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19 TESTING OF WATER RETAINING STRUCTURES

19.1 GENERAL

19.1.1 Scope

1 This Part of the specification applies to the testing of structures that are designed with the intention of retaining water.

2 Related Section and Parts are as follows:

This Section
Part 1..... General
Part 13..... Inspection and Testing of Hardened Concrete
Part 14..... Protective Treatments for Concrete

19.1.2 References

BS 8007 .....Code of Practice for Design of concrete structures for the retaining of aqueous liquids, (EN 1992-3 Eurocode 2. Design of concrete structures - Liquid retaining and containing structures, ACI 350.1 Specification for Tightness Testing of Environmental Engineering Concrete Containment Structures)

19.1.3 Submittals

1 The Contractor shall record and submit to the Engineer within 24 hours the results of the watertightness tests carried out.

19.1.4 General

1 Water retaining structures shall be watertight when subjected to external groundwater pressures or to tests as specified in this Part.

19.2 TESTING

19.2.1 General

1 The Contractor shall test watertightness of water retaining structures including storage reservoirs and other miscellaneous structures that require to be watertight.

2 All water used for testing shall be potable or irrigation water and the Contractor shall make arrangements for the supply and disposal of this water.

3 Water retaining structures shall be tested for watertightness after completion, in accordance with the following method or as directed by the Engineer:

(a) the structure shall be filled with potable or irrigation water in stages not exceeding 1 m in 24 h held at each water level for such time as the Engineer may require. Should dampness or leakage occur, the water shall be drawn off and the defects remedied to the satisfaction of the Engineer

(b) in the case of structures which are subdivided into individual tanks, each individual tank shall be tested separately. In the case of underground or partially underground structures, the testing shall take place before application of water proofing membrane, liner material or perimeter drain, filter material or backfilling is placed against the walls

(c) in the case of hopper bottomed tanks, this shall be taken to mean that no material is placed against the vertical external walls of the tank, the sloping walls of the hopper bottoms of the tanks being assumed built directly against the excavation apart from the blinding concrete

(d) no placing of material against the walls shall take place until the Engineer has given his written approval and acceptance of the water retaining structures as watertight

(e) filling shall not take place earlier than 28 d after the casting of the final sections of the structure which will be stressed by the filling of the structure.

(f) testing shall not be undertaken until the structure to be tested has been; completed structurally including roof, if any, and has been passed by the Engineer in writing as satisfactory in all respects other than watertightness, especially in regard to the final finish of the work

(g) not withstanding the satisfactory completion of the seven day test, leakage, cracks, and damp patches and sweating visible on the outside faces of the structure shall be rectified from the water face by an injection system to the approval of the Engineer

(h) repair making the outer face only watertight wall not be accepted, this applies to bobbin holes also

(i) the structure shall be retested until the watertightness is approved by the Engineer.

(j) should the structure fail a test in the above respects, the Contractor shall immediately take such steps as may be necessary to:

(i) ascertain the nature and positions of defects or leakage's

(ii) empty the structure

(iii) remedy the defects in a manner approved by the Engineer, employing workers who are specialists in this class of work

(k) when the remedial work has been completed in the manner approved by the Engineer, the testing and if necessary rectification shall be repeated until a satisfactory test is achieved.

(l) if necessary, in extreme cases of lack of watertightness, the Engineer may reject the structure or portions thereof.

19.2.2 Cleaning

1 All water retaining structures shall, on completion, be carefully cleaned of all debris, to the complete satisfaction of the Engineer as follows:

(a) shall be brushed down on all internal faces with a stiff broom while still dry

(b) all resulting debris removed

(c) all associated reservoir pipe work shall be cleaned in accordance with the specified requirements

(d) the structure shall then be flooded with approximately 75 mm of clean water

(e) whole of internal faces shall be carefully brushed down with stiff brooms using the water continuously until all faces are clean

(f) water shall then be drained off

(g) walls and floors hosed and flushed with clean water until perfectly clean.

19.3 TESTING PROCEDURE

19.3.1 Walls

1 After completion and cleaning of the structure and all associated pipe work, if any, the Contractor shall fill the structure up to the top water level and leave for a stabilising period of 21 d in order to allow for absorption and autogenous healing to take place.

2 Water shall be added over this period to maintain the top water level.

3 The Contractor shall ensure that all pipes and specials are available in ample time ahead of testing.

4 Two sets of evaporation trays shall be provided along with two sets of rain gauges.

5 Levels in the trays and structure shall be made and recorded by a hook gauge with vernier attachments.

6 Before and during testing, flows in the structure under drainage, if any, shall be monitored, measured and recorded.

7 Each under drain shall be numbered and observations reported by under drain number to facilitate analysis of the data.

8 All leaks shall be repaired within one month of their detection.

9 On the twenty-second day, two shallow watertight evaporation trays of area 0.4 m^2 shall be filled with 75 mm of water and placed to float in the structure.

10 The water level in the structure shall be recorded and the test commenced and carried out over the next 7 d.

11 Readings of water levels in the structure and trays shall be made and recorded every 24 h over this period.

12 If the water level in the tank falls by more than indicated by the evaporation trays, or other sign of leakage occurs by the end of the test period then the Contractor shall search and mark all areas of defect.

13 The structure shall then be emptied and the defects made good as specified herein.

14 After completion of remedial measures the structure shall be refilled and the test repeated.

15 This process shall be repeated until the structure is watertight to the satisfaction of the Engineer.

16 The fall of water level in the structure over the test period of 7 d, minus the fall accounted for by evaporation and rainfall shall not exceed 1/500 of the average water depth of the full structure or 10 mm whichever is less.

19.3.2 Roofs

1 The roofs of structures shall be tested for watertightness before laying of roof membrane.

2 Roof and fittings shall be hosed down vigorously and this shall be repeated in such a way as to keep the roof wet for three successive days.

3 Roof and fittings shall be deemed satisfactory for watertightness if no discernible leaks or damp patches show in the soffit.

4 Roof covering shall be completed as soon as possible after testing.

19.3.3 Disposal of Water Used for Testing

1 The Contractor shall provide suitable means for disposal of water used for testing, such that no damage results to facilities, structures or property.

2 These means shall be subject to the approval of the Engineer and local authorities.

3 Details shall be submitted to Engineer on request.

4 The Contractor shall be responsible for damage caused by his filling, testing, flushing and wastewater disposal operations.

END OF PART