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Planning of Komtel Project Engineering Head Quarters

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BACHELOR THESIS

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1.1 Definition

*The debate about the architectural framework for **human labor** goes back many centuries. To create a workplace is to assume an important **social responsibility**. It constitutes an attempt to reconcile the imperatives of production and consideration for **human needs**. The way in which the workplace is organized and laid out will have a tremendous influence on a firm's efficiency and productivity.*

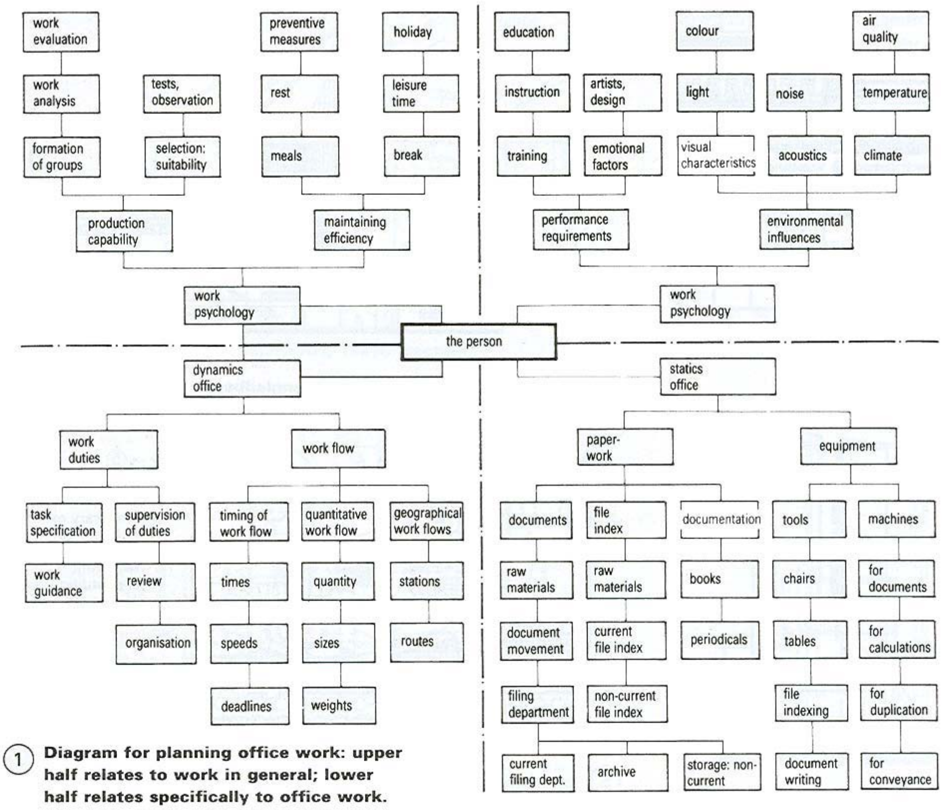
*Today, office spaces are expected to provide a reassuring atmosphere for their occupants, to compensate for the abstraction of work and **protect workers from stress**, unify the organization and express its values, **motivate** and **mobilize the staff**, **promote sociability** and **co-operation** and reflect a company's desired image.*

Office building, public facilities and commercial space share a number of features that affect their morphology. These features also represent constrains that must be incorporated into a basic program*, which distinguish an office from other workplaces and dictate its architecture.*

1.1.1 PRINCIPLES

The way in which office work is organized and roles are defined (office structure, customer management, office technology affects the requirements for office space. Building types develop and change over time.

In addition to innovative prototypes, there are types of buildings which are representative of the forces and influences around when they were built --> (3). The organization of office work increasingly focuses on human relationships and communications --> ®. As office work continues to change (from the introduction of new technologies), a clear understanding of the task required becomes a significant motivating force. Designers can influence all aspects of the working environment. Good design is extremely important, and has a strong influence on job satisfaction. The space allocated to a person to execute a task is referred to as a workstation. This can be a private office with full-height partitions and a door, an open-plan ’cubicle’ configured from systems furniture or low-height partitions, or an individual desk in an undivided space.



(1) Diagram for planning office work: upper half relates to work in general; lower half relates specifically to office work. Problems in the left half can be solved by preventive measures and training; those on the right require technical and organisational solutions

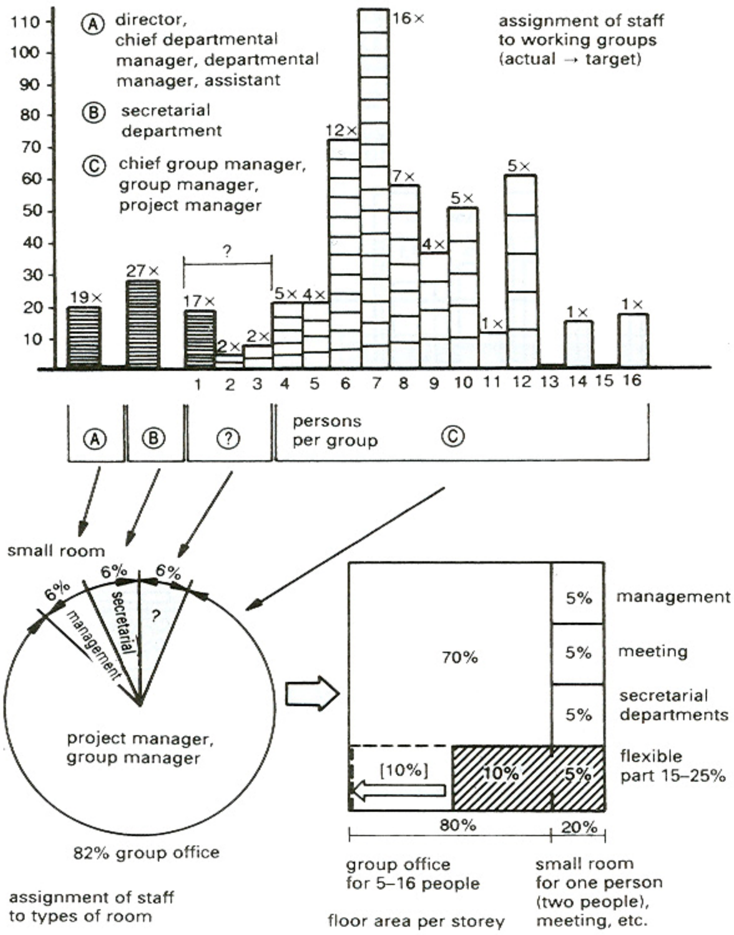
A large office building will consist of several different types of space. Office areas will have separate offices for one to three people with workstations for trainees, group offices or up to 20 people, also with workstations for trainees, and open-plan offices for up to 200 people on a single level. Some offices may combine individual workstations with areas used by groups. In an open-plan office, all spaces are multipurpose for individual or team work, except for a separate secretarial depart meant. Records areas are for the storage of files, drawings, micro-film and electronic media, filing and recording equipment, document reproduction, play-back and shredding. Central clerical services areas contain dictating, duplicating, printing and photocopying equipment, and personal computers.

The post room handles all incoming and outgoing post. Corporate display areas contain board rooms with moveable walls, exhibition areas, conference rooms and meeting rooms. Social facilities should include cloakrooms, a kitchen for each floor or area, toilets, a rest area for employees, refreshment rooms, sports facilities and a dining room with a kitchen. Additional spaces and extensions may be needed for training on audio-visual equipment. It may also be necessary to have an entrance drive, parking spaces (possibly underground) and delivery bays. Circulation spaces include corridors, stairways, lifts, and internal and external emergency exits. Central services are responsible for technical equipment, air conditioning, ventilation, heating, electric power, the water supply, data processing, the computer center, telecommunications, and cleaning and maintenance. A detailed description of the company and its organizational structure, including company-specific functions and relationships, will help produce a suitable analysis of its requirements. PRINCIPLES Trends/Criteria

This is increasingly important because of the stress caused by new technology and formalized work structures. Rising levels of physical and psychological stress have resulted in greater attention being paid to the work environment. Office workers need sufficient space, the freedom to arrange their own furniture, good ventilation and lighting, and protection against external or unnecessary disruptions.

Approximately 65% of the working day is spent in limited work areas and 10% in extended work areas. Work contacts and shared equipment are becoming more important, resulting in the need for individual and shared offices and workstations .

In addition to reorganization of existing buildings, new concepts for individual and group offices are taking shape, e.g. the interconnecting group office partially divided into zones, the combined office, or the multiple or multivalent workstation, although the latter does not appear to be popular.



⑤ **Principles of use for distribution of space**

1.1.2 Scale and organisation

Office buildings are often constructed on a large scale and contain an immense amount of space. More and more often, the offices of various divisions of a single company are grouped together for reasons of efficiency and economy, and buildings offered by developers, the larger the more profitable, are often home to several different firms. Such arrangements require the management of large office floors and many levels of major extensions if the site allows: in short, complex communications and traffic issues.

The functions for which the office spaces are used require a particularly well-designed traffic network, the importance of which is increasing despite the advent of computerization for purposes of exchange and social relations. Good transport and distribution of fluids (hot and cold air and water) also have significant implications in terms of space and allowances must be made for future developments in the arrangements of offices.

1.1.3 Increasing functions

Several guidelines apply nowadays to the planning of a specific office building project. The lobby in contemporary buildings often leads into a patio, atrium or internal ,,street'' which unifies, identifies and allocates space. A subtle transition from private to public space is necessary to allow visitors to be greeted and directed to their destination without interfering with the work of the staff.

Today, in addition to lobbies, washrooms, storage areas and waiting rooms, office buildings frequently include conference rooms, an auditorium equipped for multimedia presentations, meeting rooms of different sizes and configurations, rooms set aside for office and building automation equipped (photocopiers, printers, distributers for each floor, mixer housings) and new type of ,,social'' areas such as restaurants, cafeteria, cafes, sports or fitness facilities, areas for cultural activities. The increasing number of functions to be incorporated into a single building is a prime consideration in designing a coherent whole serving both individual and collective needs in a harmonious fashion, and striking the right balance between workplace and recreational or social facilities, always keeping in mind the need to use space economically.

1.1.4 Internal loads

The increasing variety of equipment found in offices requires many connections and a large volume of cable, not to mention the associated technical facilities.

This proliferation of equipment, combined with a high rate of occupancy, generates major internal loads and care must be taken to avoid overheating the offices. Artificial lighting in certain areas and at certain times of day also contributes to internal heat gains, which are often large enough to require cooling and protection against overheating during the better part of the year, even in temperate areas. Assessment of lighting needs as determined by the depth of the building is thus vital, as it has an impact on both working conditions and internal heat gains.

High density of occupation further demands consideration for ergonomics applied to workstation: workspace may be divided on the basis of the tasks to be performed and exchanges taking place.

1.1.5 Flexibility

The keyword is therefore flexibility. In light of past and future developments (office automation and computerization, the continuing rise in the ratio of executives to employees, in the incorporation of a work and a meeting area into each office space, developments in design and ergonomics and new standard of quality and finish), flexibility must remain a basic constant of office design. Statistics show that the average firm moves to new offices every seven or eight years and modifies the configuration of 25 % of its workstations every year. The amount of available flexibility varies. It is often non-existent or very small for the primary structure of the building, while some mobility is necessary at a second level, for the partitioning of workspaces and networks via a polyvalent organization of traffic and adaptable spatial configuration.

This flexibility helps to improve productivity by facilitating communication and circulation of documents and bringing workgroups which interact frequent closer together. Design must remain coherent, however, and preserve the privacy and confidentiality crucial for many tasks. The ,,OFFICE'' as a physical location, remains an important reference point, the territory of a particular individual, where good sounds insulation is desirable.

1.2 Origins and development

1.2.1 The Domestic model

While the history of office buildings essentially begins in the 19th century, we can also find some examples in earlier centuries (although they are of purely academic interest)

The oldest government buildings are the Palazzo della Regione, dating from 1233. Many town halls were built in Italy and began to appear in other countries during the late Middle Ages. Between 1250 and 1300, Tuscany was a centre for creativity in construction.
In Italy, during the 14th century, a new profession emerged, that of banker (usually combined with that of merchant). And where did the Medici conduct their business? In their palaces, naturally. They handled money, traded goods and guarded their records in a particular section of the palazzo that was also their home.
Town halls built in the Low Countries in the 15th and 16th centuries, such as those of Antwerp or Amsterdam, may be considered office buildings. They were designed as accounting offices, to house clerks. The Palazzo degli Uffizi, erected in Florence between 1560 and 1571 to a design by Vasari, was also an office structure, as its name indicated, with a large number of occupants.

The Palazzo degli Uffizi, Florence

1.2.2 London, 1830

But all these buildings constructed before the 19th century explicitly refer to other existing typologies, manly the domestic model.

With industrialization in the 19th century, the office building came into its own and emerged as a new type of structure, as several insurance companies had buildings put up specially for them.

The first office building thus appeared in London and some other commercial centers in around 1830. The ,,continuous'' history of the office actually begins in 1819 with the, designed in Nash's Regent Street Classical style by Robert Abraham. Three insurance office buildings followed and demonstrated greater originality than that of Abraham, namely the Westminster Fire Office (1829-1830), the Westminster Insurance Company (1832) and the Sun Fire Office (1841-1842). From this point, office construction began to take off.

These first administrative buildings followed the typology of traditional buildings, and like them were integrated into the existing urban morphology. Cellular offices were distributed along corridors. This layout varied from that of a single corridor providing access along on side only to that of centrally located offices flanked by two symmetrical office corridors (allowing the depth of office blocks to be increased to more than 15 meters). Most designers and costumers remained attached to the classical style. Similar developments occurred in New York, whereas in other cities offices were still being located in converted residences.

The growing demand for office space freed the office from its traditional framework as of around 1850. Office buildings became an object of speculation, leading many investors to put up structures for the purpose of renting to one or more companies instead of one particular user. Such buildings had to be profitable to operate and offer the largest possible amount of space to attract tenants. The strict hierarchy of offices (from the cellar to the piano nobile) corresponding to the status of the employees who would occupy them gave way to large spaces with mobile dividers and natural lighting and ventilation. The introduction of lightweight partitions independent of the building structure made it possible to adapt the building to the user's changing needs. Glazed screens, in addition to transmitting light, also promoted visual communication.

Incorporating the largest possible number of windows became a leading concern. However, while the use of iron appeared to solve many structural problems, it was not to everyone's taste. Although the new metallic structures used in warehouses and railway stations soon began to appear in office buildings as well, reducing the amount of space required to separate two windows, they were to be camouflaged with stone and brick facings for some years to come.

The united States, under the influence of architects like Badger and Bogardus, eclipsed the United Kingdom in the adoption of iron and glass facades, prefiguring the concept of large office floors enclosed in an ,,envelope''.

The County Fire Office, 1819, by Robert Abraham

W. ROUT & SONS' BUILDING, HARDY STREET.
House. Land, and Finance Agents. Offices of the Permanent Building Society and Sun Fire Insurance.

The Sun FIre Assurance Offices, 1841-1842, by C.R.Cockerell

New York, Harper's, 1854, James Bogardus

New York, Haughwout Building, 1857, by J.P. Gaynor, iron work by Daniel Bogardu

1.2.3 Chicago and the skyscraper

Offices did not find a true home or a distinctive character until the appearance of skyscrapers, which according to historians occurred in Chicago in the 1880s.

A remarkable confluence of circumstances was responsible for this development. First, the devastating fire of 1871 created a need for new construction, and the switch from wrought iron columns to steel frameworks allowed buildings to soar higher than ever before. Finally, the recently-invented lift made access to the higher floors of these buildings easier. (Otis lifts were already in use in some office buildings in Boston and New York in 1857.)
The first example of this new wave of office buildings was the then-story Montauk Block, designed by Burnham & Root and completed in 1882. Between 1883 and 1885, William Le Baron Jenney discovered, with his Home Insurance Building, that the metal skeleton system could also be applied in external walls. however, the Home Insurance Building lacks aesthetic flair: the external metallic structure remains behind a heave layer of masonry.
The Tacoma Building by Holabird & Roche, Richardson's Marshall Field department store and the Monadnock Block, also by Brnham & Root and the last building in Chicago to use

load-bearing masonry walls, followed. Holabird & Roche achieved total purity in the Marquette Building in 1894.
A breakthrough occurred in 1895, when Burnham's Reliance Building incorporated metal into the facades, which aside from small tympanums composed of brick were rendered completely in steel girders and glass.

The task was now to find an aesthetic capable of incorporating the steel framework system into a pleasing architectural composition. Louis Sullivan, an architect with fine arts training, created such an aesthetic, focusing on the basis and upper floors of his buildings. The wide, horizontal Chicago Window appeared around this time. The classic office tower, with large open floors a central hub, was thus born nearly a decade ago.
Meanwhile, the development of the Chicago School was cut short by the introduction of an eclectic type of architecture dominating the World's Fair of 1893.

Chicago, Home Insurance Building, 1883 - 1885 by William Le Baron Jenney

Chicago, Reliance Building 1890 - 1894 by Burnham and Root

1.2.4 The post-war period

After the Second World War, Mies Van der Rohe helped define the model for contemporary office buildings: a rectangular glass parallel-epiped epitomizing the slogan ,, LESS IS MORE'' and of which the Seagram and Lever Buildings are the most distinctive archetypes.

Frank Lloyd Wright, with the administrative headquarters of the Larkin company in 1904, established a prototype for tertiary buildings, with floors opening onto a large patio. Later, with the Johnson Was building, he perfected a model with which its horizontally-oriented space looked towards the large open-plan offices of the future.

While the most influential experiments took place in the United States, European architects were not idle during the this period, as the work of Peter Behrens in Germany, based on a central lobby surrounded by open floors with mobile dividers, illustrates.

After 1945, the design of office buildings was affected by four major factors: the shift from a cellular structure towards the open plan: the increased use of air conditioning: the expanding volume of usable perimeter space: and a trend towards speculation on the construction of these buildings, to the detriment of consideration for individual needs.

With the demant for higher productivity, standards were established for the proportion of usable surface area to total area, the distance separating offices from the windows, which floors to set aside for machinery and the width of interior bas modules. **Office design had become a science.**

1.3 Office organisation

Zola, Balzac and Daumier all loved to caricature, in words or pictures, the office ,,environment'' of their era: a soulless room containing wooden chairs and desks, a clock and cupboards, reproduced a seemingly infinite number of times along a dark and dreary corridor, at the end of which was located a larger office occupied for the supervisor. This style still prevailed in many buildings as late as 1930.

In modern time, workplaces have been radically transformed. The quest for the height gave rise to a new approach to offices and how to enclose them, while maintaining a open conception of space.

Offices, which were originally partitioned off, gradually became more open, abandoning the structures of ,,domestic'' architecture in favor of more efficient organizational methods borrowed from industry, such as division of labor, ,,taylorisation'' of tasks and tighter hierarchical work control. The office became a factory for producing administrative paperwork and archives. Today, a great deal of this work is performed by computers, but it once required armies of typists, rows of draughtsman and enormous storage areas. The spaces that were originally home to these new activities today remind us of the interiors of the 19th century factories, which in fact served as the inspiration for the open-plan office of Le Corbusier.

Three causes of change intervened at this stage in the history of internal office design.

1.3.1 Computerisation

The first and most general was computerization, which has had more impact in offices than anywhere else.

1.3.2 Behaviourism

A second change in attitudes grew out of advances in the science of behaviorism. Researchers concluded that offices should be considered environments rather that tools. G. Ranad said that the view ores or oil, a resource to be distributed and assigned a place in the hierarchy on the basis of their qualifications, when actually they are people in their own right who need a place of their own to work. He advocated an entirely new ecology of work.

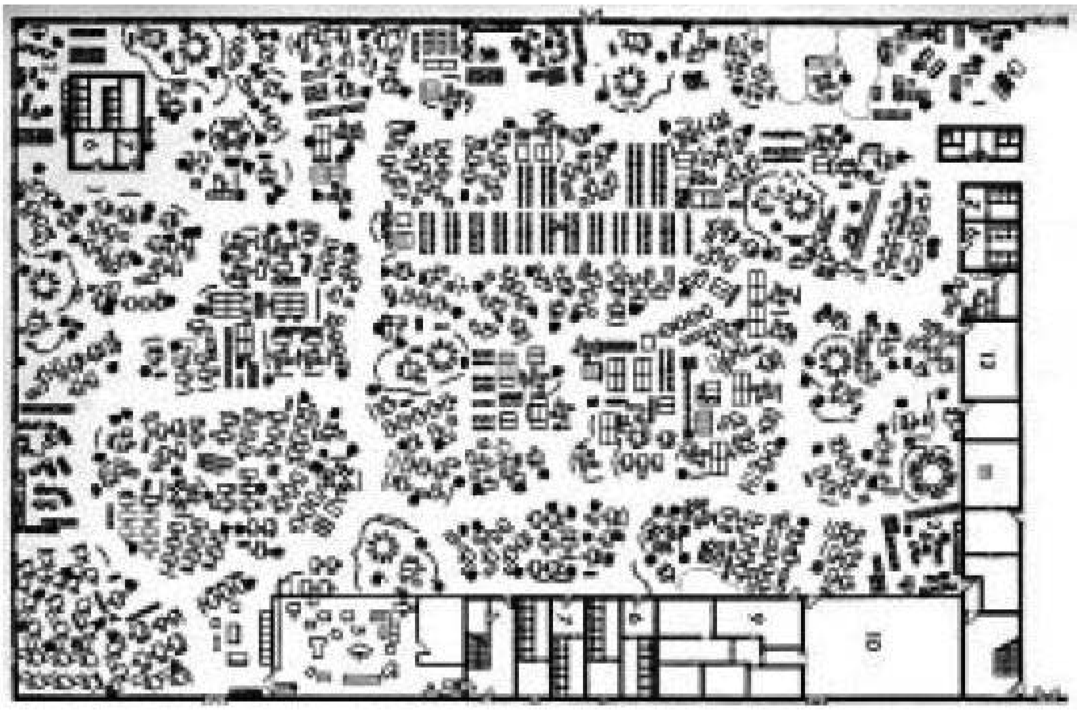
1.3.3 The quickborn method

A third source of change, which also had major consequences, was the idea advanced by the Schnelle brothers, who were conducting a survey in the Wuicborn suburb of Hamburg in 1958, that internal office design should reflect working relationships among employees, instead of a hierarchy of departments. These findings, which soon became known as the Quicborn method, were first applied in 1961.

The first steps towards an open-plan office were thus taken in the early 1960s coinciding with the first attempts to reassess the very idea of work in an office. Such reflection was necessary in the interests of both efficiency and regard for human needs. However the term ,, OPEN-PLAN '' is perhaps somewhat unfortunate, as it could not change the fact that offices are by nature enclosed spaces.

With the use of low partitions and green plants, office space was organized into differentiated units, but with greater flexibility, in an effort to help employees with a work group. The traditional hierarchy, under the influence of the social movements of the era, gave way to a less rigid and more ergonomically sound structure aimed at giving the individual more autonomy and the ability to organize his or her own area of work. Naturally, the efficiency and flexibility inherent in this approach resulted in its being adopted more widely for purely economic reasons. More than ever, offices are economic instruments which must lend themselves to adoption to the needs of a variety of users.

This model has its weaknesses, however. Employees do not have the option of staking out a personal territory: in an open space, they are constantly under observation: and noise and disorder are inevitable, not to mention the usually uninspired of such buildings.



Example of a Quickborn-method open-plan office

1.3.4 The action office

The American designer Miller fathered the third generation of office buildings, consisting of open-plan offices in which office equipment could be combined ,, a la carte''. Miller introduced this system in 1964, calling it the ,,ACTION OFFICE''. Open or closed cells combined to form individual or group offices or meeting rooms, providing vital sound insulation. Dividers stopped short of the ceiling in what were referred to as ,,semi-divided'' offices, to prevent occupants from feeling closed in. Office equipment - cupboards, blackboards, desks - was also attached to these partitions, although it could also be mounted on free-standing bases.

Other manufactures adopted different approaches to office furnishings, opting for more massive, closed work spaces than those advocated by the Quickborn method and less flexible and varied arrangements than the name ,, ACTION OFFICE'' could suggest.
Despite these trends in office furniture and user of partitions, lack of privacy and sound insulation and high rates of occupancy threatened the ideal quality of life that the open-plan office was designed to foster.

Mounting criticism and the conclusions of a study by the National Committee for Technical Control exposed the dangers this design posed to employees' health, leading to its virtual disappearance from structures built after 1984.

1.3.5 Combi and group offices

Since 1975, numerous studies of new forms of organization of office space have been conducted.

While the 1970s were characterized by the construction of many administrative centers with traditional closed offices and the spread of the open-plan approach, the 1980s saw the erection of many headquarters facilities and the appearance of new types of offices, namely the ,,COMBI_OFFICE'' and GROUP OFFICE.

The ,,COMBI-OFFICE'' has been most popular in the Nordic countries. The underlying principle is that each persona working in an office needs a quiet and completely personal area where he or she can think and produce some of his or her work. The ,,COMBI-OFFICE'' provides each worker with a small glassed-in space measuring five or six meters square just large enough for one persona - at the periphery of the building. Communication equipment and shared technical equipment are located in a spacious area at the centre of the building. Each person thus works in more than one location.

1.4 History of daylighting

Among the many systems with which modern offices are equipped (for heating, lighting, ventilation, etc), lighting, whether natural or artificial, has probably had the most influence on building typology and the most impact as an architectural element, and this since the beginnings research. The following pages trace the history of the impact of the study of the effects of lighting in office buildings.

1.4.1 Conquest of light

Builders have always tried to bring light, this natural resource that surrounds us, into their structures and to ,,domesticate'' it. Light has always played a role in human architecture, in all cultures and religions, as though it were a gift from a higher power.

The organization of knowledge about natural lighting in building has a very long history in Europe. The Romans were pioneers in this area. Vitruvius addresses the subject in Book IV of his ,, De Architectura'', noting that ,, On the side from which the light should obtain, let a line be stretched from the top of the wall that seems to obstruct the light to the point at which it ought to be introduced, and if a considerable space of open sky can be seen when one looks up above the line, there will be no obstruction to the light in that situation'' Vitruvius emphasizes careful orientation of the window above all other considerations.

Surviving Roman structures, such as the Pantheon and houses excavated in Pompeii, illustrate the strategies of the era for using natural light. Techniques differed according to the context, but always aimed to provide good lighting without excessive solar gains in summer.

Before artificial lighting became easily available, careful provision for natural lighting was particularly vital. The shortage of daylight in Northern Europe, particularly in winter, led to the use of rather large windows as soon as glass became affordable, and designs allowing light to penetrate thanks to open structures and high ceilings. Inhabitants of the Mediterranean countries, on the other hand, had to find waysto avoid overheating in summer while allowing sufficient light to enter in winter, giving rise to a very different conception of plans and windows. Buildings with patios are a response to this dual requirement: natural light is reflected rather than direct. In this system the patio is often covered with vegetation. Natural lighting and a building's thermal behavior are thereby integrated into the design. Many innovations such as the patio and Venetian blinds originated in Southern Europe.

In this context, the invention of glass facilitated a vital breakthrough in window design. Glass provided a view of the outside and allowed natural light to enter while keeping out the cold. This innovation was particularly important in the cool climate of Northern countries.

The Romans, however, were the first to experiment with thermal management using glass.
The Romans, again, instituted legal protection for access to light in existing properties, anticipating the complex planning necessary today to preserve access to light and sun in contemporary urban developments.

1.4.2 The industrial revolution

Even before industrialization, certain indoor tasks required natural lighting. The primitive state of artificial lighting meant that writing, printing and painting, for example, could only be accomplished when natural light was available. The architecture of spinning and weaving mills reflected the need to allow in natural light, as productivity was directly linked to the quantity of light available.

The need for natural lighting conditioned the form of buildings, which tended to be narrow, as their depth could not exceed two times the height of the ceilings. Where a deeper design was necessary, in a factory, for example, buildings had only one storey to let natural light enter through the roof. If a multi-storey building absolutely had to have a certain depth, light shafts (large enough to suggest the modern atrium in some cases) were incorporated.
Despite significant growth in the use of glass during the 17th century, totally glazed areas remained relatively small, partially due to structural limitations, particularly as concerns

masonry, but also due to glass production techniques imposing strict limits on the size of panes. The high price of glass was another obvious disincentive.

During the pre-industrial period, real progress was made in window technology , as regards both the metal structure and the larger size and improved quality of panes.

As in many other areas of construction, requirements for and techniques of natural lighting underwent profound changes during the Industrial Revolution. New technologies for glass production proliferated: blown-glass cylinders could be used to produce relatively large sheets of good optical quality that did not require costly pouring and polishing. Glass became cheaper and available in larger pane sizes. Window framing techniques also improved. A whole new kind of architecture based on light and air was born.

But the Industrial Revolution had another effect. The movement of people from the countryside into the towns to work in factories, mills and workshops swelled demand for natural light as a majority of the population began to work indoors.

Artificial lighting was originally introduced for the purpose of lengthening the workday. Buildings which had until now been lit by candles and oil lamps were fitted with gas fixtures producing a pure white light. The location of artificial lighting thus became fixed, a factor which only the best architects incorporated into their designs.

The spectacular spread of gas lighting was cut short by the introduction of electric lighting in the late 19th century. The electric bulb had the advantage of emitting less heat than a gas lamp of equal lighting power and it did not smoke, meaning that the ambient air remained expanded rapidly, requiring a completely new approach to building energy use.

The first attempts to manage light and heat simultaneously also occurred in the 19th century, as man became aware of his mastery of the environment. New systems grew out of new technologies and were used and developed widely.

The 19th century saw the gradual introduction of new energy systems, despite architects' lack of knowledge about and scornful attitude towards these new elements, which they preferred not to consider part of the composition of their buildings. The proof of this statement is that public buildings of the 18th and 19th century, from factories to firehouses, look no different from the outside but inside provide a great deal of room for new technologies for controlling the environment.

1.4.3 20th Century ,, obscurantism''

These new systems nonetheless gave rise to new architectural types in the 20^{th} century, including buildings with lightweight structures, low thermal inertia and large glazed areas: ,,curtain'' walls permeable to heat, cold and radiation: heavy structures lacking sufficient natural light.

None of this would have been possible without technologies for heating, environmental control and in particular artificial lighting, which was initially incandescent, with fluorescent fixtures coming into use during the first third of the century.

The development of fluorescent lighting marked the end of an era during which daylighting was at least a design aim, even in practice it was not attained. Fluorescent lighting gives at least a fourfold increase in lighting efficiency , thus reducing running costs and heat gain sufficiently for designers to abandon daylighting altogether. As soon as this decision is made, glazing areas can be drastically reduced or clear glazing can be replaced with tinted or reflective glass, so prevalent on many bland, faceless building of the 1970s. Large areas of clear glazing employed for reasons which lay somewhere between the pursuit of style and the provision of daylight, were identified as the villain, causing massive solar gains and heat losses. Designers happily retreat from the envelope which no longer has to act as an environmentally selective filter. The function of the envelope becomes of an artificial environment provided by the engineers.

Where daylighting is abandoned, the quantity of artificial light as distinct from its quality becomes an obsession. As studies in the USA suggest that productivity in offices increases as a function of luminance, lighting levels as high as 1200 LUX are adopted with no regard for energy costs. This, together with the move to the open plan, led to a monotonous and inhuman working environment of air-conditioned landscaped offices.

Even in buildings which purport to respond to the cause of energy conservation, daylighting is the most frequently neglected aspect of design. For example, the atrium is generally advocated as an energy-saving feature... but not only does the atrium fail to provide daylight to the surrounding spaces, but in most cases the atrium itself is so badly daylit that artificial lighting as to be provided for the well-being of the plants - but it contrary in the case of the thesis project (KOMTEL HQ) it centralizes and improves this lack of daylighting since it is in the middle of the structure and it is all in glass leading this to improve daylighting in the center of the building.

Daylighting design thus becomes neglected if not forgotten art with only a few exceptional cases departing from the norm. And despite the steady increases in the luminous efficiency of light sources, artificial lighting remains the largest or second-largest energy user in most non-domestic buildings...

New technologies were sometimes difficult to incorporate into the design process and were often considered added features to be distinguished as completely as possible. The false ceiling thus appeared in office buildings around 1930. In the years that followed, a few rare structures attempted to use these elements in a meaningful way, sometimes in a plastic manner, generating a new formal language.

Remarkable technological changes have taken place during the second half of the 20th century. New structural systems encouraged the spread of internationally popular architecture based on the curtain wall, which became ,,THE'' style of the century (despite its extreme disregard for the internal ambience, as is often the case where style is the first consideration).

Changing requirements for the internal environment facilitated by new construction methods coincided with higher expectations for comfort. Consequently, control of the internal environment became almost totally dependent on artificial systems with provisions for natural control almost completely eliminated, due to the low cost of fossil duels at the time.

1.4.4 Energy issues

In the last decade, significant progress has been made in the world in energy conservation in housing design. Attention turned from active solar systems to passive systems, and towards the end of the 1980s, consensus views on effective passive design were reached, design rules established, and many examples built both to demonstrate the principles and to provide monitored data to refine techniques. However, daylighting received little attention in this research since domestic-sized buildings present little challenge to daylighting design, window design being dominated by solar collect optimization. Towards the end of this period, attention began to shift to non-domestic buildings.

Many developments have occurred in the last decade, which increase the application potential of daylight. These include innovative component design such as light ducts and light-shelves, and also new materials which can be used to control and redirect light.
We can see that the recent intensification of interest in global environmental issues which has focused interest on reducing energy use in buildings has in turn strongly supported to the use of daylight in non-domestic buildings. There is also growing support for daylight, stemming from a concern for the quality of the internal environment from the occupants' point of view. The phenomenon of Sick Building Syndrome (SBS) is particularly associated with deep plan air-conditioned buildings, and lighting quality, particularly spectral composition, flicker and glare, is thought to be one ingredient in the cocktail of contributory factors. More specifically, Seasonal Affective Disorder or SAD syndrome is directly related to light deprivation. Daylit buildings, due to the non-uniformity of illuminance in both time and space, usually provide sufficient illuminance to prevent syndrome. Research is now being carried out to link these physiological requirements with architectural parameters.

These two concerns, the internal and the external environment, are beginning to come together in the designer's mind in concepts such as ,,GREEN'' buildings or ,,HEALTHY'' buildings.

Let us not forget that architecture has always lagged behind the most significant advances in control of the environment.

I.5 New organisation strategies

I.5.I The atrium

The organization of offices around a large central space, inspired by the townhouse with its courtyard, provided a great deal of flexibility which promoted the development of this approach. Office floors were arranged around a large ,, hall'', a semi-public reception area covered and protected from the outside world. The various levels of the building were thus connected to this vast common area , which contributed to the firm's image and prestige.
The hollow space provided by the atrium allowed the design of larger buildings by admitting light from the interior as well as the exterior of the structure. Office floors could be larger than in a structure with a windowless service and communication hub at its centre.

The monumental space created by the atrium is meant to foster ,, company spirit'' by constantly reminding employees of the status of the firm to which they all belong. This vertical shaft serves to unite a mass of individuals, creating solidarity within enterprise whose dimensions it reflects. This central space can even shelter collective tasks, reinforcing the staff's spirit of community.

The typology still had the disadvantages of lack of privacy and ,, ownership '' of space within a vast office floor, leading to a trend towards more flexible structures and partial divisions of space into smaller units.
The principle of a central light shaft was gradually integrated into a more comprehensive strategy, within which it became an intermediate space with a transparent covering. First, it serves as a buffer space, an area of transition between the outside and inside, a meeting place and a traffic area providing contact - filtered but nonetheless natural - with the external environment. Second, it participates actively in managing energy use in the building, conserving energy by providing controlled heat and light gains through the year.
The atrium thus gradually grew into a central agent, situated in the heart of the building and playing a leading role in organizing traffic and maintaining the quality of the internal environment . It generates a dynamic of convergence towards a focal point, a living centre subject to the play of light, in contrast to windowless areas and the centrifugal movement they create. The atrium becomes a new space, suggesting new functional and relational possibilities and giving rise to new organizational strategies.

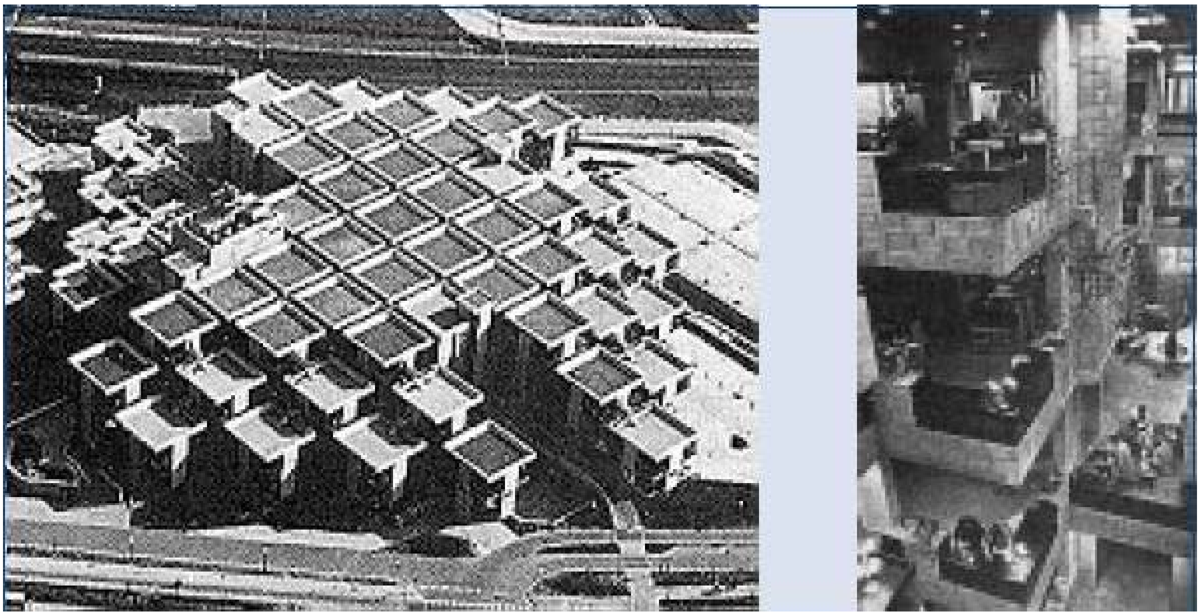
1.5.2 The ramified structure

Other methods of organization appeared, completely transforming the somewhat systematic approach to office building design that prevailed. In contrast to the offerings of the modernists, designers proposed alternatives to the one-piece, largely vertical in the form of sprawling and irregular cellular structures.

Buildings were designed as a succession of entities, ,,cells'' reproduced according to a shifting pattern, linked in a complex network taking the functional organization of the firm into account. Facilities and atmospheres became much more diverse, as size degree of openness and composition varied, as isolated workspace vied with areas for socializing and recreation and busy traffic hubs.

A new concern for the comfort and needs of the staff arose. This cellular organization was an attempt to strike a delicate balance between collective and individual interests, to allow employees to claim as their own a workspace belonging to a larger structure. Such a design allowed for ,,cohabitation'' on several levels, enabling individuality without isolation and promotion of community spirit to coexist, with many intermediate areas to facilitate the transition between levels.

This period also saw an effort to bent architecture to social objectives, give office buildings new functions and allow each building to have its own particular internal structure, while becoming an object of investment.



The Centraal Beheer, by Herman Hertzberger, built in Apeldoorn in 1972, illustrates a new approach to office space. This building which consist some 50 linked islands, is designed to house about 1000 employees in a space in which they may easily adopt to their needs. The resulst is a cellular structure forming a varitable labirynth, joined by a network of light-admitting ,,breachers'' in the structure separating the various units and channelling traffic. This many-tendrilled structure, if it manages to stay coherent, can be expanded and adapted to many uses without loosing its human dimensions.

1.5.3 HORIZONTAL DEVELOPMENT

The need for a site allowing the expression of an individual identity is another factor in office architecture. While some small or medium-sized offices attempt to meld into the existing urban fabric, an ever-growing number of firms is beginning to set up suburban or even rural areas (in industrial or business parks) out of a desire to expand, to open up to the external environment and to free building morphology from the constrains of an urban location. This shift adds new elements to the architectural strategy, including respect for the natural and human environment, use of a building's depth to take fuller advantage of natural light, the dynamic organization and arrangement of spaces around areas for relaxation, buffer zones, patios or internal networks and differentiation of spaces by function.

Development on the site no longer emphasizes the vertical as it did during the era of office towers, but rather seeks to exploit the horizontal dimension provided by such facilities, in harmony with the environment, involving significant changes to general morphology and traffic layouts. In these locations, which impose fewer inherent constrains, buildings develop a structure evocative of certain urban facilities. Elements such as a central plaza or atrium, a gallery or internal ,,street'' appear, while the design is enriched by new elements such as cafeterias, restaurants, shops, libraries, sport facilities etc. Office morphology is organized around a network of traffic routes and areas with diverse functions, with a new freedom to expand.

Building B3 in an English business park, built by Foster & Associates reflects a freedom of configuration and orientation allowing greater openness towards the outside world. The entry is located on the north side with its many windows, while the windowless service areas are situated on the southside. Offices thus open towards the east and west: their frosted white windows filter solar gains and diffuse the light. Atria running the lenght of the building connect the three units and allow natural to reach te structure's centre.

1.6 Recent developmentds and trends

1.6.1 New technologies

The explosion of computer technology has many implications for the organization of work and the configuration of workspaces. Computerization has started a trend towards miniaturization, reduced weight and mobility and has completely transformed methods of communication. A new concept of the work station has also emerged, eliminating many limitations as to its location, thanks to techniques for transmission, storage and long-distance processing of information, which itself flows more freely.

Without calling the typology of office buildings fundamentally into question, the information technology revolution has had a considerable impact on the work environment. Each building must quickly make provision for a large network of cables, facilities and access shafts: connections must be managed to make each office a ,,NODE'' in an increasingly complex communication network. Raised floors provide space for the equipment these networks require while working methods and communications become more flexible, with major implications for spatial organization. Records storage, which has undergone a complete transformation, creates a need for new technical facilities and dedicated space with a number of specific requirements, as copying, printing and filing apparatus come into wider use.

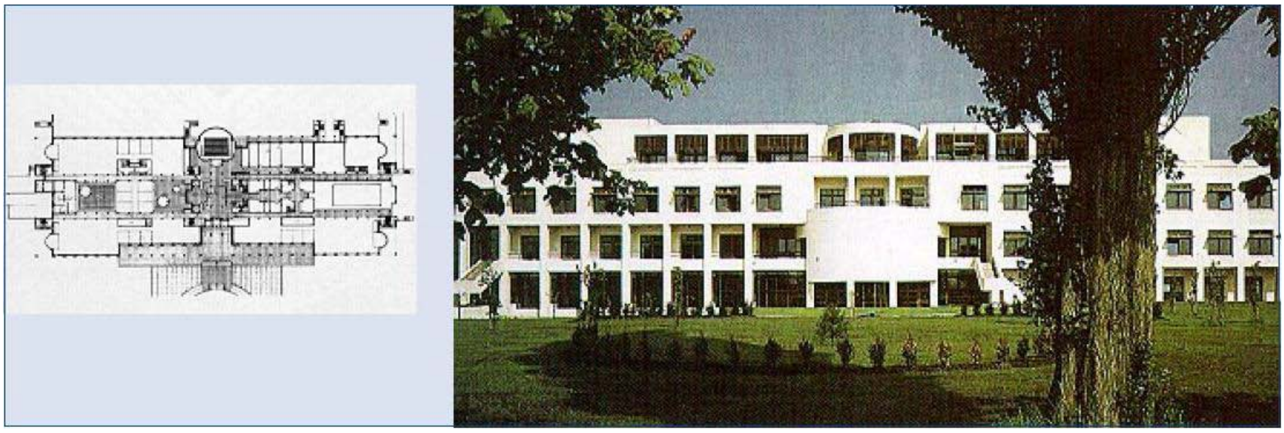
,,Intelligent'' office buildings, pro-equipped with modular cabling allowing for reconfiguration, have begun to appear. They offer any type of firm immediate use of high-powered communication tools. Simultaneously, computerized management now encompasses the operation of the building itself, in the interests of greater efficiency in many areas, including heating, ventilation, air conditioning and lighting.

1.6.2 Different models

New typologies are also emerging, ranging from the multipurpose ,,envelope structure'' which the enterprise moving in can arrange to meet its own needs, to style of architecture projecting a strong identity and meant as genuine media-friendly symbols. On the one hand, the need for a very high degree of flexibility results in the construction of ,, external envelopes'' designed with close attention to aesthetic values, in which internal arrangements and organization are left to the firm which acquires them. On the other hand, the desire to complete engenders new considerations such as the company's aims and social ambitions, its capacity to preserve or maintain its jobs, the quality of its products or services, its impact on the environment or the commercial or media uses of workplaces architecture, thereby giving birth to new and richer designs particularly expressive of an enterprise and its spirit.

Meanwhile, jobs are shifting towards small cities and non-urbanized areas, making available new sites for the construction of office buildings. Existing space may be converted, or a company may choose a business park providing freedom to expand. It may be difficult to adapt structural aesthetics to the diversity of available environments.

Service and traffic areas must ensure communication and exchange. Elaborate spatial strategies may include covered streets, atria, open stairways or informal meeting places. Buildings also incorporate cultural and sports facilities, restaurants, cafes and a greater variety of meeting rooms of varying sizes and configurations.



The headquarters of NFU Mutual and Avon Insurance Group, designed by Matthew, Marchall & Partners and located in the English countryside, encompasses a wide range of facilities, including a restaturant, swimming pool, meeting rooms and relaxation areas in a building of frank and monumental style. The structure is arranged around large lighted traffic areas (atrium and internal courtyyard) to allow better use of depth and more agreeable working conditions. Shades incorporated into the facades protect the interior from excessive solar gains.

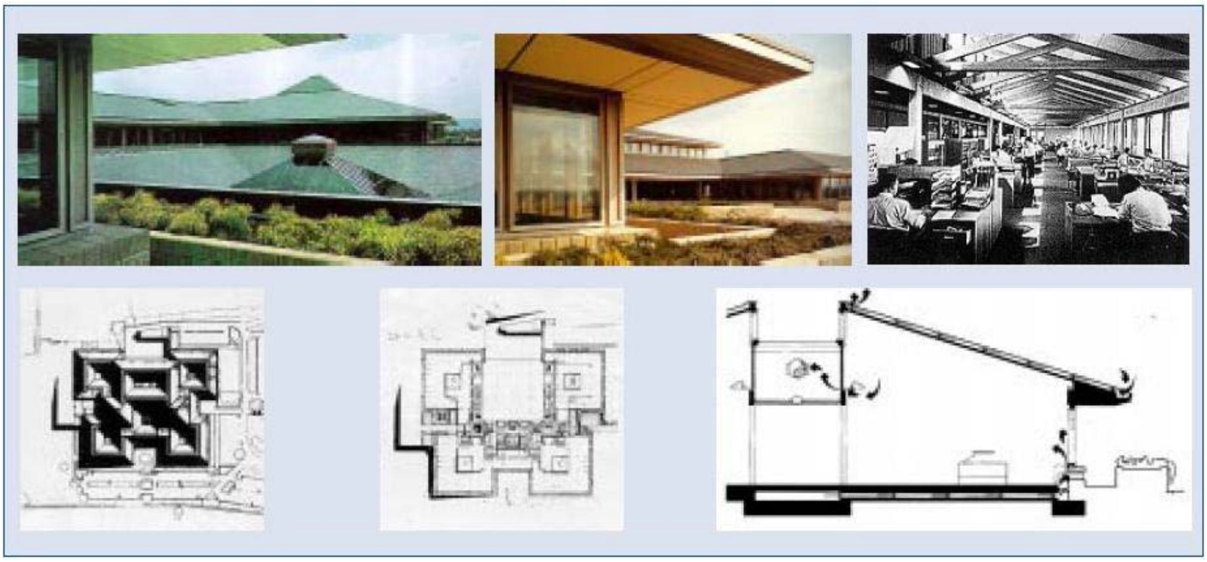
1.6.3 Energy and climate control

The need to save energy and increasing concern for employees' well-being are also factors in the new approach to office architecture. The artificial environment of hyper-conditioned buildings has begun to seem aberrant and is giving way to a concept that strives to integrate natural light and ventilation, as much to reduce operating costs as to improve the work environment.
Air quality, efficient ventilation and an harmonious visual environment are often-neglected considerations that designers are now trying to ensure in new arrangements of workplace .
If a certain degree of variation and abundant, economical natural lighting in a varied atmosphere that provides a welcome change from the monotonous traditional environment.

Given the large internal gains in office buildings, a reduction, via optimal use of natural light, in the loads generated by artificial lighting, in terms of both the energy it consumes directly and the associated cooling needs, can lead to considerable savings while improving the quality of lighting. Opening the building to natural light also requires measures to prevent glare and overheating. Treatment of facades will vary with their orientation. Light shafts, atria and internal streets bring natural light into deeper buildings.

The use of carefully designed natural ventilation, shading mechanisms, the thermal mass of the building and various monitoring systems can create a healthier and more economical internal climate varying within a reasonable range. Air conditioning is restricted to equipment rooms, computer rooms and meeting rooms, where internal gains are often too large to be handled otherwise.

Individual climate management is also becoming more advanced, allowing more precise and personalized control of each employee's microclimate, within basic limits. Fine-tuning of temperature, ventilation, light and shade at local level also contributes to staff well-being.
Concern for openness to the external climate and environment will condition the form and section of a building and requires a comprehensive reflection on architectural design in general. Depth of buildings must be limited to allow natural light to penetrate and facilitate efficient natural ventilation: design will take the features of the building site into consideration and construction methods will take more account of the need for openness to the external climate. Gradual integration of these new concepts will enable designers to combine economy with the desire to create more pleasant working conditions.



The CEGB Building in Bristol (1976), by ARUP, illustrates a concern for climate control ahead of its time. The building's visual impact on the urban landscape was deliberately imnimised through the use of low-lying volumes and nerly flat roofs. Work areas receive bi-directional natural lighting and night-time ventilation trhough the thermic mass of the building, considerably reducing the risk of overheating in summertime. The work environment is therefor particularly dynamic and diverse, with appreciable energy savings.

1.6.4 A NEW TYPE OF WORKPLACE

The growing use of computerization in individual work allows for more flexible working hours, meaning that office buildings are occupied for longer periods each day. The concept of a personal office seems to be on the way out, since the time each employee spends in the building is shrinking in proportion to the total time the enterprise as a whole operates. Simultaneously, more frequent use of personalized equipment and the many uses of which office space must lend itself are leading to a new conception of workspace, with a larger average surface area.

The manner in which employees work their motivations and the quality of social realtions must also be considered more carefully. Work-related communications take a back seat to social communications. Traffic areas and spaces for meeting and relaxation are becoming more numerous and are arranged in a complex network which must be thoughtfully structured to ensure legibility and facilitate contact without creating conflict. An office structure must now house new functions claiming up to half the space available. The walls between the domestic environment, leisure and work are beginning to crumble.

New strategies for organization combining features of open-plan and cellular design are being developed and include systems of team work and specific modes of differentiated work, breaking with traditional hierarchical structures. The dual-purpose work space or ,,combination office'' in which each staff member has a small insulated cell and access to group work spaces, and the group office for a small staff sharing particular operational needs are two illustrations of this trend.

Flexibility is a higher priority than ever, in terms of both work schedules and organization of workspace. Originality must often be scarified to some extend, although some attempts to create varied, stimulating, cheerful but multipurpose offices have succeeded. Creativity and interaction among workgroups are becoming more crucial considerations than absolute efficiency. Standards for lighting, temperature and occupancy of workspaces are being introduced, and ergonomic norms are under development. The architecture and internal arrangement of workspace reflect an effort to take into account a firm's activities and corporate culture.

1.6.5 HIGH PERFORMANCE COMMERCIAL OFFICE BUILDINGS

High performance is used to describe a building that provides a high return on investment for developer, lenders, investors, owners and occupants, as well as for the community and the natural environment. High performance buildings result from smart business choices. These buildings share a number of common characteristic. Overall they are:

- Cost-effective to built and operate
- Energy efficient
- Less harmful to the natural environment
- Safe and healthy for occupants
- Flexible, productive, and satisfaction workspaces

High performance buildings support and attract high performing organizations. When promoted effectively, these buildings differentiate their designers, developers, and owners because they are more competitive, profitable and valuable than conventional counterparts. An integrated approach to design, engineering, construction and operating reduces risks typically associated with conventional buildings. High performance commercial office buildings help developers, owner and occupants reap financial benefits associated with the health, well-being and productivity of such buildings' occupants.
Although high performance buildings integrate ,,green'' and sustainable design principles, ,,green'' buildings are only high performance if they deliver on their stated performance objectives.

BENEFITS OF HIGH PERFORMANCE COMMERCIAL BUILDINGS

High performance commercial office buildings provide seven basic benefits to developers, lenders, investors, owners, occupants and the community

1. Lower operating and maintenance costs
2. Increased building valuation
3. Corporate productivity gains
4. Improved occupant satisfaction and well-being
5. Reduced risk
6. Greater market attraction and competitiveness
7. Enhanced environmental stewardship

I.7 The project

I.7.1 Generally

PROJECT BRIEFING

The building is divided into four units:

A. General (public) area,
B. Office space,
C. Parking,
D. Service core.

A. General area is situated on the ground floor (information desk and exhibition area) and on the top floor (restaurant).

B. Office space :

Offices are organized with different types of usage, which contains around 25 working positions for each floor with an opened system. Every office space has their accompanying facilities such as copy/printing room.

C. Parking area is situated in the ground which has a connection with general areas with the core which is used from public.

There are some other functions situated in the ground which are the service room and the technical room.

D. Service core The service core is detached from the main function which is the office space. Stairs, two panoramic elevators and toiletts are situated in this area.

C1. Parking area/Technical facilities: (- 2 Floor)
C2. Parking area/Technical facilities: (- 1 Floor)
A1. General area: (Ground Floor)
B1.Workspaces/Service and assemby area – (1st Floor)
B2. Workspaces – (2nd Floor)
B3. Workspaces – (3rd Floor)
B4. Workspaces – (4th Floor)
B5. Workspaces –(5th Floor)
B6. Management – (6th Floor)
A7. Public Ares/Restaurant – (7th Floor)
D. Service core – (-2 Floor - 7th Floor)

AREAS:

C1. Parking area: 339.24 m^2 ; Technical facilities: 41.2 m^2

C2. Parking area: 339.24 m^2 ; Technical facilities: 41.2 m^2

A1. General area: 220.5 m^2

B1.Workspaces/Service and assemby area :_220.5 m^2

B2. Workspaces – 220.5 m^2

B3. Workspaces – 220.5 m^2

B4. Workspaces – 220.5 m^2

B5. Workspaces – 220.5 m^2

B6. Management – 220.5 m^2

A7. Public Ares/Restaurant – 220.5 m^2

D. Service core – 72 m^2

1.7.3 Interior walls

The interior glass partitions which are used for this project are by ALUMIL, more concretely from the P - 100 OFFICE programe. Flexible system for interior partitions with walls 70 mm thick.

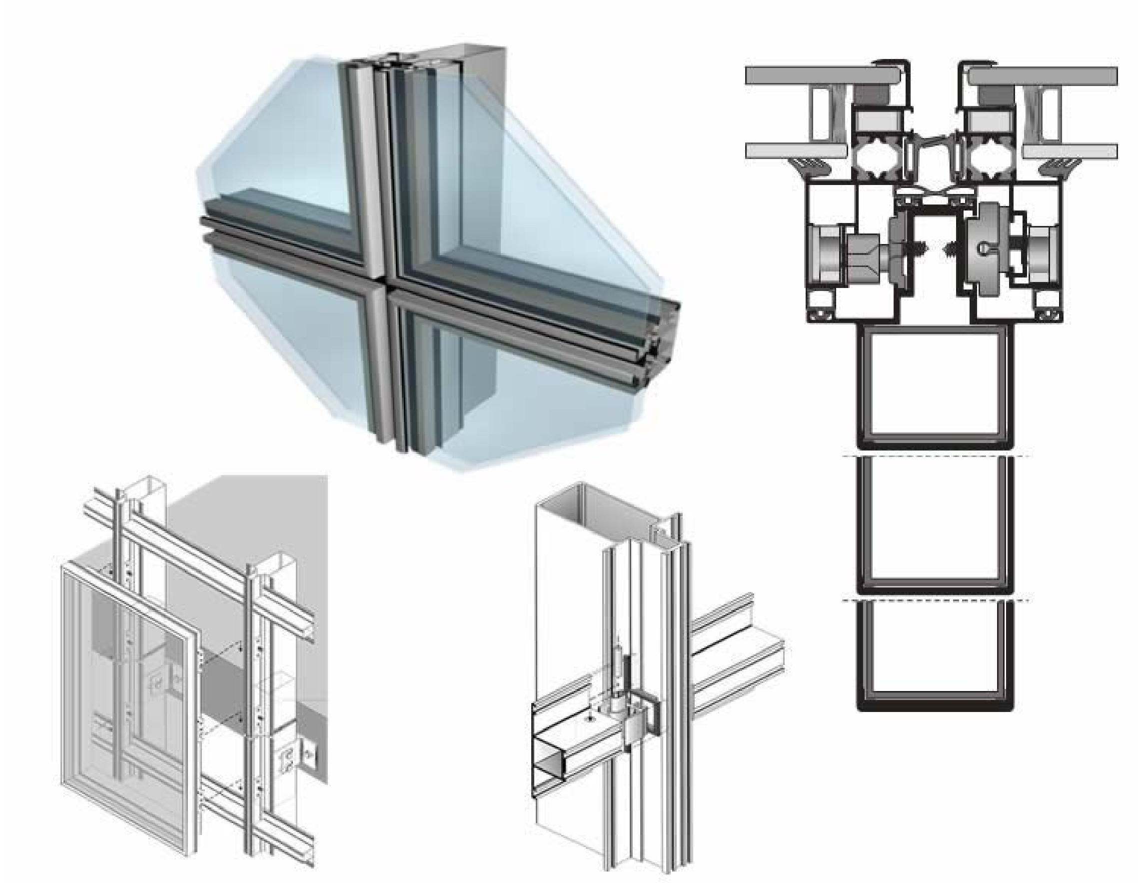
1.7.4 Curtain walls

ALUMIL M3 solar semi-structural

The System is characterized by :

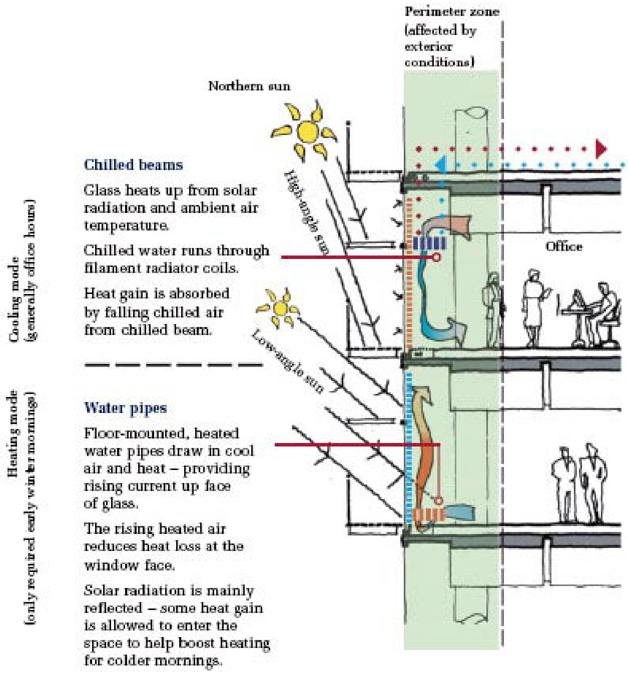
- Structural construction, which makes it capable to adjust to possible deformations of the building due to earthquake and vibrations, without applying any strains on the system.
- With a large variety of special profiles, ensuring perfect application in any construction, at the same time allowing the creation of arched or curve surfaces in angles of 900 - 1750.
- The large size columns ensure endurance against static and dynamic loads.
- Each cell is surrounded by a small frame, 15 cm wide, which contributes to the stability of the cellular construction, offering maximum safety.

- The opening windows are identical to the fixed ones, providing a uniform facade.
- The insulation of the system is achieved by using triple gaskets (EPDM) and a smart sys-tem for discharging humidity.
- The system is supported by thermal break profiles, creating an alternative system (M3T), offering the highest level of thermal insulation.

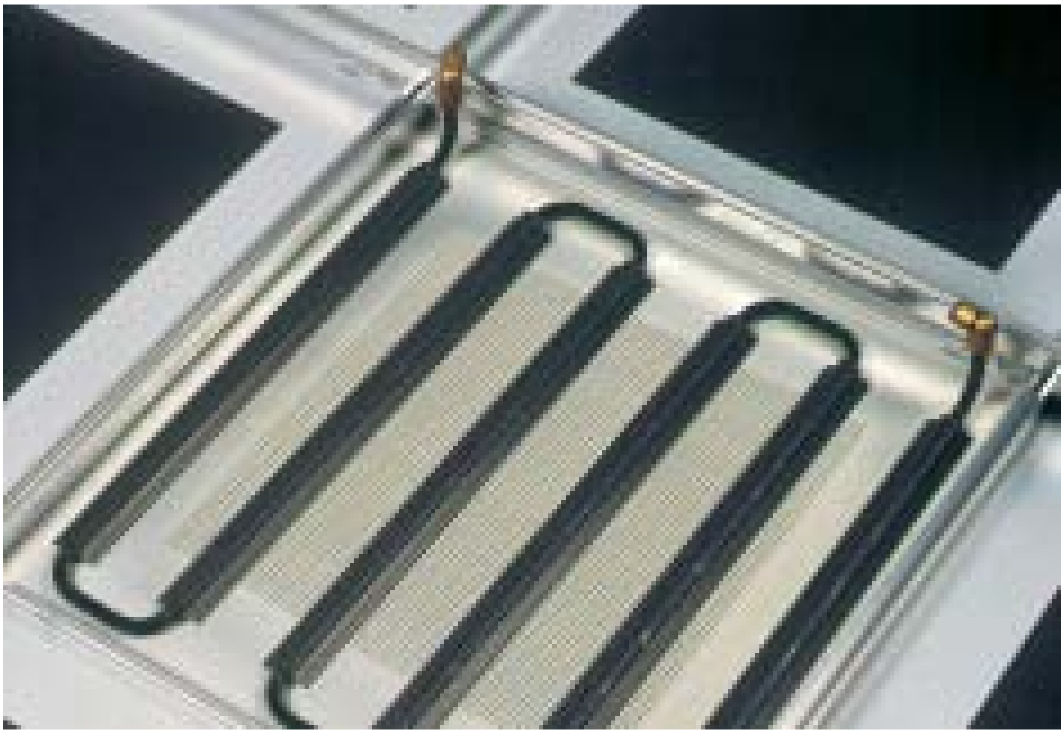


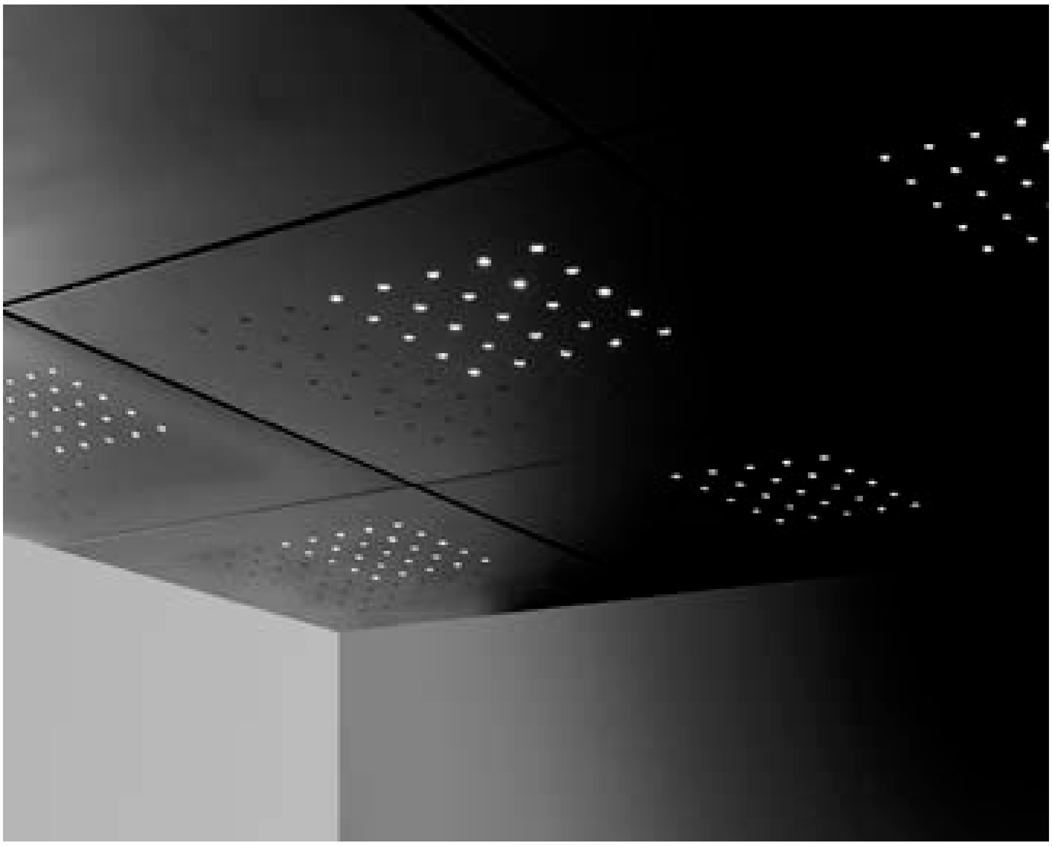
I.7.5 HVAC

One of the main topics in the thesis project and yet one of the most significant I consider being is the way HVAC works. I have combined secondary HVAC systems in a way that if treated together as one system, one could say that it can work to create a thermal comfort in the building. I have combined cold ceilings (from the company VEKTRON), perimeter floor heating (from the company CARRIER), and raised floor heating (a new product from the company BUTECH) to act as one primary heating/cooling system. All these combined heating and cooling system are controlled and monitored by the BMS (building management system), therefore providing a good energy saving system.



Perimeter floor heating





Cold ceilings by KREON

In recent few years, the fast development of building technologies and materials has brought to a consistent cut in thermal output required for having comfort both in winter as in summer. According to this, the radiant floor heating system provides now the best performance even in summer, thanks to its **cooling function**.

Cold water at low temperatures runs into the pipes coils, thus cooling the floor surface and consequently the indoor environment.
Controlling the moistness in the air is very important. In fact, when humid air comes into contact with a cold surface, it often happens a condensation reaction. You need therefore to supply your radiant floor cooling system with **air treatment devices**, capable of dehumidify air and avoid the moistness condensation on the floor.
For the same reason it's very important to use the radiant plant in complete security, and to keep water circulating at not too cold temperatures ((18-20°C) inside the pipes circuits, even if it could produce an higher thermal performance (than 20-30 W/m2).

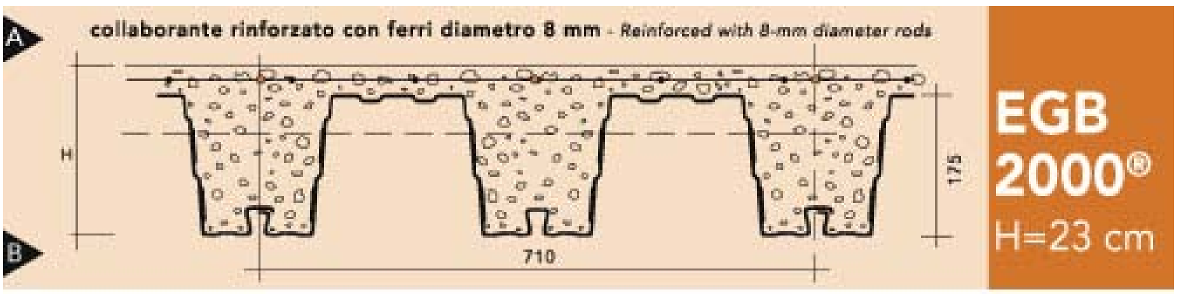
In order to face possible further needs for sensible heat, Eurotherm proposes a range of **dehu-conditioners**, i.e. dehumidifiers capable if necessary of lowering temperature of the treated air thanks to an innovative and patented system. The modular raised floor heating, with removable panels. The possibility of inspecting any component of the installation is combined with the greatest comfort of a panel heating. This kind of modular raised floor heats any room through a low temperature system installed in every module Electrical and network cables can be easily reached in the hollow space of the flooring. The full working of the system is very fast due to the small thickness of the eating module, which gives more flexibility to its functions. With the new modular raised floor heating, it is possible to match the expectations of flexibility and the quality of the office life.

Radiant raised heating/cooling floor

I.7.6 Floors

I have used prefabricated profiled slabs from the company MARCEGAGLIA. The combination of steel plates with concrete is based on their adherence, which excludes the mutual slipping, due to the surface impressions on the corrugated element.
The loft system is completed by the application 2 cm from the concrete extrados of an electro-welded net, whose standard dimensions (minimum) are provided afterwards and whose function is load distribution
and inhibit the formation of cracks. In case of patterns with more bearings an armature "in negative" can be added so as to increase the loft s bearing capacity.

The additional tables for the mentioned cases are provided. It is also possible to add an armature "in positive", which is not included in these tables since not included in the standard construction scheme. Buckle steel plates can be supplied only in galvanized condition.

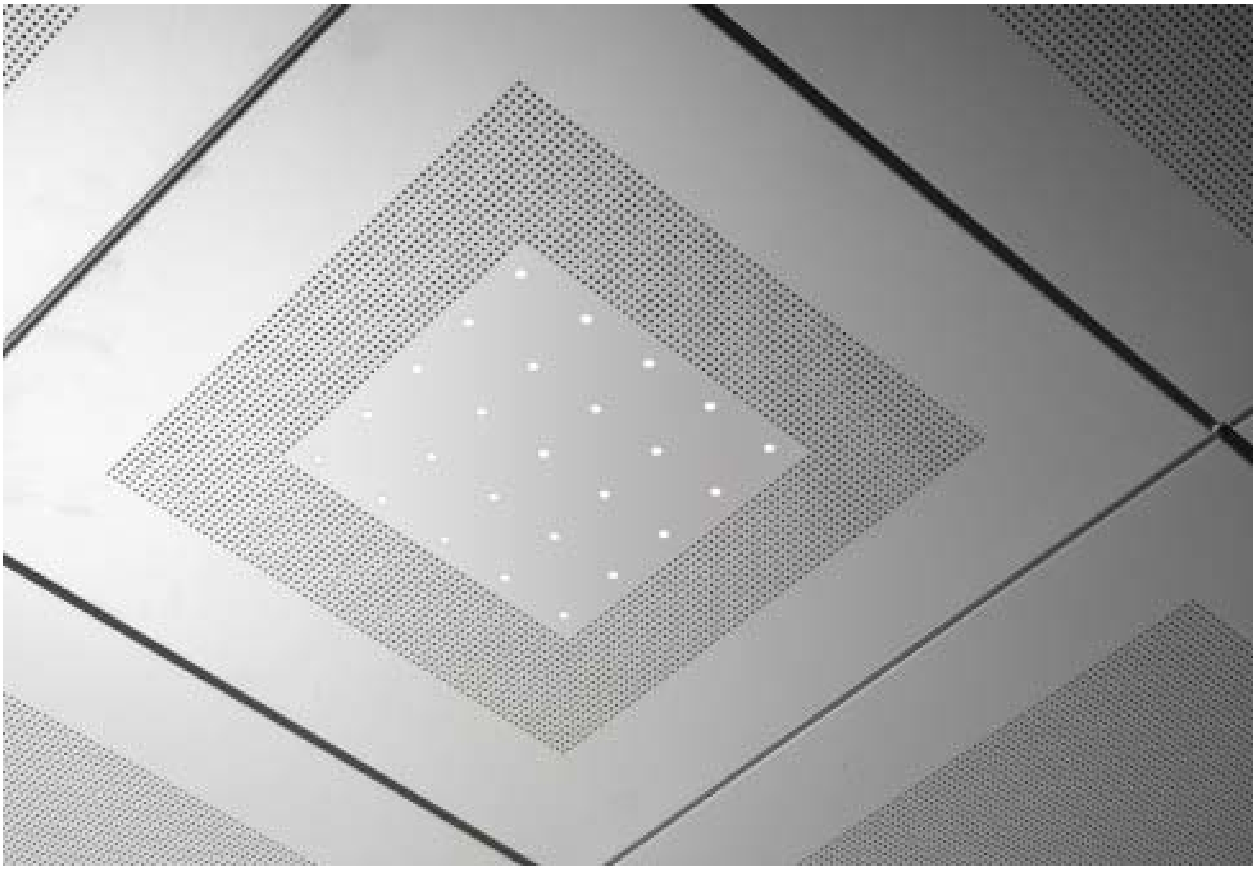


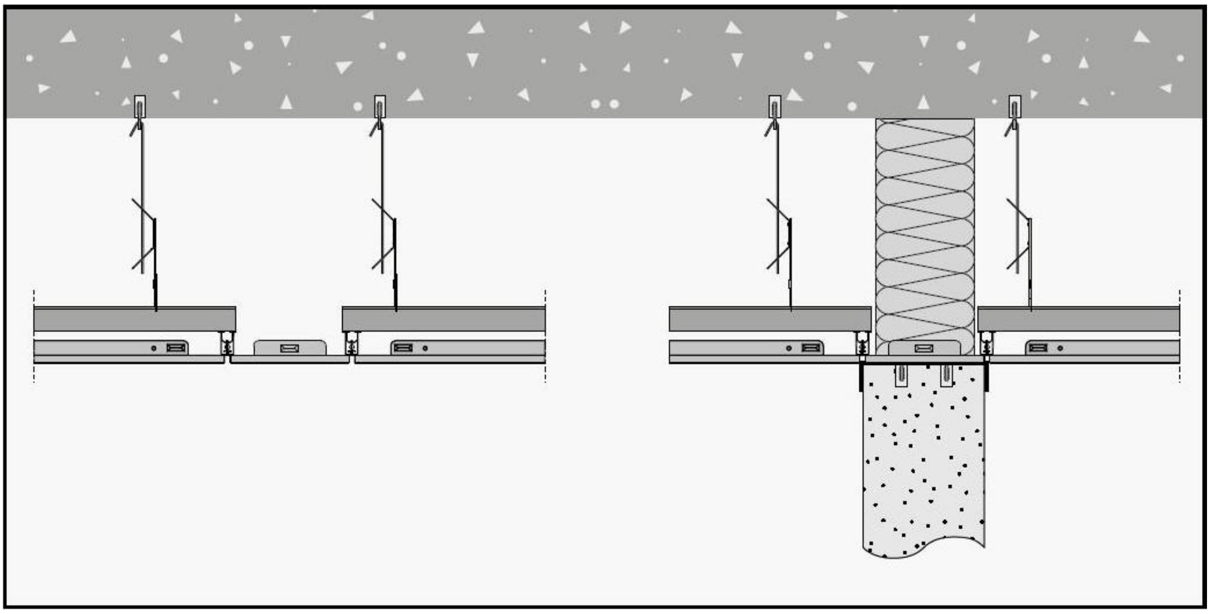
I.7.7 Ceilings

Ceilings usually have an indistinctive character in the space surrounding us. In daily life, as well as in architecture, they are seldom noticed. I tried to make these anonymous surfaces come alive: structure, relief and symmetric shadow gaps support the architectural rhythm of space whilst creating effects like rest, order... and even chaos. These atmospheres are moreover duly emphasized by the repetitive use of integrated luminaries arrays.

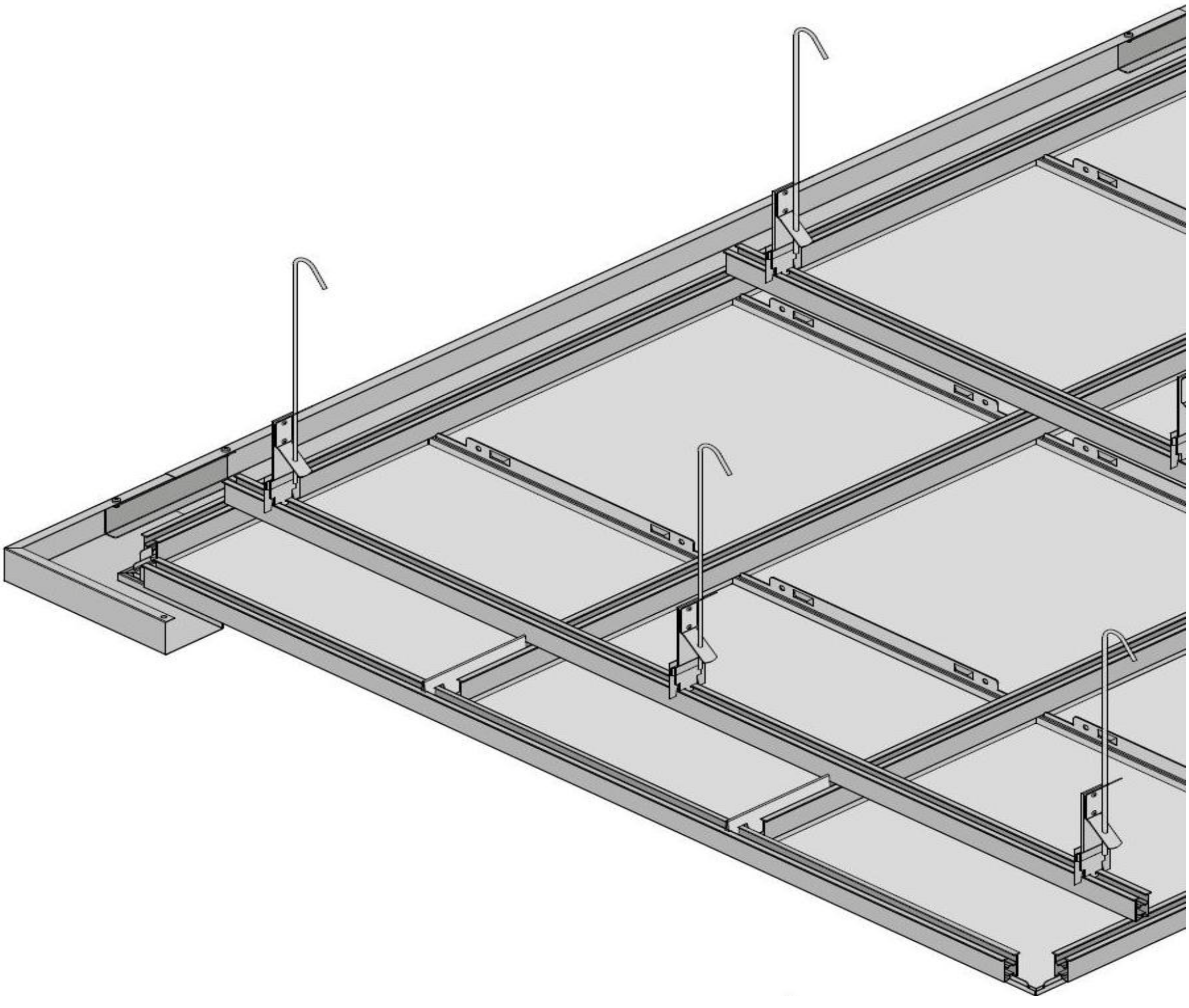
Simplicity must not be the result of an uncritical reduction. Instead, it should be the convergence and synthesis of the complex requirements imposed on ceiling solutions by contemporary architecture. Taking its cue from this concept, the ceiling solution for the thesis my thesis project does more than just span the room. It has been given a unique solution for the integration of building service systems that need to be accommodated in the ceiling: lighting, ventilation, cooling, heating, fire protection and much more. The most pursued objective was to offer unity in design translated through technical solutions.

Design that gives prominence to simplicity, permanence and calmness requires precision so as not to become trivial. The more one condenses, omits and simplifies, the more the significance of the detail is increased. Unity and simplicity of details are the very ones to concur to great architecture.





CEILING DETAIL 1

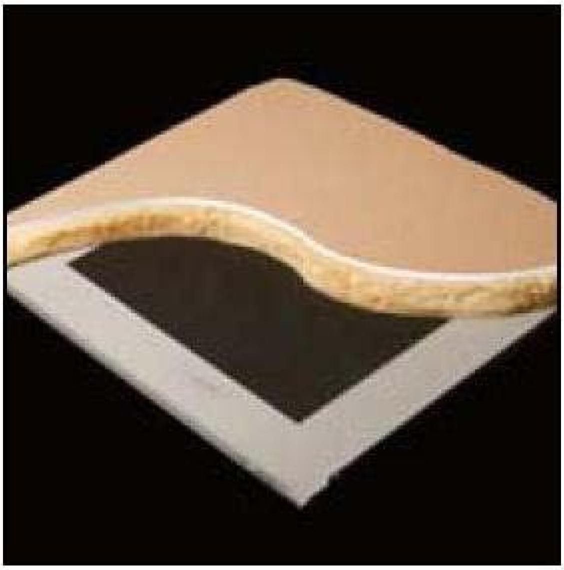


CEILING DETAIL 2

ACOUSTICS

The choice for a specific ceiling has strong influence on the acoustic properties of space. It is fundamental to the planner to take sound behaviour and function of space into account while defining the most appropriate ceiling. The noise level in an area is determined by the source and reflection of sound on walls, floors and ceilings. Sometimes these reflections are desired in cases in which, for example, speech intelligibility must overcome large distances. Most likely though, reflections can be inconvenient because high noise nuisance may arise and disturb privacy.

Two are the properties to be considered in the design of suspended ceilings: sound absorption and sound attenuation (longitudinal noise). Through its varied range of ceiling tiles with different acoustic properties,



Tile with mineral wool inlay + gypsum board

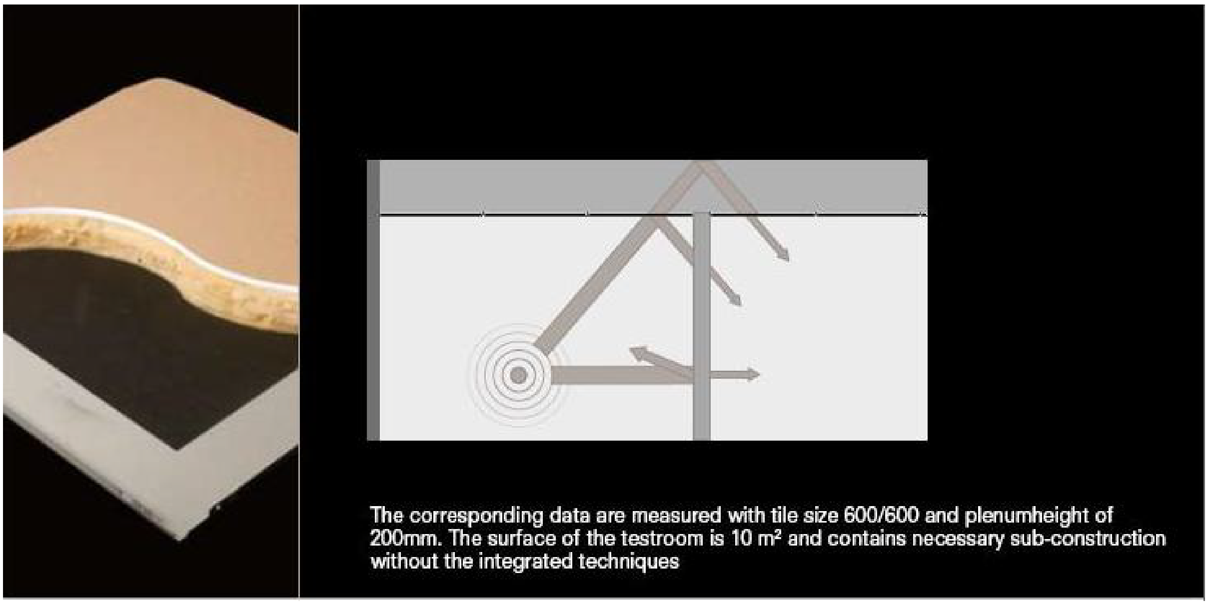
SOUND ABSORPTION

Sound absorption is the ability of a surface to absorb sound and therefore to minimise sound reflections in space. The reflected sounds are observed later than the initial sounds, fact that generates echo, raises noise level, blurs the actual message and creates an uncomfortable feeling.

Sound absorption is determined by reverbation time. Reverbation time is measured in seconds and is the time required to delete sound by 60dB. The quantity of sound that a material is able to absorb is expresses in sound absorption coefficient. This is measured according to ISO 354 / EN20354 (acoustics: absorption measurements of sound in a reverbation room).

The sound absorption coefficient is a fraction of the absorbed incident sound power. The remaining quantity of sound is reflected into space. The absorption coefficient depends on sound frequency and is usually measured in each octave band between 125 and 4000 Hz. The sound absorption coefficient has a value between zero (no absorption - all the sound is reflected) and one (complete absorption - equivalent to an open window).

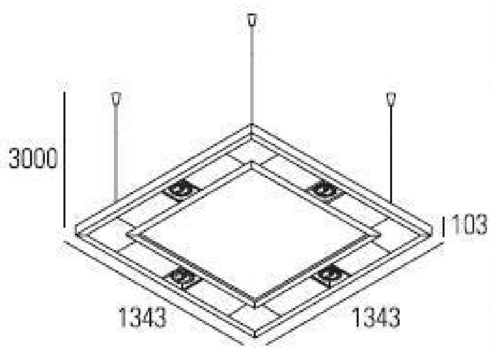
The ceiling system which I chose for the thesis project absorb sound by allowing sound waves to pass through the perforated surface where they will react with underlying material: custom-manufactured and sealed mineral wool modules. Depending on thickness (20 or 30mm) and density (50 kg / m^3) sound absorption coefficients can range from 0.8 to 0.9. Size and patterns of perforations on the tile also contribute to increase sound absorption and an optimal result can be obtained with an open area between 15 % and 22 %.

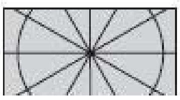


I.7.8 Lighting

Appropriate workplace lighting is an essential component of an office environment since it can impact on comfort and performance. The consequences of inadequate lighting may range from a dreary and uninteresting working environment to one where visual discomfort and fatigue are conducive to eyestrain, headaches, poor posture and muscle fatigue.

Lighting problems can occur in any type of office environment but problems tend to be more common and severe for computer users. The reason for this is that offices in the past required high levels of illumination because typewriters, pens and pencils were the dominant tools and paper was the primary medium for information. Offices today however, which rely more and more on computers, generally do not require such high levels of illumination. Computer offices should have lower illumination levels if possible since high light levels can "wash out" out the image on a computer screen and make it harder to view. If light levels are decreased, task lighting (e.g. desk lights) can be used to provide additional light for hard copy tasks.





Intra lighting - main lighting from the workspaces

Intra lighting - atrium light pendants

Intra lighting - light pendants

1.7.9 SOLAR PANELS

Solar power has been here for quite a while.

The sun is one of the most fascinating parts of our lives. It is the most luminous object in our spatial neighborhood, so much so that while it's in our line of sight, we can't even see the other stars in the sky. It has been an object of awe, and even worship, since antiquity. Ra, the head of the Egyptian pantheon of gods, was the sun god, and historians speculate that the construction of the pyramids; as well as other ancient landmarks such as Stonehenge, are all based on the sun's path through the skies during the year. The sun does so much for life on earth (ourselves included) that we tend to take it for granted. For example, without the sun's power, our water cycle would not occur, the temperatures on this planet would be so cold we would not be able to support life, and even little things, such as the wind, would not occur the way they do.

However, the exponential growth in human consumption of energy over the past century has highlighted a new potential use for the sun: solar power. The old adage "there is nothing new under the sun" rings appropriately on a number of levels here. There's the obvious sun connection, but there is also the fact that humanity has been harnessing the power of sunlight just about as long as we've been a sedentary species.

History tells us that we first switched from nomadic tribes to a sedentary pastoral society because we learned to farm. Farming, of course, is highly dependent on sunlight. Over the millennia since, we have used the sun as a source of light, heat, inspiration, and empowerment. The newest use is summed up in one word: photovoltaic. It comes from the Greek roots photos or photi which stand for light and volvere or volvitare which mean to roll. While the Latin root for photos is pure, volt draws a more direct line of descent from the scientist Alessandro Volta, the Italian physicist who created the first battery back in the 18th century.

The dawn of modern photovoltaic possibilities.

Just a few decades after Volta's work on batteries, another scientist by the name of Alexandre-Edmound Becquerel discovered the photovoltaic effect. Simply put, the photovoltaic effect is the ability of a substance to emit electrons when it absorbs sunlight. Eventually this discovery was put to use in the first photovoltaic cell, which was made of selenium and a gold connection between the cell and the measurement instrumentation. This was the first solar panel, although the cell was very small compared to today's models.

This is because modern solar panels are actually comprised of an array of photovoltaic cells. The sun's light strikes the individual cells, each of which emits electrons in response. The individual cells can be placed in either a parallel or chain circuit and those circuits connected into an array in order to produce the amount of power required.

Solar panels produce direct current (DC) which is the type of current used by any battery operated apparatus. Cell phones, cars, calculators, watches, and hand held power tools are all examples of direct current electric machines. However, our houses are utilizing alternating current (AC), which is less easily stored than DC, but easier to transport long distances. So for many applications of solar power, especially those in the home, the electricity needs to be run through an inverter to change the current from AC to DC.

The challenge of efficiency.

By the time the photovoltaic effect had been discovered and solar power was a scientific reality, another form of energy production had already leapt to the forefront. The dynamo was producing electricity for nearly fifty years before the first photovoltaic cell was created. Even more challenging was the relative ease of turbine-based electricity production. The first solar panel's conversion efficiency was a mere 1%. Betz's law says that the maximum theoretical yield of a turbine is 59.3% of the energy that passes over the blades of that turbine. Even early dynamos and turbines were miles ahead of solar panels in efficiency, and perhaps more importantly, they were less expensive to build.

Ever since inception, solar power has fought to increase the efficiency and affordability of its conversion so that it can be competitive with other forms of energy production. What is truly impressive is how little variety the rest of the electric industry displays. Without exception, other major electricity production methods revolve around the turbine. Nuclear and fossil fuel power plants use their fuel to create steam, which is used to spin turbines to create electricity. Even other alternative energy sources, such as hydroelectric power and wind power are built around the turbine.

Because of this fact, the other forms of production have had a shared pool of discoveries from which they have all advanced. Photovoltaic advances had a much more limited pool from which to work, at least to start with. The first practical applications for solar power were made during the space race of the cold war. The challenge scientists faced was how to power electronic devices in space, where the payload restrictions made even the most parsimonious engines an impractical solution. They needed to run electronics on something that wouldn't add to the takeoff weight of satellites and manned spacecraft. The only thing available out in space was light.

The time of solar power had begun.

Scientists started building solar panels for satellites, but the advances of the electronics translated very well over into photovoltaic advances as well. For one, the entire electronics industry was built on semiconductors, which were the same materials needed to produce solar power. Every advance in silicone production and handling was a corresponding leap forward in the capacity for solar panel production.

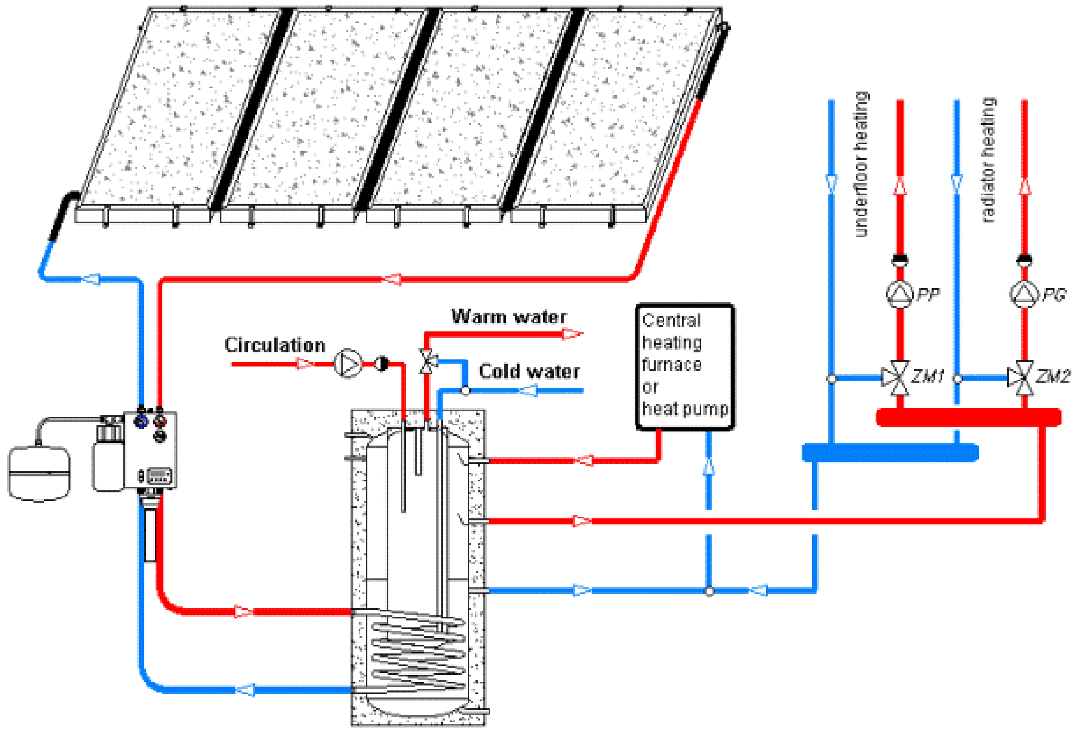
There was a lag between the need for solar power in space and the perceived need for it on earth. For one, up in space solar panels had unfiltered sunlight to work with, which had a much broader spectrum of wavelengths to absorb. The first panels didn't take full advantage of this spectrum, but the thinking of the time was that the shielding ability of our atmosphere would take the point out of using photovoltaic systems on earth.

The energy crisis of the 1970's drastically changed our outlook on electricity, and energy in general. No longer was fuel for our cars something to take for granted. No longer were our coal power plants going to run forever for next to nothing. Suddenly any method of energy production that was free of foreign influence was looked at as something desirable and worth developing.

The rise of solar power.

Although the late 70's were the impetus, viable solar panels for consumers didn't come around until more than 10 years later, in the early 1990's. The first hurdle facing them was an effective method of storage and transfer. As mentioned above, a solar array produces DC, and our homes run on AC. An inverter could convert from one to the other, but the energy was still more easily stored as DC. Lithium ion batteries provided a viable storage method, and by placing the batteries before the inverter in the system, the power only had to be converted once. This was important, because each conversion from DC to AC, or in reverse, was run at a 10% power loss. This loss has been shrunk in the years since, which is another important part of solar viability. So a battery charging system was viably in place, and a conversion system had also been worked out. That left the cost, which was still admittedly high, for us to work on.

As the 90's drew on, other factors came together to both increase the productivity of solar panels and reduce their cost. California led the way in subsidizing the switch to solar power with the California Solar Initiative, and other countries as well as the US federal government have followed suit. As importantly, grid tie-in systems were invented that let a home take full advantage of what alternative energy they had installed, while using the power company to supply any gaps in power production they had. A home that produces more power than it uses can even sell it back to the power company with grid tie-in systems. Perhaps most impressively, solar panels have gone mobile, with everything to concept solar cars and planes, to setups to power the appliances on your RV or boat.



1.7.10 Furnishings

Design and optimisation of space, division and separation, for an environment rich in sensorial stimuli, and sensorial and material contaminations that still project an image of order and harmony. An environmentally modular and complete system, not only innovates the areas, but also the processes, consenting the realisation of the layouts on the basis of the work groups and functions, hence, reducing the time needed for people to move about. The furnitures that i chose for the thesis which is produced by BENE has always distinguished itself on the market for the sensitisation towards a new philosophy to live the office experience that places man and his psycho-physic balance at the centre as a key for personal motivation, creativity, learning, output, satisfaction and health. The creation of a new design language, with the capacity to dilate and contract according to changing circumstances, where shared/inter-relational workspaces co-exist alongside spaces for thinking reflection/silence without interruption of sorts, all this thanks to the possibility for a flexible, functional and sensorial structure.

Engineer workplaces

Plane material and finishings

Structure in white coated structural steel. planes in one colour UB, in the following colours: white, light grey and coal.

Structure material and finishings

Metallic structure coated in white epoxy powders. Telescopic structure available in lacquered and methacrylate MDF .

Cabling possibility

The block cabling management system is simple and extremely flexible. The raceways for the cables are very spacious and, most importantly, allow for the total possibility for inspection.

Flexible office furniture for IT integration. Fostering interaction and communication. Easily adaptable to today's office requirements. Multifunctional unit for different office zones and applications such as team work or project-focused work; for desk sharing or classic workstations – or as a touch-down in office space. Power and network cabling are stored in a generous cable tray in the table centre; sliding tabletop or cable flap for comfortable access. Extra elements of the third working level: rails, organiser units, screens, plugbox, filing trays and shelves, flatscreen swivel support, tasklight adapters etc. Individual desks come in different sizes, modular composition allows reversible configurations.

Engineer workplaces

Communication areas

The importance of communication in all its facets has been recognised and is reflected appropriately in our custom-made, modern office space solutions. Work is given new surroundings: Open or characteristically more reserved, supporting interaction, communication and the exchange of knowledge – by chance and informally between two colleagues or formally and officially with customers and partners.

StandUP meeting point and communication area

Areas for concentration

Work doesn't only require inspiring cooperation with others, you also need to retreat and reflect. Concentration areas offer the areas you need for this – with fewer or no interruptions – for isolated and concentrated work, confidential talks and for relaxation and inspiration.

The office is a central space where a variety of changing tasks are in motion. The focus is on communication – with colleagues on the board, in employee meetings, with business partners and customers. Privacy, discretion and confidentiality at the highest levels require an ambience of style and clarity.

The desk is sometimes a meeting table. The accessory furniture highlights the manager's status. The chosen design language is less a backdrop than an unequivocal statement of corporate values and leadership philosophy. This is the source.

Everything has its place. The furniture creates a perfect work environment. The arrangement keeps people grounded and allows them to think. They have the world under control. Alone or in a team. Daily business concentrated and connected.

Focused Work **Concentration meets continuity**

No man is an island unless the job calls for it. In the intensive process of business communication, people sometimes need some peace and quiet - and self-determination. Success and the quality of the results depend on it. Good thing everything here is arranged so compactly. There is space for personal needs, even for a certain level of privacy. With its mix of mobile and stationary furniture, the inclusion and organisation of walls and vertical surfaces, this is an environment that promotes concentration and connection. On their breaks, people dive into a stream of shifting discussion topics and various streams of news. For exchange, updates, recreation. Afterwards, however – back in their own micro cosmos – their thoughts return quickly to the matter at hand.

In short

A personally designated, traditional workplace in the Back Office – in individual, multi-person or team offices.

Visually and acoustically screened for concentrated work. Functionally and ergonomically designed with a furniture ensemble consisting of work desk, table panel, dividing or office walls, and accessory furniture.

Conference room table

1.7.11 BMS (BUILDING MANAGEMENT SYSTEM)

Building Management System (BMS) is a computer-based control system installed in buildings that controls and monitors the building's mechanical and electrical equipment such as ventilation, lighting, power systems, fire systems, and security systems. A BMS consists of software and hardware; the software program, usually configured in a hierarchical manner, can be proprietary, using such protocols as C-bus, Profibus, and so on, recently, however, new vendors are producing BMSs that integrate using Internet protocols and open standards such as DeviceNet, SOAP, XML, BACnet, Lon Works and Modbus.

Characteristics of BMS

A BMS is most common in a large building. Its core function is to manage the environment within the building and may control temperature, carbon dioxide levels and humidity within a building. As a core function in most BMS systems, it controls heating and cooling, manages the systems that distribute this air throughout the building (for example by operating fans or opening/closing dampers), and then locally controls the mixture of heating and cooling to achieve the desired room temperature. A secondary function sometimes is to monitor the level of human-generated CO2, mixing in outside air with waste air to increase the amount of oxygen while also minimizing heat/cooling losses.

Systems linked to a BMS typically represent 40% of a building's energy usage; if lighting is included, this number approaches 70%. BMS systems are a critical component to managing energy demand. Improperly configured BMS systems are believed to account for 20% of building energy usage, or approximately 8% of total energy usage in the United States.

As well as controlling the building's internal environment, BMS systems are sometimes linked to access control (turnstiles and access doors controlling who is allowed access and egress to the building) or other security systems such as closed-circuit television (CCTV) and motion detectors. Fire alarm systems and elevators are also sometimes linked to a BMS, for example, if a fire is detected then the system could shut off dampers in the ventilation system to stop smoke spreading and send all the elevators to the ground floor and park them to prevent people from using them in the event of a fire.

BMSs are usually delivered as fully integrated systems and services through companies such as Inconex Com Company, Valgab Invest, Eurosting, Siemens, Honeywell, Severn Controls,Voltas, Johnson Controls, Trend Controls, TAC(Now Schneider Electric), Trane and others. Independent services companies use solutions from companies such as Rockwell Automation, KMB systems, BBP Energies, Delta, Distech, Circon and KMC controls. New, more flexible solutions that link BMS systems to enterprise management software include SAP, OpenView, Archibus, Maximo and other smaller companies and solutions including (Peekaboo!)Augusta Systems, GridLogix, Network Harbor, North Building Technologies Ltd., Bright Core and Tridium. ' Some of the newer systems such as 'Unique 5', by Severn Controls, allow control of plant such as boilers, air handling units and cooling towers to be controlled via a simple graphical interface in a web browser

FUNCTIONS OF BMS

To create a central computer controlled method which has three basic functions:

- CONTROLLING
- MONITORING
- OPTIMIZING

the building's facilities, mechanical and electrical equipments for comfort, safety and efficiency.

A BMS SYSTEM NORMALLY COMPRISES

- POWER SYSTEMS
- ILLUMINATION SYSTEM
- ELECTRIC POWER CONTROL SYSTEM
- HVAC SYSTEM
- SECURITY AND OBSERVATION SYSTEM
- MAGNETIC CARD AND ACCESS SYSTEM
- FIRE ALARM SYSTEM
- LIFT, ELEVATORS ETC.
- PLUMBING SYSTEM
- BURGLAR ALARMS
- OTHER ENGINEERING SYSTEMS
- TRACE HEATING

BENEFITS OF BMS

BUILDING TENANT/OCCUPANTS

- GOOD CONTROL OF INTERNAL COMFORT CONDITIONS
- POSSIBILITY OF INDIVIDUAL ROOM CONTROL
- INCREASED STAFF PRODUCTIVITY
- EFFECTIVE MONITORING AND TARGETING OF ENERGY CONSUPTION
- IMPROVED PLANT RELIABILITY AND LIFE
- EFFECTIVE PLANT RELIABILITY AND LIFE
- EFFECTIVE RESPONSE TO HVAC-RELATED COMPLAINTS

BUILDING OWNER

- HIGHER RENTAL VALUE
- FLEXIBILITY ON CHANGE OF BUILDING USE
- INDIVIDUAL TENANT BILLING FOR SERVICES FACILITIES MANAGER
- CENTRAL OR REMOTE CONTROL AND MONITORING OF BUILDING
- INCREASED LEVEL OF COMFORT AND TIME SAVING

MAINTENANCE COMPANIES

- EASE OF INFORMATION AVAILABILITY OF PROBLEM DIAGNOSTICS
- COMPUTERISED MAINTENANCE SCHEDULING
- EFFECTIVE USE OF MAINTENANCE STAFF EARLY DETECTION OF PROBLEMS
- MORE SATISFIED OCCUPANTS

1.8 Outlook and Conclusion

A number of trends for the future seem to be emerging. The lavishly appointed building with air condition throughout is losing ground to structures of **simple**, **functional** but nonetheless **elegant design** which may be easily be **adapted** to the needs of the various firms likely to occupy them in succession in today's uncertain economic climate. This type of **flexibility** remains economic consideration of prime importance, along with **architectural quality** sufficient to attract tenants and visitors. Environmental concerns, **air quality,**

lighting and sound insulation, and the increasing importance of energy conservation all influence the design and organization of space.

The quality of the working environment is gradually emerging as an essential factor in **productivity**. Spatial diversity and the size of areas for socialization and contact are major considerations to be incorporated into a project. Provision for mixed and varied use of space makes it more productive, more attractive and more profitable, all at the same time.
Work takes on a new dimension. Use of office space for longer periods each day is changing the concept of an ,,individual office'', while home working or work in varied locations is becoming more common. Moreover, work is being combined with leisure in a more harmonious manner, offering greater flexibility in time management.

The importance of a firm's image and new philosophies of spatial organization give the role of architecture renewed importance and encourage diversity in configuration and arrangement of workspace. The office building can claim a new-found economic durability which tends to humanize it and gradually to free it form the constrains of rigid structures. Variation in proportions and relationships, **openness** to the weather and the environment, the introduction of new modes of communication and more emphasis on individual needs and working conditions are giving birth to a new generation of office buildings.