Comparative study for samples of Dry Lean concrete

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Abstract **-** The cost of construction materials including steel is increasing continuously over the years and house are becoming unaffordable for common man. Therefore in order to provide shelter to economically deprived person of the society it is necessary to go either for alternate construction technique or to adopt conventional materials with alternate construction technique to reduce the cost of structure. In the present research work the first option i.e. alternate construction materials with conventional construction technique had been employed with the objective to utilize bamboo culms as substitute of steel bars in slab long with G.I. wire mesh to enrich tensile strength

Keywords: Dry Lean Concrete, Pavement Quality Concrete, Multi-layered slab

I. INTRODUCTION

A base course is defined as a layer of different materials lying immediately below the wearing surface of pavement.
Roy D. McQueen, John Knapton, John Emery [2010] investigated that Concrete pavers bedded in sand have proven to provide a suitable wearing surface for both air carrier jet and general aviation aircraft. Such pavements have been used for apron and low speed taxiway pavements and have been trafficked by aircraft in U.S., Europe, and the Caribbean for several years. Pavements surfaced with concrete pavers have shown to exhibit many of the desirable properties of conventional concrete pavements (e.g. resistance to fuel spills and static indentation) at significant savings in cost and construction time. P. Easwary**,** J.P. Annie Sweetlin[2016] The term pavement includes all the structural layers of road structure lying on the sub grade of the road. The main purpose of highway pavement is to provide adequate support for the loads imposed by traffic and a satisfactory surface upon which highway vehicles can operate. Based on the structural behaviour, pavements are generally classified into two categories 1. Flexible pavements 2. Rigid pavements. Thongam Prantic Singh, Dr. Rajashekhara. M. R, Suhas R[2014] Aggregate are considered one of the main constituents of concrete since they occupying more than 70% of concrete matrix. Natural material being exhaustible in nature, its quantity is declining gradually. Also, cost of extracting good quality of natural material is increasing. Parallel to the need for the utilization of the natural resources emerges a growing concern for protecting the environment and a need to preserve natural resources, such as aggregate, hence it is inevitable either to search for another alternative material or partly replace it by some other material. Concerned about this artificially manufactured aggregate and some industrial byproducts such as copper slag; that are either recycled or discarded as a waste can be used as an alternative material for conventional construction materials; thereby leading to global sustainable development and reducing pollution and disposal problems as well. Rakesh Kumar[2016] The total road network of the India is about 4.69 million km in length. Out of which about 53.8% (2.53 million km) are paved .Approximately, 2% of the total road length of the country is made of with concrete [1]. Due to overall economy and added advantages of a longer service life with a little maintenance cost, hundreds of kilometers of concrete pavements are constructed/being constructed in the country under the Government of India's National Highway Development Programmed (NHDP). Government of India is encouraging the construction of concrete pavements even at rural levels. The performance of cement concrete pavements is greatly influenced by the uniform support offered by the base or sub-base layer.

II. MATERIAL AND METHODOLOGY

In this research paper we had discussed the most important parameters:

1) Material

A) Cement

Ordinary Portland cement (OPC) and Portland Pozzolana cement (PPC) were used in DLC. The fact that PPC is not an OPC, since the earlier one contains fly ash up to 35 percent by mass resulting in significant differences in the basic properties such as normal consistency, specific gravity, and strength development at early ages etc. PPCs being fly ash based, the proportions of fly ash are not specified and hence, they do not follow any strength pattern at different ages at 3, 7 or 28 days as is the case with OPC. The bags containing this cement have the marking IS 1489 – part I. There is no 43/53 grading in IS 1489. There are cases when the PPCs showed more than prescribed strength at 7 days and in some cases, the strengths did not reach the precise level. Therefore, in this study a PPC which gave 28-day compressive strength similar to OPC 43 Grade was used.

B) Fine aggregates

The fine aggregate shall be free from soft particles, clay, sea shell, loam, cemented particles, mica, organic and other foreign matter in accordance with IS:383. Aggregates which have water absorption of more than 3 percent, shall not be used. fine aggregate were evaluated as per relevant specification for their suitability for the use in dry lean concrete.

C) Coarse aggregates

Coarse aggregate shall consist of clean, hard, strong, dense and non-porous pieces of crushed stone or gravel and shall not consist of disintegrated stone, soft, flaky, elongated, very angular or splintery pieces. The maximum size of the coarse aggregate shall be 26.5 mm.

D) Water

Water used for mixing and curing of concrete shall be clean and free from injurious amounts of oil, salt, acid, alkali, sugar, vegetable matter or other substances harmful to concrete. Water shall meet the requirements of IS:456.

E) Chemical Admixtures

Fly ash, 15-30 percent or Ground Granulated Blast Furnace Slag (GBFS), 25-50 percent by weight of cementitious material may be used in concrete as part replacement of Ordinary Portland cement, and in such case, the Ordinary Portland cement content shall not be less than 100 kg/m^3 concrete. The fly ash shall conform to IS:381 2 (Part 1), and granulated blast furnace slag shall conform to 18:12089. Site mixing of fly ash or GBFS shall be permitted only after ensuring availability of the equipment's at site for uniform blending through a specific mechanized facility with automated process control like batching and mixing plant.

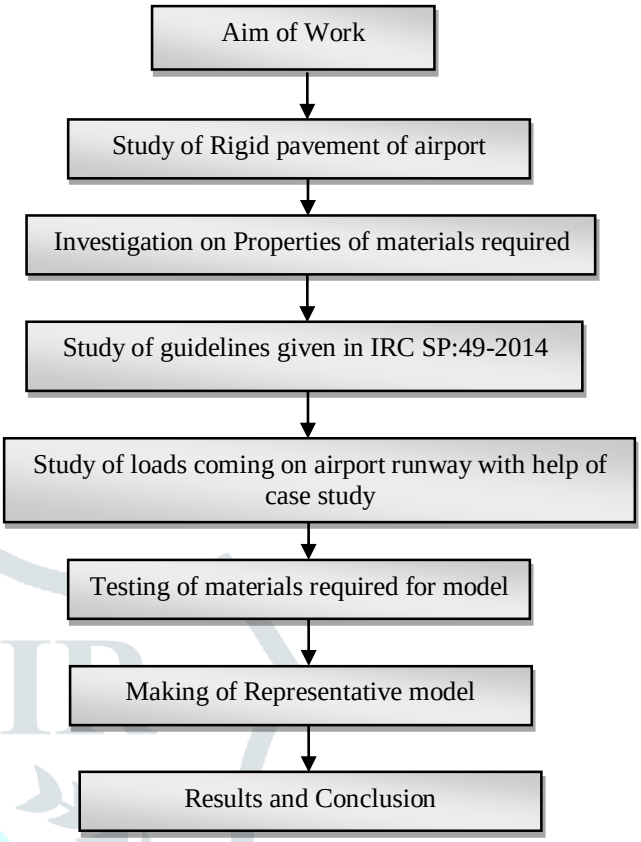
2) Methodology

The aim of our project is to use of Dry Lean Concrete

Sr. No.	Name of Test	Result Value	Requirement as per IS12269:1987
1)	Standard consistency	35%	Not Specified
2)	Fineness of Cement by Dry Sieving	226 m^2/kg	Specific surface of cement shall not be less than 225 m^2/kg
3)	Initial setting time	126 min	Not less than 30 min
4)	Final setting time	400 min	Not more than 600 min
5)	Soundness (Le Chatelier's Method)	3 mm	Not more than 10 mm

in multi-layered Rigid Pavement for airport runway. To make the representative model of runway pavement.

Flow chart of Whole Project Work



III. RESULT AND DISCUSSION

After considering these following test we concluded the following Results.

1) Test on Cement

1) Standard Consistency Test-

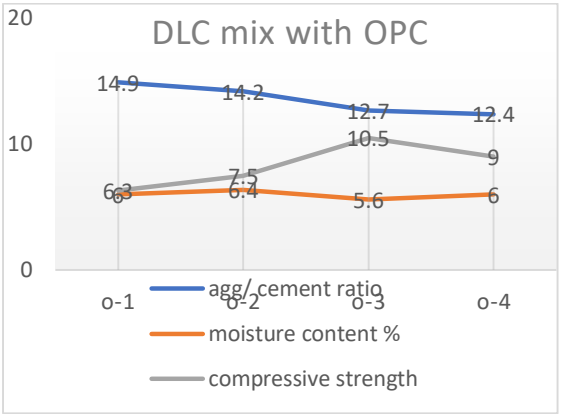
The standard consistency of cement paste is the percentage of water required to produce a cement paste of standard consistency. The standard consistency of cement paste can be defined as that consistency which will permit the Vicat plunger to penetrate to a point 5 mm to 7 mm from the bottom of the Vicat mould when the cement paste is tested. Materials used for this test are Cement and Water. The quantity of cement taken is 400gm and known quantity of water.

2) Fineness of Cement by Dry Sieving :

The fineness of cement is a measure of mean size of particles of cement. For a given weight of cement the surface area is more for fine cement than that of coarse cement. The rate of hydration
i.e. the chemical reaction between cement and water and consequent rate of development of strength rate of cement depend upon the degree of fineness of cement. Hence the rate of construction can be improved.

3)Test On Aggregate:

Water Absorption of Aggregates: The aggregate will absorb a certain quantity of water depending upon its porosity. The knowledge of this is essential in controlling the quality of concrete with respect to workability and strength



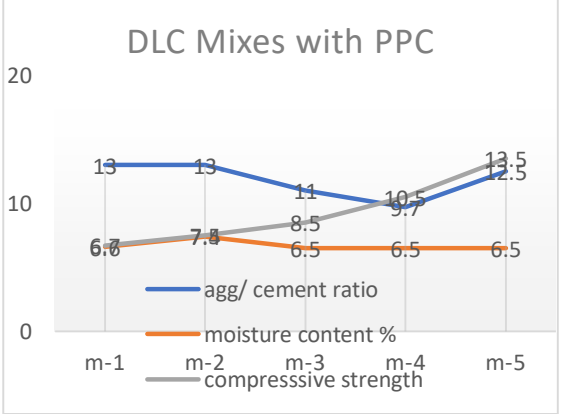
- Maximum aggregate-to-cement ratio for DLC to be manufactured with OPC satisfying the strength requirement is 13:1.
- The minimum OPC content for the manufacturing of dry lean concrete satisfying IRC:SP-49, strength requirement is 160 kg/m3.
- The minimum Portland Pozzolana cement content for the manufacturing of dry lean concrete satisfying IRC: SP-49, strength requirement is 176 kg/m3 which is 10% higher than the amount of OPC.
- The optimum moisture content for DLC manufactured with PPC is significantly higher than the case of OPC. It is 6.5% for PPC and 5.6% for PPC indicating about 10% more requirement of water for DLC to be manufactured with PPC.

Mix No.	O-1	O-2	O-3	O-4
OPC Cement (kg)	125	140	160	170
Aggregate/Cement	14.9:1	14.2:1	12.7:1	12.4:1
Water (kg)	120	132	122	138
M.C. (%)	6.0	6.4	5.6	6.0
Fresh density (kg/m^3)	2140	2220	2310	2235

Dry Lean concrete mix proportions manufactured with PPC

Mix No.	M-1	M-2	M-3	M-4	M-5
PP Cement (kg)	153	150	176	200	165
Aggregate/Cement	13:1	13:1	11:1	9.7:1	12.5:1
Water (kg)	140	155	139	138	144
M.C. (%)	6.6	7.4	6.5	6.5	6.5
Fresh density (kg/m^3)	2260	2247	2255	2270	2360

Sr. No.	Name of Test	Fine Aggregate	Coarse Aggregate
1)	Fineness Modulus of Aggregates	3.81 %	4.416 %
2)	Water Absorption of Aggregates	2.8 %	3 %
3)	Crushing Value Test	-	21.32 %
4)	Impact Test	-	9.25 %



IV CONCLUSION

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