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Comparision Between Conventional and Mechanical Concrete Road

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Abstract*— Mechanical concrete is made by confining aggregates, soils and granular materials inside a thin walled geo cylinder in which we used the waste tires , aggregates and waste concrete. It is a way of binding crushed stone aggregates together into a load bearing cellular building unit which can support compressive loads and resist lateral soil pressure. This tire derived cylinder performs functions similar to the cement or water mixture, the rebar and the formwork in hydraulic cement concrete. Stones confined in this manner can function in load supporting foundations; earth retention structures i.e. walls and dams, slope and channel erosion protection i.e. as ditch and channel liners. It is strength of mechanical cement cylinder that generally defines the overall strength of mechanical concrete and not the crushed stone. The preferred cylinder is made from a recycled auto or truck tire with both sidewalls removed. The tire treated cylinder is no longer a tire but through remanufacturing becomes tire-derived-cylinder, TDS. 78 % of construction waste consists of concrete waste, bricks and tiles. Concrete waste with various fractions was used as coarse aggregate in the research, as well as filler aggregates from the crushed concrete waste were used. Physical-mechanical properties of the samples were analyzed by comparing with reference samples where typical aggregates were used.

Keywords: waste tires, TDC, geo cylinder, aggregate, waste concrete

I. INTRODUCTION

Mechanical concrete road introduces a new, cellular-reinforced, aggregate building material, confined aggregate, concrete. This material is made by using cylinder to confine stone aggregates. The cylinder increases load-bearing capacity of all types of aggregates by providing direct lateral support. It is comparable in bearing load applications to common Portland cement (PC) concrete. In this report material behaviour and laboratory load tests conducted on different types of filler material are described. In confined aggregate (CA) a cylindrical device alone accomplishes lateral confinement and integration of stone aggregates; verses in PC concrete, cement, water and sand mortar perform this. Main materials which we used as filler is a waste concrete, which is very cheap in market and also easily available. Because of geo synthetic tires the filler material are fixed and due to this the road material does not move laterally.

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II. METHODOLOGY

Mechanical concrete geo cylinder is designed and constructed to function as a foundation, sub base. The geo cylinders are thin walled circular, cylindrical segments. This technique consists of confining the aggregates and other materials within a structural geo cylinder to confined stone aggregates, murum and recycled concrete.

A. DESIGN OF MECHANICAL CONCRETE ROAD

First the site is cleared and excavated and a flat surface is made. The edges of the tires are cut by using specific machines. After this the geo cylinders are placed on the flat surface and connected with each other. Each geo cylinder has a contact with adjacent one and those in next row at one point. The each cylinder is connected with other three cylinders compulsorily. This should proceed until the entire width of the roadway area is covered. These cylinders are connected with each other by using rebating to maintain their arrangement and geometry. The geo cylinder should be hand adjusted upward during rebating so that the top surface is relatively flat. The filling material is filled in geo cylinders by using trucks and a plain surface is made. It should achieve optimum density based on gradation characteristics. Road rollers are used to make flat surface and strong shoulders of the road. Prior to paving or other surfacing, a 0.02 to 0.04 m crushed stone aggregates should then be placed on top of mechanical concrete. Drainage requirements for roadways and State Highways specifications should be considered.

Fig 1: Laying of tire

B. DESIGN OF CONVENTIONAL CONCRETE ROAD

The design of conventional road involves the interplay of several variables such as traffic, wheel load, climate, terrain and subgrade conditions. The IRC first brought out guidelines in 1970, which were revised in 1984.The procedure begins with site clearance and excavation. This is followed by sprinkling water thus making surface flat with the help of road rollers. After this sub grade, sub base, base and WBM are laid and compacted using road rollers.

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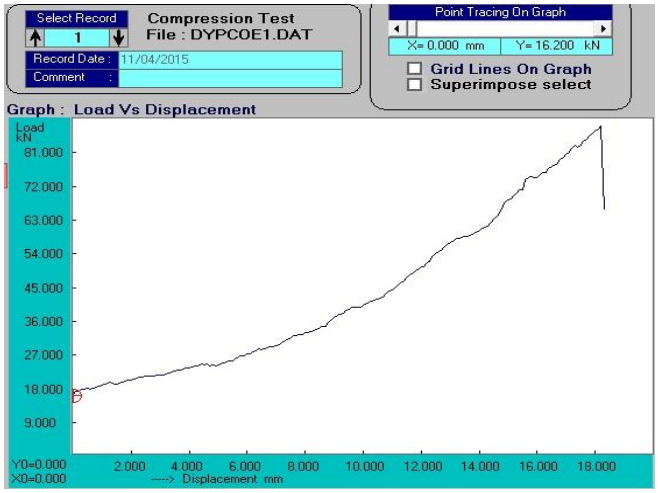
After holding, prime coat and bituminous mix are applied respectively. The procedure is terminated by compacting top surface using roller making road ready to use.

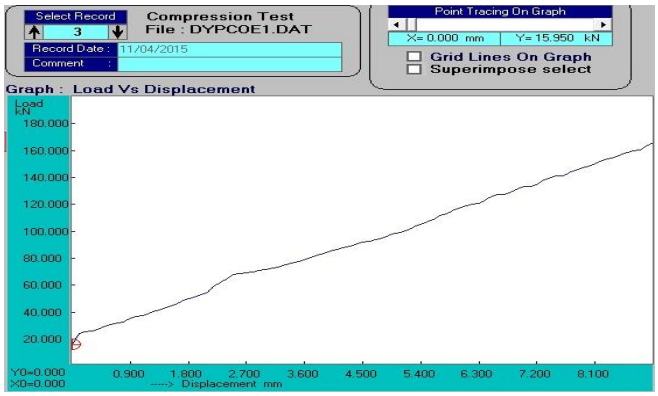
III. LABORATORY TESTS ON TIRE-DERIVED CYLINDERS WITH DIFFERENT TYPES OF FILLERS

Initial laboratory load tests were performed on aggregates, murum and waste concrete confined in tire-derived cylinder (TDC). A TDC was filled with aggregates of size 20mm. Its initial diameter was measured. This TDC was placed on a bearing plate for supporting filler material. A uniformly varying compressive load was applied using Universal Testing Machine (UTM) and corresponding lateral deflection was recorded on the graph. Then final diameter of TDC with filler was measured manually. The procedure was repeated for other fillers i.e. murum and waste concrete.

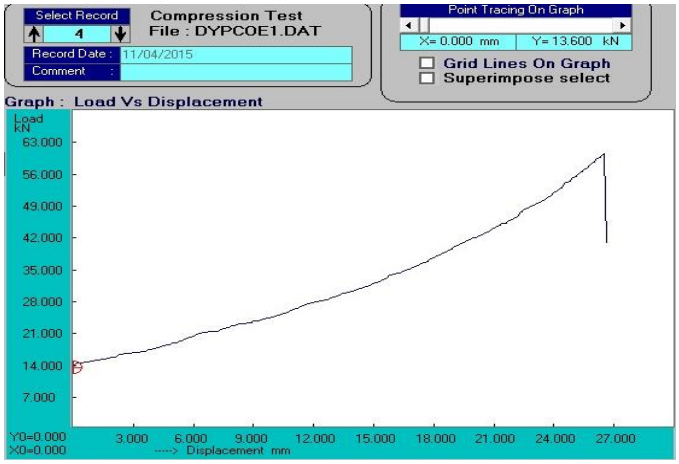
Fig. 2: Laboratory test on TDC by using UTM



Graph 1: Load Vs Displacement for 20mm aggregates



Graph 2: load Vs Displacement for waste concrete



Graph 3: Load Vs Displacement for murum

The graphs show that deflections were generally linear in relation to the loading. Increase in loading showed a proportional increase in deflection. While some creep did occur when the loading was stopped at the sustained load level. These tests measured the behaviour of filler materials and results are shown below:

Bearing Plate	Fillers	Initial circumference of TDC	Final circumference of TDC
A	2Omm aggregates	1749.55	1749.60
B	Waste concrete	1662.70	1664.21
C	Murum	1666.20	1691.64

IV. COMPARISION BETWEEN CONVENTIONAL AND MECHANICAL CONCRETE ROAD

1. Cost:

Mechanical concrete road	Conventional road
Cost per Km of 12m width road is Rs.86,82,960 /-	Cost per Km of 12m width road is Rs.1,18,57,200 /-
Total saving of Rs.31,74,240 /-	
26.77% of construction cost saving	

2. Maintenance:

All road problems come from base failures. Mechanical Concrete Tire-derived-geo-cylinders basically eliminates almost all road maintenance problems and distresses including:

a) Settlement
b) Transverse joint spalling
c) Pressure damage
d) Transverse cracking
e) Corner breaks
f) Patholes
g) Shoulder erosion

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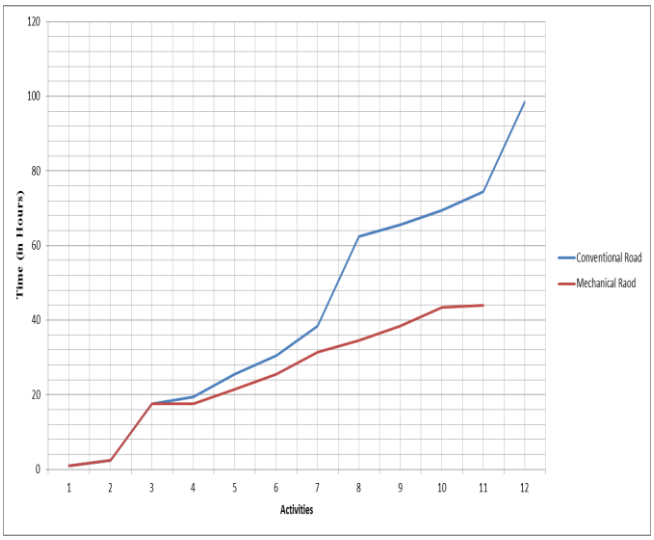
3. Time utilization:

Time required by Mechanical Concrete road is much less than conventional road. Time utilized by these methods is compared below:

Table I: Activities involved in conventional and mechanical concrete road and their corresponding time required.

Conventional Road				Mechnical concrete Road			
Sr. No	Activities	Time	Cumu Time	Sr.No	Activities	Time	Cumu Time
1	Forming of alignment using total station	1	1	1	Forming of alignment using total station	1	1
2	Marking of various Length on road	1.5	2.5	2	Marking of various Length on road	1.5	2.5
3	Excavation of road upto required depth	15	17.5	3	Excavation of road upto required depth	12	17.5
4	Compaction of sub grade	2	19.5	4	Compaction of sub grade	0	17.5
5	Laying of sub base with compaction	6	25.5	5	Laying of tires	4	21.5
6	Laying of Base with compaction	5	30.5	6	Rivetting tires	4	25.5
7	Laying of WBM with compaction	8	38.5	7	Laying of filler material in tires	6	31.5
8	Hold	24	62.5	8	Laying of Prime coat	3	34.5
9	Laying of Prime coat	3	65.5	9	Laying of bituminous Mix	4	38.5
10	Laying of bituminous Mix	4	69.5	10	Compaction of top surface using roller	5	43.5
11	Compaction of top surface using roller	5	74.5	11	Ready to use	0.5	44
12	Ready to use	24	98.5				



Graph 4: Time Vs activities of conventional and mechanical concrete road

4. Simple and Effective Technology:

Mechanical Concrete road is a simple and fast to construct with three times the load supporting capacity of conventional design section and use of unskilled labours.

5. Eco-friendly:

Mechanical Concrete road reuses waste tires and uses less material, energy and water during construction. Thus it is a Green Solution.

V. CONCLUSION

The basic research and lab tests confirm that Mechanical Concrete made with used, tire-derived cylinders is an effective, rugged, economical method for extending the usefulness and improving the load bearing capacity of filler materials. Moreover with less and unskilled labour requirement, it's initial and maintenance cost is less along with maximum durability as compared to conventional road. Mechanical Concrete reuses a chemically inert, tire-derived cylinder (TDC), to confine stone aggregates and thus provides a green, low cost, reuse technology.

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REFERENCES

[1] Pam Kasey (2006-06-08). "Bonasso Devises New Use for Old Tires". The State Journal.
[2] US patent 7470092, Samuel G. Bonasso, "System and method for reinforcing aggregate particles, and structures resulting
[3] Pam Kasey (2009-01-15). "W.Va. Engineer Patents Way to Reuse Old Tires". The State Journal.
[4] Dana Arquilla (2011-08-12). "Mechanical Concrete Concept May Go International". WBOY.com.
[5] IRC 37: 2012 "Design of Flexible Pavement".

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