Making of Paver Block by using Solid Waste

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Abstract— The disposal of solid waste without any treatment in the environment leads to problem such as a pollution. Waste generation rate in the Indian cities ranges between 200 to 870 gram/day depending upon the regions, lifestyle and size of city. The per capita waste generation is a 13.1% per year. Humans have always produced trash and disposed of it in some way so solid waste management is not a new issue. What have changed are the types and amounts of waste produced, the methods of disposal, and the human values and perceptions of what should be done with it. The present study aims at evaluating the performance of concrete for paver blocks by using different solid waste which is used in pavements and other application areas. As compressive and durability are the most significant properties for concrete paver blocks, the same have been studied for various concrete mixes with varying percentages of material.

Key words: Cement, Sand, Course Aggregate, Slag & Ceramic Waste

I. INTRODUCTION

Concrete plays the key responsibility and a large amount of concrete is being utilized in every construction practices. In various countries, the concrete paver blocks become a striking engineering and economical alternative to the both flexible and rigid pavement. Interlocking concrete pavements are special dry mix precast piece of concrete commonly used in outdoor landscaping pavement applications. Concrete paving blocks are best materials on the footpaths for easy laying, better look and finish.

The huge volume of materials required for construction is potentially a key area for the reuse of waste materials. Recycling in concrete has advantages since it is widely used and has a long service life, which means that the waste is being removed from the waste stream for a long period. Because the amount of mineral aggregates required in concrete is large, the environmental benefits are not only related to the safe disposal of mass waste, but also to the reduction of environmental impacts arising from the extraction of aggregates.

Concrete paver blocks are made with concrete basically consisting of cement, fine aggregates, coarse aggregates (10mm and below), water, chemical pigments, etc. Overall performance of concrete paver blocks used are mainly governed by properties of materials, water cement ratio, mixing process and curing process.

The use of fly ash in concrete paver blocks is aimed at reducing cement content and heat of hydration leading to better economy and durability. It will also help in safeguarding the environment from ill effects of CO2 emissions from cement industry and contribute towards the solution for safe disposal of fly ash produced by thermal power plants.

The proposed concrete which is made up by adding ceramic waste, slag in concrete may improve the certain properties of concrete. The properties of concrete containing varying percentages of materials were tested for compressive strength.

II. OBJECTIVE OF PRESENT STUDY

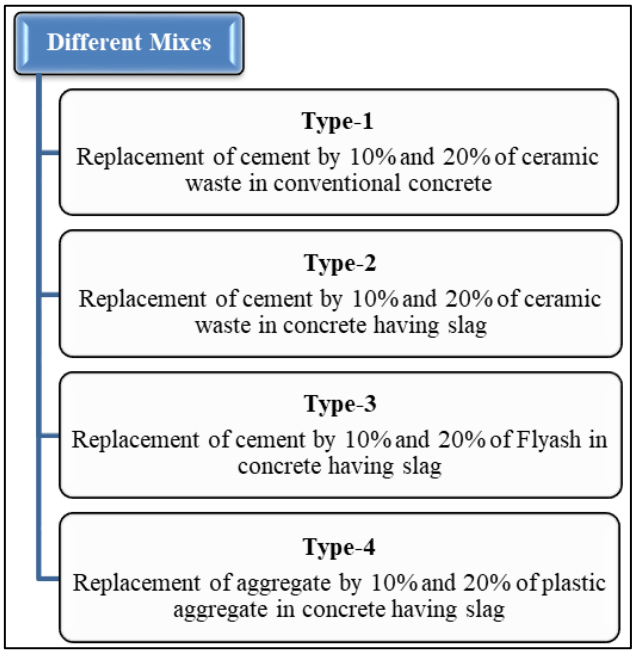
1) The present study aims at evaluating the performance of concrete for paver blocks by using different solid waste which is used in pavements and other application areas.
2) As compressive and durability are the most significant properties for concrete paver blocks, the same have been studied for various concrete mixes with varying percentages of material.

III. MATERIAL USED

The following materials used in the present study.

1.	Cement	Ordinary portland cement of 53 grade confirming as per IS 12269- 2013, SG of 3.09
2.	Fine Aggregare	Natural river sand confirming as per IS 2386-1975, SG of 2.67
3.	Coarse aggreagte	Crushed Granite stone confirming as per IS 2386-1963, SG-2.58
4.	Mineral Admixture	Fly ash
5.	Chemical Admixture & Other	Hardener, Slag, Ceramic waste
6.	Water	Ordinary portable water confirming as per IS 456

Table 1: Materials



IV. RESULT & DISCUSSIONS

A. Compressive Strength Test Results

1) Type 1

Replacement of cement by 10% and 20% of ceramic waste in conventional concrete (Cement, Sand, Aggregate)

- Material used: Cement, Sand, Aggregate
- Replacement type: Cement is replaced by 10% and 20% of ceramic waste

Replacement type	First Block	Second Block	Average Load	Compressive Strength
0%	460	445	452.5	22.62
10%	500	483	491.5	24.57
20%	680	618	664	33.2

Table 2: Load Result for Type-1

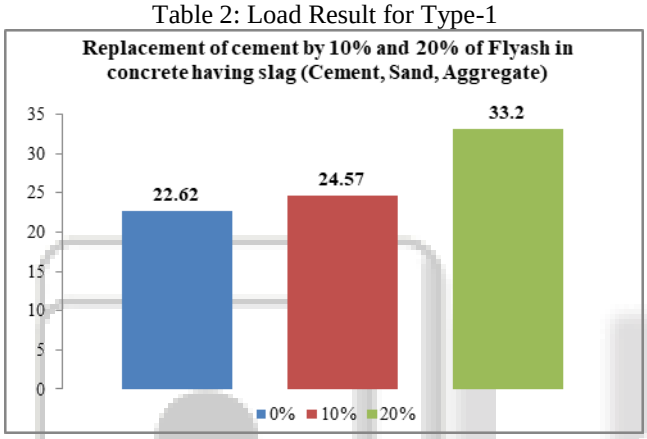


Fig. 1: Load Result for Type 1

2) Type 2

Replacement of cement by 10% and 20% of ceramic waste in concrete having slag (Cement, Slag, Aggregate)

- Material used: Cement, Slag, Aggregate
- Replacement type: Cement is replaced by 10% and 20% of ceramic waste

Replacement type	First Block	Second Block	Average Load	Compressive Strength
0%	206	217	211.5	10.57
10%	268.2	256	262	13.10
20%	327	378	352.5	17.62

Table 3: Load Result for Type-2

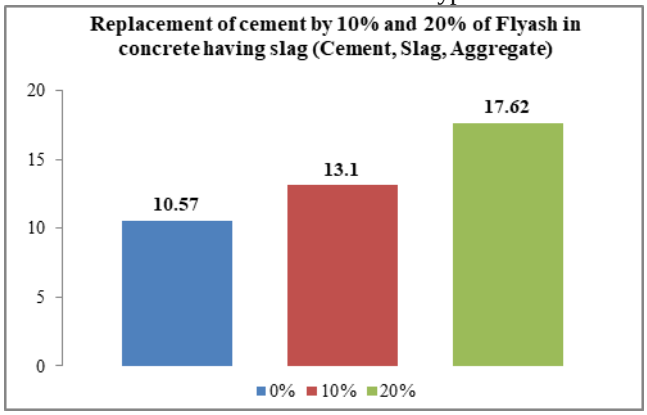


Fig. 2: Load Result for Type 2

3) TYPE 3

Replacement of cement by 10% and 20% of Flyash in concrete having slag (Cement, Slag, Aggregate)

- Material used: Cement, Slag, Aggregate, Flyash
- Replacement type: Cement is replaced by 10% and 20% of flyash

Replacement type	First Block	Second Block	Average Load	Compressive Strength
10%	271.2	293	282	14.10
20%	317	379	348	17.40

Table 4: Load Result for Type-3

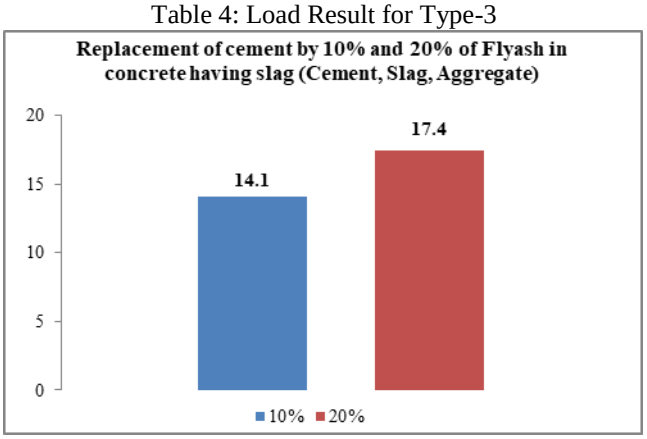


Fig. 3: Load Result for Type 3

4) Type 4

Replacement of aggregate by 10% and 20% of plastic aggregate in concrete having slag (Cement, Slag, Aggregate)

- Material used: Cement, Slag, Aggregate
- Replacement type: Aggregate is replaced by 10% and 20% of Plastic aggregate

Replacement type	First Block	Second Block	Average Load	Compressive Strength
10%	196	208	202	10.1
20%	236	247	241.5	12.07

Table 5: Load Result for Type-4

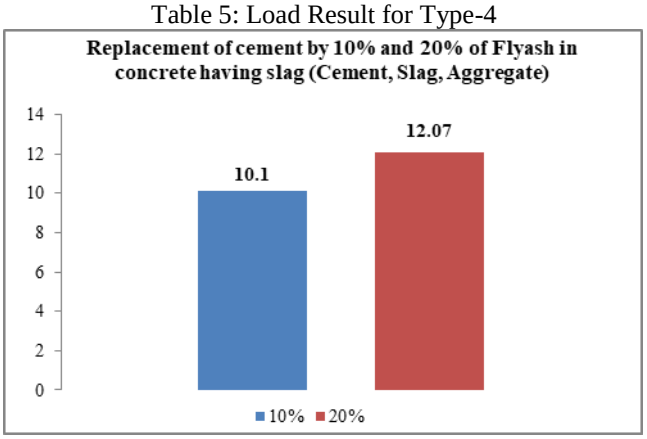


Fig. 4: Load Result for Type 4

B. Water Absorption Test Results

Water absorption test is used to determine the amount of water absorbed under specific conditions.

Type of Mix	Wet Weight	Dry Weight	Percentage Water Absorption

Type-1: Replacement of cement by 10% and 20% of ceramic waste in conventional concrete (Cement, Sand, Aggregate)			
0 %	2605.5	2471	5.44
10 %	2860	2731	4.51
20 %	2931	2766	5.96
Type-2: Replacement of cement by 10% and 20% of ceramic waste in concrete having slag (Cement, Slag, Aggregate)			
0 %	2018	1752	15.18
10 %	2300	2012	14.31
20 %	2185	1945.12	12.33
Type-3: Replacement of cement by 10% and 20% of Flyash in concrete having slag (Cement, Slag, Aggregate)			
10 %	2083	1860	11.98
20 %	2378	2165	9.83
Type-4: Replacement of aggregate by 10% and 20% of plastic aggregate in concrete having slag (Cement, Slag, Aggregate)			
10 %	1918	1791	7.09
20 %	1945	1825	6.58

Table 6: Water Absorption Test Results

V. CONCLUSION

Based on the result from the load test of different mixes of concrete paver block comparison was made for compressive strength of the same. From the result number of advantages seen like weight reduction of paver block, Ease in handle, Ease in transport, environmentally safe pavers, saving in natural resources.

Concerning to the result following conclusion are drawn.

1) Higher compressive strength was achieved when 20% of cement was replaced by equal proportion of ceramic waste and flyash.
2) There is a saving in cost of cement if cement is replaced by flyash and ceramic waste. The percentage of saving is highly beneficial for mass production of paving.
3) The use of flyash and ceramic waste in concrete paving block as partial cement replacement is possible.
4) Adequate compressive strength is achieved when 20% stone chips was replaced by equal proportion of plastic aggregate.
5) Though compressive strength is low when compared to concrete paver block they can be used in garden, pedestrian path and cycle way.
6) Water absorption is well below the permissible limit.
7) Use of flyash and ceramic waste in paver block can give us less production cost and also helps in smart waste management.

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