

CHAPTER VI – QUALITY CONTROL IN IRRIGATION PROJECTS

Section 1.-General

- 6.001 Quality control is necessary for safety, reliability, and durability of all structures and also for optimum use of building and scarce materials.
- 6.002. The degree of quality control to be exercised will depend on the importance, location, purpose and cost of the work. The Engineer-in-Charge, responsible for the quality control of the work as indicated in Appendix 7.02 of the Manual, shall specify the type of the quality control to be exercised for the works under his control as follows: -
- (i) For major, medium and minor dams and hydraulic structures costing more than Rs. 10.00 crore quality control as hereinafter specified shall be followed.
 - (ii) For other comparatively less important structures costing less than Rs. 1.00 Crore and more than Rs. 25.00 lakhs following tests as per Appendix 6.03 shall be exercised :-
S.No. 2,3,4,5,6,8(1), 8 (2), 8 (3), 9, 11.
 - (iii) For structures costing less than Rs. 25.00 lakhs following tests as per Appendix 6.01 shall be exercised.
S.No. 2, 3 (4), 3 (5), 8 (1).

Section 2- Stages of Control

- 6.003 The quality control shall be exercised at three stages i.e. :

- (1) Selection of materials,
- (2) Processing of the materials and
- (3) Execution of works.

Selection of Materials

- 6.004. Selected raw materials shall only be used in construction. In the case of manufactured articles such as steel, cement etc. a certain guarantee of the properties is already available, but some check is still needed to be sure of the quality. In the case of materials like stone, sand, soils etc. the properties vary from place to place and selection of right type of materials depend upon proper determination of properties of materials by conducting tests in the laboratory.

Processing of Materials

- 6.005. The raw materials required for construction shall be processed before execution of works. For certain processes there are no tests to check that processing is being done properly. It is only the properties of final product that reveal the inadequacies of processing.

Execution of works

- 6.006. Checking the properties of final product helps in different ways i.e. (1) in determining whether quality control has been exercised fully, properly and according to the specifications, (2) in rejecting the defective product in time and replacing it by a proper one and (3) in knowing whether design assumptions are being fulfilled or any modifications are required in design itself.

Section 3. –Means of Quality Control

- 6.007 The quality control shall be done by (1) testing of materials (2) supervision during execution and (3) analysis and interpretation of the test results.

Testing

- 6.008. Testing shall be done for determining the properties of materials, which help in their selection as well as in ascertaining the quality of the product. The standard type of equipments or apparatus shall be used for conducting tests as specified in Appendix 6.01.

Supervision

- 6.009. The officers responsible for construction shall supervise the work during construction for ensuring the quality of works by frequent inspections and shall issue inspection notes for follow up action.

**Compilation, Analysis and Interpretation of
Test Results.**

- 6.010. Compilation, analysis and interpretation of test results shall be done systematically considering the specifications and design, every month. The analysis and interpretation shall be based on sufficient data of test results.

Section 4.- Test Procedures of Quality Control

- 6.011 The test procedures shall be in accordance with Indian Standards as specified in Appendix 6.01. Where separate quality control staff is not provided, as in the case of minor projects it shall be mandatory for staff engaged on the work to ensure quality control as specified in paragraph 6.002 after getting acquainted with quality control procedures.

Sampling for Testing

- 6.012. Number of samples and sampling procedure shall conform to the Indian Standards.

Frequency of Tests

- 6.013 Frequency of tests shall be carried out as per Appendix 6.02.

Communication of Test Results

- 6.014. The results of the tests shall be communicated by the Officer-in-charge of quality control to the concerned Officer-in-Charge of execution with a view to enable him to take corrective measures immediately.

Section 5.- Organisation Set Up

- 6.015 A separate quality control unit shall be established for all dams and for structures costing more than Rs. 50.00 Crore. For other works quality control unit sufficient to carry out the test as specified in paragraph 6.002 shall be established.

- (i) Organisational set up shall be as under:-
 - (a) For each major project One Quality Control Circle headed by an S.E. with quality control Divisions and Sub-Divisions as per actual requirement. In case if the post of S.E. quality control does not exist the S.E. (D) of the C.E. formation will function as S.E Q/C. All the Q/C units will be under Administrative control of concerned C.E.
 - (b) For each medium project costing above Rs.50 crores -- One Quality Control Division headed by an E.E / Research Officer with Sub-Division as per actual requirement.
 - (c) For each medium project costing less than Rs.50 Crores –One quality control Sub-Division headed by an A.E/A.R.O.

No separate quality control staff need be posted on individual minor irrigation project but the executive staff posted shall be trained in taking samples, carrying out field tests themselves and interpret the results. 10 percent of the samples taken shall be got tested at Circle level laboratories. The Superintending Engineer shall be responsible to ensure that adequate training is given in Circle laboratory to the executive staff posted on such project.

Section 6.-Duties and Functions

- 6.016 Each major/medium project will have a main laboratory under Research Officer/A.R.O.for carrying out the tests specified in Appendix 6.01. In addition, field laboratories shall be established at work sites which will be part of the main laboratory to conduct daily routine tests.

Functions of Main Laboratory

- 6.017. (a) To conduct laboratory tests on samples of cement, sand, aggregates, stones etc. for use in masonry and concrete works.
- (b) To conduct laboratory tests for selection of soils from proposed borrow areas for use in the various zones of embankment.

- (c) To fix proportions of mortar for masonry works and proportions of ingredients for concrete work as per prescribed specifications.
- (d) To evolve various mix designs of concrete and mortars to be used in works and to make modifications, if necessary.
- (e) To organise test procedures and to submit daily reports on the quality of works to authorities specified.

Functions of Field Laboratory

- 6.018
- (a) To carry out routine daily tests of soils and filter materials such as moisture content, needle density tests, field density tests, etc. and to take samples from compacted fill from different zones of the embankment.
 - (b) To carry out routine daily tests like silt test on fine aggregates, surface moisture content tests on coarse aggregates, bulking of fine aggregates, slump test of concrete, consistency tests of mortar and to collect samples of concrete and mortar to fill in moulds as per approved frequency.
 - (c) To transport concrete/mortar test pieces to main, laboratory for curing and testing.
 - (d) To prepare daily reports of tests in prescribed proforma for compilation in main laboratory and communicating to the Officer-in-Charge of execution.

Duties of Research Officer (Executive Engineers Cadre)

- 6.019
- (a) To remain in constant touch with the execution of works of the projects.
 - (b) To suggest ways and means to improve the standard of work in case the test results indicate sub-standard quality of work.
 - (c) To organise proper upkeep and calibration of the equipment in the main and field laboratory at proper intervals.
 - (d) To organise test procedures and to submit daily reports on the quality of works to authorities specified.
 - (e) To maintain copies of approved design reports, plans and estimates, specifications, extracts of inspection notes and data of machinery used on works.
 - (f) To carry out atleast 5 percent of important tests in a month personally so that the deficiencies, if any, are brought to light.

**Duties of Assistant Research Officer
(Assistant Engineer's Cadre)**

- 6.020 (a) To ensure proper upkeep and maintenance of laboratory equipments.
- (b) To supervise the work of Research Assistants, Laboratory technicians etc.
- (c) To ensure that the correct methods of sampling and testing are being followed.
- (d) To check whether the work is proceeding in accordance with the specifications and to bring Sub-standard work to the notice of Research Officer and other specified authorities for action.
- (e) To compile daily reports of tests in prescribed forms and to submit to Research Officer, for onward transmission.
- (f) To check proper placement of concrete and mortar at project site.

Duties of Research Assistant /Embankment Inspector

- 6.021 (a) To perform important tests like consolidation tests, specific gravity test, permeability test, shear test and grain size analysis test for soil samples.
- (b) To perform tests like adulteration of cement, specific gravity tests, water absorption and compressive strength tests.
- (c) To perform necessary tests for fixing the proportions for mix designs of concrete and mortar, being used in construction works.
- (d) To maintain records of test results.
- (e) To perform needle density test, field density test etc.in the field.
- (f) To check mixing time, water cement ratio and correct quantities of ingredients in concrete and mortar at project site.

Duties of Laboratory Technicians.

- 6.022 (a) To assist Research Assistant/Embankment Inspector whenever required in laboratory and field work.
- (b) To perform tests in laboratory such as :-
- Compaction tests.
 - Limit tests.
 - Analysis of fine and coarse aggregates.
 - Silt in aggregates.
 - Slump test.
 - Collection of samples of concrete and mortars for filling moulds for compaction test.
 - Numbering samples, etc.

Duties of Laboratory Assistants

- 6.023 (a) To keep instruments clean.
(b) To assist R.A., E.I. and Laboratory Technician for conducting tests.
(c) To prepare samples for tests.
(d) To keep samples systematically.
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