RESEARCH REVIEW JOURNALS
Volume-04
Issue-04
April -2019

ISSN: 2455-3085 (Online)
RESEARCH REVIEW International Journal of Multidisciplinary
www.rrjournals.com [UGC Listed Journal]

To Study and analyze the strength characteristics of recycled aggregate

[1]Sudhir & [2]Sanjay Saini

[1,2]*Assistant professor, Department of Civil Engg. Central Universiy Of Haryana (Mohindergarh) (India)*

ARTICLE DETAILS

Article History
Published Online: 15 April 2019

Keywords
Recycled aggregate concrete (RAC).

ABSTRACT

The reuse and recycling of building & demolition wastes appears to be feasible solution in new constructions and rehabilitation after the natural disaster or maybe demolition of older structures. This becomes really important particularly for all those nations in which local and national policies are rigid for disposal of construction and demolition wastes with guidance, penalties, levies etc.

Although Recycled aggregate is used in the high power structure, but one problem mustn't be overlooked as recycled aggregate with bring down water content will have very low workability. Whenever recycled aggregate is put on, water content within the concrete mix needs to be monitored carefully as a result of the bath absorption capability of recycled aggregate will vary. This particular concrete type could just be used under the state which doesn't involve a lot of managing works.

1. Experimental Investigations

In the existing paper, an undertaking is made to learn and also check several of the qualities of recycled aggregate concrete (RAC). As the huge volume of concrete can be obtained for recycling from demolished concrete structures, area demolished concrete is utilized within the current study to create the recycled aggregates. The outcomes are including slump test, indirect tensile test, and compression test.

Water absorption test result: The water absorption capability of recycled aggregate is much higher compared to great aggregate plus healthy aggregate. The typical water absorption rate of recycled aggregate is around four %, but water absorption rate of healthy aggregate is just one %. This suggests that water absorption of recycled aggregate is around four times of natural aggregate. This conclusion suggests that much more water had to be loaded when utilizing recycled aggregate in the concrete blending to pick up a suitable workability.

Table 1.1 Water absorption test result

Type of aggregate	Weight of sample before ovan (gm)	Weight of sample after ovan (gm)	Result (%)
Fresh (20mm)	500	495	1.01
Recycled aggregate (15 mm)	500	480	4.16

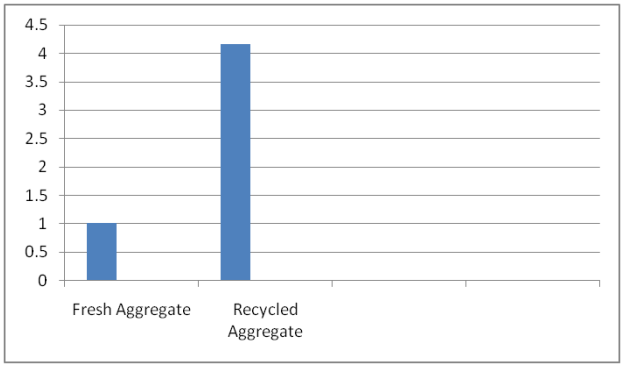

Figure 1.1 Water absorption for Fresh and Recycled aggregate

2. Bulk density test result

From the below effect we discover that the density of recycled aggregate is cheaper compared to healthy aggregate. The typical particle density of healthy aggregate is 2897.10 kg/m3 but typical particle density of recycled aggregate is just 2337.09 kg/m3. This hostile recycled aggregate is lighter compared to natural aggregate.

Table 1.2 Bulk density test result

Type of aggregate	Mass of ovan dried aggregate (gm) A	Mass of SSD aggregate (gm) B	Mass of aggregate and in wire bucket in water (gm) C	Mass of wire bucket in water (gm) D
Fresh aggregate	1450	1465	1098.5	134
Recycled aggregate	1140.5	1205.4	850.8	133.4

Bulk density (Fresh aggregate) = A*1000/ D-(C-B)
= 2897.10 Kg/m^3
Bulk density (Recycled aggregate) = A*1000/ D- (C-B)
= 2337.09 Kg/m^3

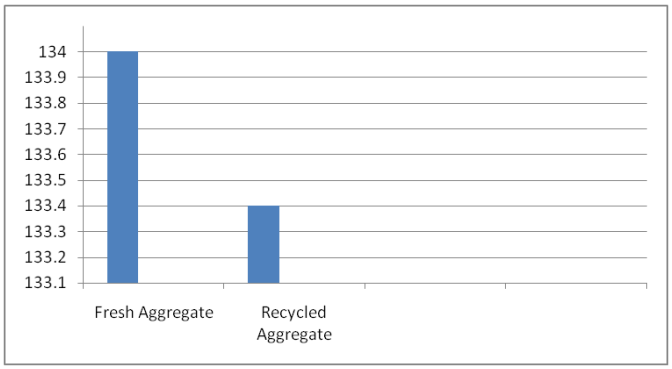

Figure 1.2 Bulk Density for Fresh aggregate and Recycled aggregate

3. Sieve analysis test result-

The outcome of sieve examination is a crucial element when figure out the quantity of various aggregate applied to a concrete blend. From the acquired result, nearly all almost all of the organic aggregate and recycled aggregate passed through 19mm sieve size, but under one % of aggregate passed through 1.18mm sieve size. Just about all the recycled aggregate passed through 13.20mm sieve size, but just eighty % of healthy aggregate passed through 13.20mm sieve size. Roughly sixty % of healthy aggregate and recycled aggregate passed through 9.50mm sieve size. The majority of the sand particle passed through 600µm sieve size.

Table 1.3 Percentage sieve size passing for all aggregate

Sieve size (mm)	% Passing			
	Fresh aggregate (20 mm)	Fresh aggregate (10mm)	Recycled aggregate (15mm)	Recycled aggregate (5 mm)
19.00	100	100	100	
13.20	44.50	100	95.45	100
9.50	8.06	90.54	28.95	98.53
4.75	0.56	1.18	0.21	2.81
2.36	0.38	0.36	0.12	0.20
1.18	0.36	0.32		0.19
600 µ				
300				
150				
75				
Pan	0.15	0.18		

4. Specific gravity test result

Fresh Aggregate

- Weight of empty pycnometer, W1 = 675 gm
- Weight of pycnometer + 1/3rd aggregate, W2 = 844 gm
- Weight of pycnometer + 1/3rd aggregate + water, W3 = 1653 gm
- Weight of pycnometer + water, W4 = 1548
- Specific gravity, G = W_2-W_1 / (W_2-W_1)-(W_3-W_4)
- Specific gravity, G = 2.64

Recycled aggregate

- Weight of empty pycnometer, W1 = 675 gm
- Weight of pycnometer + 1/3rd aggregate, W2 = 870 gm
- Weight of pycnometer + 1/3rd aggregate + water, W3 = 1665 gm
- Weight of pycnometer + water, W4 = 1548 gm
- Specific gravity, G = W_2-W_1 / (W_2-W_1)-(W_3-W_4)
- Specific gravity, G = 2.50

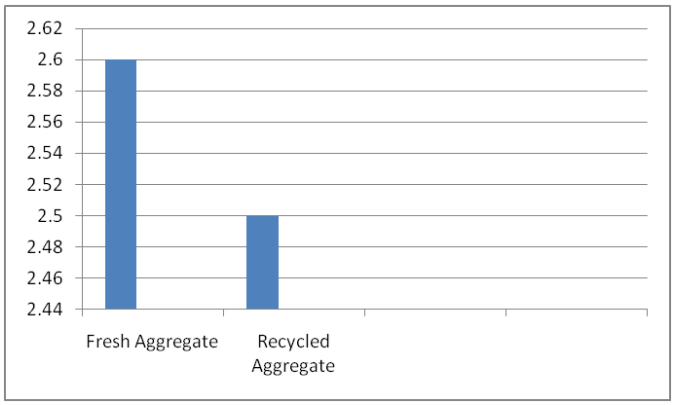

Figure 1.3 Water absorption for Fresh aggregate and Recycled aggregate

5. Crushing strength Test result

Fresh Aggregate

- Empty weight of cylinder = 1258 gm
- Weight of cylinder + aggregate = 3558 gm
- Total weight of aggregate, W1 =2300gm
- Weight of fines passing 2.36 mm IS sieve, W2 = 450 gm
- Aggregate Crushing Value = (W_2/W_1) * 100
- Aggregate Crushing Value = 19.65 %

Recycled Aggregate

- Empty weight of cylinder = 1258 gm
- Weight of cylinder + aggregate = 3800 gm
- Total weight of aggregate , W1 =2542 gm
- Weight of fines passing 2.36 mm IS sieve, W2 = 520 gm
- Aggregate Crushing Value = (W_2/W_1) * 100
- Aggregate Crushing Value = 20.45 %

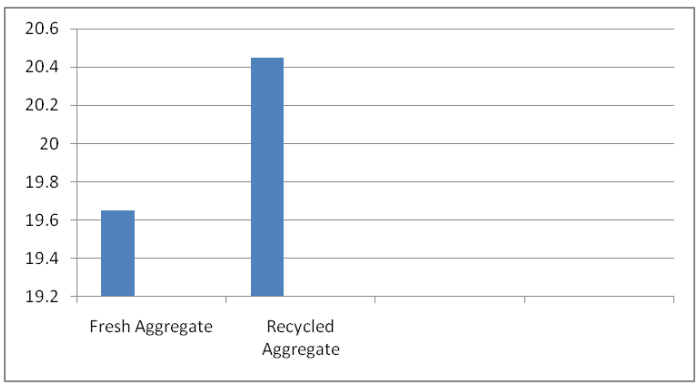

Figure 1.4 Crushing Strength for Fresh aggregate and Recycled aggregate

6. Slump Test Result

The slump test indicates a decreasing pattern of workability whenever the portion of recycled aggregate increased. Based on the outcome, the top slump gotten was 90mm and also the lowest slump was 64m m. The typical slump for every batch of blend was 82mm. Thus, target slump was attained, the place that the selection is from 50mm to 120mm.

The workability was great and could be satisfactorily handled for zero % recycled aggregate to eighty % recycled

aggregate. The slump from zero % recycled aggregate to eighty % recycled aggregate had been considered moderate as a result of the drop in the assortment of to 9mm. The typical slumps that obtained for hundred % recycled aggregate and hundred % recycled aggregate was seventy eight mm. There was not a problem for the placement as well as compaction of fresh concrete of these 2 batches. The sole issue which obtained was the batch with hundred % recycled aggregate. The main reason was due to the higher absorption capability of recycled aggregate. By the end result obtained, it indicates the workability was becoming lower when m ore recycled aggregate were utilized.

Table 1.4: The slump result for each batch of mix concrete

Percentage of Recycled Aggregate (%)	Slump (mm)
0% recycled aggregate	90
20% recycled aggregate	85
40% recycled aggregate	85
60% recycled aggregate	82
80% recycled aggregate	81
100% recycled aggregate	78

Based on the outcome, the highest slump gotten was 90mm and also the lowest slump was seventy eight mm. The typical slump for every batch of blend was 82mm. Thus, target slump was attained, the place that the selection is from 50mm to 120mm. The workability was great and could be satisfactorily handled for zero % recycled aggregate to eighty % recycled aggregate. The slump from zero % recycled aggregate to eighty % recycled aggregate had been regarded reasonable as a result of the fall in the assortment of 5mm to 9mm.

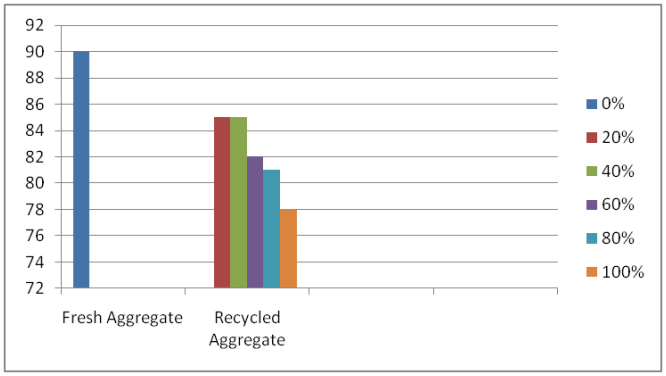

Figure 1.5 Slump for Fresh aggregate and Recycled aggregate

7. Compression Test Result

The compression test suggests that an increasing trend of compressive power in the first era of the concrete specimens. Nevertheless, it indicates that the strength of recycled aggregate specimens is cheaper compared to healthy aggregate specimens. Table 4.5 below shows that the compressive strength with age captured during the evaluation.

Table 4.5: Variation of compressive strength (N/mm^2) with age

Days	% of Recycled aggregate					
	0 %	20 %	40 %	60 %	80 %	100 %
7	39.95	35.80	34.90	33.10	26.90	30.08
28	51.40	43.10	41.98	39.95	35.05	40.10

The target power because of this project is 43.25 N/mm2. From the obtained result, it proven the sole batch which welcomed the target power will be the batch with zero % along with twenty % recycled aggregate. The compressive strength for some other batches is around forty N/mm2; count on the concrete specimens for hundred % recycled. This may due to the use of blended cement in these concrete examples which might lessen the compressive strength while utilizing the recycled aggregate. The compressive power of the concrete examples for hundred % recycled aggregate with 0.43-0-45 water/cement ratio is 40.1N/mm2, that nearly close to the target power. This proven that the hundred % recycled aggregate could achieve higher strength by decreasing the water/cement ratio. The outcomes also show that the concrete specimens with increased replacement of recycled aggregate become probably the lowest power when set alongside the concrete specimens with fewer recycled aggregate.

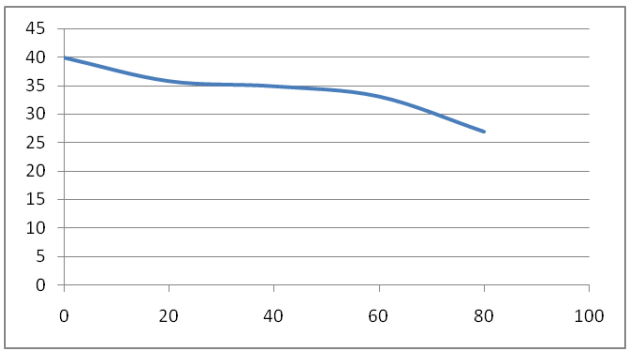

Figure 1.6 Compressive strength of recycled aggregate concrete after 7 days

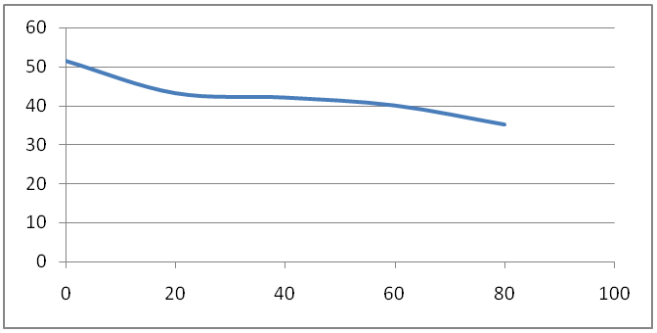

Figure 1.7 Compressive strength of recycled aggregate concrete after 28 days

8. Conclusion

Investigation on the use of waste construction materials is really important as a result of the supplies waste is slowly improving with the improved of population and also raising of urban development. The factors that lots of investigations and also analysis was ma de on recycled aggregate are because recycled aggregate is simple to get and also the price is less expensive compared to virgin aggregate. Virgin aggregate need to m I ne but recycled aggregate is able to dismiss this process.

Present study concludes that that water absorption capability of recycled aggregate is much more than new aggregate. The drinking water absorption of recycled aggregate is 4.01 % along with 1.04 % of new aggregate.

Result demonstrates much more water had to be loaded when utilizing recycled aggregate in the concrete blending to pick up a suitable workability.

Bulk density of the recycled aggregate is much less than the fresh aggregate. The typical particle density of natural aggregate is 2897.10 kg/m3 but average particle density of recycled aggregate is simply 2337.09 kg/m3. This mean recycled aggregate is lighter compared to healthy aggregate.

From the above analysis we determine that the greatest slump obtained was 90mm and probably the lowest slump was seventy eight mm. The typical slump for every batch of mix was 82mm. So, target slump was achieved, where selection is from 50mm to 120mm. The workability was great and can certainly be satisfactorily handle for zero % recycled aggregate to eighty % recycled aggregate. The slump from zero % recycled aggregate to eighty % recycled aggregate had been regarded reasonable as a result of the fall in the assortment of 5mm to 9mm.

The crushing power of the recycled aggregate is much more than the fresh aggregate; the crushing strength of new aggregate is around nineteen % along with twenty one % for recycled aggregate.

The analysis suggests that the compressive strength decreases as the percentage (%) of the recycled increases in concrete. The compressive strength of new aggregate concrete is 39.50 N/mm2 for seven days and 30.08 N/mm2 for recycled aggregate after hundred % replacement of fresh aggregate.

The analysis suggests that the compressive strength decreases as the percentage (%) of the recycled increases in concrete. The compressive strength of new aggregate concrete is 51.40 N/mm2 for twenty eight days & 40.10 N/mm2 for recycled aggregate after hundred % replacement of fresh aggregate.

Although recycled aggregate is used in the high power structure, but one problem mustn't be overlooked as recycled aggregate with bring down water content will have very low workability. Whenever recycled aggregate is put on, water content within the concrete mix needs to be monitored carefully as a result of the bath absorption capability of recycled aggregate will vary. This particular concrete type could just be used under the state which doesn't involve a lot of managing works.

References

1. Concrete Network, n.d., viewed 10 Jun 2004
2. Cost Unbound Granular Materials For Road Pavements, n.d., Review of Production, Construction and Quality Issues , viewed 25 August 2004
3. CRISO, n.d., Commonwealth Scientific & Industrial Research Organisation, viewed 4 April 2004
4. Environmental Council of Concrete Organizations, n.d., Recycling concrete saves resources, Eliminates Dumping , viewed 6 July 2004
5. Fact File C&D Recycling Industry, n.d., History, viewed 11 April 2004.
6. Fong F.K. Winston, Yeung S.K. Jaime, and Poon C.S., n.d., Hong Kong Experience Of Using Recycled Aggregates From Construction And Demolition Materials In Ready Mix Concrete , viewed 26 Jun 2004.
7. Limbachiya M. C., Leelawat T. and Dhir R. K., 2000, Use of recycled concrete aggregate in high-strength concrete , Materials and Structures, Volume 33, November 2000, p574-580.

