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Enhancing the properties of bitumen by plastic waste

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Abstract:

This project work is to enhancing the properties of bitumen by adding the plastic waste in the bitumen. Where the non-biodegradable waste are unsafe for environment and it take numerous years to disintegrated. This waste are effectively accessible at the landfill yard or any close to area. By adding this loss to the bitumen while development of street roads by flexible pavement the properties of this street roads are improved and it assists with diminishing the loss also. This waste comprise of different kind of plastic so the properties of bitumen is expanded. By the addition of this waste to bitumen the properties of bitumen like ductility, stability, softening, etc. are improved and it helps to reduce the this waste also. In this experimental work we take high density polyethylene (milk covers) in a shredded form and mixed with bitumen. The percentage of waste plastic mixed with bitumen is 5%, 6%, 7% of bitumen sample

Keywords

1. Introduction

I. General

The serious issue in the present time is plastic waste removal which impact nature to an extreme. Plastics knows about everybody and it is utilized in the day by day life. The normally plastic item are polythene, water bottles, milk covers, polythene convey packs and so forth this items are accessible in exceptionally enormous amount and this waste take a long time to unsettled so this plastic waste are reused and utilized for various purposes. In the event that plastic isn't reused, at that point The current method utilized for decay of plastic waste is landfilling and burning.

Bitumen is an extremely helpful folio for street development of adaptable street asphalt. This is generally utilized for street since bitumen have awesome properties then different materials. Bitumen are accessible in various evaluations as indicated by their infiltration esteems.

II. Objective

The motivation behind the examination is to see the impact on properties of bitumen with various extents of various plastic waste. The philosophy is to limit the other material of the bitumen with the plastic waste.

2. Literature Review

The expansion of plastic expands the hardness of the bitumen. The infiltration estimation of the bitumen changes relying upon the plastic included and the sort of plastic included. The waste plastic to be utilized is between 5% to 10%. The issues like draining are diminished in the hot temperature area by the plastic – bitumen mix. Plastic has a property of retaining sound which helps in diminishing the sound contamination of overwhelming traffic. Burden conveying limit is expanded and can oppose water.

3. Materials and it's properties

1) Plastics
- Waste milk cover (HDPE)
2) Bitumen grade (60/70)
3) Aggregate

Bitumen

Bitumen is the dark, exceptionally gooey not crystallized material determined normally as a natural side-effect of decayed natural substance and with treatment facility method as a finished item by refining of the unrefined petroleum. It hardens with introduction to atmosphere and have a cement quality by its gooey form. Bitumen will be likewise named as Asphalt or Asphalt Cement in United States of America. Bitumen is the significant segment of the clearing streets. Nature of the

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bitumen shifts with agreement to its origin or consequently it is most important to examine various properties of the bitumen before using it. Bitumen has numerous experiments to verify the quality. It is derived to adequate smoothness and consistency before considering it in asphalt development with these three techniques

- Warming, as hot bitumen cover.
- By dissolving in light oils, as Cutback Bitumen.
- By scattering bitumen in water, as Bituminous Emulsion

Plastic

High unit weight Polyethylene has been savvy thermo-plastic by direct structure and very low level in spreading. Plastic is produced at less temperature (75-320°C) and pressure value in range of (5-85 bar).

- Adjusting petroleum gas
- Synergist splitting of the raw petroleum in fuel

4. Methodology

Waste plastics have been gathered by the landfill /dump-yards which are isolated by fine sizes. Isolated plastics are cleaned by water and then dried properly. At that point plastics have partitioned in high and low thickness polyethylene. Then use high thickness polyethylene and then the plastics were destroyed with the help of shredding equipment in 1mm-3mm sizes. On other side bitumen has been warmed till 163˚c. Destroyed plastics were mixed into warm bitumen then blended. Mixing of destroyed plastics into bitumen at various amounts(6%,8%,10%). Experiments values were looked at lastly and ideal level of the including plastic to the bitumen is found. For this modified sample of bitumen the various test are performed by which the quality and properties of modified bitumen are observed

Various test for modified bitumen

- Marshal stability test
- Ductility test
- Softening

Marshal stability test

The Marshall stability and flow test gives the information about the Marshall blend structure technique. The dependability segment of the test quantifies the most extreme pressure upheld of the experiment example in the stacking pace of 50.78 mili-meter/min. pressure had been putted to example untill deformation, and most extreme pressure has been assigned as stability. During the pressuring, a connected dial-gauge check quantifies sample's plastic stream (twisting) because of the stacking..
The marshal mix design test gives the various information mentioned below

Specific gravity

- Theoretical specific gravity

$$Gm = \frac{W1 + W2 + W3 + Wb}{\frac{W1}{G1} + \frac{W2}{G2} + \frac{W3}{G3} + \frac{Wb}{Gb}}$$

- Bulk Specific gravity

$$Gm = \frac{Wm}{Wm - Ww}$$

Air voids percent (Vv)

$$Vv = \frac{(Gt - Gm)\ X\ 100}{Gt}$$

% volume of the bitumen (Vb)

$$\gamma = \frac{(wb/Gb)}{(W1 + W2 + W3 + Wb)/GM}$$

Material quantity

Aggregate 1200gm
Bitumen (4% to 5% of aggregate sample)
Plastic (5%,6%,7% of bitumen sample)

Procedure

- bitumen has been warmed upto 158ºC - 175ºC.
- destroyed plastic (milk covers) has been mixed into bitumen.
- Total (19.2mm,13.4mm,6.70mm& residue) were weighted with all aggregate of 1300 gm and afterward warmed to 145ºC.
- Warmed plastic included bitumen has been blended and moved into the compacting form.
- Sample was provided with 75 blows on the upper-side of sample blend with std. hammer(45cm,4.86kg). interchange the sample and 75 blows was provided on the bottom-side.
- Sample has been saved unmoved for 1day.
- Sample by the form is tenderly expelled.
- The progression of the samples were set up with a comparative technique by differing amounts of the bitumen amount with the plastics.
- The dried form is weighted and marked as W1.

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- Form has been drenched into water and weighted and marked as W2.
- Form has been inundated into water is evacuated and gauged as W3.
- Form has been inundated into high temp water shower at 65ºc for half-hour .
- Form has been tried for the solidness and stream.

Table 1. Marshal Stability Test

PROPERTIES	NORMAL BITUMEN (appx.)	5% PLASTIC ADDED BITUMEN	6% PLASTIC ADDED BITUMEN	7% PLASTIC ADDED BITUMEN
STABILITY (KN)	17.70	7.56	7.9	8.10
AIR VOIDS (%)	3.20	2.34	2.20	2.25
FLOW (%)	4.20	6.35	6.02	5.09
VFB (%)	74.00	65.10	68.56	71.55
SPECIFIC GRAVITY	1.04	1.00	0.99	0.96

Ductility Test

Procedure

- Bitumen has been warmed to 158ºC - 175ºC
- The destroyed milk covers spread is added to the hot bitumen is filled in the ducctility form
- Ductility sample has been kept it to cools down to room temp.
- The form is set in the ice and kept at room temp. for 60min.
- The shape has been set in the ductility machine
- The readings are taken when the bitumen breaks into strings

Softening Point

Procedure

- 60/70 Grade of bitumen is warmed to 160ºC - 170ºC
- Shredded milk covers (≥ 40 μ) are added to the hot bitumen and blended homogeneously.
- The rings are set on the glass plate to gauge the plastic included bitumen is poured (dextrin powder is applied on the outside of glass plate to abstain from staying of bitumen)
- The rings with plastic included bitumen is kept until it cools to room temperature
- The rings are put in the stand and afterward kept in the recepticle .The container is loaded up with ice and kept at 5ºC for 15 mins
- Thermometer has been placed in the represent checking the precision of temperature.
- After 18 min the mechanical assembly is putted above the fire with a work under.
- The ball has been put in the focal point of the ring and thermometer is put in the container.
- when the ball descends alongside the plastic included bitumen the temperature is reading taken. That is the mellowing purpose of the plastic included bitumen

5. Result

Table 2. Results of modified bitumen sample

PROPERTIES	PERMISSIBLE LIMIT	7% PLASTIC ADDED BITUMEN
STABILITY (KN)	≥9	8.10
Ductility (cm)	≥75	78
Softening point(˚c)	47ºC-50ºC	48ºC

6. Conclusion

In our experimental project work we use the high density polyethylene and mix with bitumen and perform a various test on it. Then we get results which shows that percentage of HDPE plastics in bitumen should be more then 7% but it also reduces the other properties of bitumen by which the modified flexible pavement road are not be able to provide the better performance.

7. References

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