

---

## Effect of Recycled Aggregate of Different Sizes on Compressive Strength of Concrete.

**Er. Maninder Savra**

Post Graduate Structural Engineer  
(M.Tech from Guru Nanak Dev  
Engineering College, Ludhiana)

**Er .Shahbaz Singh**

Post Graduate Geotechnical Engineer  
(M.Tech from Guru Nanak Dev  
Engineering College, Ludhiana)

### ABSTRACT

*In this paper attempt is made to see the effect of different sizes of recycled aggregate on compressive strength of concrete. Concrete is the one of most utilized material for construction in the present time. The large share of waste product formed in the world today is concrete. The use of recycled aggregate not only will solve the problem of dumping and disposal of concrete, also will solve the problem of utilization of non renewable natural resources i.e. Natural coarse aggregate. Thus results in the conservation of natural resources. Introducing the recycled aggregate as the replacement of natural coarse aggregate is an economical way of conserving the natural resources and solving the problem of dumping and disposal of concrete.*

*For this M30 grade of concrete was used having ratio 1:2.1:3.96 according to IS 10262:2009. To study the effect of recycled aggregate cube of size 150×150×150 mm were casted with size of recycled aggregate 16.5mm, 12.5 mm replacing 50% of natural coarse aggregate. Compressive strength of recycled aggregate is lower than the compressive strength of normal aggregate but still higher than the design characteristic strength of concrete.*

### Key words –

*Normal Concrete(NC), Recycled concrete aggregate (RCA) and Recycled aggregate (RA), Recycled coarse aggregate concrete (RCAC).*

### Introduction-

The crushed product can include a combination of material – concrete, masonry, plaster etc. Depending upon the structures which are demolished, the crushed product can have a mixture various materials such as concrete, plaster, bricks etc. Masonry and plaster has low strength and high water absorption, so when they are used in the producing new concrete, can result in creating many problems. On basis of this, the crushed product can be classified as recycled concrete aggregate (RCA) and recycled aggregate (RA).

Basically Recycled concrete aggregate is the crushed concrete, formed by crushing of concrete. Recycled aggregate contains the mixture of aggregate formed by crushed product of the plaster and masonry.

The recycled coarse aggregate concrete (RCAC) is the concrete formed by replacing the natural aggregate by the recycled concrete aggregate. RCAC is similar to the normal concrete but the only difference is that RCAC is concrete formed by the recycled aggregate which are formed by the demolishing concrete waste. At present time, the most of research on the RCAC and used of RCAC as the concrete for construction are done in the developed countries like Japan, Europe and united states etc., the research of RCAC is at initial stage in India till today. It is necessary to evaluate the physical and mechanical properties of concrete to assure its use in producing RCAC structural elements with waste material which is locally available.

### Objective and Methodology-

The main objective of this study is to determine the effect of different sizes of recycled aggregate on compressive strength of concrete according to IS 456:2000. For this M30 grade of concrete was used having ratio 1:2.1:3.96 according to IS 10262:2009. To study the effect of recycled aggregate cube of size 150×150×150 mm were casted with size of recycled aggregate 16.5mm, 12.5 mm replacing 50% of natural coarse aggregate.

The cubes were prepared using normal concrete and 50% replacement of coarse aggregate with recycled aggregate of size 16.5mm and 50% replacement of coarse aggregate with recycled aggregate of size 12.5mm.

Table 1:- Classification of Cubes

| S.no. | Mix     | Type of concrete  |
|-------|---------|---|
| 1.    | NC      | NC cube containing concrete having normal aggregate                               |
| 2.    | RAC16.5 | Cube containing 50% recycled aggregate of size 16.5mm replacing coarse aggregate. |
| 3.    | RAC12.5 | Cube containing 50% recycled aggregate of size 12.5mm replacing coarse aggregate. |

### Result and Discussion-

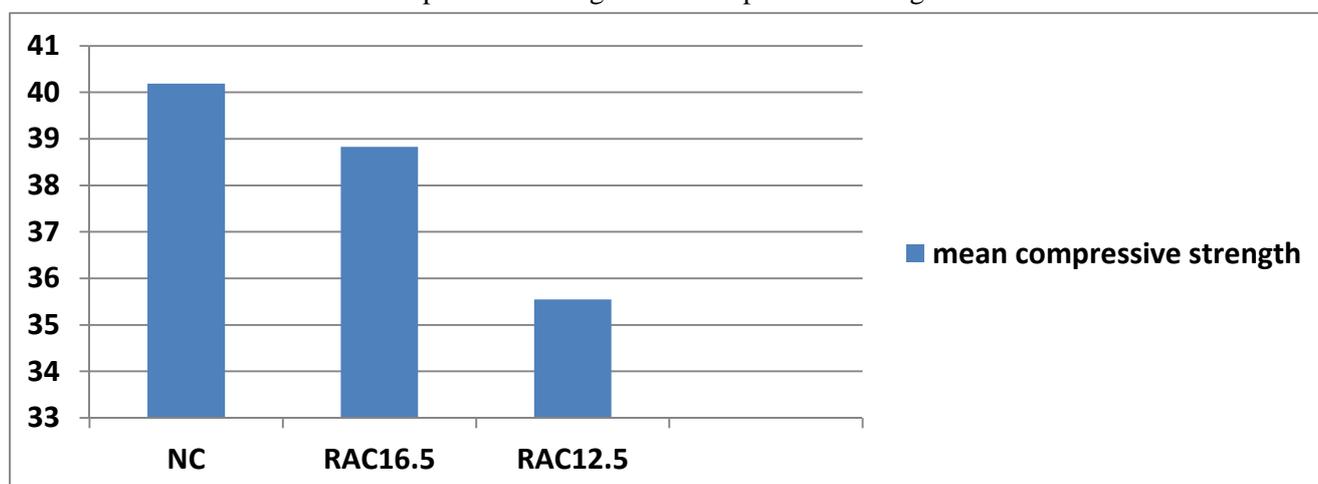
By performing test on the cubes prepared using normal concrete and 50% replacement of coarse aggregate with recycled aggregate of size 16.5mm and 50% replacement of coarse aggregate with recycled aggregate of size 12.5mm following result was obtained :-

Table 2:- Compressive Strength Of Cube

| Classification | Sample 1 | Sample 2 | Sample 3 | Mean compressive strength (N/mm <sup>2</sup> ) | Specified compressive strength acc to IS 456 for M30 grade(N/mm <sup>2</sup> ) |
|----------------|----------|----------|----------|--|--|
| NC             | 38.48    | 39.66    | 42.43    | 40.19  | >F <sub>ck</sub> =30   |
| RAC16.5        | 37.43    | 35.55    | 43.53    | 38.83  | >F <sub>ck</sub> =30   |
| RAC12.5        | 35.55    | 40       | 31.33    | 35.55  | >F <sub>ck</sub> =30   |

The compressive strength of RAC comes out to be less than that of normal concrete but still higher than the characteristic strength. The compressive strength of RAC16.5 is less than NC by 3.3%. The compressive strength of RAC12.5 is less than NC by 11.54%. The compressive strength of RAC12.5 is less than RAC16.5 by 8.4%.

Graph 1:- Showing Mean Compressive Strength



---

## CONCLUSIONS-

By performing test on the cubes prepared using normal concrete and 50% replacement of coarse aggregate with recycled aggregate of size 16.5mm and 50% replacement of coarse aggregate with recycled aggregate of size 12.5mm following result was obtained :-

1. Compressive strength of recycled aggregate is lower than the compressive strength of normal aggregate but still higher than the design characteristic strength of concrete
2. The compressive strength of RAC16.5 is less than NC by 3.3%. The compressive strength of RAC12.5 is less than NC by 11.54%.
3. The compressive strength of RAC12.5 is less than RAC16.5 by 8.4%.

## REFERENCES-

1. "A TECHNO-ECONOMICAL STUDY ON RECYCLED Address for Correspondence." (2009). 2–4.
2. Abdel-hay, A. S. (2015). "Properties of recycled concrete aggregate under different curing conditions." 1–6.
3. Ajamu, S. O., and Ige, J. A. (2015). "Effect of Coarse Aggregate Size on the Compressive Strength and the Flexural Strength of Concrete Beam." 5(1), 67–75.
4. Albaine, I. J. (2012). "Design of Reinforced Concrete Beams per ACI 318-02." 152.
5. Arezoumandi, M., Smith, A., Volz, J. S., and Khayat, K. H. (2014). "An experimental study on shear strength of reinforced concrete beams with 100 % recycled concrete aggregate." 53, 612–620.
6. Arezoumandi, M., Smith, A., Volz, J. S., and Khayat, K. H. (2015). "An experimental study on flexural strength of reinforced concrete beams with 100 % recycled concrete aggregate." 88, 154–162.
7. Ceia, F., Raposo, J., Guerra, M., Júlio, E., and De Brito, J. (2016). "Shear strength of recycled aggregate concrete to natural aggregate concrete interfaces." *Construction and Building Materials*, 109, 139–145.
8. Division, S. E., Sciences, M., New, E., Materials, B., Delhi, N., Instt, I. C., and Centre, U. P. G. (n.d.). "Use of RECYCLED AGGREGATES In CONCRETE - A Paradigm Shift."
9. Gonzalez-Fontebao, B., and Martinez-Abella, F. (2007). "Shear strength of recycled concrete beams." *Construction and Building Materials*, 21(4), 887–893.
10. Lovedeep S., Shahbaz S., & K.S. Gill (2017). "Improvement in CBR Value of Soil using Waste Concrete Fines." *International Journal of Science Technology & Engineering*, Volume 3, Issue 09, pp 1-5.
11. Shahbaz S. & Lovedeep S. (2017). "Comparison and Compatibility of Different Types of Aggregates in Pavement." *IJETSR- ISSN 2394 – 3386, Volume 4, Issue 6 June 2017, pp 279-285.*