International Journal of Scientific Research in Civil Engineering
© 2023 | IJSRCE | Volume 7 | Issue 2 | ISSN : 2456-6667

Guideline for fresh concrete cube - Storing, Transport and Testing

Manikandan Srinivasan*
Transmission Engineering Department, Dubai Electricity and water Authority, Dubai, United Arab Emirates
Manikandan.srinivasan@dewa.gov.ae[1]

ARTICLEINFO

Article History:

Accepted: 05 March 2023
Published: 28 March 2023

Publication Issue
Volume 7, Issue 2
March-April-2023

Page Number
64-70

ABSTRACT

Concrete is one of the most durable building materials. It provides superior fire resistance compared with wooden construction and gains strength over time. Structures made of concrete can have a long service life. A major component of concrete is cement, a fine, and soft, powdery-type substance, used mainly to bind fine sand and coarse aggregates together in concrete. Concrete create in line with the design mix, which is design by an Engineer according to the specific nature of structures and grade. As concrete uses in all type of construction industries, testing and confirming the adequate strength requirement is mandatory. Hence, in this article it is elaborate briefly, pertaining the concrete cube storing, curing, transport and laboratory testing. Further, little bit research conducted about two different scope of works normally perform in construction site and laboratory.

Keywords : Technical Writing - Civil Engineering.

I. INTRODUCTION

Concrete is one of the most widely used building materials in the world, it forms the main component of structural elements such as foundations, columns, beams and slabs. Concrete plays a functional role in structures beside other roles, which makes the quality of concrete essential to the core of the integrity of the structure build.

Failure to control the quality can result in high loss of resources and time, and could result in failure of the construction project, this can be assured and controlled through a set of procedures, practices, mix design methods and, testing methods.

One of the methods of checking its fit for purpose is to carry out a standard concrete cube test, which measures the compressive cube strength of the concrete and relates directly to the required design strength specified by the designer.

II. WORK PROCEDURES

Below pre-request document shall be available to commence the works.

a) Approvals for Third Party Laboratory

b) Approved mix design

c) Approved trail mix test results

There are two stages in concrete cube

a) **Site Works** - Cube labelling, Demolding, storing & transporting to laboratory

b) **Laboratory works** – Receiving sample, identification, storing and testing

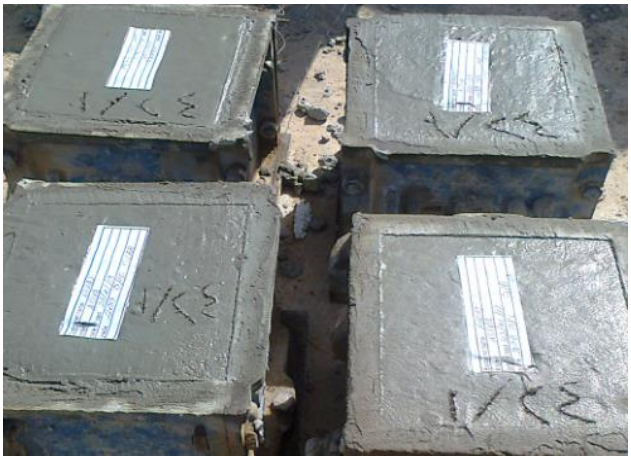
III. SITE WORKS

A. Cube labeling

It is most important to identify each concrete cube for future testing references. Enough information has to be included to identify each cube, a register must be established, and a code / serial number shall be marked on each cube for unique identifications. Cube code / serial number must be in top down order right from foundation works.

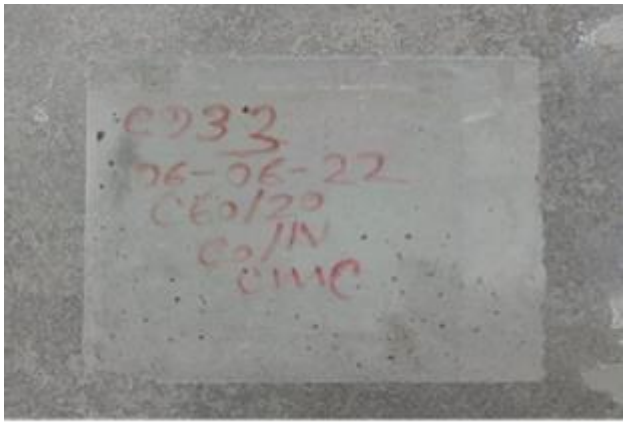
Typical identification reference shall include but not limited to, such as: cube id number/code, casting date, and mix code/reference, project and contractor names. There are two methods may use during labelling,

Method 01 – All required information usually written on a small piece of paper, placed at the top of the cubes before hardiness time.



Method 01

Method 02 - Once the cube is demolded, all required information is usually written on the cube itself by permanent marker.



Method 02

Note: *Preferable, method 02 is recommended to avoid loss of information due to water penetration.*

B. Cube storing/ storage:

Cube storing (Wet condition) & Demolding:

Once the cubes are casted, cover each mould with a wet damp cloth and plastic sheet, it is recommended to avoid surface moisture. Store inside shaded area to maintain the room temperature. Protect the cube moulds at all times from high and low temperature and drying winds.

In case the project site not suitable for shaded area (Such as OHL/Cable), cube moulds shall be kept inside the thermocol box covered by wooden materials, which shall provide the shade and helps to reduce the excess atmosphere temperate.

As per BS EN 12390-2, according to the external weather conditions cube can be demolded after 16-72hours from the casting time. Remember, new concrete can be broken easily, hence during demolding, utmost care shall be taken during handling.

Cube Stored in shaded area

Cube demolding

Cube stored in Thermocol-Wooden box

Cube storing (Site Curing Tank):

Once the cubes have been demolded, transfer the cubes to the site designated curing tanks temporary. The cubes shall be maintained the curing methodology, located in a controlled curing room. The curing tank needs to operate at a controlled temperature between 20 ± 2 degrees and provides a moist environment that allows the cubes to hydrate properly. The cubes must be fully submersed at all times. The water temperature in the curing tanks shall be monitored frequently to ensure the specific temperature is maintained at all times.

The curing tanks could be made of concrete or steel as long as they can withstand the weight they carry and usually placed in a controlled room for security and easiness of controlling the environmental conditions, domestic water supply shall be used for filling the tanks

Cube submerged in curing tank

Note: *If site curing tank not available, below elaborated procedures shall be followed.*

In case the project site is not suitable to make the curing tank (such as OHL/Cable/less space projects) and delay in sending the cubes to laboratory,

temporary curing tank shall be preferred at site to keep the curing process continues

Temporary Cube tank

Cube transport to Laboratory:

Care shall be taken to ensure that the samples are not damaged, contaminated or exposed to adverse effects of environmental conditions while being transported. This can be achieved by careful handling and placement of samples in the transporting vehicle, the samples should be covered by a damp clothing to keep the surface moist and cool, and not to be directed to sunlight. The time consumed by transportation should be minimized.

Transporting cube with wet covering

IV. LABORATORY WORKS

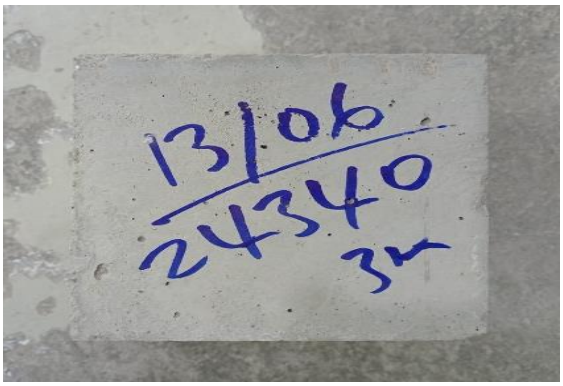
A. Receiving at Lab and identification:

The samples must be delivered to one of the accredited laboratories which is approved by local authority in the region.

Once the samples reach the laboratory, the detail of the projects identified and verified, special receiving forms will be provided as per the lab regulations to ensure proper documentation and registration.

The samples shall be counted and verified to ensure that the received documents match the received samples. It shall be registered in the lab digital system, and unique traceable job and sample codes are generated for each sample.

The samples shall be unloaded carefully and transferred into the lab to designated areas, where the cubes are identified once more and lab codes are written on each sample, the samples are then transferred and distributed to standard-compliant curing tanks that are arranged in a traceable manner according to the lab procedure.



Labelling at Laboratory

B. Sample storage at Laboratory:

Samples shall be stored in the designated curing tanks that are arranged in a traceable manner. The samples shall be kept immersed in water with controlled temperature of 20 ± 2 degrees.

Cube stored in lab curing tank

Once the cube achieves the test age, specific cube shall be taken from the curing tank and is shall be transferred to the testing area within immediate time frame.

C. Cube Compressive Strength Testing and Issuance of Test Report

Concrete Cube generally tested at 7 and 28 days from the casting date and less commonly on 1, 2, 3, 14 and 56 days or other age depending on the design requirement.

Once the cubes reach the designated testing area, each cube shall be examined by the lab technician for the required shape and dimensions as per BS 1881-114:1983.

After verifying the dimensions and tolerances, each cube shall be weighted for its mass to calculate the density of hardened concrete.

Cube stored in lab curing tank

For compressive strength test the cubes will be tested according to the standard procedure of BS 1881-116:1983 using a calibrated and certified compressive testing machines that can apply enough force higher than the expected compressive strength of concrete. The machines are compliance with BS 1881-115:1986, fulfilling all requirements to fit for the test.

This is achieved by placing the cubes in the transverse direction rather than the vertical casting direction, i.e. with the top exposed face of cube while in the mould, oriented to the side. The technician shall insure that the gap height is as per standard and appropriate spacers are loaded in the machine as needed.
The compression machine exerts a constant progressing force on the cubes to a maximum force sensed by visual signs of crushing of the cube and as no further load can be carried by the cube in its intact shape, the rate of loading is 0.2 to 0.4 N/mm²/s. The reading at failure is the maximum compressive strength of the concrete as per the standard method.

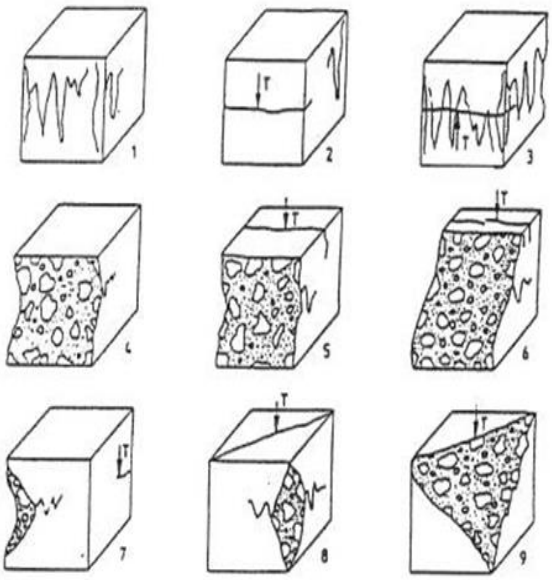
The concrete design compressive strength will be specified by the client/designer in a specific format such as

In C40mix, 40 is the design compressive strength of 40 N/mm² of a crushed 150mm in diameter and 300mm deep concrete cylinder. Therefore, using the method of testing using concrete cubes, the tested compressive strength should be compared to the second number.

Once the cubes have reached failure, the shape of the cube has been altered due to the compression. The failure shape can indicate whether the testing process is successful and the result can be adopted as a valid test value of compressive strength, this is usually identified by "satisfactory or unsatisfactory failure".

The sketch below shows the various failure schemes of a cube as given in the standard BS 1881-116.

Figure 01 – Satisfactory failure



** Note : T – Tensile crack

Figure 02 – Few unsatisfactory failure

D. Mandatory information by the laboratory:

a) Identification of the specimen
b) Checked nominal or measured dimensions and shape of specimen;
c) Date of receipt of the specimen at the laboratory
d) Condition of the specimen when received (include poor compaction, honeycombing and bad dimensions)
e) Treatment to specimen if reduction is carried out by the laboratory
f) Conditions of curing at the laboratory condition of specimen at test (as-received, saturated or oven-dry)
g) Date of test
h) Age of specimen at test, if known
i) Method of determination of volume (by calculation from the measured or nominal dimensions or by water displacement)
j) Mass of specimen (as-received, saturated or oven-

dried)

k) Type of density measured, i.e. as-received, saturated or oven-dried, and values obtained

l) Certificate that the test has been carried out to the requirement of this Part of this standard

E. REFERENCES

a) BS 1881 Part 101 – Sampling

b) BS 1881 Part 108 – Making of Test Cubes

c) BS 1881 Part 111 – Curing Cube Specimens for Strength Test

d) BS 1881 Part 116 – Compression Strength of Test Specimens

e) BS 1881 Part 115 – Compression Strength – Specification of Test Machines

f) BS EN 12390-2 - Cube demolding

V. CONCLUSION

Considering the importance of concrete structures and its long life, concrete cube plays main role to confirm and verify the required strength. Failure of any concrete cube testing, leads to failure in the concrete structures. Which shall cause the delay in constructions progress or may failure the entire project. Hence, utmost care shall take to maintain the cube from casting, demoulding, storing, curing, transportation, laboratory identification and testing.

Further, safety of construction practice is very important during construction site and laboratory works. Adequate HSE plan and all safety rules shall maintain during entire works. Further HSE activities, can verify by maintaining risk assessments, displaying traffic signage, use proper PPE's and confirming proper exit plan, etc., Strict supervision is highly appreciated to avoid inevitable concerns.

Cite this article as :

Manikandan Srinivasan, "Guideline for fresh concrete cube - Storing, Transport and Testing ", International Journal of Scientific Research in Civil Engineering (IJSRCE), ISSN : 2456-6667, Volume 7, Issue 2, pp.64-70, March-April.2023

URL : https://ijsrce.com/IJSRCE237122