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Light Weight Concrete Using Building Debris

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Abstract: Civil Engineering is a field of great responsibility. Due to increase in population construction rate has increased to a whole new level. Use of concrete is made in almost every construction. This rapid use has led to a lot of waste creation of concrete. To help reduce this we should adopt a way to reuse this concrete and help wastage in nature. The reuse of such concrete is termed as ' Concrete Recycling'. In this the new concrete is made using used up concrete from leftovers of slabs and columns. By using this method the construction of light weight concrete is made possible. Light weight concrete is a concrete which has a much less density than conventional concrete. This helps in reduction of self weight of structure. Using building debris and constructing light weight concrete will help this project achieve the motive of being environmental friendly and also a structure which has less self weight.

Keywords: lightweight concrete, building, debris, concrete, recycling

I. INTRODUCTION

Indian construction industry today is amongst the five largest in the world. The demand for new construction is ever increasing with the rise in population. Hence, the non-renewable aggregate supply has emerged as a problem in India. To overcome such obstacles or shortage, we should use materials which will help in recycling the construction debris rather than harming the environment. For solving the problem of disposal of large amount of materials and to meet the increasing need for aggregates, re-use of concrete of structural members is considered as one of the feasible application. This process of reusing concrete is also known as concrete recycling.

CONCRETE

The normal concrete used in the construction industry are M20, M25 and so on. Currently M90 is being used in worlds tallest residential building named 'The World One' in India. These types of concrete generally have a heavy weight. Therefore this leads to the increase in the weight of the overall structure. Therefore to reduce the self weight of the structure we use light weight concrete.

LIGHT WEIGHT CONCRETE

In recent years, more awareness has been paid to the development and research of light weight aggregate concrete. Light weight concrete is a type of concrete material that is lighter than the conventional concrete because of varying material composition. It maintains good durability in satisfying the required demand by making the concrete as a high performance material.

Light weight concrete is having an oven dried density of not less than 800 kg/m^3 and not even more than 2000 kg/m^3. The major benefits of using light weight concrete is that it reduces the self weight of the structure upto 15% or more

- LIGHT WEIGHT CONCRETE USING BUILDING DEBRIS.

Using building debris is itself synonymous to concrete recycling. Since this project is directed towards being environment friendly, the process of making light weight concrete will be done using the building debris. Building debris usually consist of broken walls, columns, furnitures, brick masonry, etc. among this in this project the use of broken slabs and columns would be done. This along with the making of light weight concrete using materials such as thermos-plastic, polymers, chemical additives, etc. will give us a light weight concrete keeping in mind the threats to environment. This in turn helps us use waste materials as new materials for making concrete which can be used for further constructions.

- NEED OF STUDY

Concrete is one of the maximum used material for construction in todays world. Making of concrete does need materials which can cause harm to the environment. Thus, reusing and recycling of concrete becomes an important aspect for study. This project will give an idea about using new material for making of concrete and thus reducing the strain on environment**.**

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II. LITERATURE REVIEW

1. Dr. V. Bhaskar Desai et al. did and experimental investigation to study the strength of light weight cinder aggregate cement concretes in different percentage proportion of 0, 25, 50, 75 and 100 by volume of light weight aggregate concrete can be prepared. With the help of this, the properties such as compressive strength, modulus of elasticity, etc. are studied by casting and testing.

2. Raj Vardhan Singh Chandel et al. studied about Cellular Light weight concrete. Cellular Light Weight concrete is a versatile material which is made up of cement, fly ash and protein based foam. In this paper light weight cellular concrete blocks are casted with 65% of fly ash and 35% of cement with foam content 15% of total weight and to increase its strength, sand and quarry dust is added in its composition which replace fly ash up to 30% at an interval of 5%.

3. Shemy S. Babu et al. researched and explored about the stability of the recycled plastics as coarse aggregate in concrete by conducting various tests like workability by slump test, compressive strength of cube. The result showed that the addition of plastic aggregates to the concrete mixture improved the properties of the resultant mix.

4. B. Devi Pravallika et al. studied the strength and durability properties of M40 concrete by partial replacement of coarse aggregate with natural light weight aggregate like pumice stone. The experimental program was carried out on cubes, cylinders and beams. The details of the materials used for this specimens and testing procedures incorporated in the test program are presented.

5. J. Chamundeeswari et al. had replaced the coarse aggregate partially by the plastic aggregate which are having the properties of the thermoplastics. They partially replaced the coarse aggregate by 30%. They did a comparative study on both these conventional concrete and light weight concrete.

III. RESEARCH GAP

Making of light weight concrete (LWC) is been practiced since a long period of time. It helps in making of concrete which has a density less than normal concrete. It is usually achieved with the help of using different aggregates. Aggregates used for light weight concrete are usually porous in nature. Such aggregates are having a certain amount of voids which help in reduction of density of concrete. In this project use of building debris has been done. This has been done before and the term of reusing concrete waste is termed as concrete recycling. This project intends to make light weight concrete using this technique of concrete recycling. Earlier conventional concrete has been made with earlier used concrete structures. This project aims at reducing the self weight of structure using light weight concrete and also help preserving nature by helping to recycle concrete.

IV. OBJECTIVES OF STUDY

Following are the objectives of the project:

- To understand the light weight concrete and level of application in construction industry.
- To compare the strength and density of light weight concrete with conventional concrete.
- To help increase in concrete recycling.
- To make sure that the final product is environment friendly.

DATA COLLECTION

- For M20

Material	Quantity
Cement	8 kg
Sand	12 kg
Aggregate (10 mm)	10 kg
Aggregate (20 mm)	15kg
Water	• L

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- For M25 Fig: 4.2

Material	Quantity
Cement	11 kg
Sand	11 kg
Aggregate (10 mm)	9 kg
Aggregate (20 mm)	14 kg
Water	• L

- For M30 Fig: 4.3

Material	Quantity
Cement	9 kg
Sand	9 kg
Aggregate (10 mm)	11 kg
Aggregate (20 mm)	16 kg
Water	4.5 L

Data Analysis

1. Data analysis for M20 grade concrete
- Ratio is 1:1.5:3
- Total number of cubes to be casted = 6
- Size of one cube = (150 x 150 x 150) mm
  = 3.375×10^{-3} m^3
- Hence, total dry quantity = 0.02025 m^3
- For wet volume, increase this volume by 30%
- Hence total volume = 0.026325 m^3

Considering 15% wastage, it is = 0.03027 m^3…….(Required Volume)
- Quantity of cement = 5.5063×10^{-3} m^3

1 bag of cement = 50 kg = 35L
- Hence 1 bag of cement = 0.035 m^3
- Therefore, no of bags = 0.157 bag

Therefore required quantity of cement = 7.85 kg
- Quantity of Sand = 7.85 x 1.5 = 11.775 kg
- Quantity of aggregate = 7.85 x 3 = 23.55 kg
- Quantity of 10 mm size aggregate = 40% of total aggregate = 9.42 kg
- Quantity of 20 mm size aggregate = 60% of total aggregate = 14.13 kg
- Water cement ratio = 0.45

Hence, quantity of water = 3.53 kg = 3.6 L

2. Data analysis for M25 grade concrete
- Ratio is 1:1:2
- Total number of cubes to be casted = 6
- Size of one cube = (150 x 150 x 150) mm
  = 3.375×10^{-3} m^3
- Hence, total dry quantity = 0.02025 m^3
- For wet volume, increase this volume by 30%
- Hence total volume = 0.026325 m^3

Considering 15% wastage, it is = 0.03027 m^3…….(Required Volume)
- Quantity of cement = 7.5675×10^{-3} m^3

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1 bag of cement = 50 kg = 35L

- Hence 1 bag of cement = 0.035 m^3
- Therefore, no of bags = 0.216 bag

Therefore required quantity of cement = 10.8 kg

- Quantity of Sand = 10.8 x 1 = 10.8 kg
- Quantity of aggregate = 10.8 x 2 = 21.6 kg
- Quantity of 10 mm size aggregate = 40% of total aggregate = 8.64 kg
- Quantity of 20 mm size aggregate = 60% of total aggregate = 12.96 kg
- Water cement ratio = 0.45

Hence, quantity of water = 4.86 kg = 5 L

3. Data analysis for M30 grade concrete

- Ratio is 1:1:3
- Total number of cubes to be casted = 6
- Size of one cube = (150 x 150 x 150) mm
  = 3.375 x 10^{-3} m^3
- Hence, total dry quantity = 0.02025 m^3
- For wet volume, increase this volume by 30%
- Hence total volume = 0.026325 m^3

Considering 15% wastage, it is = 0.03027 m^3…….(Required Volume)

- Quantity of cement = 6.054 x 10^{-3} m^3

1 bag of cement = 50 kg = 35L

- Hence 1 bag of cement = 0.035 m^3
- Therefore, no of bags = 0.173 bag

Therefore required quantity of cement = 8.65 kg

- Quantity of Sand = 8.65 x 1 = 8.65 kg
- Quantity of aggregate = 8.65 x 3 = 25.95 kg
- Quantity of 10 mm size aggregate = 40% of total aggregate = 10.38 kg
- Quantity of 20 mm size aggregate = 60% of total aggregate = 15.57 kg
- Water cement ratio = 0.45

Hence, quantity of water = 3.89 kg = 4 L

V. METHODOLOGY

Stage 1 – Casting of conventional concrete

- For M20, M25, M30

1. According to the data collection and analysis, we have casted concrete of desired strength for M20, M25, M30.
2. We mixed all the components such as cement, sand and aggregate and casted the conventional concrete according to the Indian standard.
3. In the next semester, casting of concrete will be done using building debris.

VI. EXPECTED OUTCOME

- The project outcome is planned to achieve light weight concrete using building debris.
- This product should have desired properties such as the self weight of structure should be less than the self weight of structure constructed using conventional concrete.
- It should also be environment friendly and help reduce the wastage of concrete.

VII. CONCLUSION

- We are expected to achieved the required the strength which can be used for construction purposes despite replacing some proportions of sand by building debris.
- We also expect to reduce the cost of making the concrete since building debris is freely available.

REFERENCES

Concrete Technology by M.S. Shetty