Use In Domestic Waste In Road Construction

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Abstract— **Domestic wastes are producing on a large scale every day. In big cities, disposal of this waste materials are posing serious problems. Municipal bodies spend huge money every year for their safe disposal purposes. These wastes materials generally composed of plastics, rags, papers, scraps, rubbers, bottles, etc. Some of these wastes are decompose into atmosphere by passing through so many biological processes but some of those are do not decompose into atmosphere, so on the basis of these the domestic wastes are of two types such as Biodegradable & Non-biodegradable. In present day we know that the density of land where people live is going increases. Peoples destroy forests to use the land only for their houses and commercial places. In this crisis we have not land to dispose of domestic wastes, so people throw these wastes in rivers and canals, and this create major problem for environment. If we use these wastes in road construction than there are so many environmental problems which are automatically solved like, Disposal of domestic wastes, Hazardous gases to atmosphere. Use of these materials in road construction is also one of the solutions for this problem. As there is little improvement bearing capacity of sub grade due to using these materials as stabilizer we can control pollution to certain extend. There is also overall economy in road construction using this method, because we can save some quantity of pavement materials. This method of construction will help to reduce pollution as well as give economical road design. Hence the use of domestic waste materials in road construction can be advantageous.**

Keyword: Disposal, Non biodegradable, Pollution control, Sieve Analysis test and Road Constructions

1. INTRODUCTION

The composition of municipal waste varies greatly from country to country and changes significantly with time. In developed countries without significant recycling it predominantly includes food wastes, yard wastes, containers and product packaging, and other miscellaneous inorganic wastes from residential, commercial, institutional, and industrial sources. Examples of inorganic wastes are appliances, newspapers, clothing, food scraps, boxes, disposable tableware, office and classroom paper, furniture, wood pallets, rubber tires, and cafeteria wastes. Municipal solid waste does not include industrial wastes, agricultural wastes, and sewage sludge. The collection is performed by the municipality within a given area. They are in either solid or semi-solid form. The term residual waste relates to waste left from household sources containing materials that have not been separated out or sent for reprocessing. Following are the different types of wastes, one is Biodegradable and another is Non-biodegradable. The Biodegradable waste is a type of waste, typically originating from plant or animal sources, which may be degraded by other living organisms. Wastes that cannot be broken down by other living organisms are called non-biodegradable. Eg –food waste, paper waste. Non-biodegradable waste materials are those which cannot be broken down by the action of microbes. These wastes materials generally composed of plastics, rags, papers, scraps, rubbers, bottles, etc.

2. MATERIAL SELECTED:

The Non-biodegradable material used for the road construction .like as plastic waste, rubber waste, cloths waste etc

Fig. 1: Domestic waste

2.1 ANALYTICAL STUDIES OF COMPOSITION OF DOMESTIC WASTE MATERIALS

Waste materials collected from various location of the city have been analyzed to determine the various contents. It helps to study how many portions of the domestic waste materials produced have potential to be used in road construction. The samples are taken from different garbage dumping sites for the study of their contents and total weight of waste taken is 2 Kg.

Fig. 2: Domestic waste sample

The results of the studies have been given in the table below:

Table 2.1: Contents of Waste Materials

Sl. No.	Waste Material		
	Contents	**Weight of the Content (in Kg)**	**% of the content**
1	Humus	0.281	14
2	Rotten vegetables, fruits, timber	0.160	8
3	Papers, cloths	0.165	8.25
4	Plastics, Thermopolis	0.215	10.75
5	Scraps,	0.654	32.7
6	Bricks, stones	0.262	13.6
7	Bottles, ceramic products	0.263	13.15
8	Others	0.00	0
9	Total Weight	2	100

Considering the only non biodegradable parts of the waste we can use about 45.25%. Scraps usually contains metals which have higher recycling value, therefore it is used in soil stabilization of sub grade. Hence from the analytical study of the mass domestic waste production, it can be approximated that about 45.25% of total waste produce can be used in road construction as the stabilizer of soil used in sub grade.

3. EXPERIMENTATION:

3.1 SIEVE ANALYSIS TEST:

To determine the Grain Size Analysis for a Coarse Grained Soil by Sieve Analysis. As per provisions of IS 460-1972 (revised), soils having particles of size larger than 75 micron (0.075 mm) are termed as coarse grain soils. Thus, sand, gravel, cobble and boulder do fall within the definition of coarse grained soils, since the size range of different types of these soils, is as under:

- Boulder – more than 300 mm

- Cobble – 80 mm to 300 mm
- Gravel- 4.75 mm to 80 mm
- Sand – 0.075 mm to 4.75 mm

When the given coarse soil contains less than 5% of fines (silt and clay sizes), it is analyzed by dry sieving; but when it contains fine soil exceeding 5%; it is analyzed wet sieving. Wetting is adopted to break the cohesive bond between fine soil particles and the coarse soil particles. Then the defined the soil particle size which is use for the road construction.

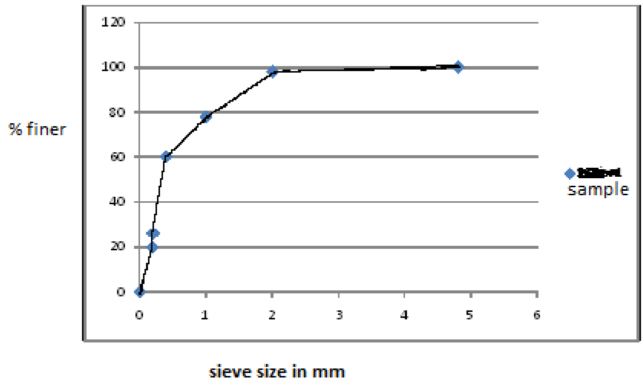
Fig.3: Sieve Analysis Apparatus

3.2. LABORATORY REPORT:

The soil properties of natural states are first of all determined the laboratory determination of soil properties are given below.
Weight of sample taken= 500 mg

Table 3.1: Contents of waste materials

Sieve size in mm	% finer
4.750	100
2.000	98.2
1.000	75.2
0.450	60.5
0.212	31.6
.150	18.9
.450	60
.212	31.6
.150	18.9
.075	4.5
Liquid limit	-
Plastic limit	-
Plastic index	Non plastic



4. Calculations:

From the above curve it is found that

$D_{60} = 0.421$ mm,
$D_{30} = 0.225$ mm
$D_{10} = 0.086$mm

Thus Cu and Cc can be calculated as

$$Cu = D_{60}/D_{10} \quad (1)$$

$$Cu = 0.421/0.086 = 4.89$$

$$Cc = (D30)2/ (D60 \times D10) \quad (2)$$

$$Cc = 0.2252/ (0.421X0.086)$$

$$Cc = 1.398$$

For the soil to be well graded, Cu > 6 and 1< Cc <3. The soil is not well graded. Hence soil cannot be SW-SM; it can be SP-SM.

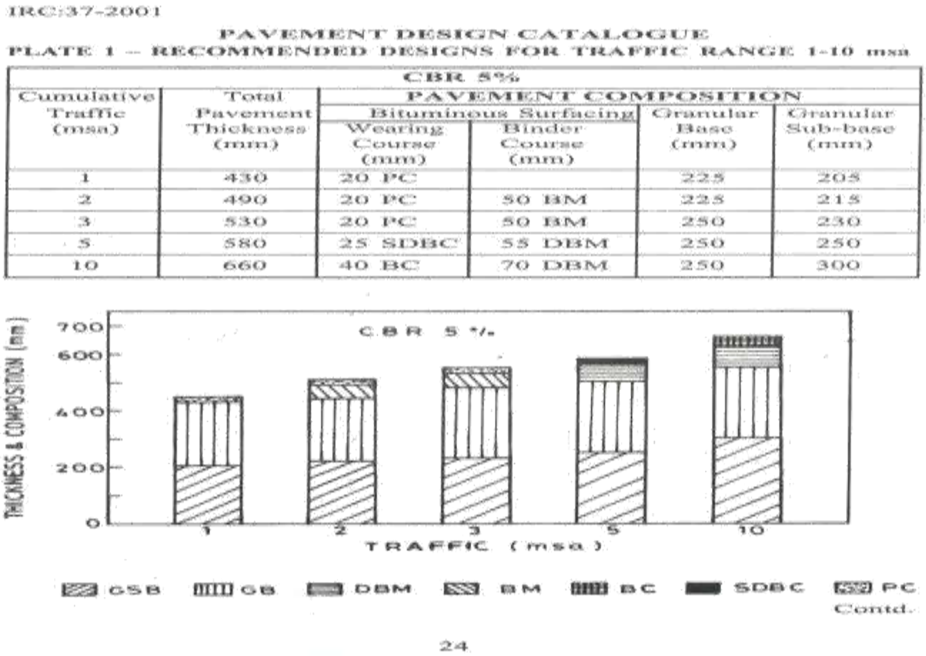
5. Pavement design for the stabilized soil

The flexible pavement is design for the soil stabilized by using domestic waste materials. The pavement is designed for the maximum CBR obtained in the above study. From the above experiment it is found that maximum CBR obtained is 8.9% at about 35% waste used in sub grade. However, let the design CBR be 8% considering some safety factor. The pavement is designed for the data obtained below:

- Double lane carriageway.
- Initial traffic in the year of completion of construction = 500 CV/day
- Traffic growth rate per annum = 8%
- Vehicle damage factor = 2.5 (standard axle per commercial vehicles)
- Lane distribution factor= 0.75 for single lane (clause 3.3.5.1)
- Design CBR = 8%
- Design life of pavement= 15 years

Putting the values in the equation we get
= 365x { 1 + 0.08 15 − 1} x 500x 075 x 2.5 0.08
=9.3 msa (million standard axles)

For this design traffic the total thickness of the pavement can be calculate from the chart given by IRC 37:2001The thickness for 9.3 msa at sub grade of CBR 8% is calculated as follows:


IRC:37-2001

PAVEMENT DESIGN CATALOGUE

PLATE 1 – RECOMMENDED DESIGNS FOR TRAFFIC RANGE 1-10 msa

CBR 5%

Cumulative Traffic (msa)	Total Pavement Thickness (mm)	PAVEMENT COMPOSITION			
		Bituminous Surfacing		Granular Base (mm)	Granular Sub-base (mm)
		Wearing Course (mm)	Binder Course (mm)		
1	430	20 PC		225	205
2	490	20 PC	50 BM	225	215
3	530	20 PC	50 BM	250	230
5	580	25 SDBC	55 DBM	250	250
10	660	40 BC	70 DBM	250	300

Fig.5: Grading of Soil Sample

6. Conclusions

The domestic waste production is becoming a great problem in our towns and cities. Most of the waste consists of garbage, plastics, tires, bottles, broken stones, clothes, etc. the disposal of these domestic waste materials are also creating problems and their safe disposal require huge capital loss to municipal bodies. Moreover indiscriminate dumping also causes many environmental problems. Use of these materials in road construction is also one of the solutions for this problem. As there is little improvement bearing capacity of sub grade due to using these materials as stabilizer we can control pollution to certain extend. There is also overall economy in road construction using this method, because we can save some quantity of pavement materials. This method of construction will help to reduce pollution as well as give economical road design. Hence the use of domestic waste materials in road construction can be advantageous and also the efficiency improves of 26.9%.

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