



HGI IT PREMIER

TECHNICAL REPORT 238-2024

***ASPHALT MIX CHARACTERISTICS TESTS
WITH GRAPHENE MODIFIED ASPHALT***

Please find in this TECHNICAL REPORT THE CHARACTERISTICS CORRESPONDANT TO THE TESTS OF ASPHALT MIXTURE USING ASPHALT MODIFIED WITH GRAPHENE for use at your discretion.

APPLIED METHODOLOGY:

- Conventional AC20 asphalt cement was used as a binder.
- Such binder was diluted at a temperature of 60° C, and a 0.5% mass ratio was incorporated into the mix.
- Dense granulometry was implemented at a ¾" (½" nominal) size, with added stone materials from the Lopez Mateos mines.
- 3 Marshall slabs with 6% AC20 asphalt cement by mass, were elaborated.
- 3 Marshall slabs with 6% AC20 graphene modified asphalt cement by mass, were elaborated.
- Viscosity curves of both binding agents were determined.

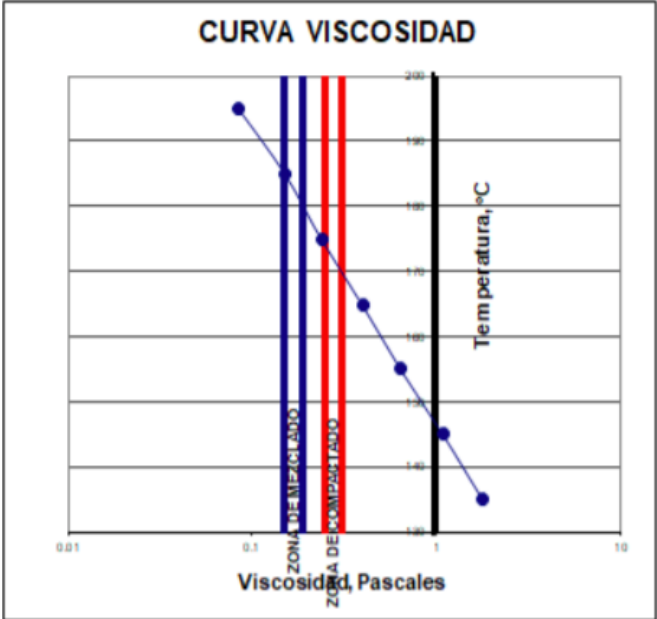
OBTAINABLE RESULTS:

SPECIMEN	ASPHALT CEMENT %	THICKNESS cm/inches	WEIGHT ON AIR, grams/oz	WEIGHT IN WATER, grams/oz	WEIGHT SSS, grams/oz	DENSITY, Gmb	Gmm	VACUUM %	STABILITY, Kg/oz
1	6.1	6.4	1205.4 / 42.51	700.4 / 24.70	1207.5 / 42.59	2.377	2.482	4.2	1056 / 37.24
2	6.1	6.42	1208.6 / 42.63	700.5 / 24.70	1210.2 / 42.68	2.371	2.482	4.5	1160 / 40.91
3	6.1	5.98	1198.5 / 42.27	695.6 / 24.53	1199.4 / 42.30	2.379	2.482	4.2	1152 / 40.63
4 GRAPHENE	6.1	6.12	1200.7 / 42.35	698.5 / 24.63	1201.2 / 42.37	2.389	2.486	3.9	1790 / 63.14
5 GRAPHENE	6.1	6.02	1196.7 / 42.21	695.6 / 24.53	1197.3 / 42.23	2.385	2.486	4.3	1840 / 64.90
6 GRAPHENE	6.1	6.21	1203.9 / 42.46	700.1 / 24.69	1204.1 / 42.47	2.389	2.486	3.9	1962 / 69.20

DETERMINATION OF MIXING AND MIX COMPACTION TEMPERATURES OF ALSPHALT MIX

PRODUCT: AC20

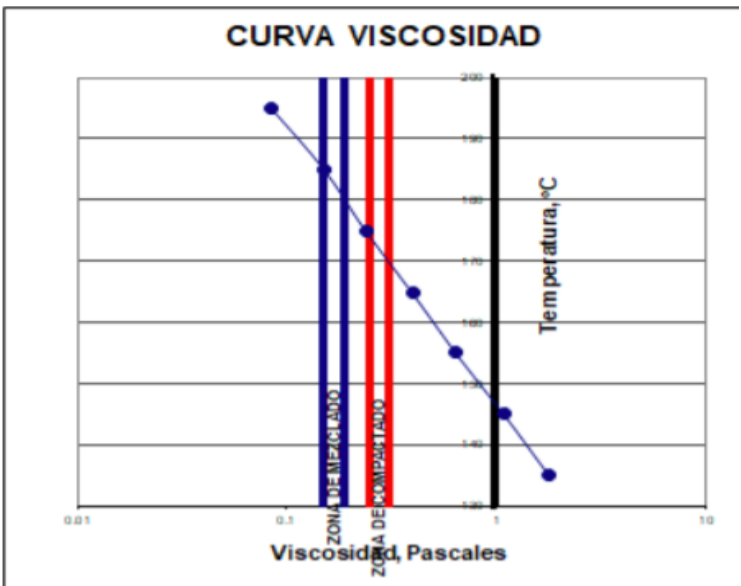
TEMPERATURE, °C	CEN TIPOISES	Pa.s
195	60	0.06
185	90	0.09
175	132	0.132
165	180	0.18
155	280	0.28
145	450	0.45
135	900	0.9
MIX TEMPERATURE, °C	165	
COMPACTING TEMPERATURE, °C	150	



DETERMINATION OF MIXING AND MIX COMPACTION TEMPERATURES OF ALSPHALT MIX

PRODUCT: AC20 with 0.5 GRAPHENE

TEMPERATURE, °C	CEN TIPOISES	Pa.s
195	85	0.085
185	152	0.152
175	240	0.24
165	400	0.4
155	650	0.65
145	1104	1.104
135	1819	1.819
MIX TEMPERATURE, °C	185	
COMPACTING TEMPERATURE, °C	170	



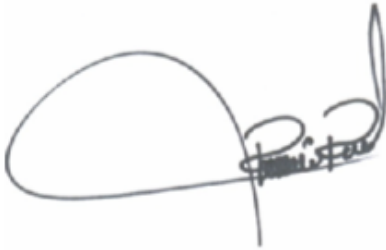
CONCLUSIONS:

While comparing results between the original binder and the modified version, it is clear that this product offers better viscosity.

The stability results in the grapheme mix yield significantly up to 70%
It is recommended to look deeper into the characteristics of this mix under the criteria established by AMAAC LEVEL II PROTOCOL (TSR, PERMANENT DEFORMATION)

Without further ado...

Sincerely

A handwritten signature in black ink, appearing to read 'Ramiro Romero Mendez', with a large loop on the left side and a vertical line extending downwards from the end.

Ing. Ramiro Romero Mendez
General Director
Ced. Prof. 2764062