

# Feasibility of Flexible Pavements by use of Plastic

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**Abstract**— The utilization of plastic and related materials is expanding exponentially because of huge development in the populace, urbanization and a changed way of life prompts to far reach littering of plastic on the scene. Transfer of waste plastic is a major issue all around because of their non-biodegradability and perilous to human wellbeing, following these is not arranged logically and in this way, make ground and water contamination. In the event that this condemnation of humankind as waste plastic is utilized as a shelter for humankind by utilizing it as added substances as a part of street development, it will end up being a better arrangement over most noticeably bad street conditions. In the present paper systems has been created to utilize plastic waste for development of bituminous streets and adaptable asphalts. As a rule bitumen is utilized as a fastener as a part of street development. Tying properties of this bitumen can be changed by mixing it with waste plastic pieces. It can be utilized for development reason. Waste plastic covered street totals can enhance street quality. This adjusted bitumen blend and totals show better tying property, solidness, thickness and the sky are the limit since they're impervious to water therefore expanding toughness of streets with expanded imperviousness to wear and tear of street.

**Key words:** Flexible Pavements, Dry process

## I. INTRODUCTION

Plastics are tough and debase gradually; the chemical bonds that make plastic so solid make it just as impervious to characteristic procedures of debasement. Plastics can be separated into two noteworthy classifications: thermoses and thermoplastics. A thermoset sets or irreversibly when warmed. They are helpful for their toughness and quality, and are in this way utilized fundamentally as a part of cars and development applications. These plastics are polyethylene, polypropylene, polyamide, polyoxymethylene, polytetrafluoroethylene, and polyethyleneterephthalate. A thermoplastic softens when presented to warmth and comes back to normal condition at room temperature. Thermoplastics can without much of a stretch be molded and formed into items, for example, milk containers, floor blankets, charge cards, and rug filaments. These plastic types are known as phenolic, melamine, unsaturated polyester, epoxy gum, silicone, and polyurethane.

Plastic in diverse structures is discovered to be very nearly 5% in metropolitan strong waste, which is poisonous in nature. It is a typical sight in both urban and provincial ranges to discover void plastic sacks and other sort of plastic pressing material littering the streets and channels. Because of its biodegradability, it makes stagnation of water and related cleanliness issues. Keeping in mind the end goal to contain this issue analyses have been completed whether this waste plastic can be reused gainfully in the development of streets. The experiments at a few establishments showed that the waste plastic, when added to hot total will frame a

fine layer of plastic over the aggregate and such aggregate, when blended with the bitumen is found to give higher quality, higher imperviousness to water and better execution over a duration of time. Along these lines, it is suggested that we may utilize waste plastic in the development of Roads.

## II. MATERIALS USED

### A. Plastic

A material that contains one or more natural polymers of extensive sub-atomic weight, strong in its completed state and at some state while assembling or handling into completed articles, can be formed by its stream is called as 'Plastic'.

The plastic utilized was the waste plastic containers, LDPE/HDPE sacks, wrappers, gathered from the adjacent houses and condo and from the landfill yards.

PLASTIC WASTE	CHEMICAL COMPOSITION	USAGE
	LDPE and HDPE	Carry bags
	PP	Chocolates, biscuit pickings.
	Polystyrene	Packing materials
	Polystyrene and polypropylene	Cups
	PET	Water bottles

	PVC	Pipes and electric cables
	Polystyrene Foam	Packing materials

Table 1: Various Types of Plastics with their Chemical Nature

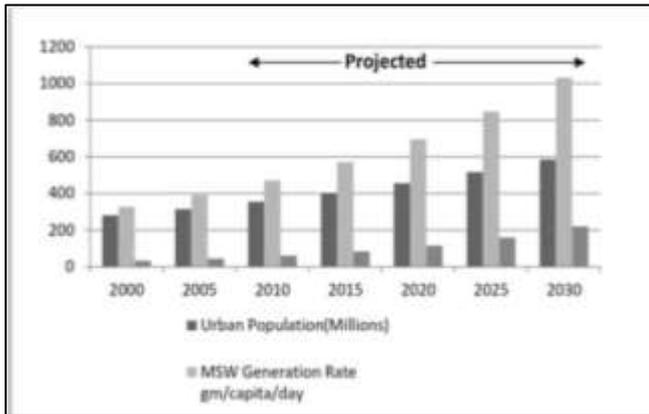


Fig. 1: Population and Municipal Solid Waste Generation Rate

### B. Bitumen

Bitumen is a sticky, dark and profoundly gooey fluid or semi-strong type of petroleum. It might be found in common stores or may be a refined item; it is a substance classed as a pitch.

The essential utilize (70%) of black-top/bitumen is in street development, where it is utilized as the paste or cover blended with total particles to make black-top cement. Its other primary uses are for bituminous waterproofing items, including creation of material felt and for fixing level rooftops

The terms black-top and bitumen are regularly utilized reciprocally to mean both common and fabricated types of the substance.

Normal use frequently alludes to different types of black-top/bitumen as "tar". Another antiquated term for black-top/bitumen is "pitch". Actually happening black-top/bitumen is some of the time indicated by the expression "rough bitumen". Its consistency is like that of cool molasses while the material acquired from the partial refining of unrefined petroleum bubbling at 525 °C (977 °F) is now and then alluded to as "refined bitumen"

The bitumen used was of grade 60/70 and 80/100.

Property	Specifica-tion (80/100)	Specifica-tion (60/70)	Test method
Specific gravity@25/25°C	1.01-1.05	1.01-1.06	D-70
Penetration @ 25°C	80/100	60/70	D-5
Softening point (°C)	45/52	49/56	D-36
Ductility@25°C, cm	100	100	D-113
Flash & fire point	>225	>250	D-92

(°C)			
Loss on heating (wt. %)	<0.2	<0.2	D-6

Table 2: Specifications of Various Grades Of Bitumen Used

### C. Aggregate

Aggregates are a segment of composite materials, for example, cement and black-top cement; the total serves as support to add quality to the general composite material the aggregate serves as fortification to add quality to the general composite material. Because of the generally high water driven conductivity esteem when contrasted with most soils, aggregates are broadly utilized as a part of seepage applications, for example, establishment and channels, septic channel fields, holding divider channels, and street side edge channels. aggregates are additionally utilized as base material under establishments, streets, and railways. At the end of the day, aggregates are utilized as a steady establishment or street/rail base with unsurprising, uniform properties (e.g. to help counteract differential settling under the street or building), or as a minimal effort extender that ties with more lavish bond or black-top to shape concrete.

The Aggregate used was of the size 20mm, 10mm. stone dust and lime was used as fillers.

Table 3: Characteristics Of Aggregate

Colour	Black, Grey, White
Strength	Needs to be good
Roughness	Preffered
Porosity	2% Tolerance
Moisture Absorption	2% Tolerance



Fig. 2: Plastic Coated Aggregate and Normal Aggregate  
Enhanced attributes of plastic coated Aggregate:

- No soundness
- No moisture absorption
- No voids
- Improved Aggregate impact value
- Improved abrasion value
- Improved crushing value

### III. METHOD OF CONSTRUCTION

There are two methods of construction namely-

- Dry process
- Wet process

#### A. Dry process- Step involved are -

- Collection of waste plastic.
- Cleaning and shredding of waste plastic.

- Shredding machine.
- Mixing of shredded waste plastic, aggregate and bitumen in mixing plant.

#### 1) Detailed Process – With Mini Hot Mix Plant –

The stone aggregate mix (according to detail) is exchanged to the blend chamber where it is warmed to 165°C (according to the IRC determination) and after that it is exchanged to the blending puddler (Temperature can be checked utilizing IR thermometer), while exchanging the hot aggregate into the puddler, computed amount of shredded plastics is splashed over the hot aggregate, within 30 seconds the splashed plastic liquefies and gets covered over the aggregate, along these lines framing a oily covering.

Likewise, the bitumen is to be warmed to a greatest of 160°C in a different chamber and kept prepared (The temperature ought to be observed to have great binding and to anticipate feeble holding).

At the blending puddler, the hot bitumen is included over the plastic covered aggregate and the resultant mix is utilized for street development. The street laying temperature is between 110°C to 120°C. The roller utilized is ordinary 8-ton limit.

#### 2) For intensive works Central Mixing Plant is used-

The working Techniques for this are given underneath- The total materials will be exchanged to the chamber through the transport line.

- The shredded plastics will be showered over the total while it is moving in the conveyer belt.
- The showering is finished by manual works standing up on both sides of the conveyer belt of the central mixing plant.
- The expansion of plastics ought to be done quantitatively

Measure of plastic to be included is 8% of bitumen.

Case in point if the bitumen amount every minute is 10Kg, the plastic should be included is 0.8 Kg. i.e. (A can or bucket can be utilized which can hold 0.8 Kg at once)

Now, as the aggregate moves in the transport line, the shredded plastics, taken in the basin are showered with a rate of 0.8 Kg/1min with suitable mechanical gadget or physically.

As the plastics is included over the aggregate, the blend (aggregate and plastics) moves into the cylinder.

As the stone is warmed the plastic waste get dissolved over the warmed stone and get covered. Gradually the plastics covered aggregate pushes ahead where this polymer covered total is mixed with bitumen. The polymer covered aggregate bitumen mix is then exchanged to the dipper.

#### 3) Advantages of Dry Process-

- Easy process with no new hardware.
- Simple procedure with no industry inclusion.
- In situ process.
- Use of lesser rate of bitumen and therefore saving investment funds on bitumen asset.
- Both Mini Hot Mix Plant and Central Mixing Plant can be utilized.
- No advancement of any harmful gasses like dioxin.
- Use of plastics waste for a safe and eco-accommodating procedure.

#### B. Wet Process

Waste plastic is ground and made into powder; 6 to 8% plastic is blended with the bitumen. Plastic increments the dissolving purpose of the bitumen and makes the street hold its adaptability amid winters bringing about its long life. Utilization of destroyed plastic waste goes about as a solid "tying operators" for tar making the black-top last long. By blending plastic with bitumen the capacity of the bitumen to withstand high temperature increments. The plastic waste is softened and blended with bitumen in a specific proportion. Regularly, mixing happens at the point when temperature achieves 45.5°C however when plastic is blended, it stays stable even at 55°C. The vivacious tests at the research center level demonstrated that the bituminous concrete blends arranged utilizing the treated bitumen cover satisfied all the predetermined Marshall blend plan criteria for surface course of street asphalt. There was a significant increment in Marshall Stability estimation of the blend, of the request of a few times higher esteem in examination with the untreated or common bitumen. Another vital perception was that the bituminous blends arranged utilizing the treated fastener could withstand unfavorable dousing conditions submerged for more time.

#### 1) Advantages of Wet Process:

- This process can be used for recycling of any type, size, shape of waste material (plastic, rubber etc)

#### IV. CONCLUSION

Plastics will build the dissolving purpose of the bitumen. The utilization of the inventive innovation fortified the street development as well as expanded the street life and additionally will help to enhance the earth furthermore making a wellspring of pay. Plastic streets would be an aid for India's hot and to a great degree sticky atmosphere, where temperatures as often as possible cross 50°C and heavy rains make destruction, leaving the greater part of the streets with enormous potholes. It is trusted that in not so distant future we will have solid, strong and eco-accommodating streets which will ease the earth from all kind of plastic-waste

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