such plates are used - one over the other.

Topography - The configuration of the earth's surface, established by survey technique of taking grade elevation readings, and depicted by contour lines along with the locations of the natural or man-made monuments on survey plats.

Torching - Applying direct flame to a membrane for the purpose of melting, heating or adhering.

Total run - The overall horizontal measurement of a stair; horizontal distance from face of top riser to face of lowest riser.

Tower crane - Single-masted, top slewing cranes with up to 90-foot+ radius reach with 80-ton load; see "Potain".

Trade Association - Group, whose members have a common interest, and combine resources to promote products/services, establish standards, or otherwise enhance common good in lieu of individual efforts.

Trade Contractor - A contractor that specialized in providing/installing specific elements of the overall construction requirements of a project.

Trade Worker - Current term for a fully qualified construction worker; previously called "journeyman" under unionized format; capable of performing a specific range of required work [carpentry, for example] properly, but at less than a supervisory level.

Transit - A surveyors instrument used by builders to establish points and elevations both vertically and horizontally. It can be used to line up stakes or to plumb walls or the angle of elevation from a horizontal plane can be measured.

Transmittal - A written document used to identify information being sent to a receiving party. The transmittal is usually the cover sheet for the information being sent and includes the name, telephone/FAX number and address of the sending and receiving parties. The sender may include a message or instructions in the transmittal. It is also important to include the names of other parties the information is being sent to on the transmittal form.

Transom - A window or opaque panel installed above a door or permanent window, which is hinged for ventilation purpose.

Travel Time - Wages paid to workmen under certain union contracts and under certain job conditions for the time spent in traveling from their place of residence to and from the job.

Tread - The horizontal board, grating, plate, concrete fill, or surface in a stairway step on which the foot is placed.

Treated lumber - Wood products [including panels such as plywood] impregnated with chemicals to reduce damage from rot or insects; also, can be treated to become fire-resistant.

Tremie - A tube with removable sections and a funnel at the top used in concrete application. The bottom is kept beneath the surface of the concrete and raised as the form is filled and is used to pour concrete underwater.

Trim - 1) The finish materials in a building, such as moldings applied around openings [window trim, door trim] or at the floor and ceiling of rooms [baseboard, cornice, and other moldings]; machined strips of wood used alone or in combination with molding; 2) also used in reference to painting and decorating where large areas or surfaces are decorated or highlighted by contrasting colors, textures or materials.

Trimmer - A beam or joist to which a header is nailed in framing for a chimney, stairway, or other opening.

True to plane – In the same plane, with no indentations or protruding elements; flat, vertical face.

Truss - Structural member formed with several smaller structural steel or wood members fastened together to make a lattice-like framework that will span long distances; utilizes principle of rigid triangular panels; designed to act as a beam of long span, while each member is usually subjected to longitudinal stress only, either tension or compression.

Tuck-Pointing - The re-grouting of defective mortar joints in a masonry or brick wall.

Turpentine - A volatile oil used as a thinner in paints and as a solvent in varnishes. Chemically, it is a mixture of terpenes.

Two-Part Sealant - A product composed of a base and curing agent or accelerator, necessarily packages in two separate containers which are uniformly mixed just prior to use.

Type-X Gypsum Board - One of a series of specially formulated fiber-reinforced gypsum boards which provide greater fire resistance; used where greater fire rating is required; fire-rated board.

U

UL/U.L. - See Underwriters' Laboratories

Ultraviolet - The invisible rays of the spectrum of light which are at its violet end. Sometimes abbreviated U.V.

Undercoat - A coating applied prior to the finishing or top coats of a paint job. It may be the first of two or the second of three coats. In some usage of the word it may, become synonymous with priming coat.

Underlayment - 1) Relatively thin, intermediate sub-floor material of plywood or fiberboard used to provide a smooth, level surface for finish materials such as carpet or other resilient flooring; usually installed over the structural sub-floor; 2) name of any substrate material.

Underpinning - The process of placing new foundations beneath an existing structure, to strengthen it and to allow deeper excavation immediately adjacent.

Underwriters' Laboratories - Highly regarded, independent testing agency that tests a wide variety of construction materials and assemblies, in addition to numerous other materials, equipment, devices, etc.

Underwriter's Laboratories [UL] Label - A label on a product or manufactured item showing the material is regularly tested by, and complies with the minimum standards of the Underwriter's Laboratories specification for safety and quality.

Unfinished Spaces – Rooms and areas, which in their final construction state, will have wall, floor and ceiling materials left in their natural state, without any applied decorative or protective materials. [It is possible to have finished work within these spaces – such a exposed piping – while the space itself is called, "unfinished"].

Uniform System - The CSI Master Format is a "uniform system" of numbers and titles for organizing construction information into a regular, standard order or sequence. By establishing a master list of titles and numbers Master Format promotes standardization and thereby facilitates the retrieval of information and improves construction communication. It provides a uniform system for organizing information in project manuals, for organizing project cost data, and for filing product information and other technical data.

Unit Price Contract - A written contract wherein the owner agrees to pay the contractor a specified amount of money for each unit of work successfully completed as set forth in the contract.

Unit Prices - A predetermined price for a measurement or quantity of work to be performed within a specific contract. The designated unit price would include all labor materials, equipment or services associated with the measurement or quantity established.

Up-Front Services - Free or reduced-rate services provided to prospective clients in the interest of obtaining a contract. Often rationalized as part of a firm's selling or public relations program.

Uprights - Vertical members supporting the sides of a trench.

U-Value - A measure of air-to-heat transmission [loss or gain] due to the thermal conductance and the difference in indoor and outdoor temperatures. As the U-value decreases, so does the amount of heat that is transferred through the glazing material. The lower the U-value, the more restrictive the fenestration product is to heat transfer. Reciprocal of R-value.

V

Valley - A depressed joint or seam formed in a roof where two areas of a roof at different slopes, and at an angle to each other, come together; must function as flashing between roof areas, and as a drainage conduit.

Valley Rafter - A rafter that forms the intersection of an internal roof angle. The valley rafter is normally made of double 2-inch-thick members.

Value - The intrinsic worth of something determine don an individual bases.

Value Engineer - A person, usually certified, who is qualified to perform value engineering services for a client.

Value Engineering - A technical review process; the close matching of engineering design to the value an owner derives from the design.

Value Management - The matching of project decisions and directions with the expressed requirements of the owner, from an owner value derived perspective.

Value Manager - A person qualified to perform value management services for a client.

Valve - A device to stop, start or regulate the flow of liquid or gas through or from piping.

Vapor - The gaseous form of any substance.

Vapor Barrier [Retarder]- A watertight sheet material used to retard the movement of moisture or water vapor into and through walls preventing condensation in them; usually plastic with or without reinforcing fibers. Usually considered as having a perm value of less than 1.0. Applied separately over the warm side of exposed walls or as a part of batt or blanket insulation; also, membrane which is placed between the insulation and the roof deck to retard water vapor in the building from entering the insulation and condensing into liquid water.

Varnish - A thickened preparation of drying oil or drying oil and resin suitable for spreading on surfaces to form continuous, transparent coatings, or for mixing with pigments to make enamels.

Vehicle - The liquid portion of a finishing material; it consists of the binder [nonvolatile] and volatile thinners.

Veining - In roofing, the characteristic lines or "stretch marks" which develop during the aging process of soft bitumens.

Vendor - Supplier who provides manufactured products or units; one that sells materials or equipment not fabricated to a special design.

Veneer - 1. A thin sheet of wood or other material that overlay lesser materials to reduce cost; the visible sheet is generally of superior quality, chosen for its beauty; less costly veneers form the inner plies; plywood is made by gluing sheets of wood veneer together. 2. Brick/stone veneer consists of one row of units placed around a framework; most "brick" houses really just have wood frames covered by veneer.

Vent - A pipe or duct which allows flow of air as an inlet or outlet.

Vent Pipe - A vertical pipe of relatively small dimensions which protrudes through a roof to provide for the ventilation of gasses.

Vent Stack - A vertical vent pipe installed for the purpose of providing circulation of air to and from any part of a drainage system.

Vent System - In plumbing, a system to provide a flow of air to or from a drainage system or to provide circulation of air within such system to protect traps seals from siphonage and back pressure.

Ventilator - Device installed on the roof for the purpose of ventilating the interior of the building.

Venting - The process of installing roof vents in a roof assembly to relieve vapo pressure; The process of water in the insulation course of the roof assembly evaporating and exiting via the roof vents.

Verbal Quotation - A written document used by the contractor to receive a subcontract or material cost proposal over the telephone prior to the subcontractor or supplier sending their written proposal via mail or facsimile.

Vermiculite - An aggregate somewhat similar to perlite that is used as an aggregate in lightweight roof decks and deck fills. It is formed from mica, a hydrous silicate with the ability of expanding on heating to form lightweight material with insulation quality. Used as bulk insulation and also as aggregate in insulating and acoustical plaster and in insulating concrete.

Vestibule - An open area at an entrance to a building; small area between sets of entrance doors.

Viscosity - The internal frictional resistance offered by a fluid to change of shape or to the relative motion or flow of its parts.

Visible Light Transmittance – The percentage of visible light (390 to 770] nanometers] within the solar spectrum that is transmitted through glass.

Visual Mock-Up - Small scale demonstration of a finished construction product.

V-joint - Joint between two pieces of material, with corners beveled to form a joint profile resembling the letter "V."

Void - 1) Air space between material or between substance in material; 2) to cause to be, or to declare invalid, non-binding, or without power.

Volatile Thinner - A liquid that evaporates readily and is used to thin or reduce the consistency of finishes without altering the relative volumes of pigment and nonvolatile vehicles.

Voltage - The driving force behind the flow of electricity somewhat like pressure is in a water pipe.

Voltmeter - measures the voltage flowing through a circuit. The circuit must be closed to allow the voltage to flow.

W

Waferboard - An engineered building panel made by bonding together large, flat flakes of wood; by-product similar to plywood and oriented strand board, but using large "chips" or pieces of wood.

Waffle slab - A two-way concrete joist system [ribbed slab], formed with square pan forms; top of slab is flat, but underside contains pattern of voids similar to a waffle cake. see Two-way Ribbed Slab.

Wainscot - The decorative lower section of a wall [beneath chair rail height] made of different material from the upper part; usually composed of wood, tile, or wall covering.

Walkways - Designated areas for foot traffic; sidewalks, paths, walk-pads on roofs, scaffolding, bridges, etc.

Wallboard - Slang for gypsum wallboard as used in drywall construction.

Wall sheathing - Sheets of plywood, gypsum board, plastic foam, or other material nailed to the outside face of studs as a closure over and between spaced framing; may be base for exterior siding/facing if nailable.

Wall tie - A small metal strip or steel wire used to bind wythes of masonry in cavity-wall construction or to bind brick veneer to the wood-frame wall in veneer construction.

Wallboard - Short term for large, paper faced, rigid sheets of plywood, gypsum, or similar materials that may be fastened to the frame of a building, usually to form the interior wall surfaces; see gypsum wallboard.

Wane - Bark, or lack of wood from any cause, on edge or corner of a piece of wood.

Warp - To bend or twist out of shape.

Warranty - Assurance by a providing party that the work, material, and equipment under warranty will perform as promised or as required by contract.

Warranty Phase - The phase of a project where the agreement by which a party accepts responsibility for fulfilling an obligation and warrant that the work under warranty meets its intended use for a specifically established timeframe.

Water Repellant Coating – Transparent coating or sealer applied to the surface of concrete and masonry surfaces to repel water.

Water Repellent Preservative - A liquid designed to penetrate into wood and impart water repellency and a moderate preservative protection. It is used for millwork, such as sash and frames, and is usually applied by dipping.

Water table - The top level of water retained in the soil, or the natural underground water layer resulting from a nearby stream, drain, or shallow rock formation.

Water Vapor - Moisture existing as a gas in air.

Water-Cement Ratio - The strength of a concrete mixture depends on the water cement ratio. The water and cement form a paste. If the paste is made with more water, the concrete becomes weaker. Traditionally, concrete mixes have been identified in terms of the ratio of cement to fine aggregate to coarse aggregate. For example, the ratio 1:2:4 refers to a mix which consists of 1 cu. ft. of cement, 2 cu. ft. of sand and 4 cu. ft. of gravel. Cement and water are the two chemically active elements in concrete and when combined, form a paste or glue which coats and surrounds the particles of aggregate and upon hardening binds the entire mass together.

Watercourse - An artificial or natural channel for intermittent drainage or a stream; constructed most often in formal gardens.

Waterproof - To render a material, or surface impervious to water; generally done by coating it with another material that will not let water pass through it.

Waterproofing - 1) Process whereby a building component is made totally resistant to the passage of water and/or water vapor. 2) Materials such as tar, asphaltic mastic or sprays, mortar parging, and heavy-body cementitious paints are common waterproofing agents.

Wattage - The electrical unit of power. KILOWATTS is 1000 watts and electric customers are billed on how many kilowatts of power they have used.

Weatherstrip - Narrower or jamb-width sections of thin metal or other material to prevent infiltration of air and moisture around windows and doors. Compression weather stripping prevents air infiltration, provides tension, and acts as a counter balance.

Weather-stripping - A strip of fabric or metal fastened around the edge of windows and doors to prevent air infiltration; can be interlocking or spring fit.

Weep Hole - Holes or slots [usually in vertical joints] in bottom courses of masonry veneer walls to allow the release of moisture accumulated in voids/cavities behind facing; important in brick veneer, other veneer work, and glazing structures.

Weep Screed - Tool used to drain moisture from concrete.

Weld - 1) The joining of components together by fusing. In thermoplastics, refers to bonding together of the membrane using heat or solvents. 2) A joint between two pieces of metal formed by fusing the piece together, usually with the aid of additional metal melted from a rod or electrode.

Welded-Wire-Fabric [WWF] - Heavy gauge steel wires welded together to form a grid for concrete slab reinforcing; wire size and spacing are available in variety; commonly called "mesh"; see Reinforcing mesh.

Wet Seal - Application of an elastomeric sealant between the glass and sash to form a weather tight seal, which are then firmly held in place by the surrounding material.

Wide-flange section - Any of a wide range of steel sections rolled in the shape of a letter I or H, with different dimensions than I-beams; usually width and depth are nearly the same dimension.

Wind brace - A diagonal structural member whose function is to stabilize a frame against lateral [wind] forces.

Wind load - Lateral forces acting against a building that, in particular, must be considered in the design of high-rise buildings.

Wind Uplift - The upward force exerted by wind traveling across a roof.

Wire Size - Conductors for building wiring are available in AWG [American Wire Gauge] sizes ranging from No. 14 to 4/0. The larger the number size, the smaller the diameter. For example #10 is smaller than #8. The larger the diameter of a wire, the lesser the resistance.

Wired glass - Glass in which a small-gauge wire mesh [similar to "chicken wire"] has been embedded during manufacture; used in fire-rated doors and windows, since glass is retained in opening by the wire.

Wood Filler - A heavily pigmented preparation used for fining and leveling off the pores in open-pored woods.

Wood members - Most commonly used at joints of wood trusses. They are fastened by nails, screws, bolts, or adhesives.

Wood Rays - Strips of cells extending radially within a tree and varying in height from a few cells in some species to 4 inches or more in oak. The rays serve primarily to store food and to transport it horizontally in the tree.

Wood Shakes [Shingles] - Individual wood roofing pieces, made of cedar [usually] which are hand split, or machined to useable size; can be fire-rated for added protection.

Woodfiber Plaster - Consists of calcified gypsum integrally mixed with selected coarse cellulose fibers which provide bulk and greater coverage. It is formulated to produce high-strength base coats for use in highly fire-resistant ceiling assemblies.

Work - The total of tasks, construction, installation, etc., that must occur to build, finish and produce the project anticipated and under contract; comprises the complete scheme of construction required by the contract documents including all labor, material, systems, tests, ratings, devices, apparatus, equipment, supplies, tools, adjustments, repairs, expendables, aids, temporary work and/or equipment, superintendence, inspection/approvals, plant, release, and permissions required to perform and complete the contract in an expeditious, orderly, and worker-like manner. The successful performance of the entire scope of the project. contract.

Work[ing] Day - Usually same as weekday [Mon. through Fri]; excludes weekends and holidays; describes the number of hours when work is performed during each calendar day.

Working Drawing - A drawing sufficiently complete with plan and section views, dimensions, details, and notes so that whatever is shown can be constructed and/or replicated without instructions but subject to clarifications. Working Drawing - One of a set of technical drawings intended for field use, by trade workers who actually perform.

Work-Life - The time during which a curing sealant remains suitable for use after being mixed with a catalyst.

Work Letter - A written statement [often called Exhibit B to a lease or rental agreement] of the specific materials and quantities the owner will provide at his own expense. The work letter defines the building standards, including the type of ceiling, the type and number of light fixtures, the size and construction of the suite-entry and interior doors. Building standards define the quality of tenant spaces. Generally, a Work Letter is associated with the leasing or renting of office space by a tenant within a Building Envelope.

Work Order [WO] - A written order, signed by the owner or his representative, of a contractual status requiring performance by the contractor without negotiation of any sort.

Work Scope Description - A narrative description of the concise scope-of-work to be bid and performed by a specific contractor, subcontractor, etc.

Wythe - A section of a masonry wall which is one unit wide, in plan [most commonly, 4-inches wide for brick]; pertains to the number of such sections in the full width of a masonry wall [for example, 3 wythes wide yields a 12" wall].

X

XCM - An abbreviation for "Extended Services -CM"; A form of Construction Management [CM] where other services such as design, construction, and contracting are included with Additional Construction Management [ACM] services provided by the Construction Manager.

Y

Yard Lumber - Lumber of those grades, sizes, and patterns which are generally intended for ordinary construction, such as framework and rough coverage of houses.

Yard of concrete - Concrete unit measure denoting 1 cubic yard (3′x3′x3′]in volume of 27 cubic feet]; will provide 80 square feet of 3-1/2″ thick flatwork.

Yard - (1) Commonly that area of a lot from the building to the property lines; (2) in zoning, redefined as that minimum prescribed distance and open area, back from the property lines where building cannot occur [also called "set-backs", or "required yards"].

Z

Z-bar flashing - Bent, galvanized metal flashing that is installed in a horizontal joint, so one vertical leg fits behind the upper material, and the other leg fits over the lower material; for example, above a horizontal trim board of an exterior window, door, or brick run; also, where material is not available for the full height and must be spliced.

Zone - A designated portion of an entity divided for servicing reasons; for example, section of a building that is served by a separate heating or cooling loop because it has noticeably distinct heating or cooling needs. Also, the section of

Zoning - (1) Restrictions of areas or regions of land within specific geographical areas based on permitted building size, character, and uses as established by governing urban authorities. (2)Local government regulations, which control the use of land, so adjacent uses are similar, compatible, and not intrusive upon each other; also regulate access, open areas, setbacks; intended to create a positive, non-intrusive general atmosphere or environment in neighborhoods; prohibits nuisance and undesirable uses from locating in other areas devoted to less objectionable uses. (3) Creating separate sections of a building to be served by different systems or portions of system of mechanical services [for example, separate supply ducts carrying air conditioned air to different areas of building].

Zoning Certificate - Document issued by government zoning agency indicating acceptance or giving approval for proposed land use or project; used in association with [and usually in addition to] building permits.

Zoning Permit - A document issued by a governing urban authority permitting land to be used for a specific purpose

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