Quality Control During Construction

Learning Outcomes

By the end of this unit the learner will be able to:

- ✓ Define quality control and discuss the economic objectives of quality control.
- ✓ Describe field quality control and explain the ways and means of achieving field quality control.
- ✓ Explain the advantages and disadvantages of contractor quality control.

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Introduction

How can you know that your construction project is going according to plan? This chapter will introduce you to the concept of quality control and measure to check the quality of work at each phase of the project until completion. Quality control ensures that the contractors meet all design and functionality specifications.

Quality Control

Construction quality control entails making sure that all material, personnel and activities are of the higher quality at each phase of the project. This is done to achieve a higher quality product or outcome.

Advantages of Quality Control

i. It provide the supervisor of the project with the opportunity to learn more about quality construction techniques and how to use them to achieve quality products
ii. It forces contractors to seek good quality skilled labour as well as the best suppliers of quality products
iii. Quality control ensures reliability of final product

Disadvantages of Quality Control

i. Contractors and designers may resist changes to their usual way of doing things when new quality control measures are introduced
ii. It may result in more expenditure in terms of additional labour and equipment hours

The planners and designers determine the quality control specification for the project and this is incorporated into the contract documents. A quality product is the result of both the owner and contractor working in partnership to ensure all quality control procedures are executed at every stage of the work. This means that materials, equipment, and labour are tested and honed to deliver to the required standards.

Communication

Communicating technical issues using dialogues, meetings and discussions is important to ensuring the success of quality control programmes. Parties involved in the construction project are encouraged to talk and listen to each other to promote positive attitudes towards quality control measures.

Quality Control and Quality Assurance

These two terms refer to one and the same thing but are carried out by two different departments involved in the project; they refer to the owner and the contractor respectively. The owner undertakes quality control measures by randomly checking the quality of activities being undertaken while the contractor usually performs quality assurance checks as the work is in progress.

Internal Quality Control

For some types of projects which may be complex, internal quality control programs are developed and implemented by trained personnel working in the field and on behalf of the project owner.

Consultants for Quality Control

Apart from the usual quality control service personnel, the services of private consultants are normally required for highly advanced technical projects requiring specialist know-how of quality control measures. Consultants are brought in at the planning and design stages to make critical contribution to ensure all quality control measure are in place. They also advise on how quality control programs should be managed.

Economic Objectives of Quality Control

Every construction project seeks to build a structure at the least cost and of a high quality. A high quality structure can be achieved at lower cost if the following costs are minimized or reduced:

i. Failure cost due to quality issues with materials or products which may result in rework, scrapping, low productivity on the field or even spoilage of items
ii. Appraisal cost inherent in conducting quality control assurance using testing, inspection and other means of product evaluation
iii. Prevention costs associated with avoiding mistakes during construction. These costs are linked to personnel training, quality control engineering and maintenance of equipment.

Some economic reasons for undertaking quality control include:

i. Cost savings by minimizing rejects or rework
ii. Cost savings by keeping within boundary of design specifications and not extending beyond
iii. Savings obtained by making quality product at no extra cost to parties involved in the project

Savings will happen when the contractor engages the services of well-trained supervisors, when he maintains a high standard of specifications and also when the contractor understands that good quality control will improve on the profitability of the project.

Field Quality Control

Field quality control requires the use of equipment, employees' expertise and other facilities depending on the quality measure stipulated in the contract. It is the responsibility of the lab manager to evaluate

equipment requirements and deployment during quality control checks. The number of personnel required to perform quality control inspection and testing will depend on the workload and scheduling of activities on the field. It is best to wait and perform quality control measurements after the peak periods of activities when more workers become available.

To ensure quality control measures are effectively, it is important to perform priority ratings for each activity to differentiate between the most and least vital activities. Priority is given to activities having the highest rating first when carrying out quality control procedures.

Field quality control usually involves:

i. The desire to provide an excellent service
ii. Discovering the most effective way of performing tasks
iii. Making use of experience to get things done
iv. Being proud of effort one makes to get tasks accomplished
v. Providing business opportunity for the contractor
vi. The owner getting joy and satisfaction from having value for money.

Achieving Field Quality Control

Quality control in the field must be carefully planned to achieve the best quality product at minimal cost using techniques as diverse as those required to carry out specific activities on the field. Developing a good quality control plan requires asking the following questions and finding the right answers to them:

i. Which aspects of quality work are required to be executed?
ii. When is the ideal time to execute each activity during construction?
iii. What methodology or procedure should be used to accomplish these activities?
iv. Who should be responsible for the work in the field?
v. Where specifically, should the work be executed?
vi. What tools, equipment or instruments are required?
vii. What inputs are required to get the structure completed, i.e. what materials and information is required?
viii. What is the expected end result of the quality control testing? Will the result of the test prompt decisions to be made and what criteria are available for this decision-making process?
ix. Would the results of the tests warrant the identification and routing of materials?
x. Should records of action be kept and in what format?
xi. What alternatives procedure should be used when differences exist in the product quality?
xii. Will there be a time limit for carrying out quality control and what will that be?

How to achieve quality control in the field

i. Developing the necessary technical and practical expertise that will be required to specify quality requirements for each activity and facility

ii. Creating clear and accurate designs, drawings, specification and models which will translate into quality products on the field
iii. Having the contractor's field management personnel take part in the design process and quality control specifications
iv. Spearheading procurement of only quality materials
v. Ensuring measures are in place to protect equipment and materials during all phases of construction
vi. Researching effective methods of construction using suitable equipment and tools
vii. Developing and using the latest quality control technology and know-how to function effectively
viii. Making contractor understand the need for quality control and making sure his staff are trained to ensure the highest quality on the field
ix. Providing assistance to establishing quality control on the job site
x. Frequent visits to the site to ensure quality control programme s are being executed and also collaborating with field staff to solve quality control problems
xi. Making available engineer with enough experience to deal with quality control issues
xii. Ensuring that the contractor explains to subcontractors all of their responsibility and the objectives of the project
xiii. Keeping effective records of issues and providing feedback to design engineers to help future projects avoid such issues
xiv. Getting design personnel involved in providing solutions to problems arising in the field of construction

Ensuring Quality Control in the Field

Quality control personnel undertake checks on the field activities to ensure that the contractor is complying with quality standards according to the design specifications. Checks may include testing, inspection, and evaluation of all resources involved in creating the structure a t each phase of the project. Personnel who can act as quality inspector include the construction manager, the engineer, the main contractor, the project owner or private consultants.

The quality inspector must not interfere with the duties of the contractor but may only advise him when incorrect procedures are being used to execute activities which may adversely affect the final product. The inspector is there to make sure that all processes are being followed as spelt out in the contract.

Promotion of Quality Control in the Field

Although the contractor may undertake quality control measures, it is normally not encouraged since he does not have enough capacity to check every aspect of the project. The contractor's main aim is to meet the specific targets within a certain time-frame, so his attention may be more focussed on meeting the targets while ignoring certain quality control aspects. The propensity by the contractor to overlook some

aspects of quality control in his quest to meet deadlines may compromise the overall quality of the project. The cost of lapses in quality control may be too high for the owner, so it is in his best interest to ensure that quality control is promoted during the execution of the project.
Ways of promoting quality control in the file are as follows:

i. Doing quality work the right way and avoiding rework
ii. Making sure all workers understand that quality control is part of their responsibility when carrying out activities in the field
iii. Ensuring contractor organises activities in an efficient an orderly manner
iv. Ensuring good relationship between staff at all times
v. Understanding the long term effect of activities being performed with the help of quality control coordinator
vi. Providing assistance to problem-solving solutions
vii. Using suitable title for a competent person chosen to perform quality control inspection
viii. Encouraging team spirit among all staff
ix. Highlighting to workers the relevance of quality control during construction
x. Ensuring that quality control personnel is able to explain why the need for quality control to supervisors
xi. Encouraging innovative thinking by field staff to arrive at better design to replace the current one provided the new design is superior
xii. Educating workers that quality control leads to safety in construction
xiii. Using promotional materials to educate workers about the benefit of having a good quality control program on the site
xiv. Owner showing interest in having a high quality structure will also promote the desire by workers to produce a high quality product

Contractor Quality Control

The contractor's quality control plan is vital to assure the project owner(s) that everyone involved is aware of the steps needed to achieve a high quality product. The quality control plan of the contractor is usually discussed by all participants before work begins. It is neither meant to control activities of the contractor nor to pry into his affaires but to endure everybody understand why it is important to maintain good quality control measure at all times.

Advantages

i. When testing and inspection are integral part of the project, then the cost can be well-managed by the contractor
ii. The contractor is in a stronger position to anticipate problems and take the necessary steps to adjust the work to solve the problem

iii. The contractor is better placed to build quality into the product than the owner's quality control supervisor
iv. Testing by the contractor can help him improve on his performance or efficiency at a relatively lower cost
v. Integrating statistical specification into the contractor's daily activity and displaying this information for other workers to view on daily basis will yield better overall quality
vi. Disputes between the contractor, suppliers and quality control department may be avoided if all quality issues are made the sole responsibility of the main contractor
vii. There will be more time available to the owner's quality control team to focus on solving more general problems on the site.

Disadvantages

i. The contractor may not have enough capacity to perform satisfactory quality control programs
ii. Contractor quality control is only suitable when the end pint specifications are available. However, not all projects have end pint specifications due to incomplete project plans
iii. Well-trained quality control experts will be required to assist the contractor to meet quality control targets. But unfortunately, there are very few personnel with these kind of skills

Factors affecting implementation of contractor quality control:

i. Quality control is only successful when the contractor has the mind to integrate it into the product
ii. If the personnel working in the field are of a high calibre, the work becomes high quality, especially when the personnel are very experience and highly educated
iii. The owner should clearly specify that he requires the services of a high calibre of quality control personnel so that the contractor will make the effort to recruit supervisors with the right kind of skill
iv. There should be separation of quality control and production function and having quality control team report directly to the site manager instead of the contractor to ensure integrity of standards

The contractor is expected to keep accurate records of all quality checks and inspection as well as details of problems and solutions. Daily progress reports are presented to the owner on all aspects of the project. The owner's quality control team may carry out spot checks to verify whether activities are being executed according to agreed plans and specifications. The owner may inspect work whenever he chooses to ensure conformity to the original contract specifications.

Importance of Specifications

Specification deals with the quality of work being undertaken in the field using the right quality of materials. Limits are set on the physical properties of materials for quality control purposes. If a quality

control inspector finds that a representative sample of a particular material being tested or evaluated falls outside the specified limits, the material from which the sample was taken may be rejected if successive tests show all results are outliers or fall outside the limits.

It is the prerogative of the designer to specify what is an acceptable or an unacceptable result from the beginning. Statistical and probability tools may be used for evaluation of samples and determining the quality of materials being used on the field. When a sample falls outside specifications, the whole batch or lot from which it was taken may be rejected.

Incentives and Penalties

Restrictions are normally imposed on the contractors to prevent them from rushing to complete the project ahead of schedule. This safeguard the project in terms of quality control objectives as specified in the contract. Penalties in the form of fines are sanctioned against the contractor if he fails to follow the specified procedures. Incentives are provided for compliance with laid down procedures. Both penalties and incentives are included in contracts, but it is advisable to avoid including penalties because they tend to strain the relationship between the owner and the contractor.

Effect of Incentives and Penalties

Incentives will motivate the workforce and crate a powerful and positive atmosphere at the work site. Penalties on the other hand may have negative connotations and have a negative domino effect on the whole project and must be avoided by the owner.

Workmanship as a Mark of Quality

Contacts should contain specification for the best quality workmanship during the course of the whole project. This statement is well-understood by worker and it should be communicated to all concerned to ensure that quality specifications can be met.

Although it is impossible to specify expectations and standard to the tiniest detail in a contract due to the assumption that all should know what is expected of them, it would be unprofessional to produce ambiguous drawings and specifications with this assumption in mind.

Final Inspection

The contractor is expected to perform tests and inspection on the final structure to assure the owner that everything is in order. Tests are conducted to determine whether to accept the facility or not. The owner normally tests the control and instrumentation or other installations at the newly constructed facility. A test run of actual working conditions and emergency situations are also carried out during this stage. When all tests are completed, the owner is given the job files, maintenance an operating manuals and the shop drawings as well as the built drawings.

The role of construction quality control has been diminishing in recent times due to a diversity of problems such as vitriolic criticisms and suspicions about the integrity of the contractor and engineers to the extent that it is now being suggested that a separate fund be provided from the overall cost of construction to be given to third parties to carry out all quality control programs. This new suggestion must be critically examined to determine whether there is substance to it or not.

Further Reading:

- ✓ ***P Gopalakrishnan, M Sundaresan, (2011), Materials Management: An Integrated Approach***
- ✓ ***Thomas V. Bonoma, Gerald Zaltman, (2011), Organizational Buying Behavior***