

Study on Strength Improvement of Pervious Concrete

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Abstract : Pervious Concrete Is A Concrete Containing Little Or No Fine Aggregate Provides Direct Drainage Of Rainwater, Helps To Recharge Groundwater In Pavement Applications. The Objective Of This Work Is To Improve Compressive Strength At Which The Strength Achieves Better Permeability. The Design Mix Is Prepared For M25 Consisting Of 53 Grade Cement, Two Different Sizes Of Coarse Aggregate Which Are Passing Through 25mm I.S Sieve Size And Retained On 16mm I.S Sieve Size As S1 And Aggregates Passing Through 10 Mm And Retained On 6mm Named As S2 Were Taken For This Work River Sand And Robo Sand Were Selected As Fine Aggregate And W/C Ratio Maintained As 0.35 In All The Cases. The Design Mix Is Developed With Constant Percentage Of Coarse Aggregate And Altering The Proportions Of Coarse Aggregate With Simultaneous Addition Of Percentages Of River Sand And Robo Sand In The Concrete. From The Experimental Results It Is Found That The Compressive Strength And Permeability Is Satisfactory At Adding Of 5% Robo Sand As A Fine Aggregate And Combination Of 80% S1 And 20% S2 As Coarse Aggregate In The Pervious Concrete.

Keywords – Pervious Concrete, Permeability, Robo Sand, Compressive Strength

Date of Submission: 01-03-2018

Date of acceptance 23-03-2018

I. INTRODUCTION

Pervious Concrete Is A Lightweight Concrete Because Of Less Amount Of Fine Aggregate. Because Of Its Porous Nature The Water Can Easily Passed Through It. It Is Also Termed As No Fine Aggregate When There Is No Fine Aggregate In The Making Of This Concrete. Pervious Concrete Is Used For Light Traffic Parking Areas, Pedestrian Walkways And Green Houses. Sand Is One Of The Natural Resources Of The Earth's Surface As A Result Of The Natural Disintegration Of Rocks. The Need And The Demand For The River Sand Have Been Increasing With The Development Era Of Construction Industry. Therefore The Use Of River Sand Is Substituted By The Alternative Material Crushed Granite Dust (Robo Sand) In Lower Amounts As A Fine Aggregate In The Pervious Concrete.

II. METHODOLOGY

Mix Design Has Been Prepared, After Procurement Of Locally Available Materials. Different Proportions Of Materials Were Taken For Different Mixes Which Are Mentioned In The Experimental Program. Laboratory Tests Were Conducted On Cement, River Sand, Robo Sand And Coarse Aggregates. We Have Performed Various Tests On Cement Like Fineness Of Cement, Specific Gravity And Setting Time. The OPC 53 Grade (Jaypee Cement) Cement Was Taken And Also Robo Sand Having The Specific Gravity Of 2.61 Was Used In This Work. The Coarse Aggregate Was Obtained From Local Supplier With A Maximum Size Of 20mm, Specific Gravity Of 2.69 And Confirm To IS: 383. After Trail Mix Is Done The Water Cement Ratio Is Fixed As 0.35 For Better Workability Of Entire Experimental Work. The Fresh Water Was Obtained From Bore Hole. The Concrete Cubes Were Cast And Cured For 3, 7 & 28 Days Respectively And Simultaneously Cylindrical Specimens Were Made For Permeability Test. For Each Time Of Hydration Period (3, 7 & 28 Days), 3 Cubes Were Tested For Compressive Strength And Another 3 Cylindrical Specimens Were Tested For Permeability. Permeability Test Was Conducted Using Fall And Head Method On The Attainment Of The Results We Proceeded Through Discussion And Finally Concluded This Work.

III. EXPERIMENTAL PROGRAM

The Experimental Program Is Followed By The Below Mentioned Table

Table 1 Experimental Program

S.No.	Mix	W/C	Cement %	Fine Aggregates %	Coarse Aggregates %	
				Robo Sand	25mm Passing & 16mm Retained (S1)	10mm Passing 6mm Retained (S2)
1	MIX-1	0.35	100	-	100	-
2	MIX-2	0.35	100	-	90	10
3	MIX-3	0.35	100	2.5	90	10
4	MIX-4	0.35	100	5.0	90	10
5	MIX-5	0.35	100	2.5	80	20
6	MIX-6	0.35	100	5.0	80	20

IV. RESULTS & DISCUSSION

In This Work The Materials Like Cement, Fine Aggregates And Coarse Aggregates Were Collected From Locally. The Used Cement Was OPC 53(Jaypee Cement) Grade And The Mix Proportions Were Prepared For M25 Grade Concrete. The Collected Robo Sand Had Specific Gravity Of 2.66. The Size Of Coarse Aggregates I.E. Passing Through IS. Sieve 25mm, And Retained On I.S. Sieve 16mm Named As S1 And Aggregates Passing Through IS. Sieve 10 Mm And Retained On IS. Sieve 6mm Named As S2 Were Taken For This Work. Tap Water Is Used For Mixing And The Water Cement Ratio Is 0.35 For All The Mixes In The Work. Permeability Test Was Conducted Using Fall And Head Method. The Laboratory Test Results Are Mentioned Below.

Table 2 Test Results On Cement

S.No	Name Of The Test	Result
1	Fineness Of Cement	98.4%
2	Specific Gravity Of Cement	3.54
3	Standard Consistency	31%
4	Setting Time (A) Initial Setting Time (B) Final Setting Time	35min 546min

Table 3 Test Results On Coarse Aggregate

S.No	Name Of The Test	Result
1	Specific Gravity Of S1	2.69
2	Specific Gravity Of S2	2.76
3	Aggregate Impact Value For S1	21
4	Aggregate Crushing Value For S1	17.15%
5	Los-Angel's Abrasion Test For S1	27%

Table 4 Compressive Strength Results

S.No	MIX	Compressive Strength(N/Mm ²)		
		3days	7days	28days
1	MIX-1	5.82	7.30	10.52
2	MIX-2	7.5	12.5	18.23
3	MIX-3	8.11	13.52	19.54
4	MIX-4	8.72	13.7	20.44
5	MIX-5	9.18	14.72	21.77
6	MIX-6	9.69	15.41	22.42

Table 5 Permeability Test Results

S.No	MIX	Permeability (Mm/Sec.)		
		3days	7days	28days
1	MIX-1	0.39	0.40	0.41
2	MIX-2	0.37	0.37	0.38
3	MIX-3	0.33	0.32	0.33
4	MIX-4	0.30	0.29	0.29
5	MIX-5	0.26	0.24	0.24
6	MIX-6	0.24	0.20	0.20

V. Discussion

- The Compressive Strength Of No Fine Concrete (Mix-1) Was 10.52N/Mm² At The Age Of 28 Days. This Strength Was Increased In The Remaining Mixes By Varying The Percentages Of Fine And Coarse Aggregate.
- The Modified Pervious Concrete Produces Compressive Strength Of 19.54N/Mm² And 20.44N/Mm² At 28 Days Of Hydration Period By Adding 2.5% And 5% Fine Aggregates (Robo Sand) And Maintained Constant Volume Of Coarse Aggregates (90%S1 +10%S2) In The Respective Mixes. By Addition Of Fine Aggregate And 10% Of S2 Coarse Aggregates, The Voids Reduced In The Mixes And It Cause To Increment Of Strength And Decrement Of Permeability
- The Compressive Strength Results Of MIX-6 Were High When Compared To MIX-5 Results Due To Increased Percentage Of S2 Aggregate In The Mix And Because Of Its Interlocking Nature.
- The Average Permeability Results Were Fall Down From 0.40mm/Sec. To 0.20mm/Sec. This Result Proved That The Porousness Decreased With Increased Percentage Of Fine Aggregate And Also S2 Coarse Aggregate In The Modified Pervious Concrete.

VI. Conclusion

In This Present Study The Strength Of Pervious Concrete Is Improved By Adding 5% Robo Sand As Fine Aggregate And 100%(80%S1+20%S2) Coarse Aggregate In The Mix. The Durability Test Results May Help For Further Study Whether The Strength Varied Or Not.

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B.V.R.Murthy"Study on Strength Improvement of Pervious Concrete "International Journal of Engineering Science Invention (IJESI), vol. 07, no. 03, 2018, pp29-31