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An Analysis of Plastic Reuse Strategies for Road Construction in Bihar for a Sustainable Society

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Abstract
Plastic waste poses a significant threat to the environment. On average, a person uses about 45 kg of plastic annually. Since plastics are non-biodegradable, they take a very long time to decompose naturally. The frequent use of plastics in our society harms soil fertility, clogs drainage systems, and causes many other problems. Managing plastic waste disposal is a major challenge today. Reusing plastic waste can address this critical issue. The Bihar Government has launched a project to build durable, water-resistant roads using single-use plastic waste under the Lohia Swachh Bihar Abhiyan, which emphasizes systematic waste collection and management. Through this program, single-use plastic waste is collected door-to-door from rural households and sent to a plastic waste management unit, where it is used in road construction. This research paper aims to analyze the government-led initiative to incorporate waste plastic into road construction in Bihar. India.

Keywords: *Single-use Plastic, Sustainable Society, Road Construction, Lohia Swachh Bihar Abhiyan*

1. Introduction
Plastics have become an integral part of our day-to-day lives. Its non- biodegradable nature creates a problem in managing the plastic waste. An overpopulated country like India and a state like Bihar are facing several challenges in developing measures to manage the increasing heaps of plastic waste in the environment. The reuse and recycling of plastic waste is the only option for policymakers to handle the increasing amount of accumulating plastic waste. Mismanagement of plastic waste and its improper disposal in the environment can lead to hazardous effects on public health and the health of animals in our vicinity. Statement of the problem: The Federation of Indian Chambers of Commerce & Industry reported that around 43 percent of the plastic waste comprises single- use plastics and packaging materials. Further, it reported that 80 percent of the total production of plastics is discarded and does not undergo a proper process of treatment before disposal. People are disposing of it in a very unethical manner like burning it and creating hazardous chemical in the air contributing to air pollution; it also ends up in landfills; disposed plastics are left to flow in the drain causing clogs in the drainage systems. Animals are eating plastics which are thrown on the streets leading to suffer them with several kinds of diseases. In the agricultural cultivable field plastics are causing a major concern which obstructs the proper cultivation in the field. [1] As per the report of the Ministry of Environment, Forest and Climate Change, India has generated 4.14 million tonnes in the Year 2022-23. However, more recent estimates in 2024–2025 suggest a much higher annual generation of around 9.3 million tonnes. Plastic waste generation has tripled over the last seven years, rising by 23% over the past five years. Only about a quarter to 14% of the waste is recycled, with significant amounts managed by the informal sector or disposed of improperly shown in Table 1. [2]

Table 1: Source Ministry of Environment, Forest and Climate Change, Government of India 2024.

India's plastic waste generation	
Financial year (April-March)	**Volume (million tonnes)**
2022-23	4.14

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2021-22	3.90
2020-21	4.13
2019-20	3.47
2018-19	3.36
2017-18	2.66
2016-17	1.57

2. Literature Review

Ogundana K. Ayodeji (2023) found in his study that there are several benefits of plastic waste in constructing roads and other building structures, contributing to sustainability in the circular economy of a nation in many of the advanced countries of the world. [4] Trimbakwala et al. (2017) have highlighted that the durability of the roads laid out with shredded plastic waste is much higher compared with roads with asphalt with the ordinary mix. It not only strengthened the road construction but also sustainably increased the road life.[5] Karwadiya, et al. 2025) have mentioned that there are more than 21,000 miles of plastic roads in India and for every km of road (3.75 m width), 1 tonne of plastic (10,00,000 carry bags) is used for every tonne of bitumen that is saved. This serves to mitigate plastic waste management significantly and also ensures the conservation of petrochemical resources.[6] Kumari, K. (2024) has analysed the existing waste collection system and the waste disposal practices in Patna town of Bihar. She has mentioned that there are opportunities in the area of solid waste management that have yet to be explored properly. [7]

3. Methodology

This research paper is based on the secondary data collected from government reports, the Economic Survey of Bihar, journals, and periodicals. Inferences have been made based on collected information and then the researcher has interpreted the information from various perspectives.

4. Objectives

This study aims to analyze the government-led initiative to incorporate waste plastic into road construction in Bihar. It attempts to evaluate existing plastic-based road construction practices in Bihar. The objective of the study is to identify and analyse policies and institutional factors towards plastic-based road construction in the State. It further aims to suggest policies, community engagement methods and strategies to improve the sustainability and effectiveness of plastic waste management practices for road construction.

5. Discussion

5.1 Government Initiatives: Policy Measures

To mitigate the problem of rising plastic waste in our environment, the Government of India announced that the use of plastic waste is mandatory in road construction. In the year 2015, the government made it mandatory to use waste plastic with bituminous mixes for road construction to overcome the growing problem of disposal of plastic waste in the Indian economy. The policy states that roads constructed within 50 kilometers of the periphery of any city with a population of over 500,000 must use a 'plastic mix'. These roads, made of a plastic mix, are cheaper than the conventional methods of road construction, which use 100 percent bitumen. Roads made by plastic mix are more durable and cost -effective. It helps improve environmental sustainability as it contributes to the circular economy. [8] As plastic and bitumen are both petroleum products, they bond well together. This combination enhances the road's capacity to carry weight. These roads show greater resistance against the damage caused by heavy rains. Plastic-mixed roads are helpful in reducing the input cost of production in road construction for each kilometer of road length. At the same time, urban local bodies have an opportunity to increase their financial resources by selling plastic waste to contractors of road construction.

5.2 Methods of using waste plastic in road construction

There are two processes for the addition of waste plastic to bituminous mixes in road construction.

- Dry Process
- Wet Process

Dry Process- The simplest process to utilize plastic in road construction is by using the "dry-processed approach, where the plastic element is added to the bitumen before it is mixed into the aggregate. Plastic waste is first segregated (except chlorinated/brominated plastic waste) and then shredded to a particular size. The cleaned Plastic waste is cut into a size such that it passes through 2.36 mm sieve using a shredding machine. The shredded

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plastic waste is then added to the aggregate, and the bitumen is heated to 160 °C to ensure good adhesion. This process is being used in National Highway (NH) projects. This has become the norm adopted in rural road construction under the PMGSY. Tamil Nadu was the first state to initiate trials on this material in the early 2000s. The experience and track records collected from these trials led to the development of a national guideline and standard protocol. Under the Pradhan Mantri Gram Sadhak Yojana (PMGSY), several implementing state-level agencies have utilized plastic waste as alternative road construction materials in various ways shown in Figure 1.[9]

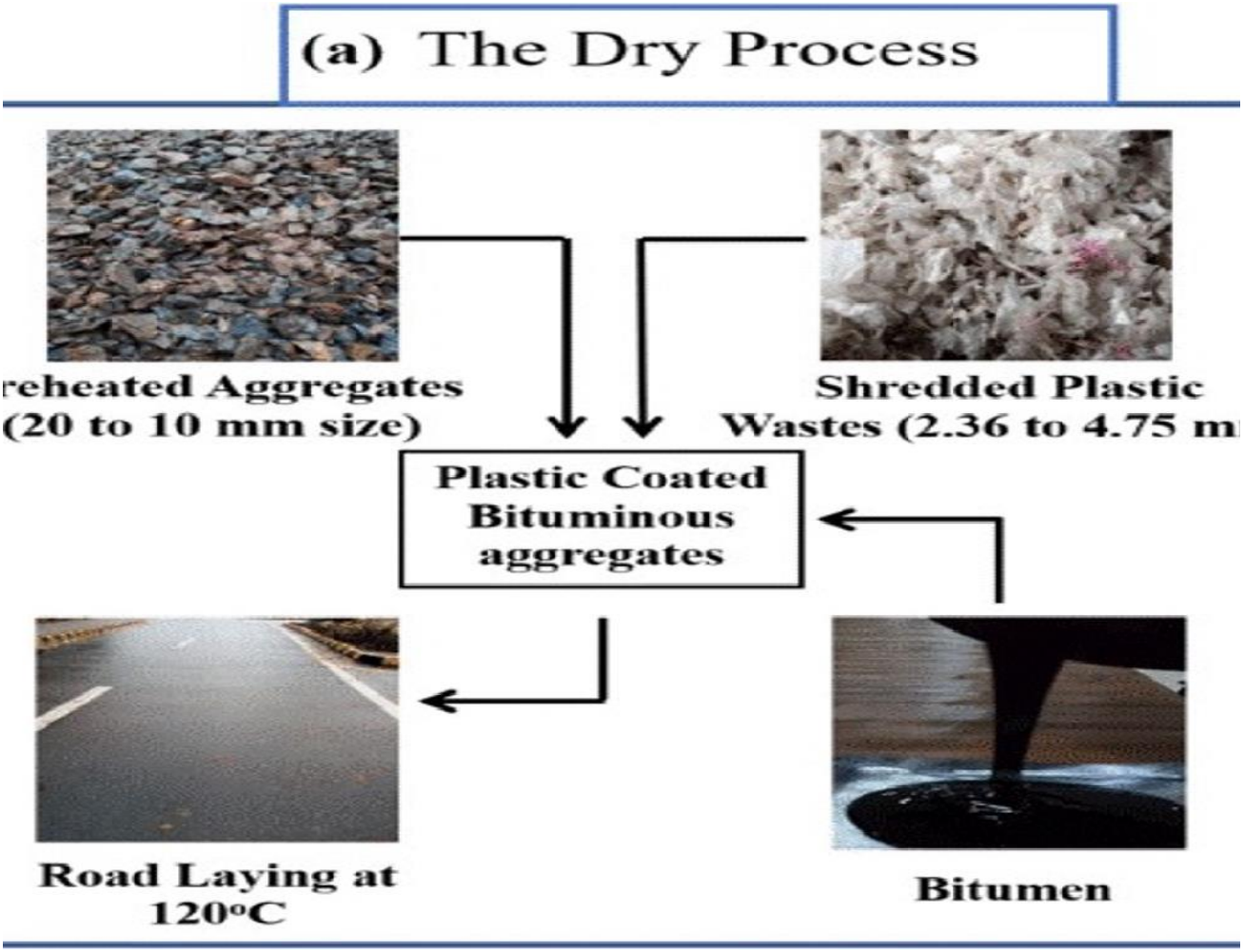

Figure 1 The Dry Process

Precautions should be taken during the road construction with pastic mix with bitumen. A safety mask should be provided to the workers engaged in the process. Oversized plastic should be removed from the mixture. Waste plastic, when heated to high temperature causes pollution in the air and microplastic pollution through runoff water, contaminating soil and water bodies, and the environment. Precautionary measures should be taken to ensure strict temperature control during mixing.[10] The length of roads constructed using waste plastic under various verticals of Pradhan Mantri Gram Sadak Yojana (PMGSY) during the last five years is given below:

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Table 2 Construction of roads using plastic wastes. Source: Ministry of Rural Development 2026

Year	Length of road constructed using waste plastic (in km)
2020-21	3133
2021-22	8848
2022-23 Year	6382 Length of road constructed using waste plastic (in km)
2023-24	5241
2024-25	4061
2025-26 (Till 13.08.25)	2058

5.3 Road construction in Bihar using 'plastic mix.'

There has been a significant expansion of rural infrastructural facilities in recent years. Rural electrification, Har Ghar Nal Ka Jal Yojna, and construction of roads on a massive scale have enabled our villagers to have access to roads, electricity, and safe drinking water in most of the villages of Bihar. There is a notable development in the highway infrastructure; around 90 percent of the National Highways in Bihar are now double-lane or wider. During the last 5 years, the construction of more than 850 kilometres of 4-lane highways has improved the urban-rural connectivity significantly. [12] Recently, Bihar has taken several initiatives in road construction, using plastic mix to mitigate the problem of plastic waste. Under the Lohia Swachh Bihar Abhiyan, the state has constructed 10.5 kilometres of roads by reusing nearly eight tonnes of single-use plastic in three districts -- Purnea, Katihar and Aurangabad. The initiative aims to reduce plastic pollution while strengthening rural connectivity. Under this scheme, plastic waste is collected door to door from the households of the villages and then processed at designated waste management units, shredded, and then mixed with bitumen before being used in road construction. This technique helps improve road durability, especially in waterlogged areas of Bihar, and makes roads more resistant to wear and tear compared to conventional methods. The rural development department plans to expand the model to other districts in the coming months, citing positive results from the pilot phase. State officials have described the project as a dual-benefit solution that promotes environmental protection and sustainable development shown in Figure 2.[12]

Figure 2 Details

Figure 2 Newly Constructed 'Plastic Mix' Roads in Bihar
Source: https://patnapress.com/bihar-plastic-waste-rural-roads-10-km [14]

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5.4 Advantages of roads constructed using waste plastics

Utilization of waste plastic in bituminous mixes has proved that the properties of the mix are improved and disposal problems are also solved to some extent. The use of this innovative technology will not only strengthen road construction but also increase the road life and help to reduce environmental pollution.[15] Roads constructed with waste plastics are stronger and more durable. It gives the best protection to the road due to the prevention of stagnant water on the road. Plastic roads do not have potholes or strips on them. The roads constructed with plastics have adequate binding and excellent bonding compared to conventional roads with normal asphalt. There is a reduction in the pores of the aggregates, which reduces rutting as well as raveling. There are no radiating effect has strong reliability in terms of strength. Integration of plastic waste particles as a modifier to the asphalt and bitumen was observed to provide better results in road construction. Polymer roads proved to be durable with fewer potholes and edge flaws as reported by the CPCB, thus receiving support from scientists and policymakers in India. Jambulingam Street in Chennai was one of India's first plastic roads built in 2002. In 2016, the National Rural Road Development Agency laid around 7,500 km of roads using plastic waste. Today, there are more than 21,000 miles of plastic roads in India and for every km of road (3.75 m width), 1 tonne of plastic (10,00,000 carry bags) is used for every tonne of bitumen that is saved. This serves to mitigate plastic waste management considerably and also ensures petrochemical resource conservation.

Conclusion

The study concludes that the reuse of plastic waste in road construction in Bihar presents a practical and sustainable solution to the growing problem of plastic disposal. Plastic-modified roads demonstrate improved durability, strength, and resistance to water damage compared to conventional roads. The approach also offers economic advantages by reducing maintenance costs and landfill burden. With proper policy support and monitoring, plastic waste reuse strategies can significantly contribute to sustainable infrastructure development in Bihar. It can be inferred that plastic wastes have several advantages in the construction of roads, with the potential to bring sustainability to the circular economy of an economic system. The model of road construction that has been implemented by the government of Bihar in three districts of Bihar- Purnea, Katihar and Aurangabad under the Lohia Swachh Bihar Abhiyan is a welcome step and should be replicated in other parts of the State.

References

[1]. Bansal, S., Kushwah, S. S., Garg, A., & Sharma, K. (2023). Utilization of plastic waste in construction industry in India – A review. Materials Today: Proceedings. https://doi.org/10.1016/j.matpr.2023.03.693
[2]. Ministry of Environment, Forest and Climate Change. (2024). Plastic waste management in India. Government of India.
[3]. http://timesofindia.indiatimes.com/articleshow/100747501.cms?utm_source=contentofinterest&utm_medium=text&utm_campaign=cppst
[4]. Ogundana, A. K. (2023). Waste plastic in road construction: Pathway to a sustainable circular economy—A review. E3S Web of Conferences, 391, 01116. https://doi.org/10.1051/e3sconf/202339101116
[5]. Trimbakwala, A. (2017). Plastic roads: Use of waste plastic in road construction. International Journal of Scientific and Research Publications, 7(4), 137–142.
[6]. Karwadiya, J., Kerketta, A. R., Pathak, S. K., Srivastava, S., & Darbha, G. K. (2025). Agronomic practices and road proximity drive plastic pollution in agricultural soils: Insights from Bihar, India on weathering, elemental association, and ecological risk. Environmental Pollution, 384, 126975. https://doi.org/10.1016/j.envpol.2025.126975

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[7]. Kumari, K. (2024). Recent trends in municipal solid waste management in Patna: A review. International Journal of Innovations in Science Engineering and Management, 3(Special Issue), 146–151.
[8]. Shrivastava, O. P. (2024, February 17). Use of waste plastic in road construction [Presentation]. Ministry of Road Transport and Highways, Government of India.
[9]. Heriawan, A. (2020, March). Upcycling plastic waste for rural road construction in India: An alternative solution to technical challenges (ADB South Asia Working Paper Series No. 69). Asian Development Bank. https://www.adb.org/publications/upcycling-plastic-waste-rural-road-construction-india
[10]. Shrivastava, O. P. (2024, February 17). Use of waste plastic in road construction . Ministry of Road Transport and Highways, Government of India.
[11]. Ministry of Rural Development. (n.d.). Rural development initiatives in India. Government of India.
[12]. Press Information Bureau. (2025, August 22). Building a connected and prosperous Bihar. Government of India.
[13]. Newsbrief. (2026, February 5). Bihar turns plastic waste into durable rural roads across three districts. https://newsbrief.in/article/1770296513-3MNdEKk1Ew4eybBihar-Turns-Plastic-Waste-into-Durable-Rural-Roads-Across-Three-https://patnapress.com/bihar-plastic-waste-rural-roads-10-km
[14]. Rajput, P. S., & Yadav, R. K. (2016). Use of plastic waste in bituminous road construction. IJSTE – International Journal of Science Technology & Engineering, 2(10), 509–512.