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Experimental Investigation To Prepared Mix Design of M25 And M20 Grade of Concrete By Using Concrete Rubble And Admixture

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Abstract - *Building industry development is advancing daily all around the world. While new ones are being built utilising cutting-edge and modern designs, older ones are being demolished or repaired. When performing construction, repair, or demolition, developers, contractors, and builders must consider where to deposit the garbage. Concrete recycling is a method that is gaining popularity that involves removing the debris from demolished concrete structures. In today's era of heightened ecological consciousness, stricter environmental restrictions, and the drive to keep building costs as low as possible, recycling has emerged as a popular choice due to its many advantages. Previously, concrete waste was regularly transported to landfills for disposal. In this research, we aim to create an IS-compliant mortar mix using concrete debris. This will aid the construction industry in protecting the environment, convince the government to find solutions for proper waste disposal in landfills and protect the environment, and educate contractors and developers on how to enhance construction industry methods and services by utilizing recycled concrete debris. This project's objectives include designing a concrete mix for M20 grade using demolition debris and a superplasticizer, designing a concrete mix for M25 grade using demolition debris and a superplasticizer, testing the aforementioned concrete mixes' slump cone performance and compressive strength, and performing various tests on recycled aggregate.*

Keywords: **Building, Concrete, superplasticizer, Aggregate.**

1. INTRODUCTION

The global building industry's expansion is getting better with time. Construction of roads, bridges, and other constructions, both residential and non-residential, is ongoing. Similar to many other countries, India is seeing a sharp rise in the need for new structures. Older buildings are either renovated or replaced with cutting-edge, modern constructions. The non-hazardous, uncontaminated things that result are referred to as debris. These include roofing, shingles, steel plates, glass, metal, wall coverings, drywall, plumbing fixtures, insulation, electrical cables, asphalt, bricks, and other building materials. These materials can be separated and recovered before being disposed of. When performing construction, repair, or demolition, developers, contractors, and builders must consider where to deposit the garbage. In order to reduce the amount of waste that is disposed of in landfills, which is what most people do for both environmental preservation and economic reasons, studies, research, and experiments are being conducted to find answers.

2. OBJECTIVE

The project's objectives are as follows:

I Using an additive and concrete shards from a demolition site, develop a mix design for M20 grade concrete (super-plasticizer)
ii) Using an additive and concrete shards from a demolition site, develop a mix design for M25 grade concrete (super-plasticizer)
iii) Apply the Slump Cone Test to the previously described concrete mixture.
iv) To test the compression strength of the aforementioned concrete mix.
v) To conduct several experiments on both recycled and natural aggregates and evaluate the outcomes.
vi) Determine whether recycling concrete is worthwhile based on the results of the tests indicated above.

3. METHODOLOGY

3.1 Collection of debris

The concrete aggregate collected from building sites is processed using a crusher unit. Only clean concrete that is devoid of trash, wood, paper, and otherdebris is accepted by crushing facilities. Rebar and other metals that can be melted down and reused after being separated using magnets and other sorting equipment are acceptable. By size, the remaining aggregate pieces are arranged. Larger pieces might be put through the crusher once more. After crushing, additional particulates are removed using a variety of techniques, such as water flotation and hand picking.

3.2 Concrete Mix Design

The objective of concrete mix design is to produce a concrete with the required strength, durability, and workability at the lowest possible cost by selecting the proper concrete elements and determining their proportions. Concrete's ratio of constituents is based on the demands placed on it in both its plastic and hardened forms. In the absence of workability, plastic concrete cannot be laid or compacted effectively. Therefore, the workability feature becomes very important.

3.3 Necessity of Curing

Many people doubt that the concrete above can be sprayed with water in time to prevent drying out within two hours. The linked question is whether the water/cement ratio will be affected negatively if water is added within, say, two hours. To put it another way, the question is how soon water can be added to concrete surfaces to provide uninterrupted hydration without interfering with the water/cement ratio.

Fig-1: Concrete Curing

3.4 Mandatory Testing Procedures

The following two checks are required to accomplish this project's objectives:

1. Sieve Analysis.
2. a Concrete Penetration Test.
3. Concrete Density and Absorption Rate to Water.
4. The Fresh Concrete Slump Cone Test.
5. Hardened Concrete Compressive Strength Test.

4. RESULTS & DISCUSSION

4.1 Results of M25 Mix

The tables below describe the findings of the numerous tests performed on M25 Grade Concrete Mix and, as necessary, compare them to the standard values.

Table-1: Sieve Analysis of Aggregate Larger than 10mm (as per IS 2386 Part 1) for M25grade of concrete

IS Sieve Size (mm)	Test No 1		Test No 2		Mean of percent retained	Cumulative percent	
	Wt. retained (gm)	Percent retained	Wt. retained (gm)	Percent retained		Retained	Passing
40	0	0	0	0	0		100
25	241.4	11	257.3	13	12	12	88
20	266.6	12	329.1	16	14	26	74
12.5	368.2	17	91.6	5	11	37	63
10	128.4	59	1330.3	6.5	62	99	01
4.75	-	-	-	-	-	-	-
2.36	-	-	-	-	-	-	-
Pan	26.4	01	23.3	1	1	100	0
Total	2187	100	2031.6	100	100		

Table-2: Sieve Analysis of M25 Grade Concrete Aggregate with a Particle Size Distribution Below 10mm (in accordance with IS 2386 Part 1)

test-1		test-2		mm IS Sieve Size	percent cumulative		percent retained mean
weight Retained - gm	Retained percent	weight Retained - gm	Retained percent		retained	passing	
				10		100	
495.5	55	379.8	42	4.75	49	51	49
135.4	15	135.2	15	2.36	64	36	15
132.6	15	165.8	19	1.18	81	19	17
59.1	7	88.5	10	0.6	90	10	9
37	4	65.2	7	0.3	95	5	5
15.4	2	25.2	3	0.15	97	3	2
20.9	2	33	4	Pan	100	0	3
895.9	100	892.7	100	Total			100

Table-3: M25 Grade Concrete Penetration Test Using Both a Standard and a Concrete Debris Mix

Penetration in mm	Mix standard	Penetration in mm	Mix debris concrete
3.8	1	4	1
5	2	5.5	2
4.5	3	5.9	3
5	4	5	4
4	5	4	5
4.46	Average	4.88	Average

Each of the five M25 mix specimens' penetration values are listed above in the table. The standard mix has an average penetration 8.61% higher than the average penetration of the concrete debris combination. The penetration, however, must be read to the closest 14 inch (6.4 mm). Because of this, the penetration of the concrete debris combination was greater than that of mortar.

Table-4: Concrete Recipe for M25 Grade

source	Ingredient Data	DLBD (kg/l)	specific gravity	quantity (Kg/Cum)	water absorption (%)
ambuja opc-33	cement	--	3	320	--
N.A	fine Aggregates	--	2.57	697	5.16
N.A	coarse Aggregates	--	2.54	1187	5.36
local	water		--	160	
CAC sf65	admixture		1.23	3.2	
0.5	water/Cementitious	aggregate / cementitious		-	5.89

Table-5: Cone of Failure (Workability) for M25 Grade Concrete

reading the final -mm	reading the initial-mm
80	100

Table-6: Concrete Compressive Strength for M25 Grade

No. of Days	3	7	14	28
Average Compressive Strength (N/mm^2)	21	25.1	30	34.9

4.2 Results of M20 Mix

The tables below describe the findings of the numerous tests performed on M20 Grade Concrete Mix and, as necessary, compare them to the standard values.

Table-7: Analysis of M20 Concrete Aggregate Sized Greater Than 10mm by Sieve (in Accordance with IS 2386 Part 1)

IS Sieve Size (mm)	Test No 1 Wt. retained (gm)	Test No 1 Percent retained	Test No 2 Wt. retained (gm)	Test No 2 Percent retained	Mean of percent retained	Cumulative percent Retained	Cumulative percent Passing
40	0	0	0	0	0		100
25	193.12	11	205.84	13	12	12	88
20	213.28	12	263.28	16	14	26	74
12.5	294.56	17	73.28	5	11	37	63
10	102.72	59	1064.24	6.5	62	99	01
4.75	-	-	-	-	-	-	-
2.36	-	-	-	-	-	-	-
Pan	21.12	01	18.64	1	1	100	0
Total	1749.6	100	1625.28	100	100		

Table-8: Aggregate finer than 10mm was sieved (in accordance with IS 2386 Part 1) to produce M20 concrete.

test-1 weight Retained - gm	test-1 Retained percent	test-2 weight Retained - gm	test-2 Retained percent	mm IS Sieve Size	percent cumulative retained	percent cumulative passing	percent retained mean
-	-	-	-	10	-	100	-
396.4	55	379.8	42	4.75	49	51	49

108.32	15	135.2	15	2.36	64	36	15
106.08	15	165.8	19	1.18	81	19	17
47.28	7	88.5	10	0.6	90	10	9
29.6	4	65.2	7	0.3	95	5	5
12.32	2	25.2	3	0.15	97	3	2
16.72	2	33	4	Pan	100	0	3
716.72	100	892.7	100	Total			100

Table-9: Comparison of Standard Concrete and Concrete Debris Mix in a Penetration Test for M20 Concrete

concrete debris mix	Penetration-mm	standard Mix	Penetration-mm
1	4.5	1	4.75
2	5.2	2	6.25
3	6.1	3	5.625
4	5.3	4	6.25
5	4.4	5	5
average	5.1	average	5.575

Each of the five M25 mix specimens' penetration values are listed above in the table. Normal mix penetration is approximately 8.26% greater than mixture of concrete debris penetration. The penetration, however, must be read to the closest 14 inch (6.4 mm). Because of this, the penetration of the concrete debris combination was greater than that of mortar.

Table-10: Concrete Recipe for M25 Grade

source	Ingredient Data	DLBD (kg/l)	specific gravity	quantity (Kg/Cum)	water absorption (%)
ambuja opc-33	cement	--	3	320	--
N.A	fine Aggregates	--	2.75	697	5.26
N.A	coarse Aggregates	--	2.45	1187	5.46
local	water		--	160	
CAC sf65	admixture		1.23	4	
0.45	water/Cementitious	aggregate / cementitious		-	4.7

Table-11: concrete M20 workability (slump cone)

final reading- mm	initial reading-mm
85	95

Table-12: Concrete Compressive Strength for M20 Grade

No. of Days	3	7	14	28
Average Compressive Strength (N/mm^2)	14.1	17.2	22.5	25

5. CONCLUSION

The M25 and M20 concrete grades both feature recycled concrete as a primary aggregate. Compressive testing, slump cone testing, aggregate specific gravity testing, water absorption testing, and sieve analysis are all performed.

The results of the aforementioned tests demonstrate that recycled concrete aggregates can be utilized in construction since they meet all of the requirements for such materials in India.

Additionally, recycled concrete that is used to create new concrete meets the requirements for workability listed in the I.S. regulations. Additionally, recycled concrete hasa higher compressive strength than regular concrete.

Utilizing recycled concrete is therefore advantageous from both a technical and environmental standpoint. Additionally, it is more affordable than conventional concrete.

To gain a deeper understanding of recycled concrete, other experiments including flexural testing, split tensile tests, vicat tests, etc., may be conducted in the project's future scope.

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