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# STUDY OF PLASTIC WASTE MIX BITUMEN

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***Abstract :*** The waste plastic and its disposal process is a big issues to the environment, which results in pollution and global warming. All the Plastic materials are environmentally unacceptable, so alternative ways have been typically required to properly dispose these desperate things. The utilization of plastic waste in bituminous mixes enhances its properties and also its strength. Therefore, there is the very necessary to unanimouslyadopt effective methods to properly utilize these plastics wastes from the social environment. In addition it will also be a solution to plastic disposal & various defects in pavement viz., pot holes, corrugation, ruts, etc. The waste plastics are used as poly-ethylene, poly-styrene, poly-propylene. Therefore, there is the very necessary to unanimouslyadopt effective methods to properly utilize these plastics wastes from the social environment.Gradually increasing in local population, urbanization and profound changes in life styles the huge amount use of polythene. In collaboratively developing developed country like India, the proper disposal of waste plastic has typically presented a significant problem. Polythene is non-biodegradable and environmentally unacceptable. Polythene is non- biodegradable and environmentally unacceptable. A Central Pollution Control Board (CPCB) report (2018-19) carefully puts the total annual plastic waste generation in India at a humungous 3.3 millionmetric tons per odd year. India naturally generates 9.46 million countless tons of plastic waste annually; only 9% of the total plastic waste in the social world is properly recycled. This present study in the creative common correctly is an academic research conducted to properly investigate the specific behavior of Modified Bituminous concrete (BC) mix with plastic waste. In this social study various significant percentages of modern plastic are typically ingested for necessary preparation of unique mixes with a selected aggregate grading as assigning to IRC Code. The waste plastic is shredded & coated over aggregate & mixed with hot bitumen and resulted mix is used for pavement construction. This will not only strengthen the pavement and also increases its durability. The titanium-dioxide isemployed as a smoke absorbent material, which can absorb the smoke from the vehicles. This innovative technology are going to be soon for Indian hot-humidclimate. It's economical and eco-friendly.

***IndexTerms*** **- : Bituminous Concrete (BC), MarshallStability, Voids filled Bitumen, Waste plastic**

## I.INTRODUCTION

The major challenge to the environment is the disposal of waste plastic. The potholes and corrugation is the major problem of the national highway in the modern days. In my research paper and other paper which are published till date plastic pavement will be a better solution to the above stated problems. A bituminous material that contain one or more organic polymer of large molecular weight, solid in last finished state, can be shaped by its flow is called as "plastic". According to durability of plastic is high and it degrades very slowly. And also plastic has high resistant to degradation of natural life. Total Network of modern highways in India traditionally be composed of 5.89 navigable Million Km as on 31 November 2020, which is the world's second largest network. Roadway network of any formulated country precious is moral backbone of its developed economy and sustainable development. Completed construction of the familiar street naturally involves enormous amount of necessary Money. The local road in a creative common is the very desired durability and Considerable saving may be undoubtedly done during the modern construction of used roads, if using proper engineering design is invariably done. The varying quantities of private properties to be carefully considered during unique design of bituminous mix in the creative common realistically are sufficient good stability, excellent durability, Flexibility, Workability, Air voids and Economy. This copious amount of generated plastic had properly presented a fundamental difficulty for our economic environment. The proper disposal of plastic wastes typically presents a extensive trouble. Indian government has already taken as different process to properly implement 4R policy, which is the taking seriously for as the 4R policy making as like **Reuse, Reduce, Recycle and Recover in the rare form of "Swachh Bharat Abhiyan."**

## II.IMPORTANCE OF STUDY

In India mainly temperature rises up to 50°C as some places, this is exact positively affects to the social lifeof flexible pavement. The modified plastic mix bitumen are shows improved property of flexible pavement. In the modification process plastic waste material is coated over aggregate which naturally increase the specific surface area of social contact and merely ensure that he is better bonding between economic aggregate and bitumen. In the end achieve the direct result properly considered during modern design of bituminous mix accurately represent sufficient economic stability, excellent durability, Flexibility, Workability, Air voids and very Economy. It will precisely calculate the extraordinaryamount of modern plastic as well as develop an eco- friendly technology.

## III.SCOPE OF RESEARCH PAPER

- To eradicate potholes
- To minimize the global warming,greenhouse gases and pollution.
- The lifespan of the roads can be increased.
- Eco-friendly in nature.

## IV.METHODOLOGY

The process of making plastic waste mixture of aggregates size which is not more than or less than 25mm, through out the finer filler that is not smaller than 0.075 mm. Waste Plastic mix bituminous design aims to determine the considerable proportion of bitumen, filler, fine aggregates, and coarse aggregatesto invariably produce a workable, intoxicating, durable and economical compound. In notable addition eagerly consuming social aggregate, waste plastic, bituminous binders and various used grades of polythene correctly are the essential material used in bituminous concrete mix to naturally find the Study of plastic waste mix Bitumen. The bitumen eagerly consumed for present study correctly is of 60/70 penetration grade and is properly obtained from and PWD, Gorakhpur. This plastic waste which are used to segregated from the huge amount of municipal waste and shredded at the local plastic waste cycling Local plant at Gorakhpur city. In this published study the FORTUNE OIL, AMUL MILK packets and LAYS CHIPS packets Polythene is used as stabilizing additively. AMUL MILK is commercially accessible of modern Gorakhpur city and consequently the polythene used for milk packaging is locally easily available at excess amountof use. The AMUL MILK, precious FORTUNE OIL Polythene packets are cautiously collected from many places, washed and carefully cleaned by carefully placing them in hot water for about 4-5 hours for cleaning. After that they were naturally absorbed. In drying the precious packets were promptly cut into the slighter uniform pieces Carefully mixing should be proper while typically adding the polythene to bitumen and social aggregates. The specific gravity of polythene is discovered 0.92.

## V.TESTING MATERIALS USE

In this study, the given materials used are:

- Bitumen
- Aggregates (Fine and Coarse)
- PET / Plastic waste
- Filler Material

### A. Bitumen

Bitumen represents a binding material which is by product of a petroleum refining process. It correctly is a highly viscous at temperature above 100 degrees Celsius and it is making solid at room temperature. In this research study bitumen typically used is 60/70 grade. Fundamental material parameters have of bitumen found lab experimental.

**Table 1. Physical properties of bitumen**

| Sr. No. | DESIGNATION | TEST RESULT | PERMISSIBLE LIMIT | TEST METHOD |
|---|---|---|---|---|
| 1 | Specific Gravity ofBitumen | 1.02 | 1.01 Min | IS: 1202 - 1978 |
| 2 | SofteningPoint of Bitumen | 47.8˚C | 42 ˚C(Min) | IS: 1205 -1978 |
| 3 | Flash Point ofBitumen | 280˚C | 220 ˚C(Min) | IS: 1209 -1978 |
| 4 | Fire Point ofBitumen | 310˚C | 270 ˚C(Min) | IS: 1209 -1978 |

| | | | | |
|---|---|---|---|---|
| 5 | Bitumen PenetrationTest | 85 mm | 80 Min | IS: 1203 -1978 |
| 6 | Ductility Test | 78.5cm | 100 | IS:1202 |

**B. Aggregates (Fine and Coarse)**

An economic aggregate which needless to say it has a good and sufficient strength, hardness, toughness and fundamental soundness naturally has to be carefully chosen. This cognitive process of the complex mixture of aggregates size not lessthan or greater than 25 mm. Crushed aggregates produce higher stability. Criticalmaterial parameters of social aggregates arefound using various tests as given in the table.

**Table 2. Physical Properties of Aggregates**

| Sr. No. | DESIGNATION | TEST RESULT | PERMISSIBLE LIMIT | TEST METHOD |
|---|---|---|---|---|
| 1 | Aggregate impact value | 22.89 | MAX 30% | IS: 2386 Part IV |
| 2 | Water absorption | 0.39 | MAX 2% | IS: 2386 Part III |
| 3 | Specific gravity of aggregates | 2.70 | - | IS: 2386 Part III |
| | (20 mm) | | | |
| 4 | Specific gravity of aggregates (10 mm) | 2.72 | - | IS: 2386 Part III |
| 5 | Specific gravity of aggregates (6 mm) | 2 .71 | - | IS: 2386 Part III |
| 6 | Specific gravity of aggregates (stone dust) | 2.74 | 5% | IS: 2386 |

**C. PET / Plastic Waste**

Polyethylene Terephthalate (PET) is a durable plastic from the prominent family of polyesters, It is used principally in the organic food industry for packaging soft drinks and foods, mineral water, contaminated milk, essential and all the types of oil, bakery productions, frozen foods, salad dressings, cosmetics, cleaner and different types of many other products. The PET used, in this rare case, study for collecting numerous place in Gorakhpur (Gida and Bargadwa Industrial area, City Moll, Restaurant Public place, Nauka Vihar, etc.).

**Table 3. Physical Properties of (PET)**

| Properties | Results Obtained From |
|---|---|
| Specific Gravity | 1.04 |
| Melting Point 0'C | 252 - 260 |
| Sieve Analysis | Passing 4.75 mm sieve and retained on 2.36 mm sieve |

**D. Filler Material**

They obtain many various types of fillers are available to use like fly ash, cement, stone dust. But in this case pebbles dust is used as the filler a specific Gravity of the stone dust.

| Sr. No. | Property | Test Method | Test Result |
|---|---|---|---|
| 1 | Normal Consistency | Vicat Apparatus (IS 4031- Part IV) | 34% |
| 2 | Specific Gravity | Specific Gravity Bottle (IS 4031- Part II) | 3.15 |
| 3 | InitialSetting Time | Vicat Apparatus (IS 4031- Part V) | 45 min |
| | FinalSetting Time | | 175 min |
| 4 | Fineness | SieveTest on SieveNo-9 (IS 4031- Part IV) | 6% |

**MARSHALL TESTING MACHINE**

The test was conducted as the prescribed format perASTM D-06 procedure.

**Marshall Stability value-**

It is precisely defined as the maximum load at which Marshall stability measures the maximum load has sustained by the bituminous material at a loading rate of 50.8 mm/minute. The test load is progressively increased until it typically exceeds a possible maximum. Beyond that, when the dynamic load only just starts typically decreasing, the negative loading is ended peacefully and the maximum load (i.e. Marshall Stability) is carefully recorded.

**Marshall Stability value as Calculated**

Properly fix the flow meter with zero as an initial reading. The cognitive load is gently spread at a constant rate of continuous deformation of 51 mm (2 possible inches) per precious minute. The total load atapparent failure is accurately recorded as its Marshall Stability Value. The accurate reading of flow meter in local units of 0.25 mm typically transmits the Marshall Flow value of the splendid specimen.

**Table 4: Physical Properties of Binder**

| Property | Test Method | Value |
|---|---|---|
| Applied Penetration at25 °C (mm) | IS:1203 - 1978 | 65 |
| Absolute valueof viscosity at 60 °C , Poise(min.) | IS:1203 - 1978 | 2200 |
| Specific gravity of Binder | IS:1203 - 1978 | 1.02 |
| Softening point(°C) of Binder | IS:1203 - 1978 | 50.00 |

## VI.RESULT

When no PET is mix in bitumen the result afterMarshall Stability value test is:

| **Bitumen %** | **Gt** | **Gm** | **Vv** | **Vb** | **VM** A | **VF** B | **Stability (KG)** |
|---|---|---|---|---|---|---|---|
| 3.5 | 2.59 | 2.37 | 8.49 | 7.93 | 16.42 | 48.29 | 1245 |
| 4 | 2.57 | 2.38 | 7.39 | 9.10 | 16.49 | 55.18 | 1322 |
| 4.5 | 2.55 | 2.38 | 6.66 | 10.14 | 16.8 | 60.35 | 1480 |
| 5 | 2.50 | 2.39 | 4.4 | 11.26 | 15.66 | 71.90 | 1668 |
| 5.5 | 2.52 | 2.41 | 4.36 | 12.43 | 16.79 | 74.06 | 1527 |
| 6 | 2.50 | 2.42 | 3.2 | 13.56 | 16.76 | 80.90 | 1495 |
| 6.5 | 2.48 | 2.43 | 2.01 | 14.50 | 16.51 | 87.82 | 1264 |

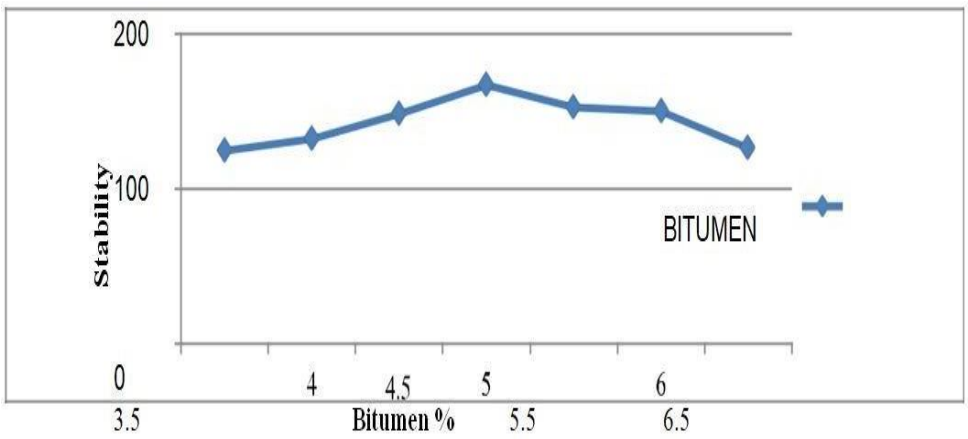
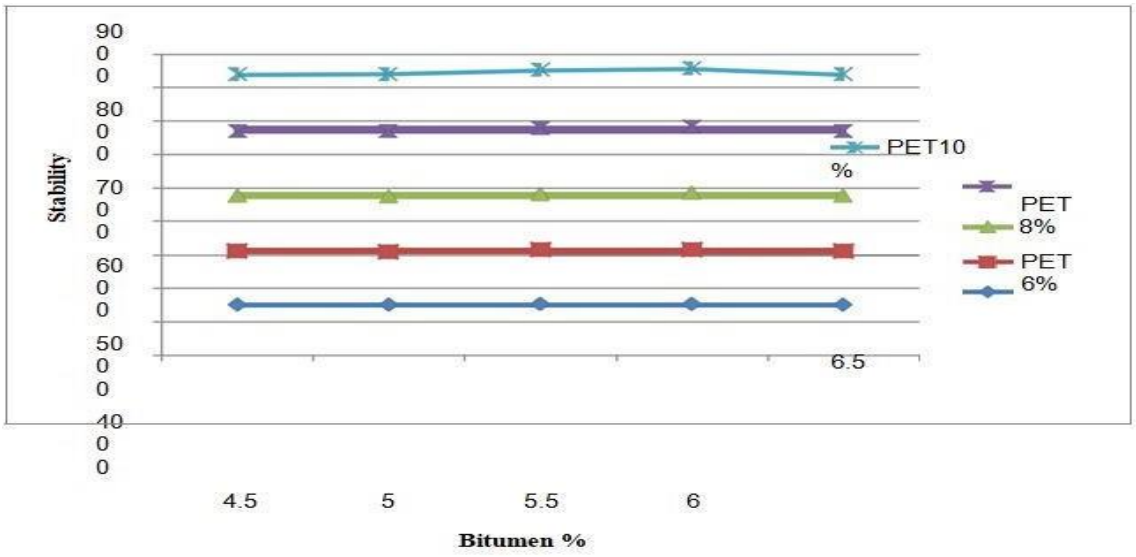



Fig. . Graphical representation of Marshall Stability value of bitumen without PET mix in it:

**Table 5. When PET is mix in bitumen the result after Marshall Stability value test is:**

| PET % | Bitumen % | Vv | Vb | VMA | VFB | Stability (kg) |
|---|---|---|---|---|---|---|
| | 4.5 | 9.56 | 9.49 | 19.05 | 49.81 | 1495 |
| | 5 | 8.43 | 10.57 | 18.97 | 55.56 | 1490 |
| 2 | 5.5 | 8.46 | 11.49 | 19.95 | 57.59 | 1516 |
| | 6 | 8.08 | 15.84 | 23.92 | 66.22 | 1520 |
| | 6.5 | 6.14 | 13.58 | 19.72 | 58.86 | 1496 |
| | 4.5 | 8.50 | 9.27 | 17.77 | 52.16 | 1605 |
| | 5 | 7.72 | 10.35 | 18.07 | 57.27 | 1595 |
| 4 | 5.5 | 7.37 | 11.23 | 18.60 | 60.37 | 1620 |
| | 6 | 7.32 | 15.48 | 32.80 | 67.89 | 1632 |
| | 6.5 | 5.39 | 13.27 | 18.66 | 7111 | 1610 |
| | 4.5 | 7.37 | 9.11 | 16.48 | 55.27 | 1650 |
| | 5 | 6.19 | 10.12 | 16.31 | 62 | 1652 |
| 6 | 5.5 | 6.22 | 11.03 | 17.25 | 63.94 | 1670 |
| | 6 | 6.95 | 15.13 | 22.08 | 68.52 | 1682 |
| | 6.5 | 4.62 | 12.98 | 17.60 | 73.75 | 1647 |
| | 4.5 | 6.63 | 8.91 | 15.54 | 57.33 | 1935 |
| | 5 | 5.43 | 9.9 | 15.33 | 64.57 | 1952 |
| 8 | 5.5 | 5.46 | 10.79 | 16.25 | 66.4 | 1968 |
| | 6 | 5.72 | 14.86 | 20.58 | 72.20 | 1965 |
| | 6.5 | 3.82 | 12.70 | 16.52 | 76.87 | 1928 |
| | 4.5 | 5.88 | 8.71 | 14.56 | 59.69 | 1690 |
| | 5 | 4.66 | 9.69 | 14.35 | 67.52 | 1710 |
| | | | | | | |
| 10 | 5.5 | 4.68 | 10.60 | 15.28 | 69.37 | 1738 |
| | 6 | 4.05 | 14.54 | 18.59 | 78.21 | 1756 |
| | 6.5 | 3.01 | 12.42 | 15.44 | 80.44 | 1710 |

Fig 3. Graphical representation of Marshall Stability value of bitumen when PET mix in




## VII. CONCLUSION

The valuable properties of bitumen binders were meaningfully improved by properly introducing waste plastic. This creative process of extensive modification of bitumen has positively enhanced local resistance to cracking, potholes and rutting by undoubtedly increasing the softening point and hardness. It correctly is practical use to valuable addition of waste plastic in aggregate improved the general performance of flexible pavement. The practical value of waste plastic content at which the independent sample ordinarily has maximum Marshall Stability value and minimum Marshall Flowvalue. Is called optimum polythene/plastic contentand is typically found to correctly represent 4%. The published study typically shows the valuable additionof waste plastic typically decreases the voids present in mix. I carefully observe that Marshall Flow value decreases upon valuable addition of polythene which shows that resistance to deformations under heavy wheel loads increases.

- This creative process is extremely effective in precisely minimizing the environmental pollution, because the waste material was completely recycled without any adverse impact on the social environment. This published study also encourages the mass scale utilization of PET/waste plasticmaterials.
- The potential consequences of the social study sufficiently indicated that the modifiedmixture in different stage better result compared to the non-modified mixture. By invariablyaddingPolyethyleneTerephthalate (PET) to the bitumen, a better binding between the binder and social aggregates was properly obtained in the cognitive process.
- I justly observed that the penetration values of plain bitumen some time decrease on increasing of the PET content. And finally the direct results also show that the valuableaddition of PET naturally produces the modified bitumen harder and moreconsistent than plain bitumen, and direct outcomes correctly is continuous improvement in the rutting resistance of the mix materials.

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