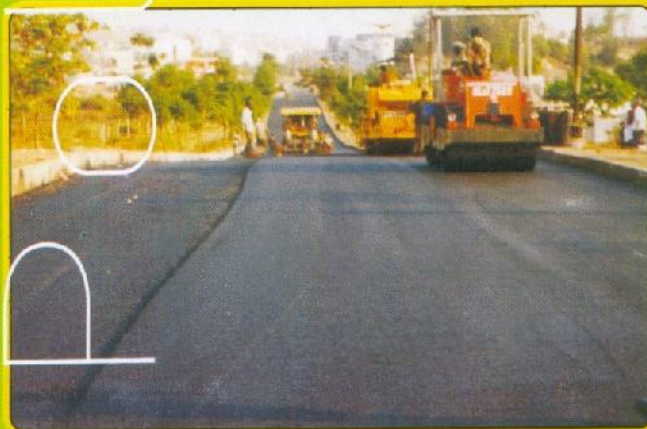


**A STEP TOWARDS
PERMANENT SOLUTION TO
PLASTIC WASTE MENACE
USING WASTE PLASTICS IN
ROAD CONSTRUCTIONS**

**GOING
TO
WASTE**



Waste plastics lead to civic problems



Ring Road in Bangalore being laid with plastic compounds

**FINDING
A
USE**

**Saves Environment
Increases Road Life
Creates Value to Scrap
Generates Employment**

The Product **"K K Poly Blend"**

"K K Poly Blend" is a polymer blend made out of littered plastic bags, PET bottles and thin film grade plastics. These are used for making a compound used for modifying bitumen that is used in the construction of roads. "K K Poly Blend" is a result of more than five years of research carried out by our company.

A couple of facts about "K K Poly Blend":

"K K Poly Blend" is cheaper than all existing bitumen modifiers

"K K Poly Blend" is the best binding agent for bitumen.

Reports on "K K Poly Blend":

There are three reports of esteemed institutions of the country on the utilization of waste plastics bags for the construction of roads. They are :

1. Utilization of Waste Plastic Carry Bags in Road Construction :
Report of Centre for Transportation Engineering (CTE),
Department of Civil Engineering Bangalore University.
2. Report of Central Road Research Institute (CRRI), New Delhi,
and
3. Field test report of Centre for Transportation Engineering
(CTE), Department of Civil Engineering Bangalore University.

The highlights of these reports are :-

- *The addition of "K K Poly Blend" to bituminous mixes increases the Marshall Stability and Flow values.
- *The compressive strength of the bituminous mix increases with the addition of "K K Poly Blend".
- *The fatigue life and indirect tensile strength values increases by a factor of three times with the addition of 8% "K K Poly Blend" to the bituminous concrete mix.

From the laboratory and field studies it has been found that with the usage of processed plastics in bituminous mixes, the life of the pavement will be enhanced by 2-3 times with the addition of 8% plastic modifier.

Soaked Test Results of Bituminous Mixes with and without bitumen modifier

Property Tested	Type of Modifier							
	Plain Bitumen		Processed Waste Plastic Bags		Crumb Rubber		EVA Polymer Modified Bitumen	
	Unsoaked	soaked	Unsoaked	soaked	Unsoaked	soaked	Unsoaked	soaked
Percent of Modifier Added	0	0	8.0	8.0	12.0	12.0	5.0	5.0
Optimum Bitumen Content (OBC) (1%)	5.0	5.0	4.6	4.6	5.0	5.0	5.0	5.0
Marshall Stability (Kg)	1135	994	1968	1791	1483	1318	1756	1591
Flow Value (mm)	2.35	2.71	3.85	4.14	3.63	3.90	3.71	4.19
Bulk Density (Gm / cc)	2.33	2.33	2.35	2.35	2.33	2.30	2.35	2.34
Volume of voids Vv (%)	4.51	4.42	3.81	3.89	4.12	4.11	3.91	3.86
Percentage Index of Retained Strength	87		91		88		90	

The Field Studies on Plastic Modified Bituminous Pavements

Bituminous overlay with and without plastics modifier was constructed on (1) a stretch of road leading through Rajarajeshwari Gate from Mysore Road, (2) on Tavarekere Road in Magadi Taluk, and (3) K M Doddi Road, about 100 Km from Bangalore. Structural evaluation was carried out before and overlay constructed by Benkleman Beam deflection test and functional evaluation was done by using Multiple Wheel Unevenness Integrator.

Table 1

Field studies conducted at Rajarajeshwari Gate in Bangalore City for 40 mm thick bituminous concrete overlay

Property	Without Plastics			With Plastics		
	Time (months)			Time (months)		
	0	4	8	0	4	8
Deflection Before Overlay (mm)	1.130	-	-	1.130	-	-
Deflection After Overlay (mm)	-	0.856	1.011	-	0.786	0.843
Unevenness (mm / Km)	2914	2346	2788	2914	2287	2541

Table 2

Field studies conducted at Tavarekere Road, Bangalore Rural, for 25 mm thick bituminous concrete overlay

	Without Plastics			With Plastics		
	Time (months)			Time (months)		
	0	4	8	0	4	8
Deflection Before Overlay (mm)	1.891	-	-	1.891	-	-
Deflection After Overlay (mm)	-	0.998	1.061	-	0.788	0.902
Unevenness (mm / Km)	2978	2456	2514	2978	2268	2411

Table 3

Field studies conducted at K.M. Doddi Road, about 100 Km from Bangalore City Rural, for 20 mm thick Pre Mix Carpet (PMC) overlay

	Without Plastics			With Plastics		
	Time (months)			Time (months)		
	0	7	14	0	7	14
Deflection Before Overlay (mm)	1.11	-	-	1.11	-	-
Deflection After Overlay (mm)	-	0.846	1.159	-	0.748	0.946
Unevenness (mm / Km)	3120	2789	3246	3120	2346	2678

Initial Demonstrations, Performance and Advantage

In the year 2003, as pilot project, 40 Km of roads were laid using waste plastics by Bangalore City Corporation. 2 years later on finding visible improvements in the road performance, the authorities placed order for 530 Km and in 2006 the Bangalore City Corporation is covering whole Bangalore City using waste plastic on a road network of 1,000 Km.

Awards :

- *CRISIL Awards for Excellence in Municipal Initiatives for the year 2004 - 2005.
- *Best Practices Award for 2004 - 2005 by the Govt. of Karnataka.
- *Appreciation by U.N. Habitat for Best Practices.

Environmental Problems due to littering of waste plastic carry bags

Huge quantities of Municipal Solid Waste (MSW) is generated in the country which contains iron, wood, building materials, glass, etc. Most of these are picked up as they fetch money for the rag pickers. The negligible benefit for picking up plastic bags does not motivate the rag pickers. Most of the leftover organic garbage becomes useless as it contains non-biodegradable plastic materials. At present only about 20% of MSW is converted into compost which is sold to farmers for agricultural purpose. If plastic is segregated, the remaining MSW can also be converted into excellent quality organic manure and given to farmers who in turn will use it for agriculture. Animals tend to eat the food found in dustbins that are thrown away in plastic bags as most of these bags are colored attractively and contain leftover food. This will be avoided altogether.

Solutions and Benefits

1. An eyesore is removed from the public view and this will result in keeping the city clean, tidy and without littered plastics.
2. From the laboratory and field studies, it was found that, with the usage of processed plastics in bituminous mixes, the life of the pavement can be enhanced by 2 to 3 times with the addition of 8% plastics modifier.
3. Rag pickers will be benefitted financially as they can earn a living by selling the collected littered plastic bags.
4. Employment opportunities are created for a large number of people both directly and indirectly.
5. Many food borne and water borne diseases will be reduced because of less accumulation of leftover food wastes.
6. Littered plastic bags separated from M S W are converted into plastic compound giving the waste plastic bags an economic value.
7. The remaining MSW can be converted into compost that can be sold to farmers as organic manure. This results in :
 - (i) Reduction of dependence on chemical fertilizers whose large scale usage degrades the soil, and
 - (ii) Conservation of water needed for farming (about 10 to 20% less water is needed when organic manures are used)
8. Compost made from remaining MSW would be of excellent quality and free of plastic bags.
9. By converting waste into energy and fuel, additional revenue can be realized as spin-off benefit.

'Plastic waste can be used to ensure road durability'

By Afshan Yasmeen

BANGALORE, JUNE 8. Did you know that plastic waste, especially the non-biodegradable kind, is precious? Yes, it can be used to increase the durability of roads.

The Bangalore Mahanagara Palike (BMP), which has initiated recycling of dry waste as part of its new cleanliness campaign, is also "seriously examining" a proposal for using plastic waste to asphalt roads.

A City-based firm, KK Plastic Waste Management Pvt. Ltd., and a team of engineering experts, led by C.E.G. Justo from Bangalore University, have developed a new way of using such waste for road reconstruction.

On a pilot basis, the firm has already laid over 35 km of roads here, and experts from Bangalore University Centre for Transportation Engineering have tested the strength and durability of the roads. The Central Road Research Institute has evaluated the experiment, and the results are "encouraging," according to the Mahanagara Palike Commissioner, M.R. Srinivas Murthy.

The firm had submitted a proposal to the Mahanagara Palike to sell its patented plastic waste compound, "KK Polyblend", for asphaltting roads, Mr. Murthy told *The Hindu* here on Sunday.

He said that the firm would be allowed to take plastic waste from the City's daily garbage collection.

K.Ahmed Khan and K.Rasool Khan, proprietors of the firm, claim to be pioneers of the technology in India. "It has been used in Canada, Brazil, etc, but we are the first to use it in India," they said.

Procedure

According to them, melted plastic is mixed with bitumen in



Plastic waste... ready for use.



A road asphalted with the new technology.

a particular ratio. The plastic acts as a strong "binding agent" for tar, making the asphalt last longer. A stretch of road made with plastic waste mix is found to be three times better than conventional roads.

The company buys plastic waste from rag pickers at Rs.8 per kg. It is then segregated, pulverised and added to bituminous concrete mixes in a blender designed by the company.

They say the technology will lead to less road repair. Rain-water will not seep through because of the plastic in the tar. And as each km of road with an average width requires over two

tonnes of polyblend, using plastic will help reduce non-biodegradable waste, they said.

Study

In 1997, a team of students at the RV College of Engineering did a study and used the polyblend to fill potholes on RV Road. Prof. Justo and A.Veeraraghavan from the Centre for Transportation Engineering reviewed it.

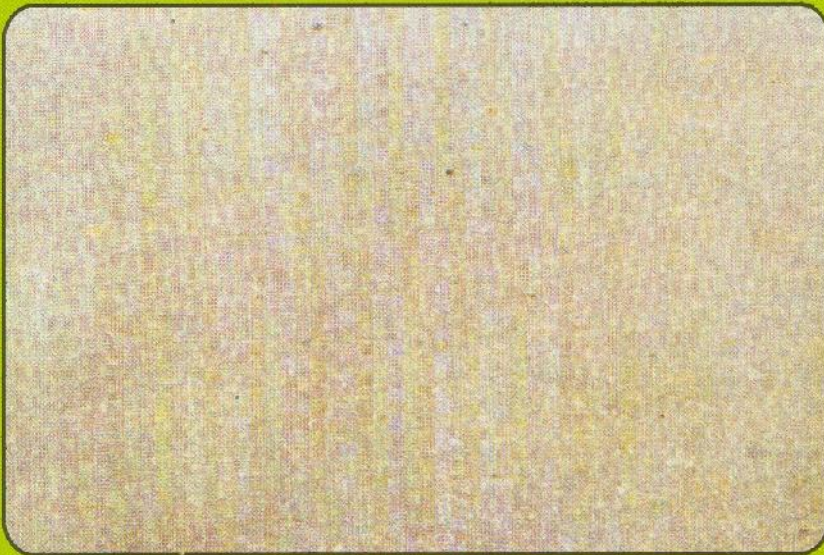
They noted that using processed plastic in bitumen reduced the amount of bitumen and increased road life, roughly, three times. But such roads cost more than conventional ones.

Press release in "The Hindu" dtd. June 9, 2003 and a few other press coverages

Comparative illustration of the effect of using plastic compounds in road constructed at same time and adjacent to the one without plastic compounds at Bangalore (Pictures taken after eighteen months)



Picture of road laid without plastic compounds



Picture of road laid with plastic compounds

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