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Review Paper Based On the Relation between the Strength of Concrete Cubes and Cylinders

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ABSTRACT
This paper reports the review about comparison of the compressive strength of cubes and cylinders of different grades of concrete. The cubes of standard size of 150x150x150 mm were cured and tested after 7 and 28 days each. The cylinders of standard size 150mm dia. and 300mm height are cured and tested after 7 and 28 days each.

I. INTRODUCTION

Concrete is a versatile material. It has many advantageous properties such as good compressive strength, durability, specific gravity and fire resistance [ISSSN 0976-4399]. Concrete is a material which can be cast in much attractive shape. Compressive strength plays an essential function in the stability of structures. Generally the BS 1881: Part 120:1983 states that, the Strength of cylinder is equal to 0.8 times of the strength of cubes. [Ref. BS 1881: part 120:1983].

II. LITERATURE REVIEW

The compressive strength of standard specimen is determined in two different ways is to be: Cubes and Cylinders. In Great Britain, Germany and Europe cubes are used. In the United States of America, France, Australia, and Canada cylinders are used as standard specimens.

The restraining effect of platens of the testing machine extends over the entire height of the cube but leaves unaffected a part of a test cylinder. According to the expression for conversion the strength of the cores in to equivalent cubes in BS 1881: part 120:1983 the strength of the cylinder is equal to 0.8 times the strength of the cubes but in reality, there is no definite relation between the strengths of the specimens of these two shapes.[[2] M.S. Shetty, Concrete technology-theory and practice, S Chand publications (2005)]

The strength of the concrete cube and standard cylinder is affected by the following factors:

1.) **Casting and curing procedure:** casting of the cube is generally done in three layers. Each layer of the concrete should be compacted properly by tamping rod. The top layer of the cube should be evenly spaced so that a uniform surface should be formed. After some times the mould should be removed carefully so that the cube should not get subjected to any cracks.
The standard cylinder should also be casted very carefully. The layer should be compacted with the help of tamping rod and vibrator. The cylinders also should be removed very carefully from the mould so that it does not get subjected to any cracks.
The curing of the concrete cube /standard cylinder should be done for 7 days, 14 days and 28 days according to the experimental results. The concrete cube /standard cylinder should be cured properly.

2.) **Testing procedure of concrete cube/standard cylinder:** the concrete cube /standard cylinder are tested by universal testing machine (UTM).

3.) **Size of Specimen:** The factor such as shape and size of the concrete cube and cylinder (h/d) ratio approximately affect the strength characteristics. The situation in the standard test, where the height/diameter ratio is 2.

4.) **Effect of size of particle:** The influence of the aggregate properties on strength is of secondary importance. Generally the maximum size of aggregate should be kept 20 mm and minimum size 10mm. the aggregate should be so placed that the spacing of particles should be minimum to avoid voids.

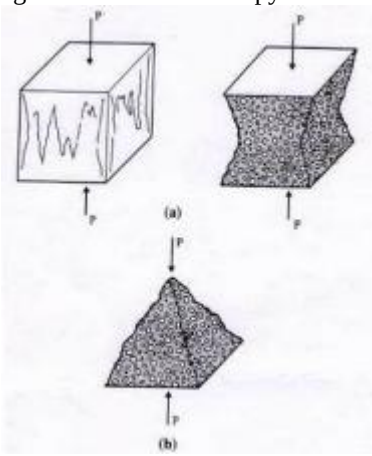
5.) **Effect of concrete strength level:** the concrete cube and cylinder strength ratio is affected by nominal strength of concrete. This ratio decreases with an increasing concrete strength according to the research by Evans.

III. FAILURE MODE OF TEST CUBE AND STANDARD TEST CYLINDER

According to the BS1881: part 116:1983 the typical satisfactory modes of test cubes are -

a) Non-explosive
b) Explosive

The influence of platen restraint can be seen from the typical failure modes of test cubes. The effect of shear is always present, although it decreases towards the centre of the cube, so that the side of cube have near vertical cracks as in case of non explosive failure. This happens when testing in a rigid testing machine. But a less rigid machine can store more energy so that an explosive failure is possible. Here one face touching the platens cracks and disintegrated so as to leave a pyramid or a cone.



Typical failure modes of standard test cylinders are –

a) Splitting
b) Shear (cone)
c) Splitting and shear(cone)

When the height to width ratio of the specimen increases, the influence of shear becomes smaller so that the central part of the specimen may fail by lateral splitting. This is the situation in a standard cylinder test where the height by diameter ratio is 2. The more usual possible modes of failure are by splitting and shear.

IV. RELATION BETWEEN THE TENSILE AND COMPRESSIVE STRENGTH

There is a close relation but not a direct proportionality, the ratio of two strength depends on the general level of strength of concrete. Generally, the ratio of tensile to compressive strength is lower the higher the compressive strength.

V. RESULTS AND DISCUSSION

From the study of previous experimental data the cube and standard cylinder were tested for 7 days and 28 days. The result shows that the strength of cube is greater than the strength of standard cylinder.

In the testing of cube the specimen is affected by lateral stresses throughout its height. In the case of standard cylinder the central region is unaffected by lateral stresses. The region of 0.866d from the top of the cylinder and the region of 0.866d from the bottom of the cylinder is affected by lateral stresses and the central region of 0.268d is unaffected by lateral stresses.

VI. CONCLUSION

On the basis of previous experimental results and according to the studied of research paper we have concluded the following points:

i) According to the influence of platen restraint on the mode of failure is greater in a cube than in a standard cylinder, the cube strength is approximately 1.25 times the cylinder strength, but the actual relation between the strengths of two types of specimen depends on the level of strength and the moisture condition of concrete at the time of testing.
ii) It is reasonable to ask whether a cube or a cylinder is a better test specimen. Compared with the cube test the , the advantages of the cylinder are less end restraint and a more uniform distribution of stress over the cross section , for these reasons the cylinder strength is probably closer to the true uniaxial compressive strength of concrete than the cube strength.
iii) According to the IS-516-1979 specified that the strength of cube of controlled specimen will be different from the standard strength of cylinder. Normally strength of cylinder is taken as 0.8 times the strength of cube, but experimental results of previous research so that there is no unique relation between the cylinder strength and the cube strength.
iv) According to the all experimental data of the relation between cube and cylinder, stated that the cylinder strength of hardened concrete is not a constant value of 0.8 times the cube strength because it depend upon so many factors water cement ratio, quality of aggregate (grading, surface texture, shape, strength and stiffness) and the maximum size of aggregate, cement content and the time period.

REFERENCES

[1.] A. M. NEVILLE , Concrete Technology published by Dorling Kindersley (INDIA) Pvt. Ltd, licensees of pearson education in South Asia
[2.] M.S. SHETTY, Concrete Technology Theory and Practice, S chand publication (2005)
[3.] IS 516 :1959 Method of test for strength of concrete Feb. 2004
[4.] BS 1881 : Part 120: 1983 – Method of determination of compressive strength of concrete cores
[5.] A. M. NEVILLE, Properties of concrete , 4th Edition (1995)