



# Recycled Roads

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**Team Iceland: Amanda Heath, Rohit Panjala, and David Van de Water**

# Background

- Ahmed Khan is trying to solve two of India's biggest problems<sup>1</sup>
- His company is trying to solve both of these problems by using recycled plastic as road material<sup>1</sup>
- India was not prepared to handle the increase in plastic waste that began in the 1980's<sup>1</sup>



<sup>1</sup> Khullar, Mridu. "Plastic Roads Offer Greener Way to Travel in India." *The New York Times*. The New York Times, 13 Nov. 2009. Web. 27 Sept. 2015. <[http://www.nytimes.com/2009/11/14/business/global/14plastic.html?\\_r=0](http://www.nytimes.com/2009/11/14/business/global/14plastic.html?_r=0)>.  
Tim Kelley photographer:[http://timkellyphotography.com/wp-content/uploads/2012/09/At-the-beach\(pp\\_w800\\_h533\).jpg](http://timkellyphotography.com/wp-content/uploads/2012/09/At-the-beach(pp_w800_h533).jpg)

# Background

- Waste plastic is mixed with asphalt to form a polymerized bitumen<sup>1</sup>
- Polymer mixture consists of materials found in plastic water bottles<sup>1</sup>



# Relevant History

- India
  - Plastic waste on beaches
  - Accumulated for years
  - Plastics can last up to a thousand years



Surfing India  
<http://www.surfingindia.net/files/surf-files/u5/ChildOnTrashedBeach.jpg>



# Relevant History

- Khan brothers
  - Determined right ratio of bitumen to plastic <sup>1</sup>
- Lockheed Martin's Bridge
  - No steel corrosion <sup>2</sup>
  - Can carry equivalent loads as regular bridges<sup>2</sup>
  - Faster maintenance <sup>2</sup>

<sup>1</sup> Rustad, Harley. "Plastic roads: as India's waste problem piles ever higher, one manufacturer has devised a novel use for its discarded product--roads made from plastic bags." *Geographical* May 2015: 50+. *Academic OneFile*. Web. 29 Sept. 2015.

<sup>2</sup>Aref, A.J, and I.D Parsons. "Design and Performance of a Modular Fiber Reinforced Plastic Bridge." *Composites Part B: Engineering*. 31 (2000): 619-628. Print.



Chennai Pista

<http://www.chennaipista.com/wp-content/uploads/2013/12/plastic.jpg>

# Significance

- India's beaches are getting polluted with plastic waste from the oceans
  - 60-80% of marine debris consists of plastic <sup>1</sup>
  - Plastics are durable <sup>1</sup>
  - Affects certain cities more <sup>2</sup>
- Plastic is also affecting wildlife and domestic animals
  - 3000 Cows died in Lucknow, India after eating plastic <sup>2</sup>
  - Absorb toxins which can damage organisms nearby <sup>2</sup>

<sup>1</sup> Jayasiri, H B, C S. Purushothaman, and A Vennila. (2013) "Plastic Litter Accumulation on High-Water Strandline of Urban Beaches in Mumbai, India."

<sup>2</sup> Khullar, Mridu. (2009) "Plastic Roads Offer Greener Way to Travel in India."

# Significance

- Plastic roads alone cannot fix this problem, but it can help remove some excess plastic waste



# Current State

- Bitumen aging is the main factor leading to road deterioration
  - These properties improved when plastic was added <sup>1</sup>
- Research is still being done for cost efficiency <sup>1</sup>
  - Is it better for the long term?
- Plastic-Modified bridges have also started making their way to India
  - Many of these exist in the US and England <sup>2</sup>



Fibercore Europe

<http://www.archiexpo.com/prod/fibercore-europe/product-146011-1554723.html>

<sup>1</sup> Kumar, Praveen, and Rashi Garg. (2011) "Rheology of Waste Plastic Fibre-Modified Bitumen."

<sup>1</sup> Aref, A.J, and I.D Parsons. (2000) "Design and Performance of a Modular Fiber Reinforced Plastic Bridge."



# Challenges of Current State

- Plastic collection
- Implementation
- Increase average cost of pavement by 9.91%<sup>1</sup>

1 Kumar, Praveen, and Rashi Garg. "Rheology of Waste Plastic Fibre-Modified Bitumen." *International Journal of Pavement Engineering* 12.5 (2011): 449-459. Print.

## ■ Plastic instead of bitumen will help roads last longer and without potholes TN to get 300-km plastic roads

PRAMILA KRISHNAN | DC  
CHENNAI, NOV. 19

Fed up with potholes on your roads? There could be a solution in sight. If all goes according to plans, some 300 km of roads in Tamil Nadu will get long lasting plastic coating under a ₹50 crore project of the state government.

"The idea is to use plastic instead of bitumen as not only will such roads last longer, but they will be free of potholes also," says an officer of the state environment department, which has drawn up the project.

To begin with plastic waste will be collected using the services of SHGs from both domestic and industrial consumers, and then recycled for road topping. The results of previous experiments with plastic-topped roads give reason for hope. One such road laid in 2002 on Jambulingam street off busy Nungambakkam in Chennai is still in good shape and the people here couldn't be happier.

T.M. Suganthi, who lives



Jambulingam Street in Nungambakkam has been without potholes for the last nine years. It was re-laid with a plastic coating a decade ago.

—DC

If all the roads in our city are laid with plastic, like this road, driving in Chennai will not be such a nightmare

— T.M. Suganthi  
resident of Jambulingam St

college, in Madurai, R. Vasudevan, who introduced the technology for laying roads using plastic waste in the state, says several private firms and resorts in Tamil Nadu have already opted for plastic-coated roads for longevity. "Also, we have started a project of collecting plastic waste with the help of more than 20,000 school children for roads in Madurai. When the plastic waste is collected from homes, it doesn't need to go to the landfills, making garbage disposal that much easier," he says.

on the street, says the road is still free of potholes. "If all the roads in our city are laid with plastic, driving in Chennai will not be such a nightmare," she adds.

The government's deci-

sion is, however, based on the durability of the plastic roads laid over 1,200 km in the period 2002-07 in various districts of Tamil Nadu. Satisfied with their condition, the AIADMK government decided to go

in for more plastic-topped roads to both protect the environment and provide good roads, in the revised budget for 2011-12.

Head of the chemistry department of the Thyagaraja engineering

News For Us

[https://newsforus.files.wordpress.com/2011/11/20\\_11\\_2011\\_002\\_014-plastic-roads.jpg](https://newsforus.files.wordpress.com/2011/11/20_11_2011_002_014-plastic-roads.jpg)

# Challenges of Current State

- Industry for maintaining regular roads worth 350 billion rupees a year <sup>1</sup>
- Adopting new technologies too rapidly
- Internal feud among companies and corruption
- Environmentalists believe in enforcing policy to reduce plastic <sup>2</sup>



Manipal World News  
<http://manipalworldnews.com/wp-content/uploads/2013/09/064.jpg>

<sup>1</sup> Khullar, Mridu. "Plastic Roads Offer Greener Way to Travel in India." *The New York Times*. The New York Times, 13 Nov. 2009. Web. 27 Sept. 2015. <[http://www.nytimes.com/2009/11/14/business/global/14plastic.html?\\_r=0](http://www.nytimes.com/2009/11/14/business/global/14plastic.html?_r=0)>.

<sup>2</sup> Khullar, Mridu. "Plastic Roads Offer Greener Way to Travel in India." *The New York Times*. The New York Times, 13 Nov. 2009. Web. 27 Sept. 2015. <[http://www.nytimes.com/2009/11/14/business/global/14plastic.html?\\_r=0](http://www.nytimes.com/2009/11/14/business/global/14plastic.html?_r=0)>.

# Future of Plastic Roads

- Mixture of PET is stiffer and more stable than the original asphalt solutions<sup>1</sup>
- Materials bring benefits to highway construction, from longer lasting roads to decrease in maintenance cost<sup>3</sup>
- Slowly growing industry<sup>3</sup>



1 Ahmadinia, E, M Zargar, M.R Karim, M Abdelaziz, and P Shafiqh. "Using Waste Plastic Bottles As Additive for Stone Mastic Asphalt." *Materials and Design*. 32.10 (2011): 4844-4849. Print.

2 Kumar, Praveen, and Rashi Garg. "Rheology of Waste Plastic Fibre-Modified Bitumen." *International Journal of Pavement Engineering*. 12.5 (2011): 449-459. Print.

3 Khullar, Mridu. "Plastic Roads Offer Greener Way to Travel in India." *New York Times* 13 Nov. 2009. Web

India Civic <http://indiaticv.com/savenature/jusco-plastic-road-future/>

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**The End :)**