

## Study On Utilisation Of Building Materials From Demolished Structures

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### ABSTRACT

Recycling of concrete waste aggregate is a hot topic. Numerous papers, reports and articles have been prepared illustrating how we could and should make greater use of recycled aggregate in the construction industry. The present project makes an effort to assess a safe and economic use of such concrete as a structural grade concrete of M30. Extensive tests for structural properties such as workability, compressive strength, split tensile strength and flexural strength tests on concrete specimens made up of recycled and natural aggregate are to be carried out with the use of GGBFS as mineral admixture. The recycled aggregate concrete can be used as a substitute for the natural aggregate and it is necessary from viewpoint of environmental preservation and effective utilization of resources. Further the replacement of crushed concrete waste will lead to saving in the cost of the aggregate.

### INTRODUCTION

There are enough indications today that environmental issues will have a dominant role in the sustainable development of the cement and concrete industries in the 21<sup>st</sup> century. With 1.50 billion tones world cement production getting converted into approximately 4 to 5 Million cubic meters of concrete per annum, concrete has the distinction of being the largest man made material in the world. Many experts, who believe that concrete will maintain its leading role even in the foreseeable future in the 21<sup>st</sup> century, attribute this to a variety of its advantages, chief amongst which are fairly durable and maintenance – free service life, adaptability to any shape and size, a wide range of structural properties and cost effectiveness.

However, the concrete industry world wide is drawing upon enormous natural resources and disposing large quantities of construction and demolition waste in landfills. Both these are damaging to the

environment and are no longer considered sustainable. It is widely recognized that there is a limit on the availability of natural minerals used for making cement and producing aggregates. In the long term rapid depletion of the resources may contravene the principles of sustainable development, which require the need of the present be met without compromising the ability of future generation to meet their own needs.

### RECYCLED AGGREGATE CONCRETE

Conventional concrete aggregate consists of sand (fine aggregate) and various sizes and shapes of gravel or stones. However, there is a growing interest in substituting alternative aggregate materials, largely as a potential use for recycled materials. While there is significant research on many different materials for aggregate substitutes (such as granulated coal ash, blast furnace slag or various solid wastes including fiberglass waste materials,

granulated plastics, paper and wood products / wastes, sintered sludge pellets and others), the only two that have been significantly applied are glass cullet and crushed recycled concrete itself. Recycled concrete is widely available, though it is typically not geared toward use as a concrete aggregate substitute. Therefore prices may be high to obtain aggregate of a particular size range specification. Crushed glass aggregate is less widely available than recycled concrete, and is also not usually sold as aggregate

### GROUND GRANULATED BLAST FURNACE SLAG

The main focus of this research is to determine the potential of GGBFS as mineral admixture and calcium nitrate as a strength gain and corrosion inhibiting substance in concrete. To establish the feasibility of using GGBFS and calcium nitrate in concrete, more information and performance data were gathered in critical areas, such as workability, strength and durability of concrete. This chapter presents the literature review, with specific focus on the workability, strength and durability of concrete containing GGBFS as mineral admixture and calcium nitrate as a strength gain and corrosion inhibiting substance in concrete.

- Reduced heat of hydration
- Refinement of pore structures
- High ultimate strength with low early strength
- Increased resistance to chemical attack
- Improved alkali-silica reaction resistance
- Reduced permeability to other external agencies
- Resistance to sulfate and seawater
- Better finish and light colour

In India we produce about 7.8 million tons of blast furnace slag. All the blast furnace slag is granulated by quenching the molten slag by high power water jet, making 100% glassy slag granules. The blast furnace slag is mainly used in India for manufacturing slag cement. In other countries its use as admixture is more common than its use as slag cement. Now in India, since it is available separately as ground granulated blast furnace slag (GGBFS), its use as admixture should become more common. Recently for marine outfall work at Bandra, Mumbai, GGBFS has been used as an admixture to replace cement to the tune of 70%. In large projects with central batching plant and in ready mix concrete this cement substitute material could be used as useful mineral admixture and save cement to the extent of 60 to 80 percent.

### THE MIX PROPORTION

For M30 Grade concrete

Cement : FA : CA : W/c  
ratio

1 : 1.28 : 2.46 : 0.42

**Mix-A:** Conventional concrete with 100% natural CA

**Mix-B:** Concrete with 100% recycled CA

**Mix-C:** Concrete with 100% recycled CA + 10 % GGBFS

**Mix-D:** Concrete with 100% recycled CA + 20 % GGBFS

**Mix-E:** Concrete with 100% recycled CA + 30 % GGBFS

### TEST RESULTS AND DISCUSSION

Values of compressive strength at different percentage of replacement at different age are given below:

### Compressive Strength of Concrete (N/mm<sup>2</sup>)

Days	Mix-A	Mix-B	Mix-C	Mix-D	Mix-E
7	22.25	18.84	20.45	22.76	18.21
28	33.85	27.12	30.94	34.25	27.01

The maximum compressive strength of 34.25 N/mm<sup>2</sup> was attained at 20% replacement, while the minimum strength of 27.01 N/mm<sup>2</sup> was attained at 30% replacement. The strength reduced as the percentage of replacement increased above 20 % replacement.

#### Split Tensile Strength Test

Values of split tensile strength at different percentage of replacement at different age are given below:

#### Split tensile Strength of Concrete (N/mm<sup>2</sup>)

Days	Mix-A	Mix-B	Mix-C	Mix-D	Mix-E
7	3.30	3.04	3.16	3.34	2.99
28	4.07	3.65	3.89	4.09	3.64

The maximum split tensile strength of 4.09 N/mm<sup>2</sup> was attained at 20% replacement, while the minimum strength of 3.64 N/mm<sup>2</sup> was attained at 20% replacement. The strength reduced as the percentage of replacement increased above 20 % replacement.

#### Flexural Strength Test

Values of flexural strength at different percentage of replacement at different age are given below:

#### Flexural Strength of Fly ash Concrete (N/mm<sup>2</sup>)

Days	Mix-A	Mix-B	Mix-C	Mix-D	Mix-E
7	3.41	3.14	3.25	3.43	3.07
28	4.19	3.78	4.08	4.22	3.74

The maximum flexural strength of 4.22 N/mm<sup>2</sup> was attained at 20% replacement, while the minimum strength of 3.74 N/mm<sup>2</sup> was attained at 30% replacement. The strength reduced as the percentage of replacement increased above 20 % replacement.

#### Workability

#### Workability of Concrete

Test	Mix-A	Mix-B	Mix-C	Mix-D	Mix-E
Slump (mm)	84	73	78	85	92
Compaction Factor	0.912	0.88	0.90	0.915	0.925

#### CONCLUSION

- Recycled aggregate possesses relatively higher water absorption as compared to those of fresh granite aggregates. This is mainly due to the porous mortar adhering to the recycled concrete aggregate.
- Workability of recycled aggregate concrete mix is slightly less than natural aggregate concrete mix.
- Recycled aggregate can be effectively used for the following purposes.
  1. To prevent the environmental pollution.
  2. To minimize the cost of concrete by using recycled aggregate.
  3. To reduce the demand of natural aggregates.
- Addition of admixtures is essential for concrete with recycled aggregate for improving the strength of concrete.
- Up to 20% replacement of cement by GGBFS increases the strength of recycled aggregate concrete.
- Beyond 20% replacement of cement by GGBFS does not increase the strength of concrete.

- Workability of recycled aggregate concrete increases when cement replaced by GGBFS.

## REFERENCES

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