



USE OF PLASTIC WASTES IN ROAD CONSTRUCTION

BY

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PROBLEMS DUE TO PLASTIC WASTE

1. Land Filling



2. Incineration



VARIOUS BITUMINOUS ROAD DEFECTS

1. Block Cracks
2. Crocodile Cracks
3. Diagonal Cracks
4. Slippage Cracks
5. Corrugations
6. Depression
7. Rutting
8. Shoving
9. Flushing
10. Polishing
11. Raveling
12. Delimitation
13. Potholes
14. Kerb Defects

SOLUTION



RAW MATERIALS FOR ROAD

CONSTRUCTION

- ❖ Aggregate
- ❖ Bitumen (Tar)
- ❖ Waste Plastics

ROAD AGGREGATE CHARACTERISTICS

Colour	Black > Grey > White
Strength	Need to be Good
Surface Roughness	More Preferred
Porosity	2% - Tolerance
Moisture Absorption	2% - Tolerance



BITUMEN CHARACTERISTICS

- ❖ Structure- long molecules
- ❖ Viscosity – not suitable beyond 160°C

PROCESS INVOLVED IN PRODUCING WASTE PLASTIC FLAKES



SEGREGATION .



CLEANING.



SHREDDING PROCESS



COLLECTION PROCESS

CHARACTERIZATION OF WASTE PLASTICS

❖ 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

❖ 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

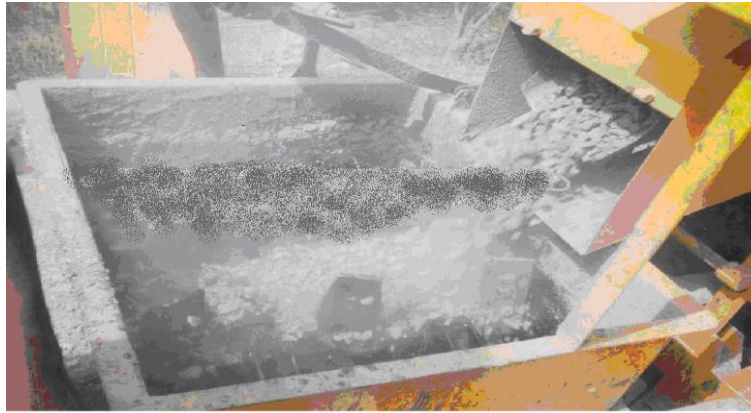
FIELD TRIALS

There are two type of field trials

1. Dry process

2. Wet process

DRY PROCESS



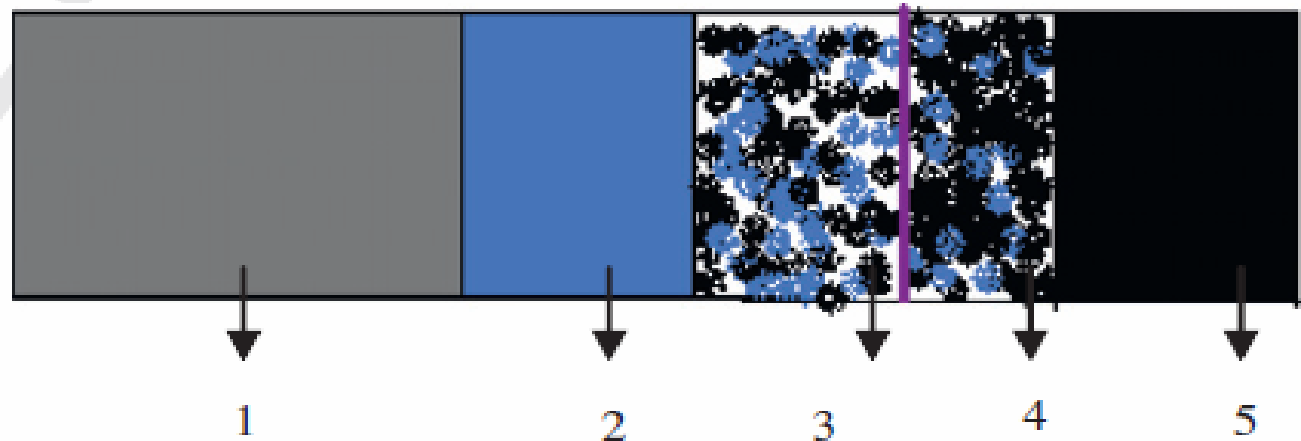
Heated aggregates



Adding shredded plastic



Aggregate-plastic- Bitumen Mix



Key: Black- Bitumen; Blue- Polymer; Grey - Aggregate

1. **Aggregate.**
2. **Area of Plastics bonded with aggregate (polymer **coating**).**
3. **Area of **bitumen-plastics** blend (due to diffusion between molten **plastics** and hot **bitumen**).**
4. **Area of Loosely bonded bitumen with dispersed **plastics**.**
5. **Area of Plain bitumen **layer**.**

CHARACTERISTICS OF POLYMER MODIFIED BITUMEN

- ❖ 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

- ❖ 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

COST BENEFIT ANALYSIS FOR ROAD CONSTRUCTION

MATERIAL NEEDED	MATERIAL NEEDED	PLASTIC-TAR ROAD
80/100 Bitumen	11250Kg	10125Kg
Plastic waste	NIL	1125Kg
Cost	Rs.393750	(BIT)Rs.354375+(plastic)Rs.13500 = Rs. 367875
Cost Reduced	NIL	Rs. 25875.00
Carbon Credit Achieved on avoiding burning of plastics	NIL	3.5tonnes

COMPARATIVE STUDY OF PERFORMANCE

TEST	BITUMEN ROAD	PLASTIC TAR ROAD	REASONING – PLASTIC TAR ROAD
Skid Resistance <65	More than the expected value 76	Within the limit 45	Not very smooth – supported by texture value
Sand Texture .6-.8	More depth 0.83	Less depth >0.6	Due to bonding- in permissible limit
Roughness 4000	More bumps 5200	Less Bump >4000	Better binding- less rutting and raveling
Benkelman beam 0.5-1	Rebound slightly High 1.55	Rebound Less 0.5-1	Supported by bonding base surface defect is taken care of by the plastic tar road
Density 2.86	Moderate 2.88	Moderate Value 2.55	Better binding

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
- ❖ Generate jobs for rag pickers.
- ❖ Develop a technology, which is eco-friendly.

DISADVANTAGES OF PLASTIC ROADS

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

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

CONCLUSION

- ❖ 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 plastic waste.



**THANK
YOU**