MADHAV INSTITUTE OF TECHNOLOGY & SCIENCE

(A Govt. Aided UGC Autonomous & NAAC Accredited Institute Affiliated to RGPV, Bhopal)

Gwalior, Madhya Pradesh - 474005

A MIN -PROJECT REPORT

ON

"Optimizing the proportion of recycled concrete aggregates in conventional aggregates based on the abrasion value criteria."

Submitted by :

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CERTIFICATE

Madhav Institute of Technology & Science, Gwalior

This is to certify that the project entitled "**Optimizing the proportion of recycled concrete aggregates in conventional aggregates based on the abrasion value criteria.**" presented by the students of group- 12 is in complete satisfaction of the necessity of the recompense of Bachelor of Technology degree in Civil Engineering at Madhav Institute of Technology & Science, Gwalior is a genuine work completed by the students under my watch and direction.

To the best of my insight, the matter epitomized in the theory has not been submitted to any other college/Institute for the recompense of any Degree or Diploma.

Under the Guidance of -
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INTRODUCTION

As buildings, roads, bridges, and other structures are demolished every year, hundreds of thousands of tons of debris is generated. As the world moves towards saving the environment, and governments offer tax rebates to those investing in fuel-efficient technologies in an effort to reduce their carbon footprint; recycling this debris is the perfect way for any contractor to save the environment and their expenses, all while ensuring strength in the foundation of their new structures.

The purpose of aggregate is to increase the volume of a concrete mix while ensuring minimum air is trapped within the structures. The material that makes up the aggregate is of different shapes and sizes, allowing them to fit snugly with one another.

The larger, coarser aggregate particles settle together to constitute a skeletal structure for the mixture. Smaller particles serve as fillers between the spaces between these larger particles, and in turn particles even smaller rush to fit into the gaps between the fillers.

Finally, the smallest gaps within the aggregate are filled with cement particles, holding the whole structure together. This property shows that the better the size distribution provided in aggregate, the stronger a concrete structure will be; however, it is necessary to keep in mind the optimum amount of recycled aggregate that should be added to the concrete mix. Changes in the blend can lead to an overall decrease in the strength of your structure, which is why recycled aggregate remains most appropriate for bases and sub bases.

RECYCLED CONCRETE AGGREGATES

Recycled aggregates are aggregates derived from the processing of materials previously used in construction. Examples include recycled concrete from construction and demolition waste material (C&D), reclaimed aggregate from asphalt pavement and scrap tyres. 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. Other materials that may be present in RCA are gravel, crushed stone, hydraulic-cement concrete or a combination deemed suitable for pre-mix concrete production.

Benefits of Using Recycled Concrete Aggregates

Recycled concrete aggregate presents numerous benefits:

- Increased protection from seepage.
- Reduced costs, since it doesn't need to be mined.
- Reduced environmental impact, more appealing to governments and customers.
- Preserves natural resources such as gravel, water, coal, and oil.
- Reduced space wastage in landfills.

Risks of Using Recycled Concrete Aggregates

As with everything, the aggregate also presents certain risks that constructors should be aware of:

- If a high concentration of aggregate is used, the structural integrity of the casts fail, leading to cracks and numerous faults within the structure.
- The aggregate must be refined. Otherwise it could lead to various challenges. A prime example of that is the use of recycled concrete for Highway 427 (Canada). The presence of deleterious materials, i.e., gypsum, wallboard, drywall, and plaster found in the final cast were due to unrefined concrete aggregate, leading to cracks in between lanes, as well as an uneven road surface.
- Brittle concrete might be mixed within the aggregate, leading to uneven grading.
- Supplements need to be added to make the final cast as strong as it can be with natural aggregate.

- Visual inspection is necessary to ensure the mix is refined.

PROCEDURE

Trial 1: (With only conventional aggregates)

1. Clean aggregates dried in an oven at 105-110^{0}C to constant weight, conforming to grading B as per table 1 is used for the test.

Grading	Weight in gms of each test sample in the size range, mm (Passing and retained on square holes)										Abrasive Charge	
	80-63	63-40	50-40	40-25	25-20	20-12.5	12.5-10	10-6.3	6.3-4.75	4.75-2.36	Number of spheres	Weight of charge, gm
A				1250	1250	1250	1250				12	5000+/-25
B						2500	2500				12	4584+/-25
C								2500	2500		8	3330+/-20
D										5000	6	2500+/-15
E	2500	2500	2500								12	5000+/-25
F			5000	5000							12	5000+/-25
G				5000	5000						12	5000+/-25

2. Aggregates weighing 5 kg for grading B is taken as test specimen and placed in the cylinder of the Los Angeles Abrasion Testing machine.

3. The abrasive charge is also chosen in accordance with Table depending on the grading of the aggregate and is placed in the cylinder of the machine.

4. The cover is then fixed dust-tight. The machine is rotated at a speed of 30 to 33 revolutions per minute. The machine is rotated for 500 revolutions for grading B.

5. The machine should be balanced and driven in such a way as to maintain uniform peripheral speed.

6. After the desired number of revolutions, the machine is stopped and the material is discharged from the machine taking care to take out entire stone dust. Using a sieve of size larger than 1.70 mm IS sieve, the material is first separated into two parts and the finer portion is taken out and sieved further on a 1.7 mm IS sieve.

7. The portion of material coarser than 1.7mm is washed and dried in an oven at 105 to 110^{0}C to constant weight and weighed.

Observations:

Type of aggregate taken = Coarse aggregates
Grade of sample used = Grade B
Original weight of aggregates = 5000 gm
Weight of aggregate retained on 1.70 mm sieve = 3800 gm
Percentage wear = 24%

Trial 2: (With conventional aggregates + 20% RCA)

Follow the same procedure as in trial 1.

Observations:

Type of aggregate taken = Coarse aggregates
Grade of sample used = Grade B
Original weight of aggregates = 5000 gm (4000 gm conventional aggregates + 1000gm RCA)
Weight of aggregate retained on 1.70 mm sieve = 3400 gm
Percentage wear = 32%

Trial 3: (With conventional aggregates + 40% RCA)

Follow the same procedure as in trial 1.

Observations:

Type of aggregate taken = Coarse aggregates
Grade of sample used = Grade B
Original weight of aggregates = 5000 gm (3000 gm conventional aggregates + 2000gm RCA)
Weight of aggregate retained on 1.70 mm sieve = 2900 gm
Percentage wear = 42%

According to IRC:

Type of work	Abrasion Value
For Wearing surfaces	≤30%
For Non Wearing surfaces	≤50%

CONCLUSION

As we know that for wearing surfaces the value of abrasion of aggregates should be less than or equal to 30%. Therefore, we can add approximately 20% or less recycled concrete aggregates in our conventional aggregates for wearing surface uses.

Also for non-wearing surfaces the value of abrasion of aggregates should be less than or equal to 50%. Therefore, we can add about 40% of recycled concrete aggregates in our conventional aggregates.