

# Impact of Chemical Admixture on Recycled Aggregates Concrete

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## ABSTRACT

*Concrete is one of the most widely used construction materials in the world, mainly due to its favorable features such as durability, versatility, satisfactory compressive strength, cost effectiveness. But with the depleting natural resources and the huge amount of concrete waste produced, it becomes essential to identify an effective way to solve the need of the moment. This research deals with reclamation of the aggregates obtained from the old concrete, and using them in creating a durable and normal strength concrete with 100% of the recycled concrete aggregate with addition of chemical admixtures of specific gravity 1.19.*

*For this purpose the old concrete debris is broken into required aggregate size and some basic tests are carried out, then the compressive strength of this recycled aggregate concrete is compared to that of the concrete made with normal aggregate. The concept of direct percentage replacement is followed. The test results show that the density of the recycled aggregate is low compared to the normal natural aggregates, thus resulting in the decrease in density of concrete. The chemical admixture at 1.5, 1.8 and 2% of weight of cement is added and the compressive strength for 1.8% was found to be similar to that of normal aggregate concrete.*

## 1. INTRODUCTION

Concrete is one of the most widely used construction materials in the world, mainly due to its favorable features such as durability, versatility, satisfactory compressive strength, cost effectiveness and availability. On the other hand Construction Demolition (C&D) wastes consist of the materials generated during the construction, renovation and demolition of buildings and other structures. In India its common practice for large Construction Demolition (C&D) projects to pile waste in the road, resulting in traffic congestion.

## 2. OBJECTIVE

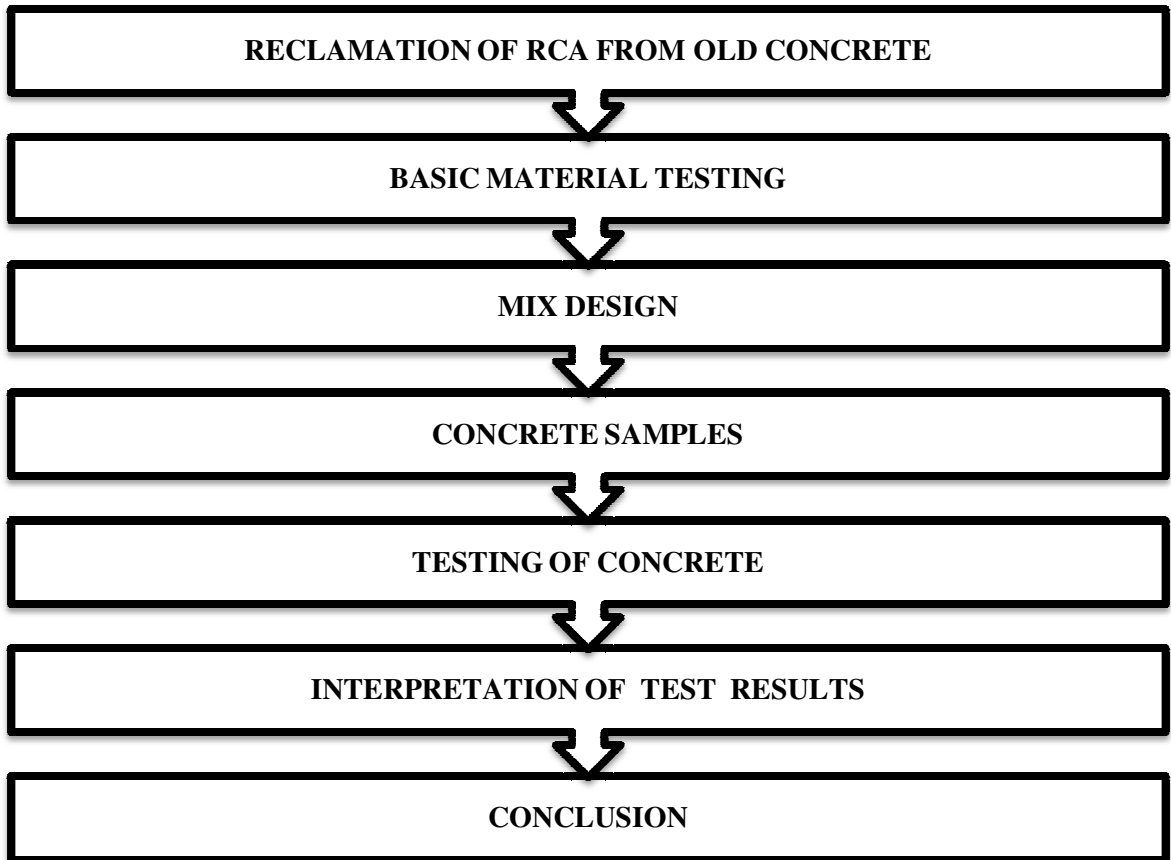
*This study aims at*

- The replacement of natural coarse aggregate with Recycled Concrete Aggregate

- Creating durable and moderate strength concrete using RCA and admixtures

### 3. METHODOLOGY

The following flowchart depicts the steps which are followed for the execution of the project.



### 4. RECLAMATION OF RCA FROM OLD CONCRETE

Coarse recycled concrete aggregate (RCA) is produced by crushing sound, clean demolition waste of at least 95% by weight of concrete, and having a total contaminant level typically lower than 1% of the bulk mass

Here first the old concrete is collected from the concrete laboratory debris, and then these collected specimens of the concrete are broken down into desired aggregate size (20 mm or less). This process is done manually by using hammer. Then the sieving is done to remove the fines present and for the grading of the aggregates. In case of doing this reclamation in large scale the crushers can be used.

## 5. MATERIALS AND ADMIXTURE

The basic components of the chemical admixture are synthetic polymers, which allow mixing water to be reduced considerably and concrete strength to be enhanced significantly, particularly at early age. The admixture is normally dispensed, depending on the desired plasticizing or water reducing effect, at a rate of 1.0-3.0 ltr/100kg of cement, here 1.5% of cement is considered and 15% in water is reduced. The sand used is falling under Zone II and OPC cement is used. The specific gravity of the admixture is 1.19 and is chloride free

## 6. MIX DESIGN

Mix design is prepared based on the properties of the aggregate, cement by following IS code book

Mix	Water (L)	Chemical admixture (L)	Cement (kg/m <sup>3</sup> )	Fine aggregate (kg/m <sup>3</sup> )	Coarse aggregate (kg/m <sup>3</sup> )	
					Natural	Recycled
I	191.58	0	425.73	666.10	1185.97	0
II	191.58	0	425.73	666.10	0	1185.97
III	162.85	5.428	361.87	711.37	0	1266.57
IV	157.09	7.85	392.74	704.57	0	1255.36
V	157.09	7.85	426.94	701.079	0	1248.25

## 7. RESULTS AND DISCUSSIONS

### *Bulk density*

Density is defined as the mass per unit volume. The bulk density depends on the particle size distribution and shape of the particles. Bulk density of aggregates is compared. Density of normal aggregates is 1601kg/m<sup>3</sup> while that of recycled aggregates is 1257 kg/m<sup>3</sup>. This is owed to the adhered cement content and the voids present in the adhered mortar.

### *Specific gravity*

Specific gravity is the ratio of the mass of a substance relative to the mass of an equal volume of water at a specified temperature. Specific gravity of normal aggregate is 2.87 whereas recycled aggregate is 2.53. This is owed to the adhered cement content and the voids present in the adhered mortar.

### *Slump*

Slump is defined as the ease with which the concrete can be placed in a particular environment. Slump of the ordinary aggregate was 75mm but the RCA concrete was around 50 mm, this significant declination can be owed to the following reasons

- The use of RCA decreases workability of fresh concrete at a given water content, increases the water requirement at a given consistency,
- Increases shrinkage at a given water/cement ratio. These effects are the greatest when the old concrete is used as both coarse and fine aggregate

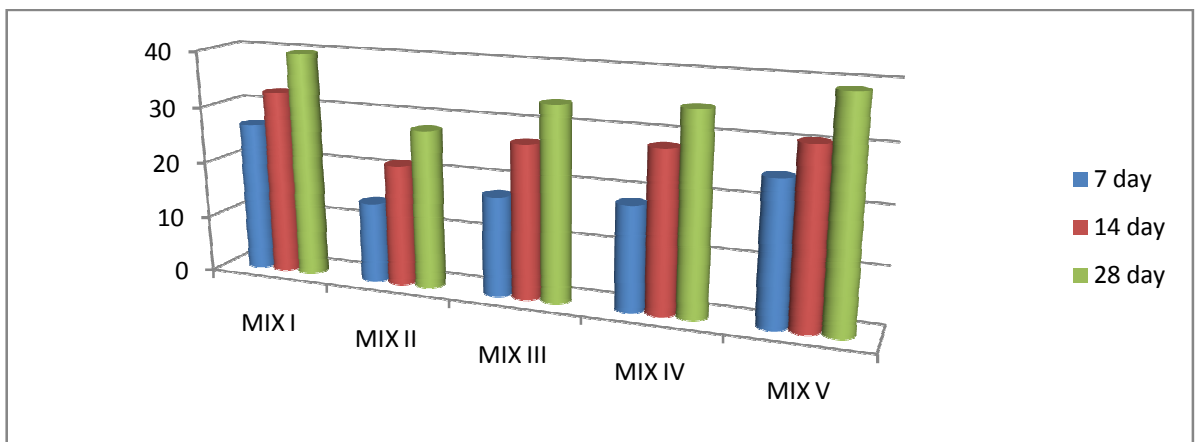
But the usage of admixture increased the slump around 80cm

### 8. COMPRESSIVE STRENGTH

Compression test is conducted on hardened concrete. The test specimens, cubical in shape are of size 150\*150\*150mm. The cube is placed in a compressive testing machine and the load is applied at a rate of 1 kN. The compression tests are made at recognized ages of 7, 14 and 28 days. Specimens cured in water are tested immediately on taking it from wet condition. The bearing surfaces of the specimens and testing machines are wiped clean and they are placed in such a manner that the load is applied to the opposite sides of the cubes at cast.

**Table 1 Compressive Strength**

Average Compressive strength	7 day	14 day	28 day
MIX I	26.47	39.68	32.56
MIX II	14.09	27.82	21.26
MIX III	17.48	33.88	26.86
MIX IV	18.26	34.71	28.05
MIX V	24.8	38.88	30.57



**Fig 1 Compressive Strength Comparison b/w Normal and Recycled Aggregate Concrete with and without admixture**

The reduction of 28 day strength of recycled aggregate concrete is observed, there is around 30% reduction in strength. It also observed that 34% and 45% reduction for 14 and 7 day strength.

By addition of 1.5% of chemical admixture 21.8% increase in strength of 100% recycled aggregate is observed.

For the same water and admixture content by cement content is increased when comparing mix III and V. Thus w/c ratio decreased to 0.35., the % of admixture as % of cement content is 1.84% in mix V, for recycled aggregate by increasing the cement proportion higher strength can be obtained this can be contributed as for the recycled aggregate's roughness obtained because of the breaking operation, the bond is increased only by excess cement content but the cement content value doesn't exceed the norms value and is similar to the cement content of mix I( normal aggregate concrete)

## 9. CONCLUSION

Based on the analysis and evaluation of the findings presented, the following set of general conclusions is drawn

- The density of the aggregates itself decrease from 1601.40 Kg/m<sup>3</sup> to 1257.78 Kg/m<sup>3</sup>
  - This is owed to the adhered cement content and the voids present in the adhered mortar
- The density of the concrete decrease with the usage of recycled aggregate around 6%
- The slump is also found to decline in the recycled aggregate concrete
  - The use of RCA decreases workability of fresh concrete at a given water content, increases the water requirement at a given consistency,
  - Increases shrinkage at a given water/cement ratio.(Concrete Technology- A M Neville
- The slump is also found to decline in the recycled aggregate concrete but admixture has improved the slump
- By addition of 1.5% of chemical admixture 21.8% increase in strength of 100% recycled aggregate is observed.
- While the addition of 2% chemical admixture with lower w/c of 0.35 give similar strength of the nac

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