Polymer Modified Bitumen



ئامادەكردنى :

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وەک پێداويستى گۆڕينى پلەى ئەندازيارى لە ڕێپێدراو بۆ ڕاوێژکار

polymer modified bitumen

Polymer modified bitumen (PMB) is one of the specially designed

bitumen grades that are used in making pavement,

roads for heavy duty traffic and home roofing solutions to

withstand extreme weather conditions. PMB is a normal bitumen

with the added polymer, which gives it extra strength, high

cohesiveness and resistance to fatigue, stripping and

deformations, making it a favorable material for infrastructure.

Pavements designed and constructed for heavy-duty traffic and extreme weather conditions require specially designed engineered Bitumen Grades.

When a polymer is added to regular bitumen, it becomes more elastomeric, which provides it with additional elasticity. The polymer that is added is styrene butadiene styrene (SBS), which acts as a binder modification agent

The primary objective of SBS polymer modified bitumen is to

provide extra life to pavement, roads and construction designs. Some of the qualities

exhibited by PMB are:-

- Higher rigidity
- Increased resistance to deformation
- Increased resistance to cracks and stripping
- Better water resistance properties
- High durability

Advantage of using polymer modified bitumen

- 1- Stronger road with increased marshal stability value and greater Rigidity.
- 2-Better resistant towards rainwater and water stagnation.
- 3- No stripping and no potholes.

4- Better resistance to permanent deformation

- 5- Reduction in pores in aggregate and hence less rutting and raveling.
- 6- Much higher durability.



One of the projects which is used styrene butadiene styrene (SBS)

(Construction of Dukan-Chwarqurna Dual way Project From KM: 35+000 to 53+580) first stage / with bridges.

In our project we had three layers of flexible pavement which (Binder 1,2) and wearing surface as a last layer.

We used polymer in wearing surface, because the road has many loads.



Procedure for preparation polymer modified bitumen and used in the mix design of asphalt: -

1- First time we installation the machine to prepare and mixing the styrene butadiene styrene (SBS) with bitumen in the site of the project.as below picture: -



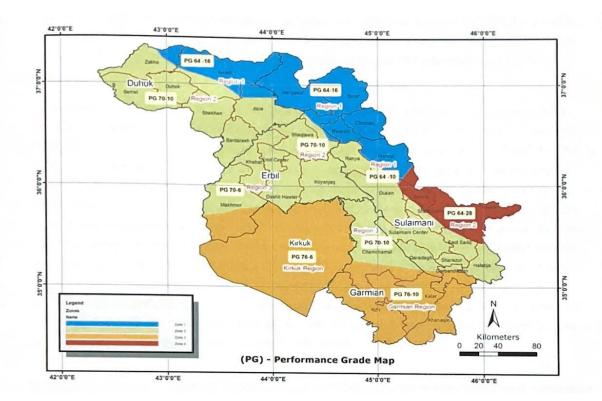
2- We prepare for mix design of super pave by mixing the materials (coarse aggregate, fine aggregate, fine sand, filler, bitumen, polymer) and used in the last layer.



- (0-5 mm)
- **(5-12mm**)
- (12-19mm)

3- When use polymer in mix design of asphalt, must be determine the temperature of the zone of the project, because deferent ratio for preparation and mixing the (ABS) and bitumen which is start from (2-10) according to the weather.

In Kurdistan we decide and chose the fermeture by this map which is determine all zones:



Zones	Maximum air temperature, (° C)	Minimum air temperature, (° C)	(Region included)				
Zone -1-	64	-16	Duhok-Region one, Erbil -Region one, Sulaymaniyah Region two.				
Zone -2- 70		-10	Duhok-Region two, Erbil -Region two &three Sulaymaniyah Region three.				
Zone -3-	76	-10	Garmyain-Region-one, Kirkuk - Region one,				
Zone -4-	64	-28	Sulaymaniyah Region one.				

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We use Performance grade (PG) (-10, 82) for Rania and by three mixes of bitumen grade (40-50) and polymer (KRATON D1192) by (%3.5, %4, %4.5) and compere to table: -

	Binder Grade Veri	fication and Accepta	nce	
Test	Test Temperature	Acceptance Limit	Purpose of Test	
	Fresh U	Inaged Binder		
Flash Point	NA	≥ 230 ° C	To ensure safety from fire	
Viscosity	135 ° C	≤ 3.0 Pa-s	To ensure workability	
Rheology (G*/sinδ)	64 ° C	≥1.0 KPa	To ensure rutting resistance	
	Binder Aged in the Ro	olling Thin Film Oven	(RTFO)	
Mass Loss	163 ° C	≤ 1.0%	To ensure durability	
Rheology (G*/sinδ)	64 ° C	≥2.2 KPa	To ensure rutting resistan	
Binder af	ter aging in RTFO and I	Pressure Agin g Vesse	el (PAV) at 110 °C	
Rheology (G*. sinδ)	25 ° C	≤ 5.0 MPa	To ensure fatigue resistance	
BBR Rheology (S)	-12 °C	≤ 300.0 MPa	To ensure thermal cracking	
BBR Rheology (m)	-12 °C	≥ 0.300	resistance	
Quality	y Control Tests – Check	ing for Consistency (unaged Binder)	
Softening Point C ^o	NA	60*-	ASTM D36	
Penetration dmm	25	Report	ASTM D5	
States and the second	Tests for Polymer Mod	ified Binders (Unaged	l Binder)	
Elastic Recovery %	25	65*	Elastic behavior ASTM D 608	
Different in softening point C ^o	NA	4*	Storage Stability - ASTM D71	

The sign (*) means that this values are applicable for binder grade PG 76 and above.

After check three samples and we decided to use **(% 4**) for all project.

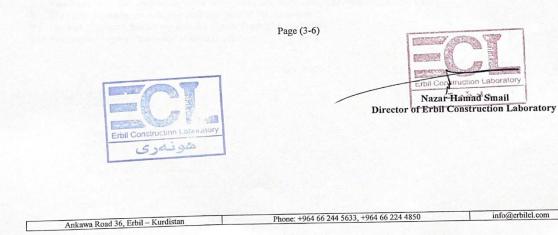
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Form No. PGR02	Revision No.	2.1a Approved	by Formance (PG)	Approved on -
Listed below, detailed test res	ults of sample (s). Hope	to pay its cost accordin	g to the attached payme	nt billhead. "With appreciation" ECL Report
Letter of test request No. Date	Date of sample receiving	Date of test finishing	No. of sample(s)	No. Date
1862 17/3/2021	17/3/2021		1	R-408721 2 7 -65- 202
Name of Test Requester		oject Name/Sample L		Contractor's Name
D.M.P.R.B.R	Construction of (Dokan-Chwarqurna) Stage / Ranya	Road with bridge First	USAS Co.
				% of Additive 3.5
Test Penetrat	ion	specification ASTM D5	unit dmm	35
Softeni	ng	ASTM D36	C°	61 >240
Flash		ASTM D92 ASTM 6084	C° %	62*
RV		ASTM D4402	c.P	<3000
Compatibility In Terms Of Di	fferent In Softening Point	ASTM D7173	C°	The second secon
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G*/Sin∆ AS	STM D7175		≥2.2 kPa 2.4016	kPa
·我们的人的是你的。"		Long Term Aging B 40 Ma	y PAV x 5000 kPa <5000) kPa
	STM D7175 STM D6648	-10 M	ax 300 Mpa 59	Mpa
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G*/Sin∆	ASTM D7175	82	≥2.2 kPa	3.301	EkPa	istruction Laboratory
		Long Term A	ging By PAV	The state of the s	STRUCTURE DECKS	
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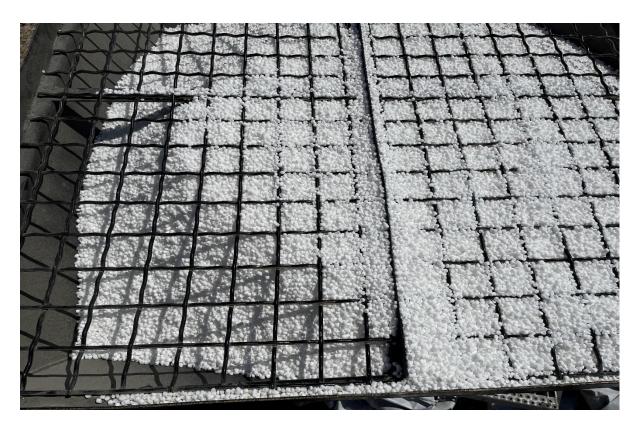
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			1000	- Contractoria	A CONTRACTOR				-	
Parar	neter	Test Method	Test Tem	herature	Specifi	antion	NA	ed Value		
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G-/2	<u>sin</u>	ASTM D7175	82 Sh	2 ort Term Ag	≥1.0		2.98	kPa	a 🗟	N
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4- After get the mix design for the wearing surface and we start the work in the site, first time we mix polymer and bitumen by added (%4) of (SBS) to bitumen grade (40-50) and mix for (30 minute in temperature (180-220 Celsius) in the tank of the machine until the particle of the (SBS) dissolve in the mixture.





After that the mixture must be move to the main storage tank, and mixing by three motors for about at least (**6 hours**) before mix with aggregates and make asphalt.



Before use modified bitumen mix with aggregates must be test of (softening point, penetration, and Elastic recovery) in the site laboratory





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5- Product the asphalt mixture by the temperature (180 Celsius) and move to the site of the road and lay by digital paver machine and compacted only by steel roller compacter





Conclusion and Recommendation: -

polymer is not so much used In Kurdistan, because of

difficult process and expensive of it's price which is

needed (1.5-2 \$) for every square meter of asphalt,

also, all projects have not surface course (wearing coat)

but in the future polymer must be use in all roads which undergo more loads.

References

1-introduction take form RABIT (RAHA BITUMEN) company is one of the market leaders in production from google

2- My experience from projects

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