

Study the Stability of Bitumen mix prepared using Single layer plastic and Multilayered plastic

¹Ghulam Mustafa Qalander, ²Saurabh Gupta

¹M.tech Student, ²Assistant Professor, Department of Civil Engineering, Arni University, India.

Abstract—India has a huge potential of using its plastic waste for laying plastic roads which are being defined as Plastic road which is actually nothing but mix of aggregate (sand and stone chips), bitumen and shredded plastic. Plastic roads are quite the rage in the European Union which has taken on massive environmental conservation and pollution mitigation goals. The problem with plastic decomposition as being non biodegradable has always provide ways for its reutilization rather than looking for the ways for decomposing it, one of such way is to use plastic as binder in the bitumen which leads to utilization of waste plastic in a bulk in road construction. India has already built some 21,000 miles of roads using plastic waste.

An attempt has been made in order to meet the above demands; utilization of plastic waste multi layer as well as single plastic has been done in preparing bitumen mix.

Index Terms—Single layer Plastic waste, VG-10 bitumen, road construction, Multilayer plastic, Bitumen Asphalt.

I. INTRODUCTION

Mostly plastics found in the environment are non-biodegradable because plastic is widely used due to its low cost, versatility and durability. This durability is partially based on plastic being an uncommon target for bacteria, which makes it non-biodegradable. To encourage use of waste plastic on National Highways (NHs), Ministry of Road Transport and Highways has issued guidelines for its use within 50 km periphery of urban areas having population of more than five lakh. The guidelines also stipulate taking up of a stretch of at least 10 km as pilot project for assessment of its performance. Moreover, the Government has decided that in 2019-20 the *Swachhata Hi Seva* Campaign (SHS) will focus on plastic waste management as main theme, wherein instructions have been issued for collection and re-use of waste plastic. This includes awareness generation, recycling, effective disposal of collected plastic waste including its usage in road construction. Waste plastic has already been utilised in wearing course of about 50 km of NH stretches. Indian Roads Congress (IRC) has formulated IRC SP: 98:2013 “Guidelines for the use of Waste Plastic in Hot Bituminous Mixes (Dry process) in Wearing Courses” based on laboratory as well as field performance studies/investigations carried out in India. As per IRC SP: 98: 2013, plastic waste is used up to 8 percent by weight of bitumen in the bituminous wearing course and as per mix design requirement.

II. MATERIAL AND METHODS

The various type of material used were VG-10 bitumen was used @4.5% per MT mix, Single layer waste plastic,

Multilayered waste plastic and casting sample for Marshall Stability.

Firstly, we have to cast conventional bitumen mix i.e. BM₁, after it samples for BM₂ (8% SLplastic) and BM₂ (8% MLplastic) as per their proportioning were casted and tested test as shown in table 1:

	%age of Waste Plastic by Wt. of Bitumen	Coarse Aggregate 11.2mm gauge	Bitumen VG-10	Waste Plastic	
				Single Layer	Multilayer
BM	0%	1150	54.18	0	0
BM ₁	8%	1150	50.39	3.8	0
BM ₂	8%	1150	50.39	0	3.8

Table 1: Quantities of Material of Bitumen Mix for Moulds

III. RESULT AND DISCUSSION

The volumetric and mechanical properties of the mix obtained after adding waste plastic i.e. single and multilayer waste plastic are tabulated below

Mix designation	%age of Waste Plastic	Bulk Specific Gravity G _b (g/cm ²)	Theoretical Specific Gravity G _t (g/cm ²)	Void Analysis			Marshall Stability (kN)	Flow (mm)
				AV (%)	VM A (%)	VFB (%)		
BM	0	2.331	2.458	5.16	15.68	67.09	9.394	1.784
BM ₁	8	2.316	2.432	4.769	16.221	70.599	9.490	1.673
BM ₂	8	2.322	2.451	5.263	16.004	67.114	8.469	1.664

Table 2: Test Result Values of bitumen mix

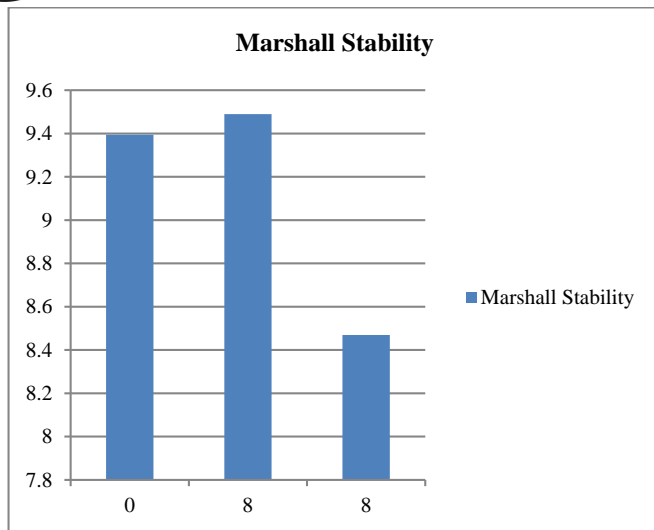


Fig1 Stability relation using Marshall Stability test

IV. CONCLUSION

The stability was found to be 9.490 KN for the bitumen mix by replacing bitumen contents @8% of waste plastic single layer with bitumen contents is more by 1% than the reference mix with 0% waste plastic and stability is more by 11% as compare to mix with multilayer waste plastic by replacing the bitumen content @8% by weight of bitumen. The increased in Marshall Stability value resulted in the improvement of toughness of the mix.

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