

Roads performance in **hot climates** in LIBYA

Eng. Tareq Al-Ghadamsi
Executive Manager
JAWHAR TECH

Roads in Libya

What we have ?

Approx

83000 km of roads

48000 paved

35000 unpaved

59 airports

Roads Condition



Modified or Unmodified

Reasons to go to modified bitumen

WAS

The results that can meet different issues

Climate condition Hot Cold

Operation conditions load traffic

Durability

Getting the results

Better understanding can be worked out with Super Pave results & Specifications

- **Empirical testing**

 - Penetration Elastic Recovery Viscosity SP(softing point)

- **Performance at wide temperature range**

 - Rheology (DSR, PAV, RTFO)

- **Asphalt mix performance**

 - Rutting

 - Low temperature cracking

 - Fatigue

 - REAL TEST SECTIONS (BEST ONE, REAL PERFORMANCE)

Choices

- Aromatic oils / distillation currents
- Natural Asphalt (asphaltite / gilsonite)
- Sulfur
- Limestone
- Oxidants (PPA alone)
- Fibers (for increase cohesion)
- High molecular weight waxes
- Adhesion promoters (antistripping agents)
- **POLYMERS (wide examples it is every where eat them wear them work with them)**
- Etc.

Polymers Classification for PMA

Task force 31 (AASTHO)

- Created in 1991
- First attempt to classify PMA with polymers in the US.
- Determines physical characteristics in the asphalt based on the polymer used.
- Evaluates and characterizes polymers used then.

ASTM Classification

- Created on year 2000
- Based strongly on TF 31
- 4 types of PMA.
- Determines physical characteristics of a PMA based on the polymer used.
- It suggests some other polymers can be used if they comply with required characteristics.

Selecting Elvaloy RET

- It is not a type of rubber like SBS
- It is not an EVA resin
- It is not “just polyethylene”

It is not just an additive Cohesion and Adhesion promoters (PR Blast , anti stripping,rubber)

It is a part of the Asphalt and can be classified According to standers

- Only polymer that was designed for Bitumen Modification (Other products designed for other applications.)
- Only polymer system to form graft with bitumen. Will not separate □ long term transportation is very easy.
- Allows for long-term storage and transportation of modified bitumen.
- Easier paving, less sticky, paves like unmodified bitumen
- Excellent resistance to fatigue, rutting moisture damage.

Other Reasons For Choosing **Elvaloy**

- **Harsh Climatic Conditions (hot extremes-cold)**
- **Adjustable rate of dose (1.1, 1.2,1.22. etc) depending on Neat Asphalt type and PG needed**
- **Quality control easily worked out assuring that the resulted Asphalt concrete will meet the needs**
- **Resisting the Oxidation effect (chemically stable)**
- **this point is important for hot countries desert areas ,long hot days**
- **Cost effective due to durability**
- **We found what we are looking for**

Starting in Libya

The conditions we met

Testing

No Super Pave so can not classified the polymer in other words modified bitumen can not have a meaning so tests all most are done out side the country

Now we are preparing Super pave lab

Tank made

we found a big work shop and tools to work out the mixing tank

Under standing the target we are looking for PG 76

Trail Section

This can show the real performance of ELVALOY RET

Tests and lab

- PENTRATION

VISCOCITY (Brookfield)

SHRP1006, AASHTO TP48, ASTM D4402



Tests and lab

- Softening point recovery



Torsional Elastic



Testing Results

SHRP PERFORMANCE GRADE ANALYSIS

Modification with Elvaloy® to determine sufficient performance of Polymer Modified Bitumen.
 Tests performed according to EN 14023 4170
 .Specification. Neat bitumen Pen.grade 60/70 from ref. Az zawiya. Used PPA Innovalt N400

:Data/Results on Base Binder

TEST:	UNIT:	SPECS:	TEMP. ° C:	REQUIREMENTS:	RESULTS:
Penetration	0,1mm	EN 1426			67
Softening Point	° C	EN 1427			47,0
Fraass Breaking Point	° C	EN 12593			---

Dynamic Shear [G*/sin δ @ 1,59 Hz]	kPa	T315	64	70	76	min. 1,0	G* [Pa]	δ [°]	G*/sin δ [kPa]
							1190	87,9	1,190
							546	88,6	0,550
							---	---	---

Testing Results

SHRP PERFORMANCE GRADE ANALYSIS

Data/Results on Modified Binder:

Properties:

43/10 + 1,2% Elvaloy® 4170 + 0,25% PPA

Penetration	0,1mm	EN 1426			44
Softening Point	° C	EN 1427			60,5
Fraass Breaking Point	° C	EN 12593			---
Elastic Recovery	%	EN 13398			68,5
Torsional Elastic Recovery	%	M – MMP – 4 – 05 – 024/02			44

				G* [Pa]	δ [°]	G*/sin δ [kPa]
Dynamic Shear [G*/sin δ @ 1,59 Hz]	T315	70	min. 1,0	---	----	----
				976	70,9	1,030
				548	72,1	0,580

Failure point	° C	T315			76,3
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Rotational viscosity	Pa.s	T316	135		1,850
			165		---

Properties after RTFO test:

Mass Change	%	EN 12607-1		1,0 max	---
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				G* [Pa]	δ [°]	G*/sin δ [kPa]
Dynamic Shear [G*/sin δ @ 1,59 Hz]	T315	70	min. 2,2	3110	64,6	3,440
				1720	65,2	1,890
				----	----	----

Failure point	° C	T315			80,5
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Properties after PAV (110° C, pressure 2.1 kPa, 20 hr.):

				G* [Pa]	δ [°]	G*/sin δ [kPa]
Dynamic Shear [G*x sin δ @ 1,59 Hz]	kPa	T315	5000 max.	---	---	---
				---	---	---
				---	---	---
Creep Stiffness	Stiffness, 60s	MPa	T313	-12	300 max.	---
	m Value, 60s		T313	-12	0,300 min.	---

SUPERPAVE™ BINDER GRADE					76 (76,3)
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The Tank



The Tank



The Mixing Tank (50 metric tons)



The Mixing Tank (50 metric tons)



The Mixing Tank Control



The Trail Section



The Trail Section



The Trail Section Paving



The Trail Section Paving



The Trail Section After 4 Years



The Trail Section After 4 Years



Mix Design properties

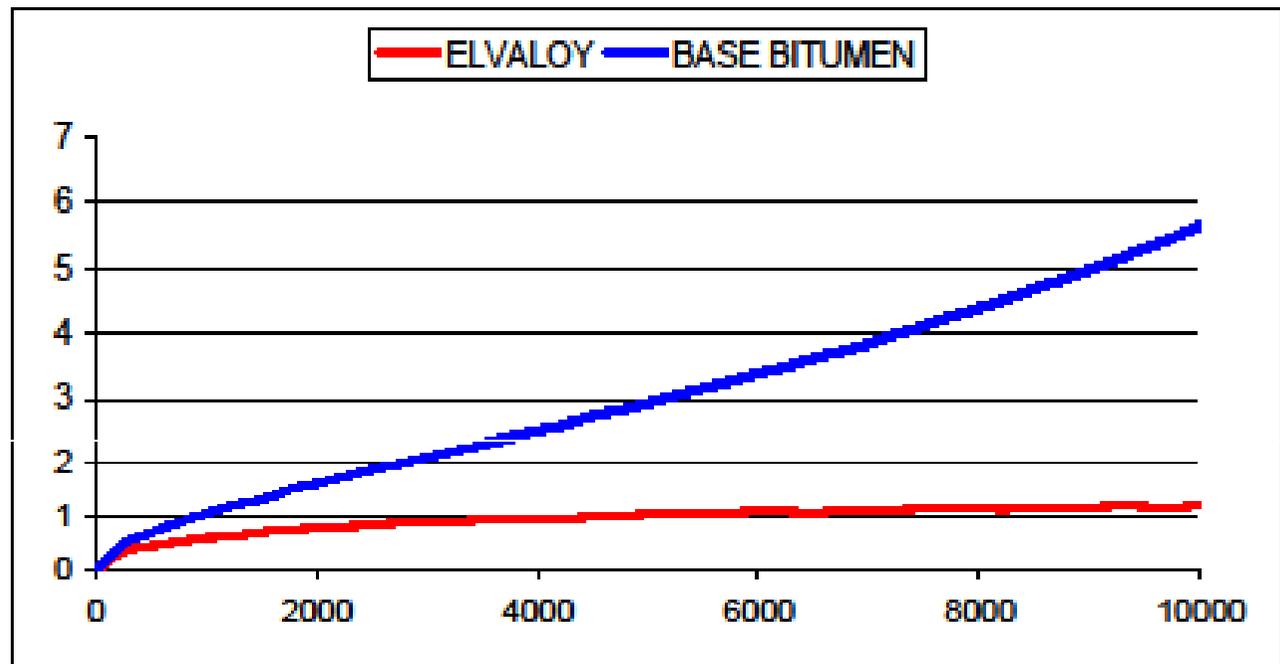
Bituminous course,		Bir Ghanam section -Nalut -Azziaya project 216 Km		
Properties	mark	Unit	result	
Design binder content	Pb	%	4.0	
Voids in Mix	VIM	%	5	
Voids in Mineral Aggregate	VMA	%	14	
Voids Filled with Binder	VFB	%	64	
Maximum Theoretical Density	Gmm	kg/m ³	2486	
Mix density at Design Binder Content	Gmb	kg/m ³	2380	
Bitumen Type	A	-	60/70	
Specific gravity of bitumen	G _b	kg/m ³	1030	

Results

The resistance of asphalt mixtures against rutting tested in accordance to the European standard no. EN 12697-22



produced:	CTU	asphalt type	Libyan standard
sample no.		bitumen type	ELVALOY AM
sample date	25.08.10	slab no. 1 Air voids	99,5 %
test date	27.08.10	slab no. 2 Air voids	99,9 %
mixing temperature	165 °C	slab no. 1 thickness	50 mm
test temperature	60 °C	slab no. 2 thickness	50 mm
		average thickness	50 mm



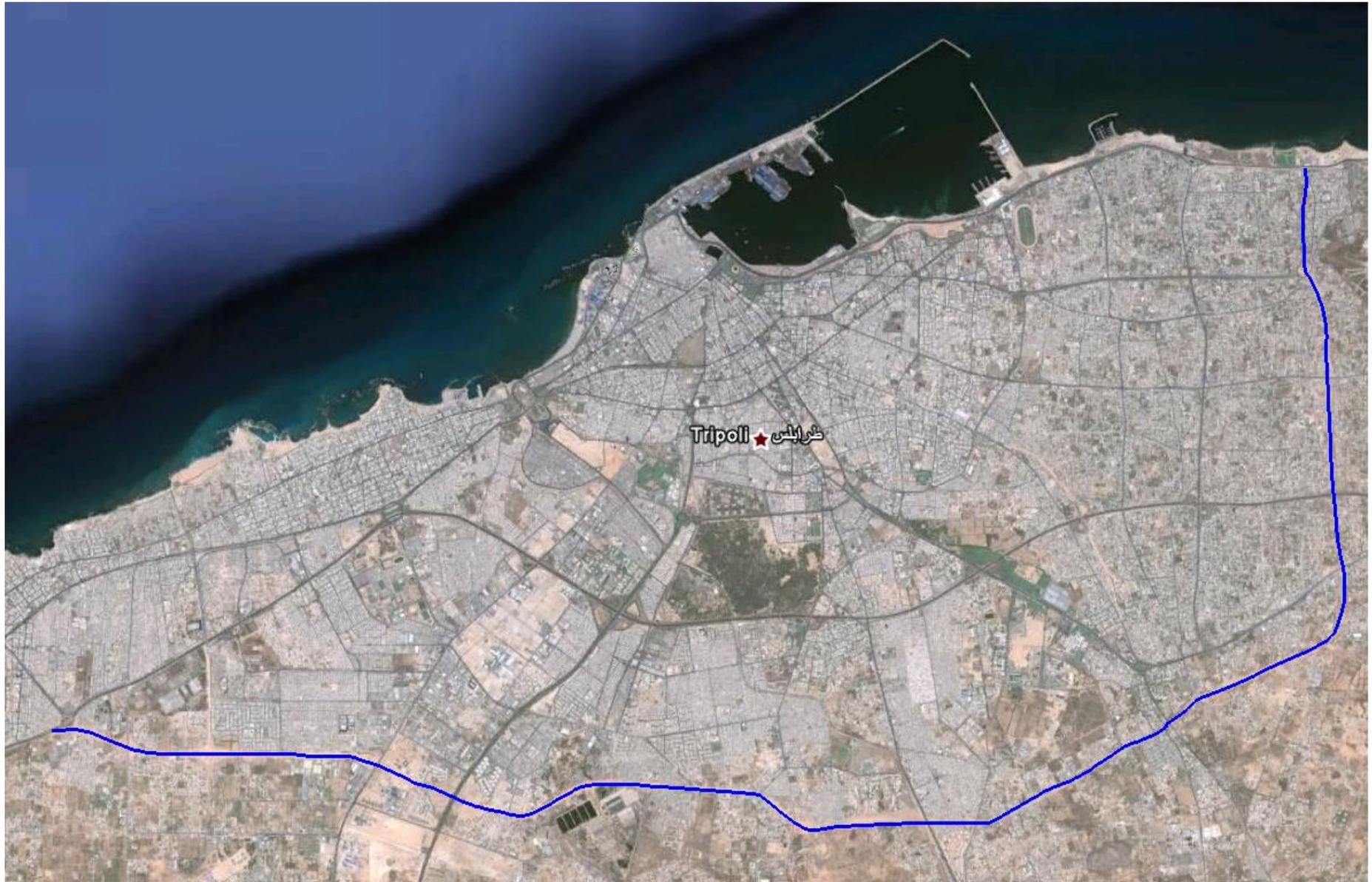
sample	average rut depth after	average rut depth after 10 000	$d_{10\,000} - d_{5\,000}$ (mm)
Elvaloy	1,04	1,21	0,17
Base	2,94	5,64	2,70

ELVALOY ASPHALT RESULTS			
Mean proportional rut depth WTS_{AIR}	$\frac{d_{10\,000} - d_{5\,000}}{5}$	0,034	mm
PRD_{AIR}		2,1	%

BASE ASPHALT RESULTS			
Mean proportional rut depth WTS_{AIR}	$\frac{d_{10\,000} - d_{5\,000}}{5}$	0,54	mm
PRD_{AIR}		5,9	%

tested by: O. Vacin

3rd Ring Road Tripoli (8-lanes) about 28 Km will be using Elvaloy



Conclusion

- 1) We worked out having **PG 76** Under super pave easily
- 2) Under uncontrolled load transportation (about 18 -20 axle load) we get no rutting
- 3) No Cracking (temperature in such areas changes about 20 C to 30 C by the day)
- 4) No asphalt deformation at the trail section due to breaking at check point positioned at the beginning of the trail section

If you Know the target you can work it out with
Elvaloy RET to meet your needs
we do it and everybody can

Thanks