

In construction projects, a change refers to an alteration or a modification to pre-existing conditions, assumptions or requirements. It can be caused by either internal or external factors. Different changes may have different effects or consequences. The objective of change management is to forecast possible changes; identify changes that have already occurred; plan preventive impacts; and co-ordinate changes across the entire project.

Types of change

A change that occurs during a project can be a 'gradual change' or a 'radical change', depending on the degree of severity. A gradual change, also known as incremental change, happens slowly over a prolonged period and its intensity is low. A radical change is sudden, dramatic and has a marked effect. Gradual changes often occur during the design development stage, where many decisions are fine-tuned and refined progressively. Radical changes occur more often post erection or post design development phases.

Project changes can also be classified as 'anticipated changes' and 'emergent changes'. Anticipated changes are planned in advance and occur as intended. On the other hand, emergent changes arise spontaneously and are not originally anticipated or intended.

Another way to view project change is through its necessity. In this way, project changes can be classified as 'elective changes' and 'required changes'. An elective change is where one may choose whether or not to implement; and a required change is where there is no option but to make the change.

Causes of change

The causes of project change may originate from either external or internal pressures that are being applied to the project. External causes may be due to technological changes, changes in the customer expectations and tastes, changes in competitors' activities, changes in government and policies, changes in the economy and finally demographic changes in the society. Internal causes may result from changes in management policy, changes in organisation objectives and changes in the long term survival strategy of the organisations involved.

At a more detailed level, the causes of construction project change are usually generated from either design or construction activities. The design-generated causes include design changes, design errors, omissions and operational improvements.

Construction driven causes are often linked to the unsatisfactory site conditions that hinder good workmanship, material handling and plant operation. The design and construction issues must be considered in conjunction with how the team is managed, co-ordinated and communicated with to reduce problems resulting from insufficient work separation, insufficient construction planning and disturbance in personnel planning.

Effects of change

While some changes may bring benefits to a project, most changes, if not managed properly, can result in cost and time overruns. The major cost due to change is the cost of rework or revision of work. Rework is the unnecessary effect of re-doing a process or activity that was incorrectly implemented in the first place and can be created by defects or variations. The cost of rework in construction projects can be as high as 10 - 15% of contract value. Rework is an example of a direct effect of project change. In addition to direct effects, project changes can also bring some indirect effects, which will ultimately have an impact on project cost and schedule.

The process

Construction contracts are unique in that they typically provide the owner the right to make revisions to the contract documents without avoiding the contract. Therefore, effectively managing changes requires successfully completing several crucial activities. Again, although this process is not exhaustive, it identifies the essential steps as follows:

Step 1. Identify the contract requirements.

Step 2. Identify the potential change and create a potential change order file.

Step 3. Determine entitlement, measure the effect of the change, and calculate the cost of the change.

Step 4. Negotiate and execute the change order.

Step 5. Maintain complete records of the executed change.

Step 1: Identify contract requirements

The contract documents identify the requirements for the project in terms of its scope, schedule and budget. The contract requirements must first be identified so that any deviation (that is, a change) can be recognised, because a change is essentially a requirement that deviates from the requirements set forth in the contract documents. The contract documents typically include the following components:

- Contract. Addenda, agreement, special provisions, and all similar or related provisions and references.
- Specifications. General provisions, technical specifications, supplemental provisions or specifications, and other referenced standards.
- Plans. Project plans, standard plans, standard details, boring logs, or other information that depicts the work to be constructed or site conditions prior to the start of construction.

It is important to apply general rules of contract interpretation when reviewing the contract documents. This means reading the contract as a whole and following the order of precedence clause when interpreting the component contract documents. For example, the order of precedence clause might indicate that if there is a conflict, the specifications take precedence over the plans.

The owner and contractor should also pay particular attention to the contract clauses related to notice and changes, because these clauses are the logical starting points for the identification and administration of changes.

Step 2: Identify the potential change and create a change order file

When a potential change is identified, it is important to correctly classify it and follow the correct procedures. In this step of the process, a potential change is classified among the different types of change provisions that are defined by the contract. Next, a potential change order (PCO) file should be created to track the issue. Creation of the PCO file should be performed before entitlement for the potential change is determined. Public contracts are often thorough in identifying the different kinds of changes that might be encountered during construction and defining the procedures that must be followed upon their identification. The common types of change provisions defined in public contracts are a change in the character of work, a differing site condition, a suspension of work, extra work, or elimination of work.

Step 3: Determine entitlement, measure the effect of the change, and calculate the cost of the change order

Upon receipt of a PCO, the owner must, in a timely fashion, evaluate the PCO and determine whether the contractor is entitled to the recovery of the additional time and costs requested. Such an evaluation should be performed in the following sequence: establishing entitlement, measuring effects, and pricing costs.

1. Determine entitlement

As previously stated, the changes clause indicates that changes to the contract might be necessary for the satisfactory completion of the project or project conditions can differ from the conditions originally shown in (or reasonably interpreted to be part of) the contract. The first step in determining the contractor's entitlement to additional costs or time related to an alleged change is establishing that a change, according to the contract, has in fact occurred, and then determining whether the contract provides the contractor with remedies for the change.

To establish that a change has occurred, the contractor should identify the specific change-related contract language associated with the alleged change. Then, referencing the specific change provision, the contractor should demonstrate that the alleged change is in fact a change by comparing it to the baseline requirements set forth in the contract. After establishing that a change has occurred according to the contract, the contractor must show that the relevant contract provision enables the recovery of additional time or costs that result from the allowable change.

2. Measure the effect of the change

Only after a contractor has established entitlement to a change can the effect of the change begin to be measured. Typically, a change will consist of either the addition or elimination of work. If a change requires the addition of work, the contractor should use the contract's time extension provision to determine how the delay associated with the change should be measured and the appropriate extension of time determined.

However, if the contract's time extension provision does not provide direction to the contractor on how to request additional contract time for the delay that might result from the additional contract work, then the contractor should use an appropriate schedule analysis technique to measure the delay to the project and the duration of the appropriate time extension.

3. Calculate the cost of the change order

The third step in the owner's evaluation of the contractor's proposed change order is calculating the cost of the change order. Typically, the change provisions will instruct the contractor as to how to calculate the cost of the change. In some instances, there might be a contract unit price that can be used to determine the change order value. However, when a contract unit prices does not apply or the line item is priced on a lump sum basis and the contractor and owner are unable to come to an agreement on the calculation of the price for the change, then the contract could instruct the contractor to calculate the cost of the change according to the contract's time and materials, or force account, provision.

Step 4: Negotiate and execute the change order and avoid disputes

Step 5: Maintain complete records of the executed change

Documentation of changes is a key responsibility of all project management personnel. At the beginning of the project, the staff should create standardised forms, procedures, contract document log, issues log, RFI log, and PCO log to maintain detailed records and document changes that arise during the project.

The contract documents log should begin with the bid documents and include the most recent drawings or sketches that might be issued as part of an RFI or supplemental specifications by the owner or its design consultants. It should include the title of the revised document, the vehicle used to incorporate the document into the contract, and the date issued. The creation of the contract documents log aids in establishing the baseline requirements of the contract. As documents are revised and incorporated into the contract, they should be inserted into a 'posted' set of documents that is available to all project personnel. This will ensure that the most recent information will be used as the project progresses and work is performed. The posted set of documents can then be used as the history set of documents detailing changes as they occurred throughout the project and used in evaluating changes or aid in generating the as-built set of documents.

Conclusion

An effective Project Manager must have the ability to quickly identify and determine the time and cost effects of a change and effectively communicate with all project participants. The procedure for managing changes provided here is intended to identify best practices to effectively manage changes on construction projects. The terminology used and contract documents referenced in this paper are geared toward traditional design-bid-built public improvement projects, although the basic principles are applicable to almost any construction project. It should be noted that any change management procedure is only as effective as the participants' ability to communicate and collaborate with one another during the course of the project.

The essential steps for managing changes on construction projects are as follows:

Step 1. Identify the contract requirements.

Step 2. Identify the potential change and create a potential change order file.

Step 3. Determine entitlement, measure the effect of the change, and calculate the cost of the change.

Step 4. Negotiate and execute the change order.

Step 5. Maintain complete records of the executed change.

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