JETIR.ORG ISSN: 2349-5162 | ESTD Year : 2014 | Monthly Issue

JOURNAL OF EMERGING TECHNOLOGIES AND INNOVATIVE RESEARCH (JETIR)

An International Scholarly Open Access, Peer-reviewed, Refereed Journal

Comparative Study On Dry Lean Concrete Manufactured with OPC 53 To Be Used For The Construction Of Concrete Roads

Name of author : Mohammad suhail khanday

Email: khandaysuhail11@gmail.com

Qualification : BTech Kashmir university (Civil Engineering)

MTech NIT Srinagar (Geotechnical Engineering)

Abstract

Dry-lean concrete (DLC) lies below the wearing course of the rigid pavement section to overcome the major reasons for its failure, such as improper base support, seepage of underground water, and frost action. Dry Lean Concrete (DLC) is an important part of modern rigid pavement .DLC is generally manufactured with a huge aggregate-to-cement ratio, which lies below the wearing course of the rigid pavement section. In this study, aggregates obtained from tunnel muck material by crushing were used as coarse and fine aggregates in DLC and cement used is Ultratech OPC 53.

From all the combination it is observed that Density is maximum(2.416 g/cc) of the mix containing cement aggregate ratio 1:15 (35% 20mm 25% 10mm 40% crusher sand) at 4.06% moisture content With respect to aggregates. Cubes were casted on the combination at which the density is maximum. It is observed that that the compressive at 3 days is 15.41 Mpa and after 7 days compressive strength is 17.67Mpa.

1. Introduction

Dry Lean Concrete is an important part of the modern rigid floor. It is smooth concrete with a large proportion of aggregate in relation to cement than conventional concrete and is generally used as a base/sub-base for hard paving.The dry lean concrete is compacted using a 10 to 12T vibrating roller in the field. Extra dry lean concrete is mainly done with ordinary Portland cement.

It consists of crushed sand, cement, and water. The DLC is a sub-base for concrete pavements; the minimum cement content in lean concrete must not be less than 150 kg/cum concrete (according to MORTH).For DLC Cube Test, each cube must have an individual strength of 7.5mpa or more and an average of 5 cubes must have a force greater than 10mpa. The DLC plate must have an average thickness of 150 mm.Dry lean concrete is manufactured with ordinary Portland cement according to the IRC specification: SP-49: 1998.

The design of the DLC mix is not comparable with the conventional concrete mix. In contrast to conventional concrete mixtures, the water/cement ratio is not the criterion for the design of the DLC mixture, but it is the optimum moisture content (OMC) to guarantee the total compaction of the concrete under lamination.The mixture should not be too moist, because it gets stuck in the roll drums. Therefore, it is important to determine the ideal moisture content for the correct compaction and mixing ratios, i.e. the aggregate/cement ratio to produce the required compaction and compressive strength of the concrete.

1.1 Optimum Moisture Content of Dry lean concrete

The ideal moisture content for a DLC mix is determined to guarantee complete roll compaction. The ideal moisture content is determined to achieve complete compaction and maximum dry density.

It is usually determined by compressing DLC hubs using a vibrating hammer. The Vee Bee Consistometer Test can be used in the laboratory to know approximately the mixtures of OMC and DLC.

According to IRC SP-49, 1988, the minimum cement content in a DLC must not be less than 150 kg / m3 of concrete. If this minimum cement content is not sufficient to produce concrete with the specified strength, it must be increased if necessary.

However, this specified amount of cement is for OPC. In the case of PPC, nothing is quantified about the amount of cement.

1.2 Concrete Strength of DLC

The average compressive strength of a DLC mixture should not be less than 10 MPa in 7 days.

The compressive strength of the cube for 7 days is the main acceptance criterion for dry lean concrete mixes.

Therefore, standard cubes prepared from dry lean concrete mixtures were tested for strength development at 7 days.

2. Material properties

Ordinary Portland cement was used in the study. Compressive strength of the cement at 3 days, 7 days and 28 days was 28.74,42.27 and 55.84MPa respectively. Crushed stones of maximum nominal size of 20 and 10 mm were used as coarse aggregate. The density and water absorption of the 20 mm were 2.96 g/cm3 and 0.96%, and 10 mm were2.92 g/cm3 and 1.27 % . Stone dust, a by-product of the production of crushed stone, was used as fine aggregate, and its density, water absorption and fineness modulus (FM) were 2.81 g/cm3 , 2.00% and 2.89, respectively.

3. Design Mix of DLC as per MORTH section 600

3.1 Grading of 20mm

Grading 20mm				
	Percentage Passing			
IS Sieve size	sample 1	sample 2	sample 3	Average
26.5	100	100	100	100
19	77.32	78.11	77.12	77.52
9.5	6.23	5.96	7.15	6.45
4.75	3.26	3.12	2.95	3.11
2.36	0	0	0	0
0.6	0	0	0	0
0.3	0	0	0	0
0.15	0	0	0	0
0.075	0	0	0	0

3.2 Grading of 10mm and Crusher Dust

Grading 10mm				
	Percentage Passing			
IS Sieve size	sample 1	sample 2	sample 3	Average
26.5	100	100	100	100
19	100	100	100	100
9.5	90.86	89.32	91.32	90.5
4.75	7.02	6.82	5.93	6.59
2.36	1.91	1.52	1.64	1.69
0.6	0	0	0	0
0.3	0	0	0	0
0.15	0	0	0	0
0.075	0	0	0	0
Grading of Crusher sand				
	Percentage Passing			
IS Sieve size	sample 1	sample 2	sample 3	Average
26.5	100	100	100	100
19	100	100	100	100
9.5	100	100	100	100
4.75	99.24	97.98	97.81	98.35
2.36	87.58	87.56	85.16	86.77
0.6	38.48	36.55	37.58	37.54
0.3	28.56	26.22	31.02	28.6
0.15	21.21	17.14	17.66	18.67
0.075	9.47	7.31	8.44	8.41

Fig 1 and 2 . Shows grading of aggregates

3.3 Design mix of DLC as per MORTH section 600

Design Mix of DLC as per MORTH section 600							
Grading (All -in aggregates)							
IS Sieve size	Percentage passing of individual aggregate			20MM 35% 10MM 25% C. SAND 40%			
				Total percentage passing	specific Limits (MORTH Table 600-1		
	20mm	10mm	crusher sand		Mean	Lower	Uper
26.5	100	100	100	100.00	100	100	100
19	77.52	100	100	92.51	85	75	95
9.5	6.45	90.5	100	65.65	60	50	70
4.75	3.11	6.59	98.35	36.02	42.5	30	55
2.36	0	1.69	86.77	29.49	29.5	17	42
0.6	0	0	37.54	12.51	15	8	22
0.3	0	0	28.6	9.53	12	7	17
0.15	0	0	18.67	6.22	7	2	12
0.075	0	0	8.41	2.80	5	0	10

3.4 Flakiness and Elongation Index test as per IS: 2386- Part -1

Sieve size (mm)		Total weight of aggregates(200 pieces) gm	Flakiness Gauge		Elongation Gauge
Passing	Retained		Passing (gm)	Retained(gm)	Retained(gm)
25	20	3027	221	2806	186
20	16	2112	153	1959	110
16	12.5	1095	115	980	81
12.5	10	525	67	458	55
10	6.3	225	36	189	18
Total Weight		6984	592	6392	450
Flakiness Index(%)		8.48			
Elongation Index(%)		7.04			
Total FI &EI (%)		15.52			

Fig 3 and 4 shows Flakiness and Elongation of aggregates

3.5 Observation sheet for moisture density relationship of DLC mix as per MORTH clause 601.7

Weight of wet sample in grams	vol of cube cc	wet density (gm/cc)	Actual moisture content on oven dry	Dry density (gm/cc)	Average moisture content	Average dry density (gm/cc)
8250	3375	2.444	3.18	2.369		
8150	3375	2.415	3.18	2.340		
8280	3375	2.453	3.18	2.378	3.18	2.362
8420	3375	2.495	3.62	2.408		
8420	3375	2.495	3.62	2.408		
8300	3375	2.459	3.62	2.373	3.62	2.396
8590	3375	2.545	4.06	2.446		
8490	3375	2.516	4.06	2.417		
8380	3375	2.483	4.06	2.386	4.06	2.416
8440	3375	2.501	4.68	2.389		
8460	3375	2.507	4.68	2.395		
8550	3375	2.533	4.68	2.420	4.68	2.401
8350	3375	2.474	5.08	2.354		
8490	3375	2.516	5.08	2.394		
8530	3375	2.527	5.08	2.405	5.08	2.385

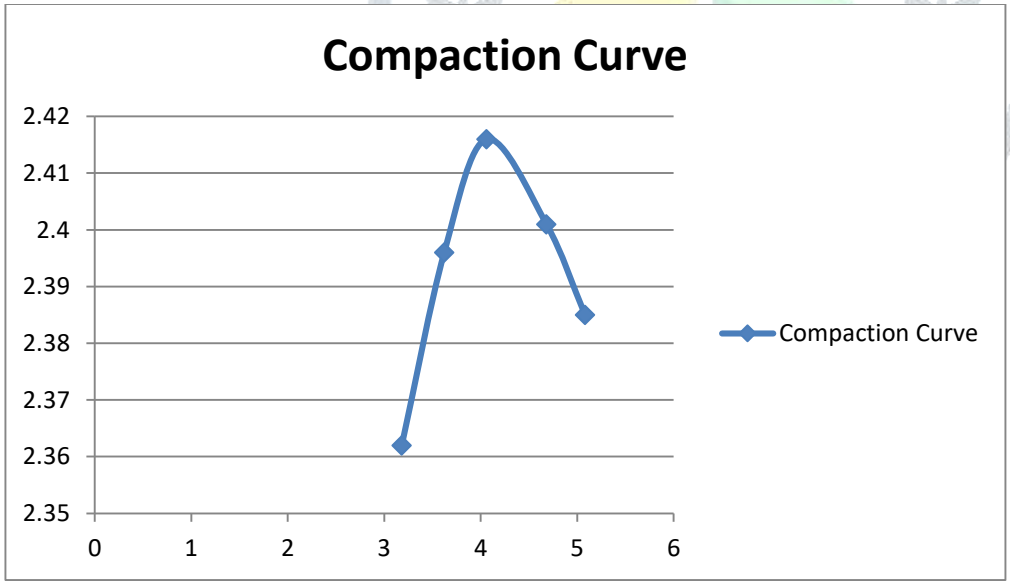

Fig 5 shows compaction curve

3.6 3 days and 7 days compressive strength of cubes casting

3.6a 3days compressive strength of DLC cubes

Weight (gm)	Density (g/cc)	Load (KN)	Load (N/mm2)	Average strength N/mm2
8492	2.516	342.5	15.22	
8488	2.515	343.6	15.27	
8562	2.537	333.5	14.82	15.11
8498	2.518	350.1	15.56	
8570	2.539	367.7	16.34	
8510	2.521	342.4	15.22	15.71

3.6b 7 days compressive strength of DLC cubes

Weight (gm)	Density (g/cc)	Load (KN)	Load (N/mm2)	Average strength N/mm2
8580	2.542	390.3	17.347	
8430	2.498	370.7	16.476	
8410	2.492	410	18.222	17.348
8520	2.524	400	17.778	
8500	2.519	420	18.667	
8560	2.536	395	17.556	18.000

Fig 6 and 7 shows compressive strength tests of DLC cubes.

4. Conclusion

1. Flakiness and Elongation index of the sample taken for comparative study of DLC mix design is 8.48% and 7.04% respectively. The combined Flakiness and Elongation Index is 15.52%.
2. Individual gradation of 10mm 20mmand crusher sand was done .From the grading it was seen that 35% of 20mm, 25% of 10mm and 40% 0f crusher sand specify the limits of MORTH 600-1 in conducting combined grading.
3. From the observation sheet of moisture density relationship of DLC mix as per MORTH clause 601.7it was seen that at 4.06% moisture density is maximum equal to 2.4169 g/cc.
4. Compressive strength of cubes after 3 days and 7 days was observed as 15.41 and 17.67 respectively.

5. Refrences

1. MoRTH (2012). National Highways Development Project: An Overview. <http://morth.nic.in>.
2. Guidelines for the Use of Dry Lean Concrete as Sub-Base for Rigid Pavement, IRC SP-49. Indian Road Congress Special Publication 49, New Delhi, 1988.
3. Mathur R., Misra, A.K., and Goel, P. A Technical Report on “Study of Strength of Concrete vs Grades of Cement in the Market.” Report No. QSP/CRRI/RPD/OLP-426, January 2010.
4. Speci□cation for Coarse and Fine Aggregates from Natural Sources for concrete, IS 383, Bureau of Indian Standards, New Delhi, 1970.
5. Methods of Test for Aggregates for Concrete: Part 3 Specific Gravity, Density,and Bulking, IS 2386 (Part 3), Bureau of Indian Standards, New Delhi, 1963.
6. ASTM C1435. “Practice for Molding Roller-Compacted Concrete in Cylinder Molds Using a Vibrating Hammer.” “Annual Book of ASTM Standards, Vol. 04.02, Concrete and Aggregates”, American Society for Testing and Materials, ASTM International, West Conshohocken, PA, USA, 2003.
7. Method of Test for Strength of Concrete, IS 516, Bureau of Indian Standards, New Delhi, 1959.