EXPRERIMENTAL ANALYSIS ON DIFFERENT AGGREGATE SIZES TO ANALYZE THE COMPRESSIVE STRENGTH OF CONCRETE

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ABSTRACT: Adding to manmade problems are natural reasons for this problem getting worse each year. As the health of countries worsens, the health of its states & cities worsen too. The absorbing of Water such as wastelands, saltpans, wetlands and mangroves of our country are shrinking due to reestablishments of land uses for development – this leaves more and more storm water to be dealt with by civic authorities who are already burdened with a multitude of problems.
this study an attempt has been made to identify the various properties necessary for the design of concrete mix with different size of aggregates. M25 grade concrete has been chosen as the reference concrete specimen. 2mm, 3mm 4mm has been used as fine aggregate with the replacement of conventional fine aggregate.
This will not only allow the sustainable use of aggregates available to us but also provide an effective and mass management of concrete block. The concrete block specimen with different sizes of aggregate i.e. 2mm, 3mm, 4mm, 10mm, 15mm was created, the curing of samples is done for 7, 14, 21 days, A compressive test is performed and is found that 4mm aggregate size enhances higher compressive strength compared to other samples.
Keywords: - Concrete Block, Concrete, Aggregate, Compressive Strength.

I. METHODOLOGY & EXPERIMENTAL INVESTIGATION

MATERIALS USED

The basic ingredients which were used in this investigation are:

- OPC (ultra tech cement)
- Natural Coarse aggregate (sedimentary rock source)
- Natural Fine aggregate (sand)
- Water (fresh drinkable water)

ORDINARY PORTLAND CEMENT

The ultra tech cement of 53 grade manufactured by the ULTRATECH Cement Company was considered in this study, which is Indian standard code - IS 12269:1987 having strength for 28 days being a minimum of 58 MPa or 530 kg/sqcm.

COARSE AGGREGATES

- Coarse aggregates were used for the preparation of test samples using OPC (ultra tech cement).
- Graded fine aggregate were used & is described by its nominal size i.e. 2mm, 3mm and 4mm.
- The coarse aggregate having nominal size 10mm, 15mm has been used in this study.

FINE AGGREGATE

- Fine aggregates acts as filler material between the coarse aggregate.
- For the present study locally available sand was used.
- Dust and debris were removed properly before preparing the samples of different aggregate.

PREPARATION OF CUBE & BEAM SAMPLES

Cube Samples	15 x 15 x 15 cm
Grade	M25
Volumetric Proportions for M25	1:1.5:3

M25 grade of concrete was considered for the preparation of samples. The Table 3.3 shows the weights of materials taken for the preparation of test samples.
The process included the 5 basic steps and these steps are as follows:

- Weighing & Batching
- Mixing
- Placing
- Compacting
- Curing

Table: 3.3 Material Proportions (per m^3 of concrete)

CEMENT	FINE AGGREGATE	COARSE AGGREGATE	WATER	NO. OF CUBES PREPARED
373.38	609.60	1220.8	186.69	5
373.38	579.12	1220.8	149.31	5
373.38	548.64	1220.8	149.31	5
373.38	518.16	1220.8	149.31	5

Weighing and Batching of materials

The first step in the preparation of the cube sample is the weighing and batching of materials. The materials are batched according to the requirements and then a fixed amount from this batched lot of materials is taken for the preparation of sample. The figure 3.1 shows the simple batching done in the laboratory;

Procedure for compaction factor test:
1. The concrete sample was gently placed in the upper hopper of the apparatus using the hand scoop and was leveled. After that the cylinder was covered properly.
2. Trap door present at the bottom of the upper hopper was

opened in such a way that Concrete falls in to the lower hopper. Also, the concrete sticking on its sides was gently pushed with the road to the lower hopper.
3. Then, the trap door of the lower hopper was opened too and the concrete was allowedto fall in to the cylinder below.
4. The excess of concrete present above the top level of cylinder was cut off using trowels and was leveled.
5. The outside of the cylinder was cleaned.

II. COMPRESSIVE STRENGTH TEST RESULT

The compressive strength test was performed on the cubes of size 15 cm x 15 cm x 15 cm to check the compressive strength of rubberized concrete and the results obtained are given in Table 4.1.

Target mean strength for 28 days for M25 concrete (f'ck) = fck + 1.65×s
= 20 + 1.65×4
=26.6 N/mm^2
Where, f'ck= target mean strength at 28 days
fck = characteristic compressive strength at 28 days &
s = standard deviation = 4 (for M25 concrete)

Table 4.1 Results of compressive strength test

Aggregate Size 2 mm			
load	7 days	14 days	21days
200	18.3	18.9	19.1
400	17.8	18.2	18.6
600	17.4	17.7	18.3
700	16.9	17.1	17.9

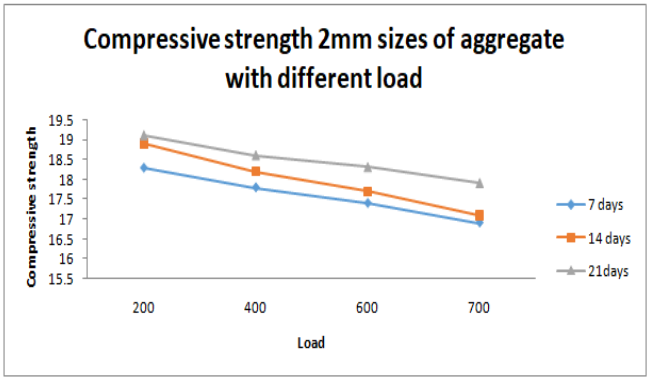

Figure 4.1 Graph shows results of compressive strength test

Above shown graph represents a comparative analysis aggregate strength of denser and coarse aggregates for compression testing from above comparison the conclusion would be withdrawn for compressive strength of 2mm aggregate.

Table 4.2 Results of compressive strength test

Aggregate Size 3 mm			
load	7 days	14 days	21days
200	18.8	19.3	19.7
400	18.3	19	19.2
600	17.6	18.4	18.6
700	17.2	17.9	18.1

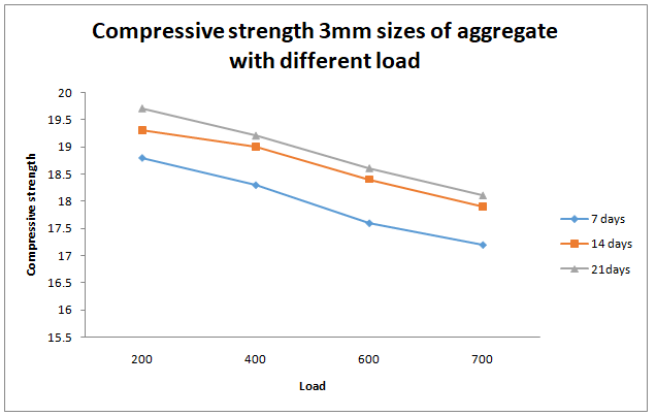

Figure 4.2 Graph shows results of compressive strength test

Above shown graph represents a comparative analysis aggregate strength of denser and coarse aggregates for compression testing from above comparison the conclusion would be withdrawn for compressive strength of 3mm aggregate.

Table 4.3 Results of compressive strength test

Aggregate Size 4 mm			
load	7 days	14 days	21days
200	19.8	23.3	20.8
400	19.2	22.9	20.4
600	18.9	22.5	19.9
700	18.3	21.9	19.2

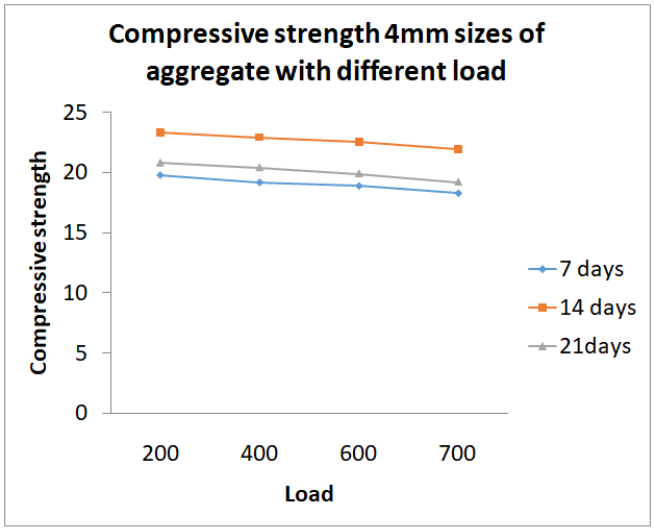

Figure 4.3 Graph shows results of compressive strength test

Above shown graph represents a comparative analysis aggregate strength of denser and coarse aggregates for compression testing from above comparison the conclusion would be withdrawn for compressive strength of 4mm aggregate.

Table 4.4 Results of compressive strength test

Aggregate Size 10mm			
load	7 days	14 days	21days
200	19.5	19.8	20.4
400	19.1	19.3	20.1
600	18.7	18.9	19.8
700	18.1	18.4	19.3

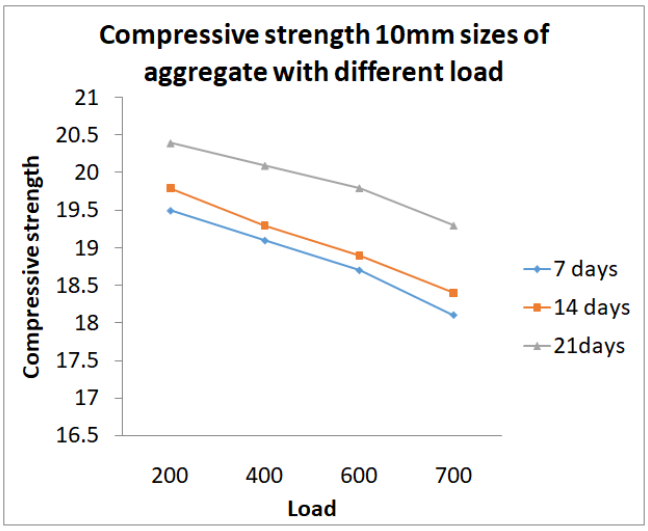

Figure 4.4 Graph shows results of compressive strength test

Above shown graph represents a comparative analysis aggregate strength of denser and coarse aggregates for compression testing from above comparison the conclusion would be withdrawn for compressive strength of 10mm aggregate.

Table 4.5 Results of compressive strength test

Aggregate Size 15 mm			
load	7 days	14 days	21days
200	18.8	19.5	19.8
400	18.5	19.1	19.3
600	17.9	18.3	18.7
700	17.2	18.1	18.4

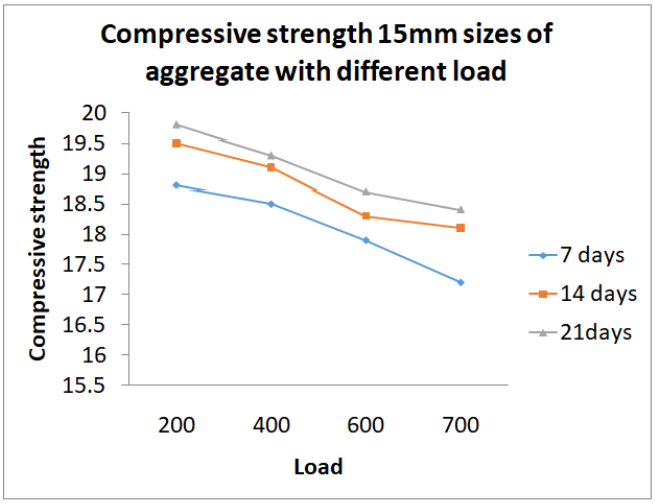

Figure 4.5 Graph shows results of compressive strength test

Above shown graph represents a comparative analysis aggregate strength of denser and coarse aggregates for compression testing from above comparison the conclusion would be withdrawn for compressive strength of 15mm aggregate.

DISCUSSION

By this study, it can be concluded that by varying the size of aggregate optimal changes were observed in compressive strength of structure.

The variation of the compressive strength of the aggregate with respect to the variation of size of concrete block is shown in figure

III. CONCLUSIONS

- Concrete with larger size of aggregate posses low workability i.e with increase in size of aggregate the concrete block workability decreases.
- The compressive strength of the concrete decreases in all sizes of aggregate in curing of 7 days. With the addition of fine aggregate, the reduction in strength cannot be avoided. However, these data provides only preliminary guideline for the strength-loss of locally produced modified concrete in comparison with the conventional concrete of 650KN targeted strength.
- The high compressive strength is observed in 4mm of aggregate compared to all sizes of aggregate concrete blocks in each days of cured samples.
- The inclusion of fine aggregate in concrete that would help to control noise going both ways and hence make the roof soundproof and will also prove to be a good cooler for sure, Another advantage is that shrinkage and hence cracking is reduced
- Barriers made with crumbed rubber would be much more forgiving if they be run into, which would not only help protect the barrier itself but also the vehicle that hits it.

FUTURE SCOPE

- Different block size could be used to analyze compressive strength.
- Different beams can be used for analyzing flexural strengths.
- Different load could be also analyzed for Blocks.
- Different pressure could be analyzed for beams.
- Different percentage of rubber crumb quantity mixed in concrete and also analyzed compressive and flexural strength's.

REFERENCES

[1] Nourredine Arabi Houria Meftah Hanane Amara Oussama Kebaïli Layachi Berredjem Valorization of recycled materials in development of self-compacting concrete: Mixing recycled concrete aggregates – Windshield waste glass aggregates, Construction and Building Materials Volume 209, 10 June 2019, Pages 364-376.

[2] Khuram Rashid Ardavan Yazdanbakhsh Munib Ul Rehman, "Sustainable selection of the concrete incorporating recycled tire aggregate to be used as medium to low strength material", Journal of Cleaner Production Volume 224, 1 JULY 2020, Pages 396-410.

[3] Hilal El-Hassan Peiman Kianmehr Souhail Zouaoui, Properties of pervious concrete incorporating recycled concrete aggregates and slag, Construction and Building Materials Volume 212, 10 JULY 2020, Pages 164-175.

[4] Yongchang Guo Jianhe Xie Jianbai Zhao Kexian Zuo, Utilization of unprocessed steel slag as fine aggregate in normal- and high-strength concrete, Construction and Building Materials Volume 204, 20 April 2019, Pages 41-49.
[5] Negasi N. Gebremichael S. Mahmoud Motahari Karein Moses Karakouzian Kazem Jadidi, Investigation of setting time and compressive strength of ready-mixed concrete blended with returned fresh concrete, Construction and Building Materials Volume 197, 10 February 2019, Pages 428-435.
[6] Roseli Oliveira Guedes Martins, "Influence of blocks and grout on compressive strength and stiffness of concrete masonry prisms, Construction and Building Materials Volume 182, 10 September 2018, Pages 233-241
[7] G.Pennarasi S. Soumya K. Gunasekaran., "Study for the relevance of coconut shell aggregate concrete paver blocks", Volume 14, Part 2, 2019, Pages 368-378.
[8] Shuqing Yang Tung-Chai Ling Hongzhi Cui Chi Sun Poon Influence of particle size of glass aggregates on the high temperature properties of dry-mix concrete blocks, Construction and Building Materials Volume 209, 10 June 2019, Pages 522-531.
[9] Zhanggen Guo An Tu Chen Chen Dawn E. Lehman, "Mechanical properties, durability, and life-cycle assessment of concrete building blocks incorporating recycled concrete aggregates," Journal of Cleaner Production Volume 199, 20 October 2018, Pages 136-149.
[10] Paul O. Awoyera Julius M. Ndambuki Joseph O. Akinmusuru David O. Omole, "Characterization of ceramic waste aggregate concrete," HBRC Journal Volume 14, Issue 3, December 2018, Pages 282-287.
[11] Bo Wu Hemao Jin, "Compressive fatigue behavior of compound concrete containing demolished concrete lumps, Construction and Building Materials Volume 210, 20 June 2019, Pages 140-156.
[12] Violeta Migallón Francisco Navarro-González "Parallel approach of a Galerkin-based methodology for predicting the compressive strength of the lightweight aggregate concrete Construction and Building Materials Volume 219, 20 September 2019, Pages 56-68.

