



UNIT-11

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.

Unit 11

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Introduction

How can you determine whether your construction project is going according to plan? This chapter will introduce you to the concept of quality control and measures 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 ensuring that all materials, personnel and activities are of a 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 provides 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 the reliability of the 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 that 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 dialogue, meetings and discussions is important for ensuring the success of quality control programmes. Parties involved in the construction project are encouraged to talk and listen to one another 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 progresses.

Internal Quality Control

For some types of projects which may be complex, internal quality control programmes 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 knowledge of quality control measures. Consultants are brought in at the planning and design stages to make critical contributions to ensure all quality control measures are in place. They also advise on how quality control programmes 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 minimised or reduced:

- i. Failure cost due to quality issues with materials or products which may result in remedial work, scrapping, low productivity in 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.

Economic reasons for undertaking quality control include:

- i. Cost savings by minimising rejects or remedial work
- ii. Cost savings by keeping within the boundary of design specifications
- iii. Savings obtained by making quality product at no extra cost to parties involved in the project. Savings will be made when the contractor engages the services of well-trained supervisors, when he maintains a high standard of specifications and when he understands that good quality control will improve 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 measures 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 in the field. It is advisable to wait and perform quality control measurements after the peak periods of activities when more workers become available.

To ensure quality control measures are effective, it is important to perform priority ratings for each activity to differentiate between the most and least vital activities. Priority is given to activities with the highest rating 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 one's efforts to accomplish tasks
- v. Providing business opportunities for the contractor
- vi. Ensuring the owner experiences 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 in the field. To develop a good quality control plan, you must ask the following questions and find the right answers to them:

- i. Which aspects of quality work need 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 complete the structure, i.e. what materials and information are required?
- viii. What is the expected end result of the quality control testing? Will the result of the test cause decisions to be made and what criteria are available for this decision-making process?
- ix. Will 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 alternative 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, specifications and models which will translate into quality products in the field
- iii.** Having the contractor's field management personnel take part in the design process and quality control specifications
- iv.** Spearheading procurement only of 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.** Ensuring the contractor understands the need for quality control and making sure his staff are trained to ensure the highest quality in the field
- ix.** Providing assistance to establish quality control on the job site
- x.** Making frequent visits to the site to ensure quality control programmes are being executed and collaborating with field staff to solve quality control problems
- xi.** Making available engineers with enough experience to deal with quality control issues
- xii.** Ensuring that the contractor explains to subcontractors all of their responsibilities 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.** Involving design personnel 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 at each phase of the project. Personnel who may act as quality inspectors 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's job is to ensure 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, this is not normally encouraged since he will not have the capacity to check every aspect of the project. The contractor's main aim is to meet the specific targets within a certain timeframe; hence, he may be more focused on meeting the targets while ignoring certain quality control aspects. The propensity for 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; therefore, 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 field are as follows:

- i. Performing quality work in the right way and avoiding the need for remedial work
- ii. Making sure all workers understand that quality control is part of their responsibility when carrying out activities in the field
- iii. Ensuring the contractor organises activities in an efficient and orderly manner
- iv. Ensuring good relationships between staff at all times
- v. Understanding the long-term effect of activities being performed with the help of the quality control coordinator
- vi. Providing assistance to find problem-solving solutions
- vii. Using a 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 are able to explain the need for quality control to supervisors
- xi. Encouraging innovative thinking by field staff to arrive at a 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 programme on the site
- xiv. When the owner shows an interest in having a high-quality structure, this will also encourage 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 among all participants before work begins. It is intended not to control the activities of the contractor or to pry into his affairs but to ensure that everyone understands why it is important to maintain good quality control measures at all times.

Advantages

- i. When testing and inspection are an integral part of the project, 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 specifications into the contractor's daily activities and displaying this information for other workers to view on a daily basis will yield better overall quality
- vi. Disputes between the contractor, suppliers and quality control department might 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 the capacity to execute satisfactory quality control programmes.
- ii. Contractor quality control is only suitable when the end-point specifications are available. However, not all projects have end-point specifications due to incomplete project plans.
- iii. Well-trained quality control experts will be required to assist the contractor to meet quality control targets. Unfortunately, there are very few personnel with these kinds of skills.
Factors affecting implementation of contractor quality control:
 - i. Quality control is only successful when the contractor is minded 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 experienced and highly educated
 - iii. The owner should clearly specify that he requires the services of high-calibre quality control personnel; the contractor will then make the effort to recruit supervisors with the right kind of skills.
 - iv. There should be separation of the quality control and production functions; the quality control team should report directly to the site manager rather than the contractor to ensure

integrity of standards.

The contractor is expected to keep accurate records of all quality checks and inspections 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 in order to ensure conformity to the original contract specifications.

Importance of Specifications

Specification deals with the quality of work being undertaken in the field using materials of the right quality. 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 that all results are outliers or fall outside the limits.

It is the prerogative of the designer to specify what constitutes an acceptable or unacceptable result from the beginning. Statistical and probability tools may be used to evaluate samples and determine the quality of materials being used in 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 contractors to prevent them from rushing to complete the project ahead of schedule. This will 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 stipulated procedures. Both penalties and incentives can be 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 create a powerful and positive atmosphere at the work site. Penalties, on the other hand, may have negative connotations and produce a negative domino effect on the whole project and must be avoided by the owner.

Workmanship as a Mark of Quality

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

Although it is impossible to specify expectations and standards 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 inspections 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 of other installations at the newly constructed facility. A test run of actual working conditions and emergency situations is also carried out during this stage. When all tests are completed, the owner is given the job files, maintenance and 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 range 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 programmes. This new suggestion must be critically examined to determine whether there is any substance to it.

Further Reading:

- ✓ *Pengzhong Li, Paulo Antonio Rodrigues Periera, Helena Navas, (2021), Quality Control: Intelligent Manufacturing, Robust Design and Charts*
- ✓ *Thomas V. Bonoma, Gerald Zaltman (2011), Organizational Buying Behavior*