

Some Important Quality Control Tests Commonly Conducted at Construction Sites

Many and assorted quality control tests are conducted regularly in the quality control laboratories at various construction sites. The types and quantum of tests conducted depend on factors like the type of project, size of the project, the degree of importance laid on the quality domain, budget for the project and so on.

For example, the degree of quality control (QC) adopted for the construction of an ordinary road may be somewhat different from that of a highway project. In case of the later the quality procedures are expected to be more stringent as compared to the former for obvious reasons. Accordingly, the types and frequency of QC tests may vary to some extent in spite of the fact that they are projects of similar nature. Similarly, the QC requirements for an ordinary waste water treatment project would presumably be more relaxed as compared to the same for a nuclear power project – again for obvious reasons. There can be many more examples like these.

A project on a healthy budget will have more space for the quality domain than one on a leaner budget. There can be a host of other factors too influencing the quality matters of a project. These are some of the reasons why the degree of QC or the extent of QC tests may vary from project to project or place to place.

Delving in textbooks or other related technical literature one might end up with a large number of quality tests suggested for every occasion. Yet, only a handful of them are actually conducted in project sites and one needs to be conversant with those relevant ones rather than getting lost in a sea of information. Mentioned below are some important QC tests commonly conducted in quality control laboratories at various construction sites:

Cement: initial & final setting time, compressive strength test (3, 7 & 28 days strength using mortar cubes), % passing through 75 micron IS sieve. These tests are routinely conducted in a site QC laboratory. Few more necessary tests which are not frequently performed are soundness test (Le chatelier or Autoclave expansion test), determination of specific surface (air permeability test), heat of hydration, chemical composition tests, etc. These tests are often conducted in professional off-site labs that are well equipped for all sorts of tests.

Fine aggregates (sand): particle size distribution (sieve analysis), specific gravity, water absorption, moisture content determination, etc. Zone of sand, fineness modulus, etc are determined from sieve analysis. Tests for determining clay or silt content and organic impurities are conducted occasionally, including during selection of source of sand. Bulking of sand is usually tested only when nominal concrete mixes are used for less important pours.

Coarse aggregate: sieve analysis, specific gravity, water absorption, moisture content determination, flakiness index, elongation index, aggregate impact value, aggregate crushing value, LA abrasion test, etc. Petrographic examination of rock is done initially to ascertain the quality of the quarry material. Aggregate impact value is a more useful test as it indicates the quality of stone chips unlike the aggregates crushing value test which gives idea of the quality of the source material (rocks).

Reinforcing steel: determination of yield & ultimate stresses, % elongation test, bend & rebend test, testing of nominal diameter and weight per unit length, etc. Tests like ultrasonic flaw detection, torsion test, fatigue test, chemical composition test, etc are also conducted (less frequently) usually in off-site approved labs in some projects.

Concrete: workability test (slump test, compaction factor test), compressive strength test (cube or cylinder), determination of total chloride and sulphate content in concrete, cement content in mix, temp. monitoring of concrete, especially for mass concreting work (using infrared digital thermometer or other device), etc. Trial mixes are prepared as per design calculations in the initial stage of designing a concrete mix in order to ascertain desired workability, strength, etc of the mix. Testing of accuracy of batching plant is done by routine calibration of the same (once in 2 or 3 months).

Common NDTs conducted at construction sites for testing quality of hardened concrete structures are core test, Schmidt hammer or rebound hammer test, ultrasonic pulse velocity test.

Bricks: compressive strength test, efflorescence test, dimensions test, water absorption test. Tests like soundness & warpage tests are also conducted sometimes.

Water: pH value, determination of chlorides, sulphides and sulphates content, iron and Mn content, turbidity test, hardness test, determination of solids, determination of alkalinity, BOD & DO, etc.

Grout: compressive strength test (for 1, 3, 7 & 28-day cubes), fluidity test (immersion or cone method), expansion test, bleeding test, volume change test, etc. Trial mixes are also prepared at initial stage to ascertain desired workability, strength, etc. Mock tests can be conducted at site lab to ensure proper grouting operation before actual execution at site.

Soil tests: Standard Proctor test to determine maximum dry density & OMC, in situ bulk & dry densities & moisture content ((core cutter or sand replacement method for bulk density and oven drying or calcium carbide method for moisture content), determination of Atterberg limits by Casagrande apparatus (LL, PL & SL), plasticity index, grain size analysis (sieve analysis & pycnometer), CBR test, etc.

Some soil tests like the direct shear test, triaxial shear test, soil bearing capacity determination test (plate load test), unconfined compressive strength test, etc are occasionally conducted for mainly design purposes. These tests as well few other tests are usually conducted in well equipped off-site labs.

Roadwork: sieve analysis for coarse aggregates for pavement & selected fill materials, flakiness index, sodium & magnesium soundness tests for coarse aggregates, aggregate impact value, LA abrasion loss test, 10% fines value, water absorption by aggregates in bituminous base course, marshall stability test, retained stability test, bitumen penetration test, flash & fire point test, viscosity of coal tar, ductility test, determination of sulphate, chloride & organic matter content for selected fill materials, sand equivalent, det. of friable particles, bitumen stripping, extraction & grading analysis test for asphaltic mix, in situ bulk density & det. of degree of compaction for bituminous base course, modified Proctor test to determine maximum dry density & OMC of sub-grade soil and selected fill materials, in situ density & moisture content of compacted subgrade (core cutter or sand replacement method for bulk density and oven drying or calcium carbide method for moisture content), atterberg limits & CBR test for subgrade and selected fill, etc.

In fact, there are more tests for each of the above-mentioned categories or materials. Also, there are quality tests for other materials or other types of work. As already mentioned, depending on the importance laid on quality aspects and few other factors the types or quantum of tests performed may vary from laboratory to laboratory or place to place – even for projects that are quite similar in nature.

Source: <http://civilconstructionresourcez.wordpress.com/2012/11/22/some-important-quality-control-tests-commonly-conducted-at-construction-sites/>