# 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**

| Polymer | Solubility | | Softening Temp in Deg.C | Products reported | Decom position Temp Deg.C | Products reported | Ignition temp. range in Deg. C | Products reported |
|---|---|---|---|---|---|---|---|---|
| | Water | EPT* | | | | | | |
| PE | Nil | Nil | 100-120 | No gas | 270-350 | $CH_4, C_2H_6$ | >700 | $CO, CO_2$ |
| PP | Nil | Nil | 140 - 160 | No gas | 270-300 | $C_2H_6$ | >700 | $CO, CO_2$ |
| PS | Nil | Nil | 110-140 | No gas | 300-350 | $C_6H_6$ | >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.**

| *% of Plastics* | *Ductility (cm)* | *Penetration (mm)* | *Softening Point (°c)* |
|---|---|---|---|
| 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

| *Percentage of Plastics* | *Aggregate Impact value* |
|---|---|
| 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 d 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 relive the earth from all type of plastic waste**

# REFERENCES


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# THANK

# YOU