AN EXPERIMENT ANALYSIS ON MAXIMUM STRENGTH CONDUCTED, ALONG WITH A CALCULATION OF THE PROPORTION OF LIMESTONE REPLACEMENT FOR CEMENT.

[1]T.Hari Shankar, [2]N.Jyothsna Redla, [3]M.Varun Kumar, [4]A. Venkat Akhil
[1,2,3]Assistant Professor, [4]UG Student, [1,2,3,4]Department of Civil Engineering, Brilliant Grammar School Educational Society Group of Institutions Integrated Campus, Hyderabad, India

ABSTRACT
The primary material used in building is concrete. Sand, coarse aggregate, cement, and water make up concrete. Between 21 and 31 billion tonnes of concrete are consumed annually, making it the most common building material worldwide. The concrete industry is constantly seeking for additional cementitious material to help with the significant waste disposal issue and resource depletion. Limestone is used in the study to replace some of the cement and steel fibre is added to the concrete to assess the relevant qualities. In place of cement, lime increases the concrete's compressive strength, split tensile strength, and flexural strength. The durability of concrete is also increased by adding limestone powder. Steel fibres help in reducing the micro racks of concrete and also increasing the flexural and tensile strengths of concrete. Here we compare, the compressive strengths of different cubes caste with partially replaced limestone powder in the order of 10%, 20% and 30 %, with that of the nominal concrete cube. Out of the cubes cast above the maximum strength yielded and its corresponding percentage of limestone replacement is noted. The optimum value of fibre is found.
Keywords—Concrete, steel fibre, limestone, compressive strength

INTRODUCTION

Concrete is the most typical material utilized worldwide and in India's building sector. To satisfy the design specifications of a structure, concrete mixes are created with a variety of mechanical qualities. Concrete is a material with several phases and is thus complicated. In order to get properly reinforced, crack growth must be reduced at the macro, micro, and nano levels in order to optimize the responsiveness of concrete to loads. For construction of buildings, compressive strength Concrete is the material that is most often utilized nowadays. Concrete has a very poor tensile load bearing capability. For improving the performance of concrete with under tensile loading or dynamic loading, these various types of fibres are used, which causes brittle failure of concrete components. Fibre reinforced concrete is relatively a new construction material developed through extensive research and development work during the last two decades. It has already found a wide range of practical applications and proved to be a reliable construction material having superior performance characteristics compared to conventional concrete. To improve several properties like tensile strength, cracking resistance, impact and wear resistance, ductility and fatigue resistance,incorporation of fibre in concrete has been found. This paper aims to have a comparative study between ordinary reinforced concrete and steel fibre reinforced concrete thereby adding to that body of knowledge through experimental investigation and analysis by performing tests on steel fibre incorporated cubes & cylinders and motivating sustainabledevelopment.
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WORKABILITY

The property of concrete which determines the amount of useful internal work, necessary to produce full compaction i.e. workability is the amount of energy to overcome Friction while compacting. Also defined as the relative ease with which concrete can be mixed, transported, moulded and compacted.
Depending up on the water cement ratio in concrete, the workability of concrete determined by the following three methods.

- Slump Cone Test
- Compaction Factor Test
- Vee-bee Test

In this study the slump cone test is considered to determine the workability of concrete. The test procedures are given below.

Determination of Workability of Slump Cone test

Concrete slump test or slump cone test is to determine the workability or consistency of concrete mix prepared at the laboratory or the construction site during the progress of the work. The slump test is the most simple workability test for concrete, involves low cost and provides immediate results. Due to this fact, it has been widely used for workability tests since 1922. The slump is carried out as per procedures mentioned in IS: 1199 – 1959. Generally concrete slump value is usedto find the workability, which indicates water-cement ratio, but there are various factors including properties of materials, mixing methods, dosage, admixtures etc. also affect the concrete slump value. Mold for slump test i.e., slump cone, non- porous base plate, measuring scale, temping rod. The mold for the test is in the form of the frustum of a cone having height 30 cm, bottom diameter 20 cm and top diameter 10 cm. The tamping rod is of steel 16 mm diameter and 60cm long androunded at one end.

A concrete mix (M15 or other) by weight with suitable water/ cement ratio is prepared in the laboratory for casting 6cubes after conducting Slump test.

Test procedure

- The mould for the slump test will be frustum of a cone, with 300 mm (12 in) of height. The base of cone is 200 mm(8in) in diameter and cone has a smaller opening at the top of 100 mm (4 in).
- For testing of workability, the base should be placed on a smooth surface and the container is filled with concretesample in three layers.
- Each layer should be tamped 25 times with a standard 16 mm (5/8 in) diameter of a steel rod, at rounded end.
- The top surface is struck off by means of screening and rolling motion of the temping rod when the mould iscompletely filled with concrete.
- The decrease in the height of the centre of the slumped concrete is called slump.
- The slump cone is measured by placing the cone just besides the slump concrete and the temping rod is placed overthe cone so that it should also come over the area of slumped concrete
- The decrease in height of concrete to that of mould is noted with scale
- The above operation should be carried out at a place free from Vibrations or shock and within a periodof 2 minutesafter sampling.

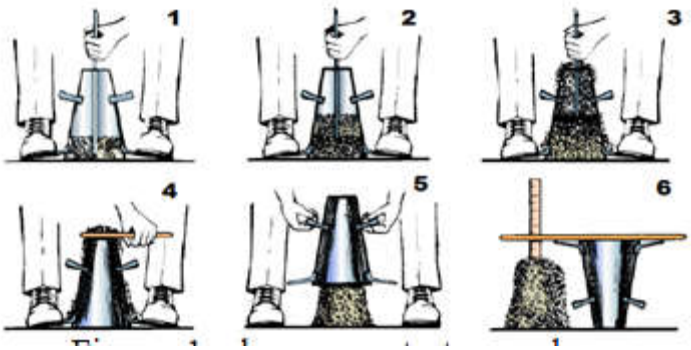

Figure. 1- slump cone test procedure

Test Results on Workability

When the slump cone test is carried out then the results may be concluded by the following shapes shown in figure-2

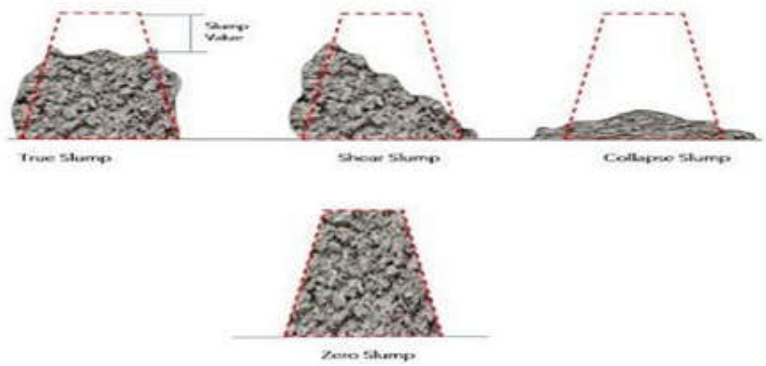

Figure. 2- slump cone test results

True Slump – True slump is the measurement is taken between the top of the cone and the top of the concrete after the conehas been removed as shown in figure-1.
Zero Slump – Zero slump is the indication of very low water-cement ratio, which results in dry mixes.
Collapsed Slump –This is an indication that the water-cement ratio is somewhat high, i.e., concrete mix is too wet or it is ahigh workability mix.
Shear Slump – This indicates that there sult is incomplete, and concrete to be retested. Slump Cone Test: The results of slump cone test are shown for a percentage of constant steel fibers of 15% with increasing the lime stone percentage at the intervals of 0%, 10%, 20%, and 30% respectively. The below table shows the standard slump values for the slump cone test.

TEST RESULTS FROM SLUMP CONE TEST FOR WORKABLITYIN MM

S.No.	percentageof Steel Fibers	Percentageof lime stone	Slump(mm)
1	0%	0%	40
2	1.5%	10%	25
3	1.5%	20%	20

Compressive strength
DETERMINATION OF STRENGTH
Compressive strength is the ability of material or structure to carry the loads on its surface withoutany crack or deflection. Cubes with dimension of 150mm×150mmx150mm used for Compression test. This method of curing is called as water curing by immersion. The concrete specimens were cured for specified number of days (7, 14& 28 days) in water at 25± 2^0Cand later specimens are taken out of water for testing.
TABEL 2:
TEST RESULTS FROM COMPRESSIVE STRENGTH RESULTS OF M25 GRADE CONCRETE 7,14,28 DAYS

S.No.	percentageof Steel Fibers	Percentageof lime stone	Compressive strength (Mpa)		
			7 days	14 days	28days
1	0%	0%	19.88	22.77	28.55
2	1.5%	10%	20.2	25.5	35.11
3	1.5%	20%	25.66	29.22	39.55
4	1.5%	30%	23.66	27.66	36.44

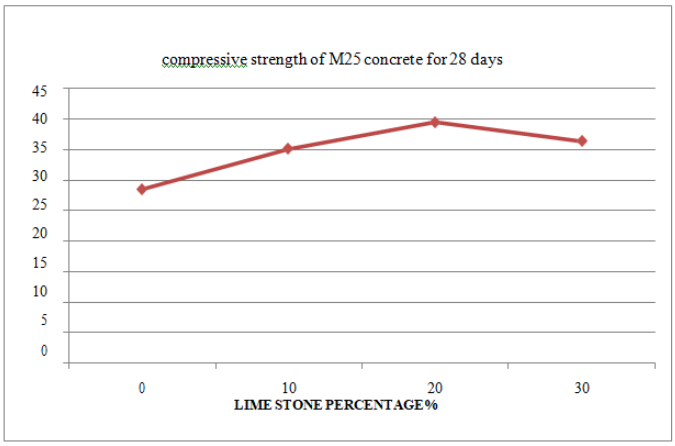

Figure. 3- Comparison of Compressive strength for percentages of lime stone

Split Tensile Strength

The tensile strength of concrete is one of the basic and important properties which greatly affect the extent and size of cracking in structures. Moreover, due to its brittle nature the concrete is very weak in tension. Hence when tensile forces exceed its tensile strength it is not expected to resist the direct tension at which tensile strength to be estimated Initially, take the wet specimen from water after 7, 28 of curing; or any desired age. Apply the load continuously without shock at a rate within the range 0.7 to 1.4 MPa/min(1.2 to 2.4 MPa/min based on IS 5816 1999)

The split tensile strength was conducted by using 150mm and 300mm cylinder as per IS 5816-1999. The following tables gives the results of concrete having 0%, 10%, 20%, and 30% of lime stone by keeping the steel fibres content as1.5%.

TEST RESULTS FROM SPLIT TENSILE STRENGTH RESULTS OF M25 GRADE CONCRETE 7,14,28 DAYS

S.No.	percentageof Steel Fibers	Percentageof lime stone	Split Tensile Strength (Mpa)		
			7 days	14 days	28days
1	0%	0%	1.48	2.29	2.68
2	1.5%	10%	2.33	3.08	3.11
3	1.5%	20%	2.43	3.8	3.61
4	1.5%	30%	2.26	3.18	3.31

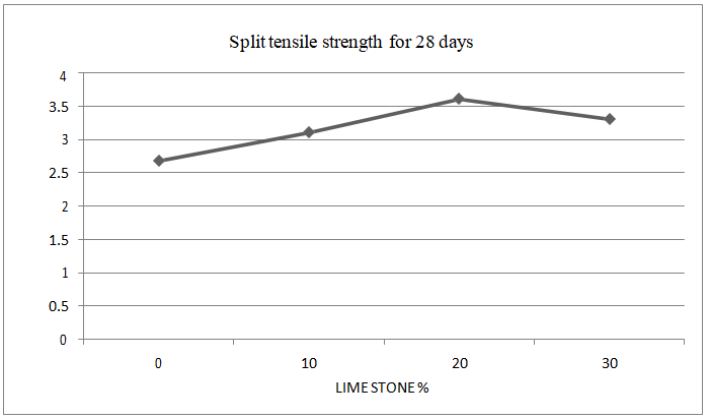

Figure. 3- Comparison of Split Tensile strength for percentages of lime stone

CONCLUSION

Based on the results obtained from the present investigation, the followingconclusions are made, they are,

a. Workability is decreased gradually when the mix of concrete is done with limestone and steel fibers as compared to normal concrete.

b. At 20% of limestone content the compressive strength is increased gradually up to 39.55 N/mm2when compared with normal concrete.
c. The maximum value of compressive strength is 39.55 N/mm2 and split tensile strength is 3.61 N/mm2
d. It can also be concluded that the optimum content of lime stone added to the concrete is 20% by keeping the steel fibers with 1.5% constant value.
e. Further increase in the lime stone content and the steel fibers results in making the concrete workability low and it can make the concrete as „balls. It results in the presence of voids in the concrete.
f. It can also note that during the testing of specimens, they cannot be collapse as compared to normal concrete.
g. In the present study the M25 grade concrete had been considered and the present work can beextended with different percentages of limestone and the steel fibers content.

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