



Plastic Roads as Most Economical Roads of kashmir

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Abstract

The two biggest challenges in a developing UT like Kashmir is to build a network of road system with limited financial sources available and to design roads of high strength that can withstand at any temperature variations. Climate of Kashmir comprises of a wide range of weather conditions .Due to varied weather conditions , the existing bituminous pavements in Kashmir are not able to withstand against such temperature variations which in turn degrades the strength of roads leading to formation of cracks, crashes, spinouts , potholes & breakdown of roads. Also the cost of the construction of such pavements is very high , but they don't give the satisfactory results at the end. The road network system of Kashmir can be made better with low financial implication by making use of waste plastic in pavement construction. Plastic roads proves as to be most economical , as the cost of construction is low as compared to normal bituminous roads and the output performance of such roads is extraordinary.

Keywords; Plastic roads , economical ,Kashmir, Snow.

1.Introduction

Due to high cost of cement concrete roads , preference is usually given to construction of bituminous roads. Flexible pavements with bituminous concrete surface are widely using in Kashmir. Bitumen , a binder is one of the most important constituent of such roads. Kashmir being a cold region area , the grade of bitumen commonly used here is VG-10. The cost of the bitumen is very high that is almost Rs.29220/-per MT and Bituminous pavements constructed with such high financial cost does not prove to be economical at the end as the bitumen does not provide the desired performance in the field as it should provide .The properties of the bitumen can be modified by using waste plastic. Using waste plastic does not only modifies the properties of bitumen only but also decreases use of bitumen content in pavement construction which inturn leads to construction of such pavement at low financial cost. Pavements designed by using waste plastic came to known as" plastic roads" .

Today the availability of the waste plastic is enormous as the plastic materials has become a part and parcel of our daily life due to its economic value, easy availability , easy processability , light weight , durability and energy efficiency. Therefore use of plastics is increasing day by day , and the amount of waste plastic generation is also increasing at the same rate. The present disposal of waste plastic is done either by land filling or by incineration. Both these processes are not eco-friendly. Under such circumstances , to find an alternative use of waste plastic is a need of hour as there is no proper mechanism present for disposing of such wastes. The better binding property of plastics in its molten state with bitumen mix is helping in finding

out the safe disposal of waste plastic , by using then in road laying. Saving in bitumen quantity can also be achieved by using waste plastic in bituminous mix.

2.Methodolgy

2.1 materials used

Various materials used for construction plastic road were as.

1. Plastic ; The plastic used was the waste plastic bottles (PET plastics). The reason of selecting PET plastics was its good characteristics like ;
 - It absorbes water which makes it hygroscopic which inturn was a positive point in the road construction as because of this property , road will not allow percolation of water deep down into pavement layers.
 - It has an excellent level of resistance as compared to other plastics.
 - It has high flexural modulus, therefore has a tendency to make our pavement more flexible.
2. Bitumen; the bitumen used was 80\100 penetration grade . properties of bitumen were as

Table 1; properties of pure bitumen

Property	Test result	Test method
Penetration (mm)	92	I IS; 1203-1978
D ductility (cm)	8 94	Ii IS; 1203-1978
V viscosity	54	IS;1206-1978
Specifiv gravity	1.01	I IS;1202-1978

3. Aggregates

The aggregates were obtained from local quarry and the properties of aggregates were found as

Table 2 : properties of aggregates.

property	Test value	Test method
Aggregate crushing value test	18%	IS; 2386-1963
Loss angels abration test	26%	MORTH 5 TH revision
water absorption	0.5%	MORTH 5 th revision
Specific gravity	2.5	MORTH 5 th revision
Combined flankiness & Elongation index	23%	MORTH 5 th revision

4. Modified bitumen. Waste plastic was added to bitumen to enhance its properties . waste plastic was added from 3-11 % by weight of bitumen with an increment of 2%.
The properties of modified bitumen were as ;

Table 3 : properties of modified bitumen.

Test	3%	5%	7%	9%	11%
Penetration (mm)	94	96.30	99.12	105	108
Ductility (cm)	93	91.3	87.2	86	82
Viscosity	55	70	76	80	84.3
Specific gravity	0.98	0.97	0.95	0.93	0.90

5. Preparation of blend

Waste plastic was shredded to a size of 5mm and quantity of 7% was taken (by weight of bitumen). Aggregates were heated at 130 degree. Bitumen also was heated upto maximum of 160 degree

At the mixing chamber, the shredded plastic was added over the hot aggregates and the plastic coated aggregates were mixed with hot bitumen at a temperature range between 150-165 degree.



Fig 1 shredded waste plastic



fig 2 bitumen in liquid state

6. Construction of road pavement

The road stretch (1km) constructed by using waste plastic was compared with normal bituminous road and the various observations were note down.

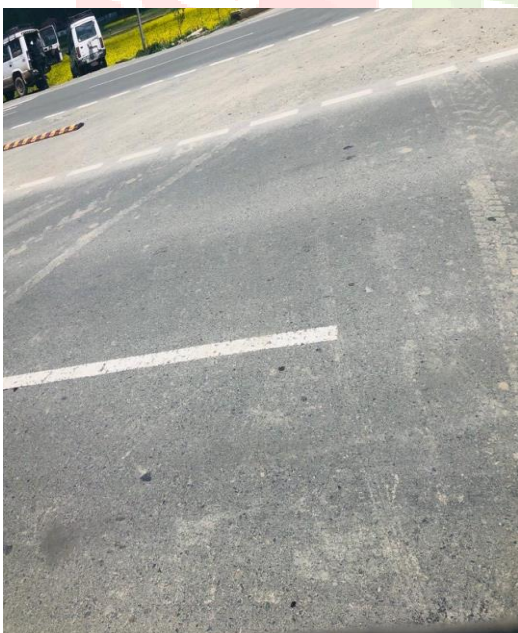


Fig 3 plastic road stretch construted in Kashmir

3. Cost Estimation and cost comparison

3.75 meters road having length 1km was constructed by using waste plastic and it was compared with road sealed with pure bitumen only.

Cost of pure bitumen in Kashmir = Rs 39/kg

Surface area of road covered with bitumen= length of road *width of carriage way

$$= 1000 \text{ meter} \times 3.7 \text{ metres}$$

$$= 3700 \text{ Sq.M.}$$

Cost of gravel chips Rs 560 per brass (2.83 cub.M)

Volume of bitumen used per sq.M = 1 kg

3.1 Road seal coated with bitumen only

Total volume of bitumen required for seal coat

$$= 3700 \text{ sq.M} \times 1 \text{ kg}$$

$$= 3700 \text{ kg}$$

Total volume of gravel chips required

$$= 3700 \text{ sq.M} \times 0.006 \text{M (6mm)}$$

$$= 22.2 \text{ cub.M}$$

Cost of pure bitumen for coating = total volume of bitumen required \times rate of bitumen per kg

$$= 3700 \times 39$$

$$= \text{Rs } 1,44,300/-$$

Cost of gravel chips= total volume of chips required \times rate of chips per brass

$$= 22.2 \times (\text{Rs } 560 \div 2.83 \text{ Cub.M})$$

$$= 22.2 \times \text{Rs.198}$$

$$= \text{Rs. } 4400$$

Total cost of road sealed with bitumen = cost of bitumen for coating + cost of gravel chips

$$= \text{Rs. } 1,44,300 + \text{Rs.} 4400$$

$$= \text{Rs. } 1,48,700 \approx \text{Rs. } 1,49,000$$

3.2 Road seal coated with bitumen and shredded waste plastic

Cost of waste shredded plastic in Kashmir = Rs 12/kg

Plastic waste used in construction = 7% of weight of bitumen.

As per MORTH 5th revision , use of waste plastic mixing in bitumen is in between 6% -8%.

Total volume of waste shredded plastic required for construction of 1km road

$$= \text{total volume of bitumen required} \times 7\%$$

$$= 3700\text{kg} \times 7/100$$

$$= 259 \text{ kg}$$

$$\begin{aligned} \text{Total cost of waste shredded plastic} &= 259 \text{ kg} \times 12/\text{kg} \\ &= \text{Rs } 3108 \end{aligned}$$

Cost of seal coating of road constructed with mixture of bitumen and waste plastic

= actual cost of bitumen required after plastic mixing + total cost of plastic

$$= (3700\text{kg} - 259\text{kg}) \times 39 + \text{Rs } 3108$$

$$= \text{Rs } 1,37,307/-$$

Total cost of plastic road constructed = Rs 1,37,307 + cost of gravel chips

$$= 1,37,307 + 4400$$

$$= \text{Rs } 1,41,707/- \approx \text{Rs } 1,42,000/-$$

- Cost of plastic road seal coat is almost 5% to 7% less than that of normal bituminous seal coat road.
- In every one KM of plastic road constructed, Rs 7000 is saved.

4. Conclusion

- Plastic road constructed was found to be economical as the cost of construction was low and the output performance was found to be extraordinary.
- Road strength was found to be twice than that of normal bituminous roads .
- Resistance towards water stagnation was found , & hence they prove to be as pothole free roads .
- Construction of such roads proves to be safe disposal mechanism of waste plastics.
- Such roads proves to reduce accidental threats as there is no pothole formation mainly.
- Roads made from plastic was found to be durable against extreme weather conditions like floods , harsh snowy winter etc.
- long lifespan as compared to normal bituminous roads .

5.Refrances

1. Mr. Dinesh M.Sutar , “feasibility of plastic coat road with respect to cost and their performance”, International journal of Engineering and Technology ,volume 03-12, December 2016, pp1513-1518.
- 2.Avula Vamshi, “Use of waste plastic in construction of bituminous road”, Journal of Engineering ISSN: 2325-0224 123 vol 2, No. 3 , 2013 , pages:123- 128.
3. parth H . Sadadiwala, “ Utilization of waste plastic in Bituminous Mix”, ISSN (online): 2348-7750, volume 03, special issue No. 01, March 2015.
4. Amit.P. Gawande, “ Economics and viability of Plastic road: A review”, Journal of current chemical and pharamaceutical sciences, ISSN: 2277-2871 volume 3, No.4 , 2013, pages 231 – 242.
5. Handbook for PWD Engineers (building and road construction), public works department, jammu & Kashmir (2020)
- 6.Ministry of Road transport and highways, GOI, guidelines for use for plastic waste in pavement construction (5th revision)

