

Discussion on controlling measures and the influence of engineering change

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Abstract—This paper discusses the engineer change of the main causes and influence on engineering cost, calculated the reasonable method to avoid and control engineering change and approach, in order to achieve the purpose of scientific management to effectively control investment through analyzing the engineering change in detail, and combined closely with the project cost.

1 Introduction

The change or optimization of the construction materials, construction technology, construction method, structural layout, use function, component size, technical index and project quantity of part or all of the project in accordance with the procedures agreed in the construction contract due to the change of site construction conditions, the requirements of the construction unit, the optimization of design scheme, the change or the instruction of the supervision engineer, all these are called engineering change.

Engineering change has a wide range and complex relationship, which makes the calculation and audit of

engineering change more complex and difficult. Good control of engineering change can timely grasp the real-time investment information of engineering project, and engineering change cost estimation is one of the main basis for engineering change decision-making. Therefore, good control of engineering change is related to the smooth progress of the whole project investment, and it is more conducive to do a good job in investment change estimation and timely send dynamic investment information. The data shows that under the traditional construction mode, different engineering changes will greatly affect the price, cost and project operation (Table 1). Therefore, it is of great significance to do this work well.

Table 1 Influence of change on cost and operation

NO.	Proportion of price change(R)	Total cost change (Great/Little)	Project operation (Yes/No)
1	$R \leq 10\%$	Little	No
2	$10\% < R \leq 15\%$	Little	Yes
3	$15\% < R \leq 20\%$	Little	Yes
4	$R > 20\%$	Great	Yes

2 Main causes of engineering change

2.1 Changes due to unreasonable design

At present, there are some construction units that do not pay reasonable attention to and supervise the design work, and there are still a large number of engineering designs that do not carry out design bidding, do not select the design scheme of survival of the fittest, and lack the awareness of high-quality products; in order to save the

cost of design and consultation, some construction units may design the engineering construction drawings through informal ways of private design, It is likely to lead to incomplete drawings, mismatches or errors, and great differences with the actual situation on site, resulting in frequent design drawings modification, resulting in engineering changes, seriously affecting the construction progress, and at the same time, causing difficulties in project cost control. In addition, there may be some design personnel with low quality who only focus on the technical aspects, but ignore the economic,

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social and environmental benefits of the project construction, resulting in unnecessary design changes in the construction process, delaying the construction period and increasing the project cost.

2.2 Changes due to improvement of construction standards

In the actual project, there are often changes in the number of projects, construction materials, construction technology, etc. due to the unilateral requirements of the construction unit to improve the construction standards.

This will make the project cost greatly exceed the project budget, beyond the investment limit. For example, the original design of a real estate sales center and club decoration project is to lay ceramic tiles on the ground and wallpaper on the wall. At the end of the project construction, the leader of the construction unit went to the site for inspection, which did not meet the decoration effect of the lobby floor and wall that had been completed according to the drawing. It was required that the floor should be chiseled and replaced with marble, and the wall should be replaced with modeling wall, resulting in engineering changes.

2.3 Changes caused by non strict implementation of project construction procedures

In the actual engineering construction, some construction units do not implement the necessary engineering construction procedures, and do not make scientific and feasible preparation for the project, so the project starts in a hurry. It results in the phenomenon of design, construction and change at the same time. In the process of construction, once problems are encountered, they can be changed if they want to. After the change, the necessity and rationality of the project change can not be effectively controlled, managed and supervised. There is no corresponding responsibility restriction for the large loss and waste caused by the project change. In addition, in order to maximize the probability of winning the bid, the construction unit often uses the method of lowering the price or deliberately quoting at a price lower than the normal market price, or using the unbalanced quotation method. The bad result is that the project cost greatly exceeds the approved amount of investment, and even causes the problem of capital gap, which leads to various problems.

2.4 Design change caused by imperfect management of development organization

In the actual engineering project, there are often some construction units, in order to obtain more profits, usually want to use various methods to cause unnecessary engineering changes. Some construction units even make changes without the consent of Party A, resulting in the fact that the construction house has to be recognized. If the construction site managers of the development organization are not strong sense of responsibility, lack of

experience and ability, and the management is not perfect, it is easy for the construction unit to "drill" all kinds of loopholes. At the same time, in the actual construction process of construction projects, there are often some reasons that the construction unit unilaterally in order to change the design effect of the building, change the use function, adjust the plane layout and decoration methods and so on, resulting in the increase or decrease of engineering quantity.

2.5 Supervision does not perform its duties

In the actual project, some supervisors do not control the project and the project cost. They often just act as if they are going through the motions. For example, the project changes proposed by the construction party are generally approved, signed and sealed after they are not reviewed. Some of them even sign the changes after the project is completed and the project is hidden, so there is no further research on the site. Because the supervision work is irresponsible, not serious and rigorous, and the signature of the changed project is not taken seriously, which is also the reason for the frequent occurrence of engineering changes.

2.6 Unreasonable administrative intervention

At present, some leaders of the relevant competent departments of construction projects and the leaders of the construction units often only stay on the total cost of budget and settlement, which leads to the lack of comprehensive and systematic project cost management, and the lack of the whole process, multi-faceted, real-time and dynamic management. In the stage of project preparation and construction, it is not careful to organize the construction party, the construction party, the supervision party and other parties to participate in the joint review of drawings. When problems are found in the project construction or after the construction is completed, it is necessary to discuss and solve the problems, put forward changes or modifications to the project, and even remove the parts that are under construction or have been completed, resulting in the delay of construction period and the waste of a lot of materials and people power.

3 Control measures for engineering change

3.1 Strengthen the preparatory work of construction project

It is one of the effective ways to reduce the engineering changes in the process of engineering project construction to do a good job in the preparatory work and investigation and analysis of engineering project. In particular, before the design of the project plan, the discussion of the construction project plan should be held many times, so that the design unit can fully understand the process requirements, functional requirements and

corresponding special requirements of the building, and determine the overall design concept, design style and overall layout, so as to avoid engineering changes.

3.2 Control the design of drawings

Good design drawings are the foundation of the smooth progress of the project, and good design drawings are the first key to control the engineering change and design modification. Through the comparison of several schemes in engineering design bidding, the advantages and disadvantages are selected to make the engineering design more scientific, complete, applicable and economical. Secondly, after the preliminary design drawings come out, the drawings should be reviewed to avoid the design changes in the construction process. Third, do not report for approval, design and construction at the same time. Before the project has not been approved, the drawings have not been reviewed, and the relevant environmental protection procedures have not been completed, the relevant government departments must resolutely prohibit the construction of engineering projects.

3.3 Strictly grasp the relevant rules of engineering change

The construction project related personnel must adhere to the spirit of high responsibility and strict scientific attitude towards the engineering change. The engineering change should be carefully investigated in advance, with relevant graphic data, in line with the existing design requirements, in order to meet the construction requirements.

The engineering design change must be carried out strictly under the constraints of the relevant provisions of the construction contract, and any engineering change cannot make the contract invalid. The project change shall be strictly implemented in accordance with the procedures required by the contract terms and shall be submitted for examination and approval. The project change without the approval of the construction unit and the design sheet shall not be constructed without authorization.

3.4 Reasonable management of engineering change

From the beginning of the project to the completion of the settlement, the engineering change runs through the whole construction process of the construction project. How to manage the engineering change is an important link to reduce the adverse impact of the engineering change on the whole project.

3.5 Standardizing the management of project bidding and construction contract

The project bidding shall be carried out in strict procedures. After a construction unit wins the bid, the construction contract shall be signed in accordance with

the provisions of the bidding documents, and the provisions in conflict with the relevant provisions of the bidding documents shall be strictly signed. We should pay attention to and strengthen the examination and management of construction contract.

3.6 Accurate preparation of bill of quantities

In the bidding stage of the project, the preparation of the bill of quantities should be done well. The prepared bill of quantities should be reviewed by the relevant departments to check the omissions and make up for the deficiencies, so as to reduce the deviation in the calculation of the base bid price or the errors, omissions and weight of the bill of quantities as far as possible.

Acknowledgments

Based on the detailed analysis of engineering change, and combined with the actual project, this paper discusses the main causes of engineering change and its impact on the project cost, so as to obtain reasonable methods and ways to avoid and control engineering change, and effectively control the project investment with scientific and reasonable management means.

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