

USE OF PLASTIC WASTE IN ROAD CONSTRUCTION

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INTRODUCTION

- plastic waste - hazard to the environment.
- plastics waste - construction of **flexible pavement.**



Plastic Road At Thambaram (2007)

What is plastic??

A material that contains one or more organic polymers of large molecular weight, **solid in its finished state** and at some state while manufacturing or processing into finished articles, **can be shaped by its flow.**

- **Types of plastics**
 1. Thermosets.
 2. Elastomers.
 3. Thermoplastics.

NATURAL RESINS

- 1. solids or semi solid materials**
- 2. light yellow to darkbrown in colour**
- 3. carbon, hydrogen and oxygen.**
- 4. globules on the bark .**

SYNTHETIC RESINS

1. derived primarily from petroleum.
2. polystyrene, polyesters and acrylics
3. used in the manufacture of varnishes, plastics, adhesives and rubber.

Various Resins Of Plastic

- 1. Polyethylene terephthalate (PET,PETE)**
- 2. Density polyethylene(HDPE)**
- 3. Vinyl(Poly vinyl chloride or PVC)**
- 4. Low Density Polyethylene(LDPE)**
- 5. Polypropylene(PP)**

BASIC PROCESSES

- 1. Segregation .**
- 2. Cleaning process .**
- 3. Shredding process .**
- 4. Collection process .**

1. SEGREGATION

- plastic waste collected from various sources must be separated from other waste.
- Maximum thickness of 60 microns.



SEGREGATION PROCESS

2 cleaning process

- Plastic waste get cleaned and dried.



cleaning process

3 Shredding process

- will be shredded or cut into small piece.
- the different types of plastic wastes are mixed together



shredding process

4 Collection process

- the plastic waste retaining in 2.36 mm is collected.



collected plastic

FIELD TRIALS

- **There are two type of field trials**
 - 1.Dry process**
 - 2.Wet process**

1.DRY PROCESS

- The aggregate is heated to 170°C in the Mini hot Mix Plant .



Heated aggregates

- **the shredded plastic waste is added in equal proportion.**



Adding shredded plastic

- Immediately the hot Bitumen 60/70 or 80/100 grade (160°C) is added .



Aggregate-plastic- Bitumen Mix

- The mixture is transferred to the road and the road is laid.

2.Wet Process

- **Waste plastics by direct mixing with hot bitumen at 160°C**
- **Mechanical stirrer is needed**
- **Addition of stabilizers and proper cooling.**
- **Since the wet process require a lot of investment and bigger plants**
- **Not commonly used..**

CHARACTERIZATION OF WASTE PLASTICS

1 Binding property

- Plastic is a good binder.

% of plastic coating over aggregate	Compressive strength (MPa)	Bending strength (MPa)
10%	250	325
20%	270	335
30%	290	350
40%	320	390

BINDING PROPERTY

- 2 Thermal study

<i>Polymer</i>	<i>Solubility</i>		<i>Softening Temp in Deg.C</i>	<i>Products reported</i>	<i>Decomposition Temp Deg.C</i>	<i>Products reported</i>	<i>Ignition temp. range in Deg. C</i>	<i>Products reported</i>
	<i>Water</i>	<i>EPT*</i>						
PE	Nil	Nil	100-120	No gas	270-350	CH ₄ ,C ₂ H ₆	>700	CO,CO ₂
PP	Nil	Nil	140 - 160	No gas	270-300	C ₂ H ₆	>700	CO,CO ₂
PS	Nil	Nil	110-140	No gas	300-350	C ₆ H ₆	>700	CO,CO ₂

Thermal study

CHARACTERISTICS OF POLYMER MODIFIED BITUMEN

- that the **use of higher percentage of plastics** in polymer modified bitumen is not favorable.

<i>% of Plastics</i>	<i>Ductility (cm)</i>	<i>Penetration (mm)</i>	<i>Softening Point (°C)</i>
1%	64	95	54
2%	55	90	50
3%	20	80	50
5%	11	55	72
10%	7	Nil	75

CHARACTERISTICS OF PLASTIC COATED AGGREGATE

1 .Aggregate impact value

- plastics improves aggregate impact value.
- helps to improve the quality of flexible pavement

<i>Percentage of Plastics</i>	<i>Aggregate Impact value</i>
Nil	25.4
1%	21.20
2%	18.50

Aggregate impact value

2. Los Angel's Abrasion Test

- wear and tear values of plastic coated aggregate is found to be **decreasing** the percentage of plastics
- (Eg. 37% without plastic, 32% with 1% plastic and 29% with 2% plastic)

3. Soundness Test

- The plastic coated aggregate, did not show any weight loss, **improvement** in the quality of the aggregate.

ADVANTAGES OF PLASTIC ROAD

- **Use higher percentage of plastic waste.**
- **Reduce the need of bitumen by around 10%.**
- **Increase the strength and performance of the road.**
- **Reduce the cost to around Rs. 5000/Km. of single lane road.**
- **Generate jobs for rag pickers.**
- **Develop a technology, which is eco-friendly.**

DISADVANTAGES OF PLASTIC ROADS

1. Cleaning process

- Toxics present in the co-mingled plastic waste would start leaching.

2. During the road laying process

- But the presence of chlorine will definitely release noxious HCL gas.

3.After the road laying

- **The components of the road, once it has been laid, are not inert.**
- **It is opined that the first rain will trigger leaching. As the plastics will merely form a sticky layer, (mechanical abrasion).**
- **once the road is started to be used will cause the release of fine polymer particles.**
- **When air-borne, these will cause a particulate problem.**

CONCLUSION

- **Plastic will increase the melting point of the bitumen**
- **use of the innovative technology not only strengthened the road construction but also increased the road life**
- **Help to improve the environment .**
- **plastic road would be a boon for India's hot and extremely humid climate where durable and eco-friendly roads which will relieve the earth from all type of plastic waste**

REFERENCES

- Vasudevan .R, utilization of waste plastics for flexible pavement, Indian High Ways (Indian Road Congress), Vol.34, No.7. (July 2006).
- S.S.Verma,(2008),Roads from plastic waste, *The Indian Concrete Journal* ,pp.43-47
- Kajal , N K S Pundhir , Sangita and A Chandra(2007), Use of waste plastics and copper slag for low cost bituminous roads, *Journal Of Scientific and Industrial Research*,Vol.66.pp.938-994
- IRC, “Tentative Specifications for Bituminous Surface dressing Using Pre-coated Aggregates,” IRC: 48-1972, Indian Roads Congress
- ISI, “Indian Standards Specifications for Roads Tar”, IS: 215, Indian standard Institution

THANK

YOU