

## Based on perspective of the owner of the design change control of the construction project

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**Abstract.** Continuous construction project cycle is long, large investment and a lot of participants, the internal and external factors, involving a lot of unpredictable change easily to project design. This paper respectively from the perspective of the owner, designer, contractor, this paper expounds the formation of design change, analyze the design change might brings to the project schedule, cost, and combined with practical engineering cases and widely existing problems, and from the owners' perspective, how to realize the control and management of design change are expounded, and gives corresponding solutions.

### Introduction

The characteristics at a point in time make construction projects much more uncertain than normal projects. Before the project starts to construct, any design can't predict all the situations that the project will encounter, so design alteration is inevitable.

Design alteration, which is to modify, alter, and improve the previous design properly, normally, should send out drawings or design alteration notices. From design unit's view, design alteration is to guarantee and promote the project quality, or correct the previous design mistakes, or to satisfy construction site conditions.

### Negative affects caused by design alteration

No matter for construction project owner, design or contractor, design alteration will not only increase the project cost, some will influence the duration and quality of project, even cause compensation disputes. As design alteration and previous design has the same legal effect, which is the basis of project claims. In addition, the alteration is related to a wide area of content, caused by complicated reasons, covering a long period, will influence the final cost of the project and the vital interest of the project owner and contractor directly. Design alteration is a preliminary work, which will influence the follow-up work and construction duration and project cost directly. To analyze the influential factors, propose control directions and management contents, is an important part of cost control.

### 3 Main reasons of design alteration

Different perspective, different influential factors, During project construction, project owner, design and contractor unit may all propose design alterations. The writer categorizes and summarizes the main reasons of design alteration with project practical cases as below:

**From project owner perspective.** The main reason is inadequate preparation of preliminary work. Such as geological survey, before designers start to design, the project owner should provide complete, detailed and precise material to the design unit, to avoid unsuitable preliminary documents. Secondly, during design, the project owner changes its design opinions too frequently, and authorizes the design unit to change designs, is another important reason of design alteration.

**From design unit perspective.** The design unit works for the project developer. Excellent design not only can prevent project delay caused by multiplicative alterations, but also helps project owners to control investment, enhance quality, shorten duration and save cost. Defective design gets opposite

effects: such as inadequate depth of design, design mistakes, improper match of majors among design departments, or design alteration caused by designers themselves, not only influencing design progression, and also cause economic damage and reduce the efficiency of design unit.

**From contractor perspective.** Along with a rapidly growing economy, the internal construction market competition is getting fiercer. During the bidding process, “win the bidding at a reasonable low price” gets more popular, which means some contractor reduce the quotation price to win the bidding, and put their focus on making design alteration during construction. Even worse, they receive unreasonable designs from the design unit through power rent-seeking, to make up their loss and get extra profits. In addition, because of the uneven construction level, some contractor can't comprehend drawings accurately, don't construct according to drawings, which leads to construction function change or hidden safety and quality troubles, and the design units have to alter designs to resolve those problems. Although contractor shoulder responsibilities, to project owners, project duration and quality certainly will get different levels of influence.

### How project owner achieves control and management of design alteration

Design alteration leads to cost increase indirectly. As the project owner and the contractor struggle to reach an agreement on indirect cost calculation, the indirect cost influence caused by design alteration becomes the reason of design claim dispute. The management of design alteration is one of the main reasons of construction project investment management and progress control. Project owners should deal with design alteration properly according to construction engineering's basic process and characteristics, to prevent or reduce the cost, quality and duration negative effects caused by design alteration. This article mainly from the following several aspects in the construction project owner management and control of design change, as shown in table 1.

Table 1 In the construction project owner to change control system design

	The focus of the control	The content of the control
Owner to control the key of design change	The early stage of the construction project	Geological exploration: ensure the accuracy of the data
		The function of the project: the functional requirements of project complete
		Project goal: the project specific goals
		Positioning of the project: the project location (such as complex)
	Optimizing design scheme	Multiple solutions: through value engineering to determine the most economic and reasonable scheme
		Select the designer: design experience, strong ability of the unit
		Cost awareness: to guide the designer cost consciousness, the implementation of quota design
	The management of the contractor	Communication: to enhance the owner (the designer) communicate with the contractor
		Contractor selection: the construction technology, and high management level
		Rent-seeking behavior: avoid rent-seeking between contractor and designer
	The design change process	Contract basis: the contract shall determine the design change process
		Contractor selection: the construction technology, and high management level
Data record: design change causes, solutions, and related content		

**To do adequate preparation of preliminary work.** Preparedness ensures success, unpreparedness spells failure. The preparation of preliminary work is directly related to the quality of project implementation. Project owners should do enough preparation, including geological survey, data collection and so on, and then provide complete, detailed, and precise material to the design unit. Geological survey is part of the basics for project design, and influences design, construction and other stages. From many past cases, which are not difficult to find out, projects have to change designs, mostly because geological survey is not detailed enough, inaccurate or even seriously wrong. Thus, in preliminary work, the project owner should pay high attention to the geological survey, and pick a very professional survey team, and provide accurate and clear preliminary material.

Case 1: In 2013, in a post disaster reconstruction project of Wen chuan, geological survey paper only identifies there are lots of boulders and cobblestones underground, so the design basis is piling foundation. However, construction site shows the diameter and density of cobblestone is seriously different from the fact. Because the actual diameter and density of cobblestone is high, the quantity of yellow mud for piling is apparently increased, and makes it more difficult to construct. Contractor receives cost compensation through design alteration with confirmation of project owner at the site. Only calculating yellow mud, 3 million RMB has increased.

**To control design alteration strictly.** Construction project normally has characteristics of high duration. If design problems can not be resolved timely, to postpone preliminary stage to construction stage, design alteration will be more, certainly will lead to enforced idleness, shutdown, rework and so on, eventually duration delay, project and construction cost increased. Thus, to control design, alteration should start at the preliminary work stage. The project owner should consider about purchasers' requirements and wishes sufficiently, to prevent big changes in the later stage, so unnecessary removal and decoration will not happen. In design progression, workers of the project developer should assist designers; provide all accurate data as reference to designers. When the design almost finishes, project owners should organize people to review project function, technical feasibility and economic rationality and so on thoroughly, to analyze in depth, raise questions, to make design changes early, which can prevent design changes as the project function can not satisfy using requirements in later stage because of insufficient early consideration.

**Try to optimize design plan.** As everyone knows, design result decides 85% even higher project cost, so design plan management (although the total design cost is only 2% of total project cost) is of uppermost priority of project cost management. The same single project may have two or more design plans, which results in different cost. Thus, in the precondition of satisfying function, to compare different plans, to determine a technique-advanced, economy-reasonable plan which can achieve the necessary function with lowest lifecycle cost, it's highly important and necessary. Project owners should hire experienced, technical, reputable and high qualification grade design unit. Project owners should guide design unit workers to enhance cost consciousness, to promote cost quota design under the premise of design quality is guaranteed, control the design influence to project cost. Under the premise of design quality is guaranteed, project owners should have a good communication with the design unit, to reduce project cost by limiting concrete, reinforcement bar and joint design and so on.

Case 2: one project owner hires a design unit to design a multilevel parking garage, including a two-level basement. After communication between project owner and designers, based on past empirical data, designers reduce steel content  $128\text{kg}/\text{m}^2$  to  $128\text{kg}/\text{m}^2$  by increasing pillar spacing and changing size of pillars and beams. It reduces the quantity of concrete iron, saves the models quantity and emulsion paint of pillars and beams, saves construction cost, and increase the project profit indirectly.

**To strength construction unit management.** At present, lots of projects are launched, project bidding naturally increases. Because the construction and management level are uneven, some contractors win biddings at an unreasonable low price; however in construction, they adjust the price many times, or increase project items or price to guarantee profit by changing design. Thus, project owners should consider overall abilities of contractors and strength management towards them under the premise of low bidding price.

Case 3: One contractor offers quotation price to build SBS modified pitch waterproof coiled material roof, which has included cleaning base course, implanting ointment to flashing head, and painting cold priming oil. The contractor requires the design unit to state clearly about independent painting cold priming oil in the roof of the building with strong emphasis; demands audit unit to add quotation item of painting cold priming oil. The purpose of that is to repeatedly calculate price to get unreasonable profit.

**Perfecting the process of design alteration and site sign.** The economic impact caused by design alteration is the important and difficult point. When design alteration happens, project owner can not determine the cost by shopping around normally, on the contrary, they can only negotiate with contractor based on its own experience, which certainly will increase the cost. Thus, perfecting signing right of related people is important and necessary. Such as, the altered drawings signed by the design unit must get project developer's written confirmation. If without project owner's written confirmation, design alteration notification is invalid; if project developer confirms orally, formalities must be completed afterwards.

Every design alteration must make a good record, including time, reason, plan, and proposed unit and so on. Design alteration must be technically-feasible and economically-rational; project developer should make a discreet decision after balancing duration, cost and other factors.

### The tag

Based on causes and adverse effects of design changes are discussed in this paper, in combination with the actual case from the perspective of the owner to summarize the causes and management of design change and control method. Design change is part of the engineering change, it is related to the construction schedule, quality and cost of the project, whether responsibility in the designer, contractor, or the owner, the main body of its management is the owner. Therefore, as a key link in cost control, the owner should improve their management level, the strict control design change, design change control as much as possible in the early stages of the design.

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