Current Asphalt Concrete (AC) Mixtures in Israel

החברה הלאומית לדרכים בישראל בע"מ

Maa'tz- The Israeli National Roads Company Ltd.

19/11/2008

Presented by:

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Yona – Engineering Consulting & Management ltd

Welcome to Israel

Facts and Figures
Israel 2008

- 25 Asphalts plants,
- 5-6 Million ton annual production,
- Plant qualification required,
- QA/QC system implemented,
- Hot climate (9 months),
- High traffic volumes and axle loads.

Up until the 90's

- 19 mm (3/4") or 12.5 mm (1/2") Dense Graded asphalt Mixes (DGM) only,
- 60/70 penetration bitumen only,
- Limestone/Dolomite aggregates only,
- AC mixes viewed only as a source of strength and low deformability.

In the 70's due to low skid resistance problems, a Gap Graded Mixture (GGM) using basaltic coarse aggregates was adopted.

In the <u>early 90's</u> due to increased Rutting and Bleeding in DGM it was decided to:

1) Lower bitumen content by reducing fines in the mix and increase energy of compaction from 50 to 75 blows.

2) Move from Penetration to Viscosity grading and adopt stiffer bitumen (AC-30, AC-40).


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VOLVO
FH12


PAZ OIL CO LTD
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Since 1994 Israel adopted 3 Advanced AC Mixes

"S" - Based on US SHRP Program (Superpave). Widely used for all pavement layers.

SMA- Stone Mastic Asphalt , Based on German technology. Widely used for wearing courses in main roads.

Porous Asphalt (PA) – with more than 20% air voids. Based on French technology. Seldom used for noise reduction only.

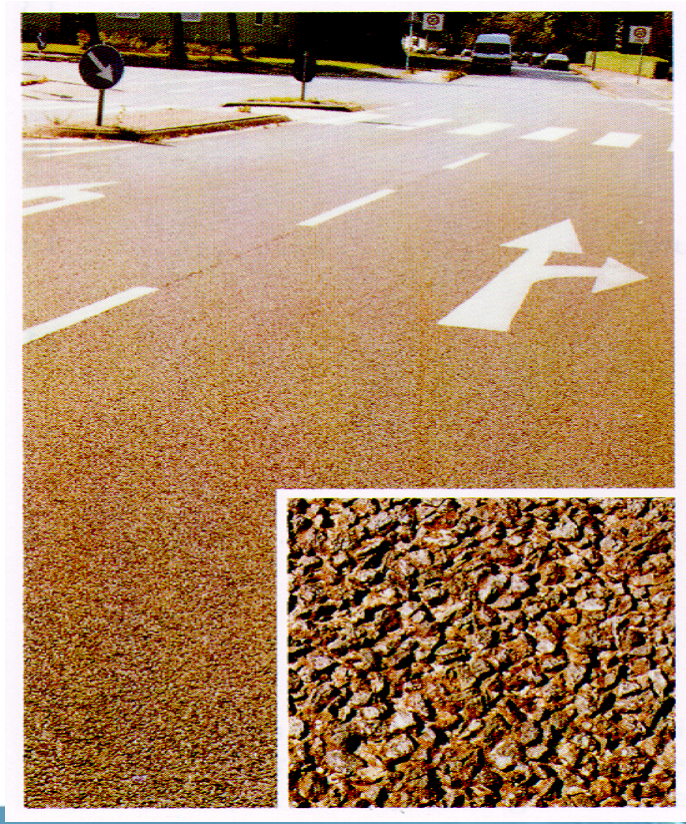
Advanced AC mixtures offer:

(in addition to stability and deformability)

- ✓ Increased durability,
- ✓ Noise Reduction,
- ✓ Improved rut resistance,
- ✓ Higher skid resistance,
- ✓ Better ride quality,
- ✓ Faster drainage,
- ✓ Enhanced road marking visibility.

The First SMA Project

After more than 30 years still in good condition !

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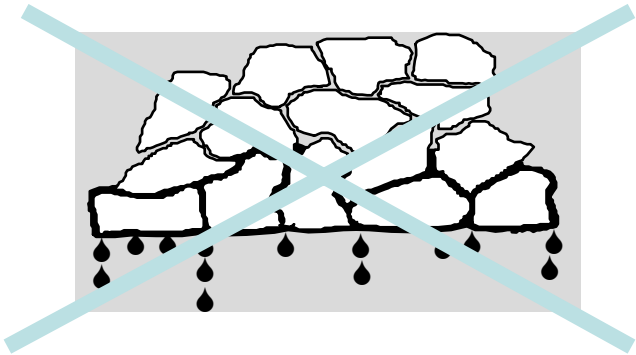
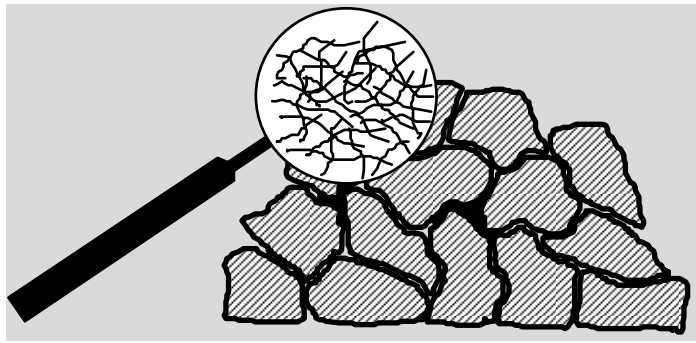
Basics of Advanced AC Mixes

1. **Maximize stone-to-stone contact in granular skeleton , for improved stability and rut resistance.**
2. **Thicken bitumen film for improved flexibility and durability.**

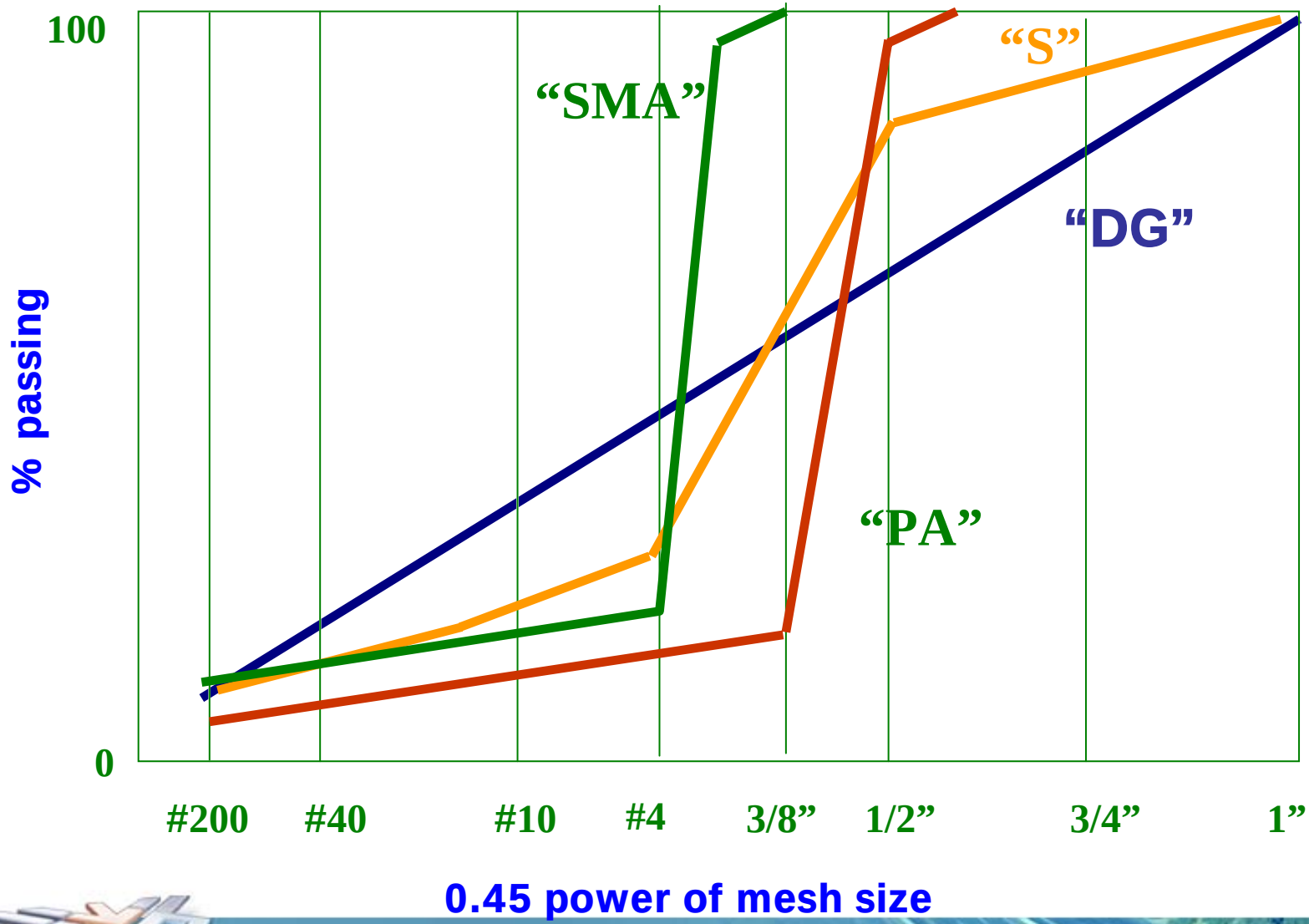
<u>The key:</u> High VMA.
<u>There is a problem:</u> How to avoid drain down of higher bitumen content from a coarse aggregate skeleton.

Use stabilizing fibers

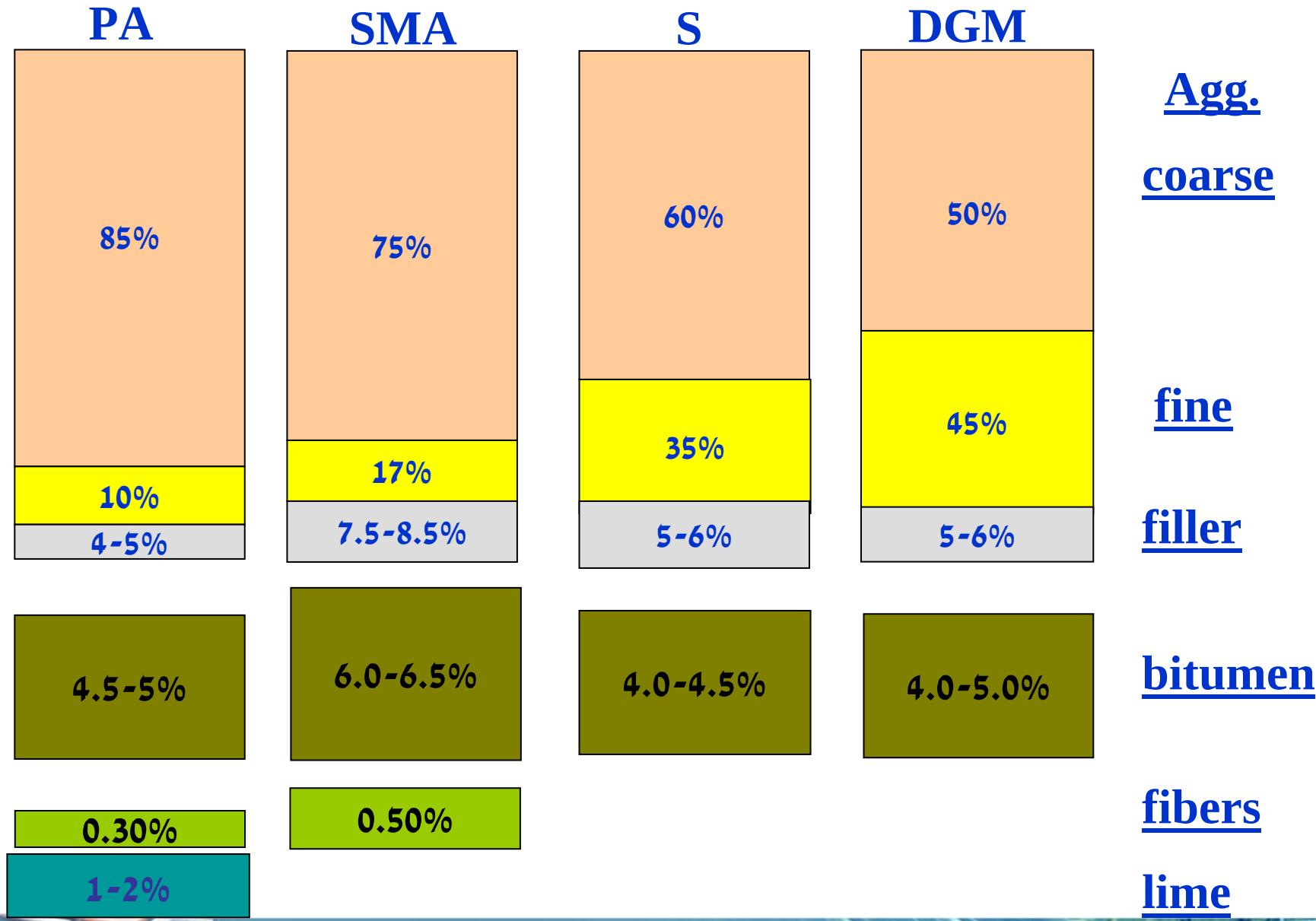




Typical Grading

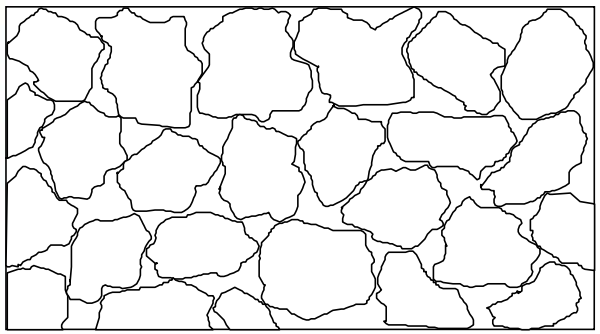


TYPICAL MIXTURES COMPONENTS

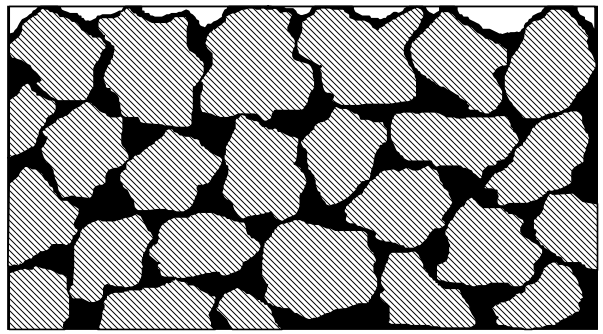


SMA Components

Stone Skeleton



Stones



Filler + Sand + Bitumen

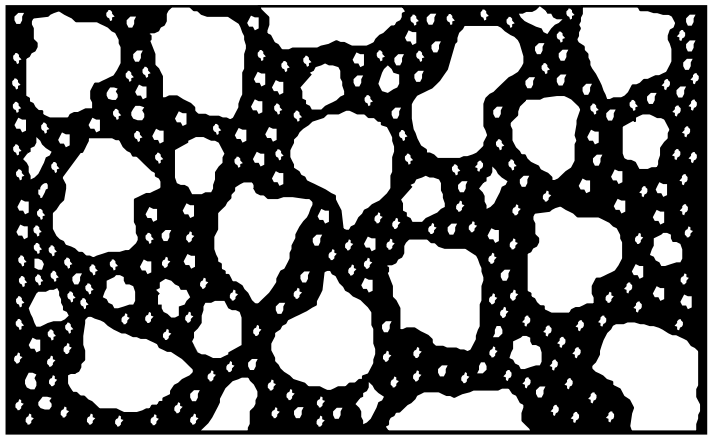
+

Fibers

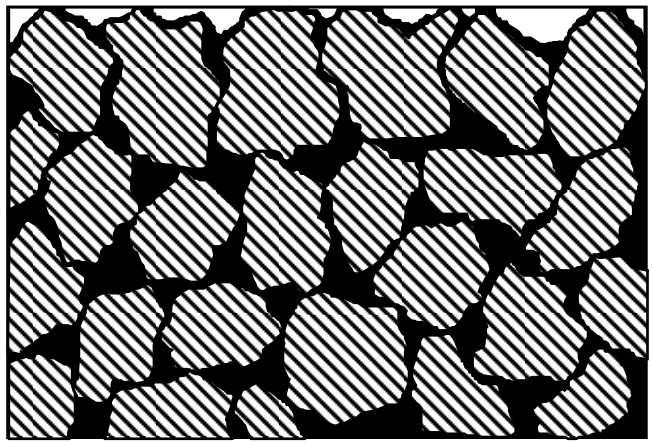
Mastic

S tone
M astic
A sphalt

Typical Mix Skeleton

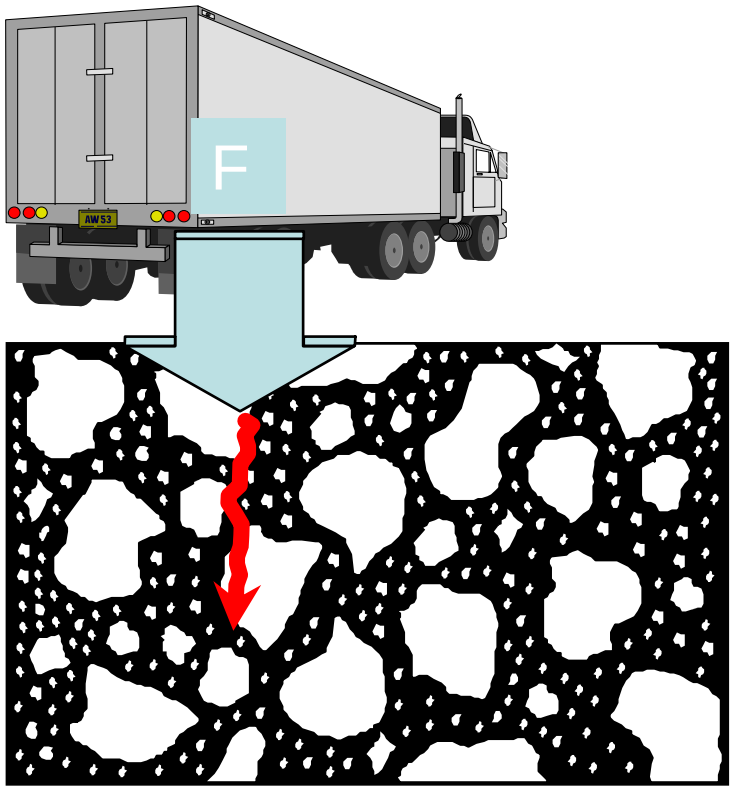


DGM

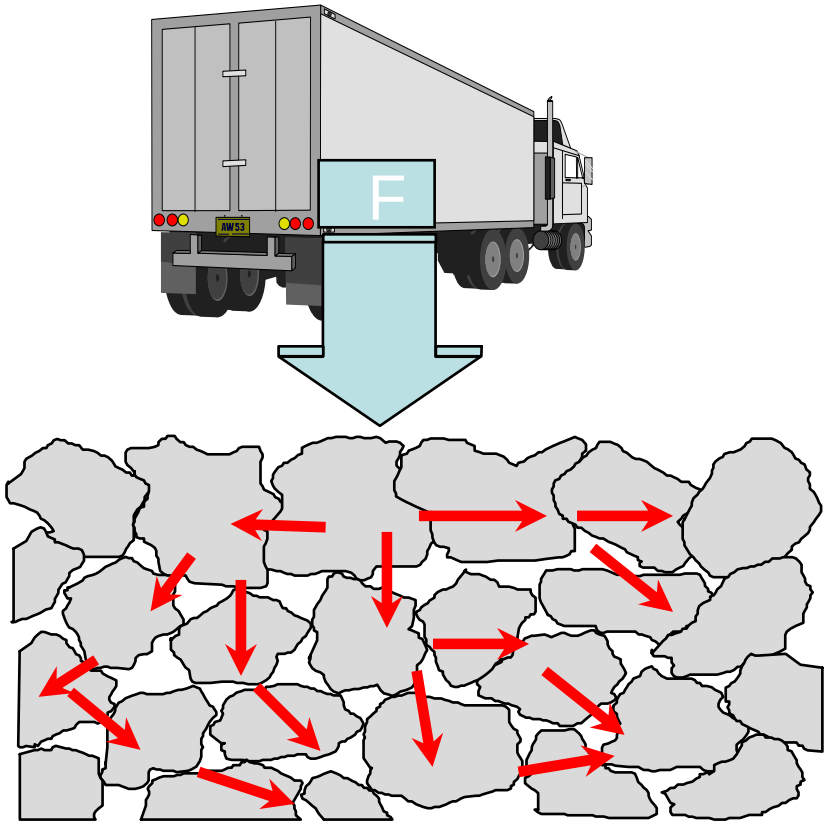


SMA

Load Transfer



DGM



SMA

Netivey Ayalon Highway Test, 2004

Compare 4 AC mixtures with respect to:

- Noise Reduction,
- Skid Resistance,
- Ride Quality,

Mixtures tested:

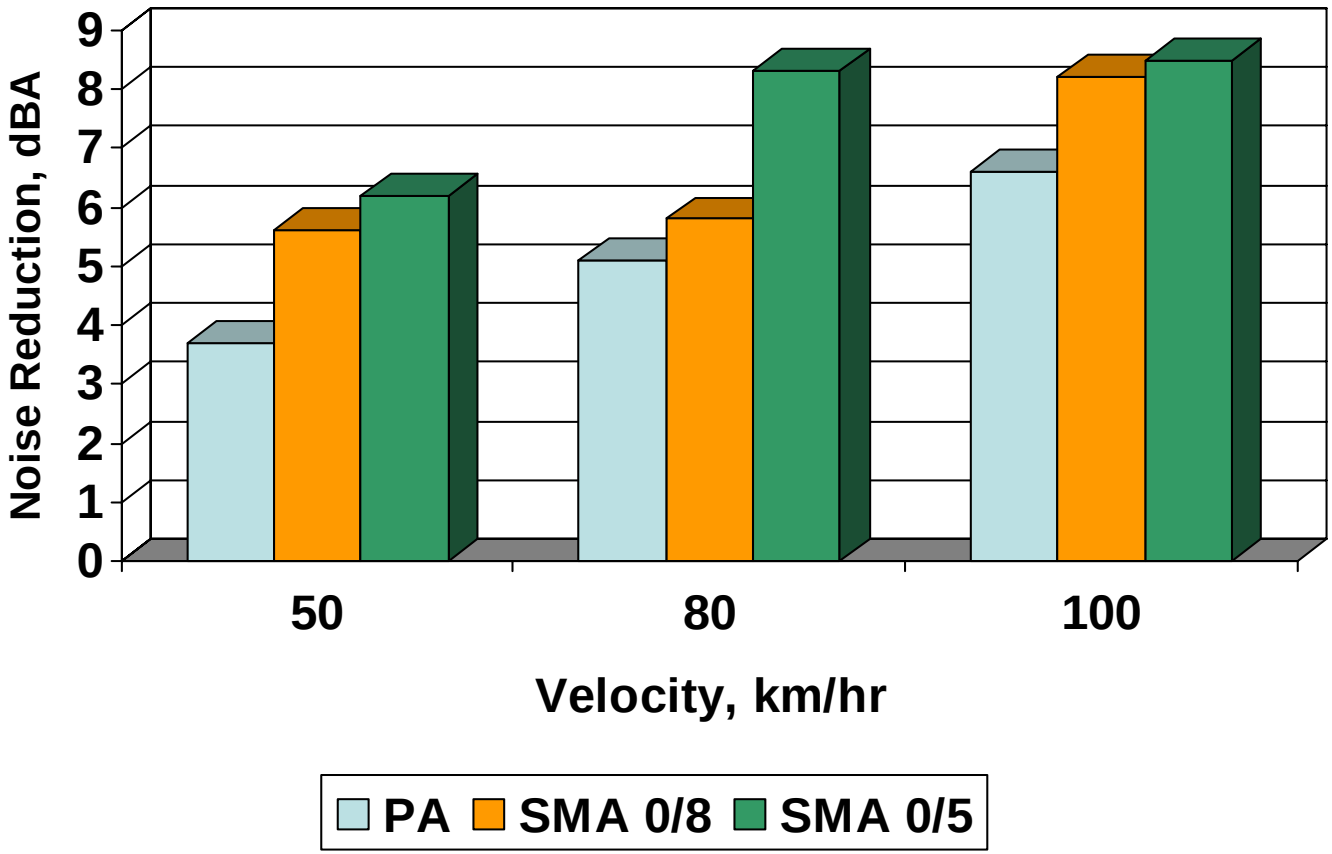
- DGM – reference mix,
- PA,
- SMA0/8,
- SMA0/5.

Noise Reduction (in dBA) with respect to DGM

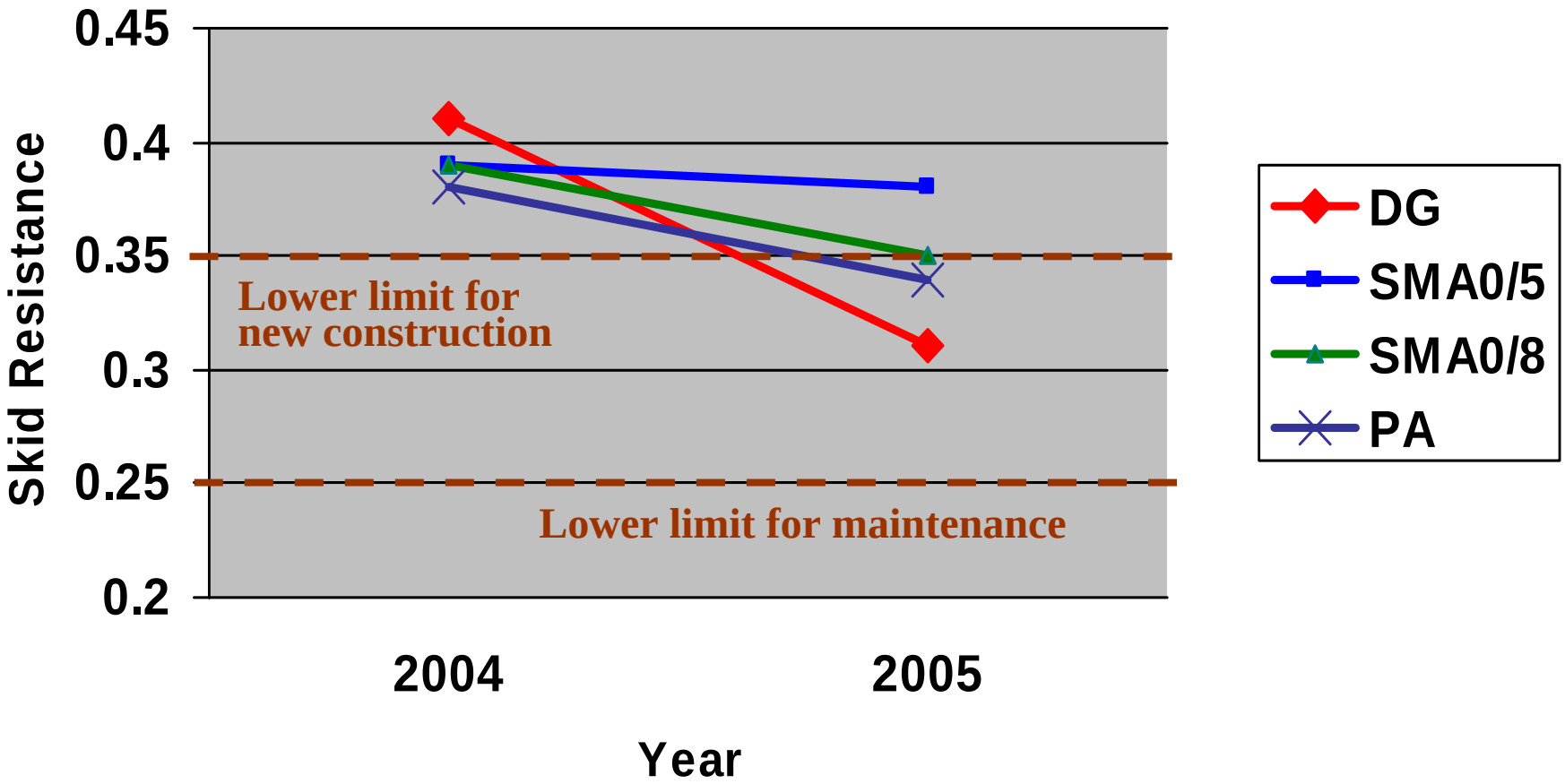
Vehicle velocity (km/hr)	SMA 0/5	SMA 0/8	PA
50	6.2	5.6	3.7
80	8.3	5.8	5.1
100	8.5	8.2	6.6

Note: A 3 dBA reduction is equivalent to a 50% cut in traffic volume or doubling the distance from the ear to the noise source.

Noise Reduction vs. Velocity



Skid Resistance



Improved ride quality
IRI (m/km)

Mix Type	IRI
PA	0.86
SMA0/8	0.76
SMA 0/5	0.88

Facing new problems - 2007

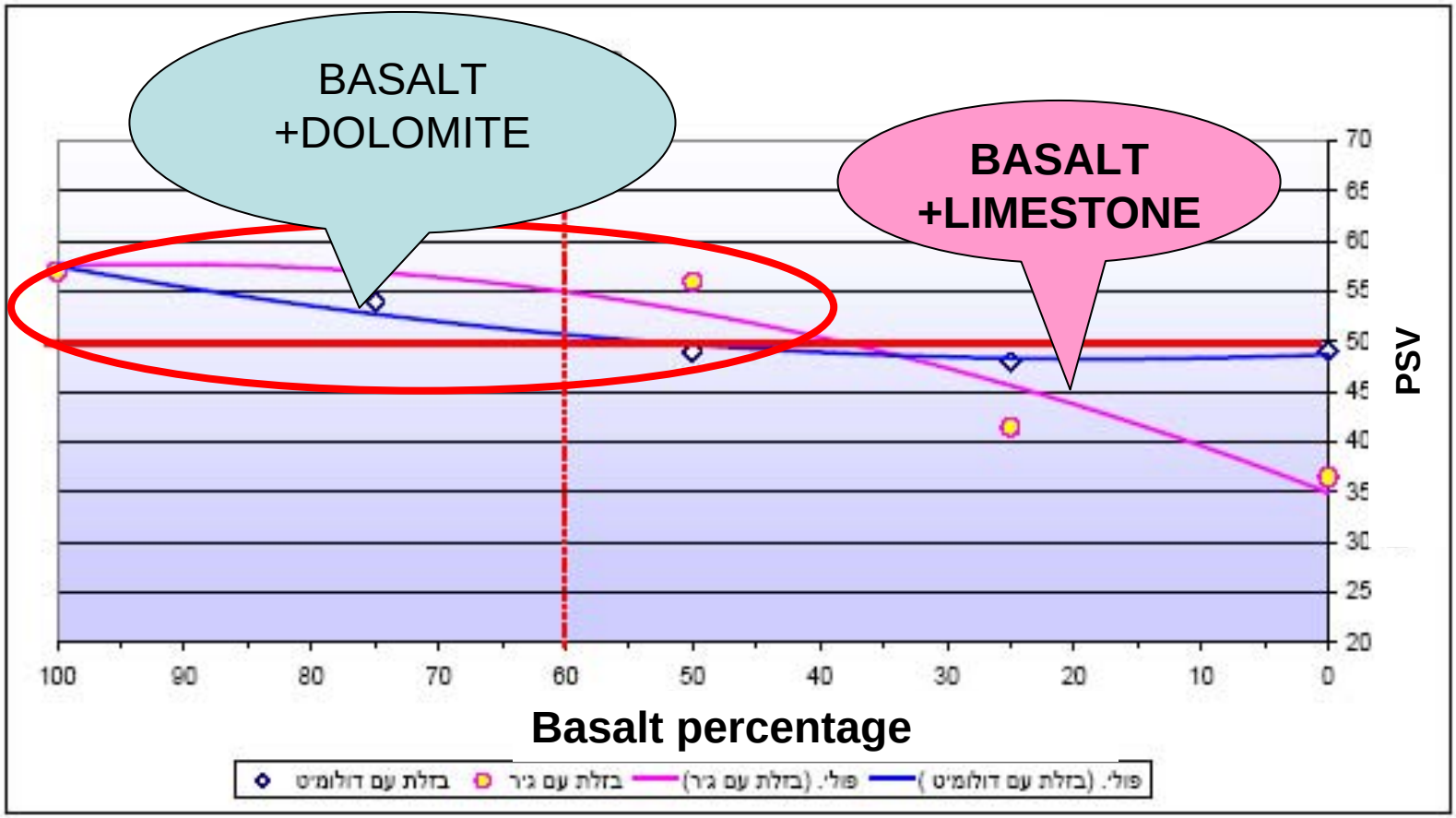
Problems:

1. Lack of high PSV aggregates in the 5-10mm fraction,
2. Raising costs of bitumen and aggregates,

Solutions:

1. "Zebra" Mixes (50%-50% Basalt/ Limestone),
2. Thinner SMA layers,
3. New SMA gradings.

Effect of Basalt Aggregate Percentage on PSV of "ZEBRA" Mixtures



Thin Layers Test Sections

SMA grading	Road No.	Thickness (mm)	Main Agg. Fraction (mm)
0/5	1	15-20	2-5
0/10	4	20-25	5-10
0/15	2	30-35	10-15


SMA0/15
SMA0/10
SMA0/5
01/01/2008

Materials implemented (9 combinations)

SMA gradings	Bitumen gradings	Fibers types
0/5	PG 68-10	Viatop 66
0/10	PG 70-10	Viatop Premium
0/15	PG 74-10	Viatop Superior

Properties Of Thin Layers

SMA grading	Skid Resistance	Roughness IRI,	
		(m/km)	Topography
SMA0/5	0.46	1.4	Hilly
SMA0/10	0.49	1.4	Plain
SMA0/15	0.42	1.5	Plain

Preliminary conclusions on thin SMA Layers (After 1 year)

- There were no problems in the production and laying of all mixes,
- All mixes satisfied stability and air voids specification requirements,
- All layers display high skid resistance and low IRI.

Typical Costs for Wearing Courses

Mix	Typical layer thickness (cm)	Typical mix price (NIS/ton)	Layer cost (NIS/m^2)
DG	5	200	24.0
S	4	250	26.0
SMA0/15	3.5	300	25.0
SMA0/10	2.5	350	20.0
SMA0/5	1.5	400	13.5

Present Policy on AC mixtures

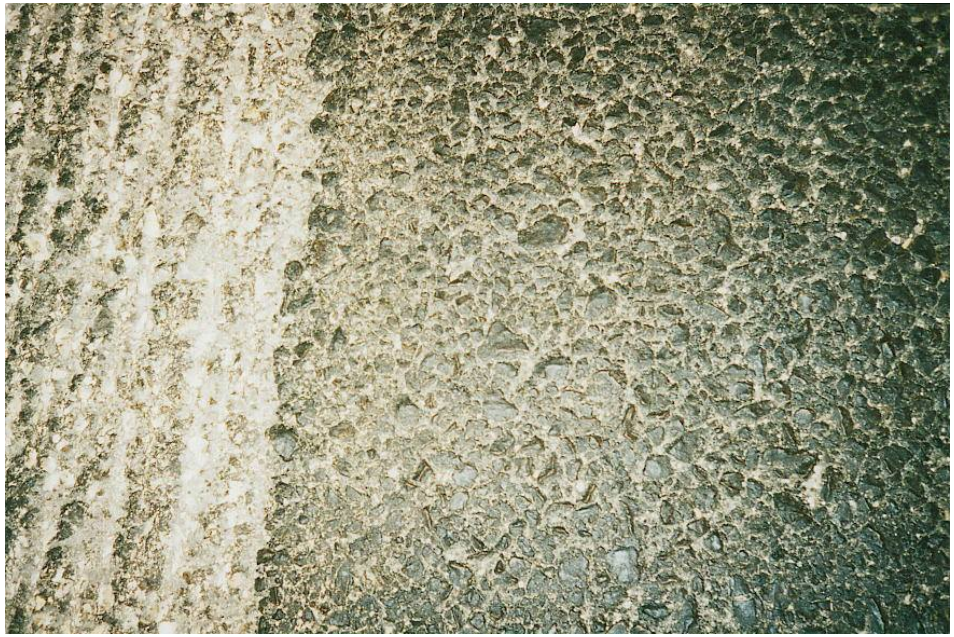
- DGM – Mostly for urban use.
- S – for base and binder courses in all roads. Wearing course – for secondary roads.
- SMA Mixes – Wearing course for main roads.
- GGM, PA – Seldom used.


VÖGELE
HAMM

First use of SMA0/8 in Rd #4, 1999

Ride Quality at paving: 1.4 m/km

Skid Resistance after 6 years: 0.38 (ROAR)




CONTACT

First use of SMA0/5 in Tel Aviv, (Rd #2040), 10/2003

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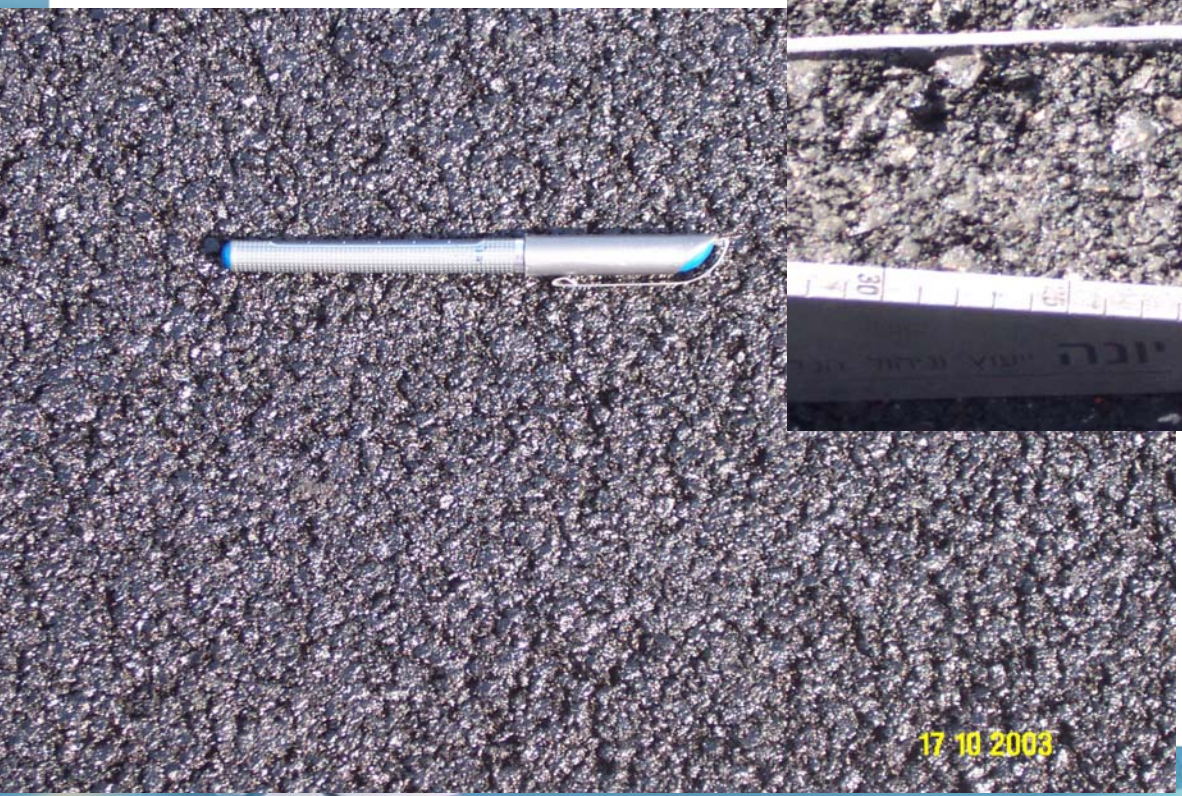
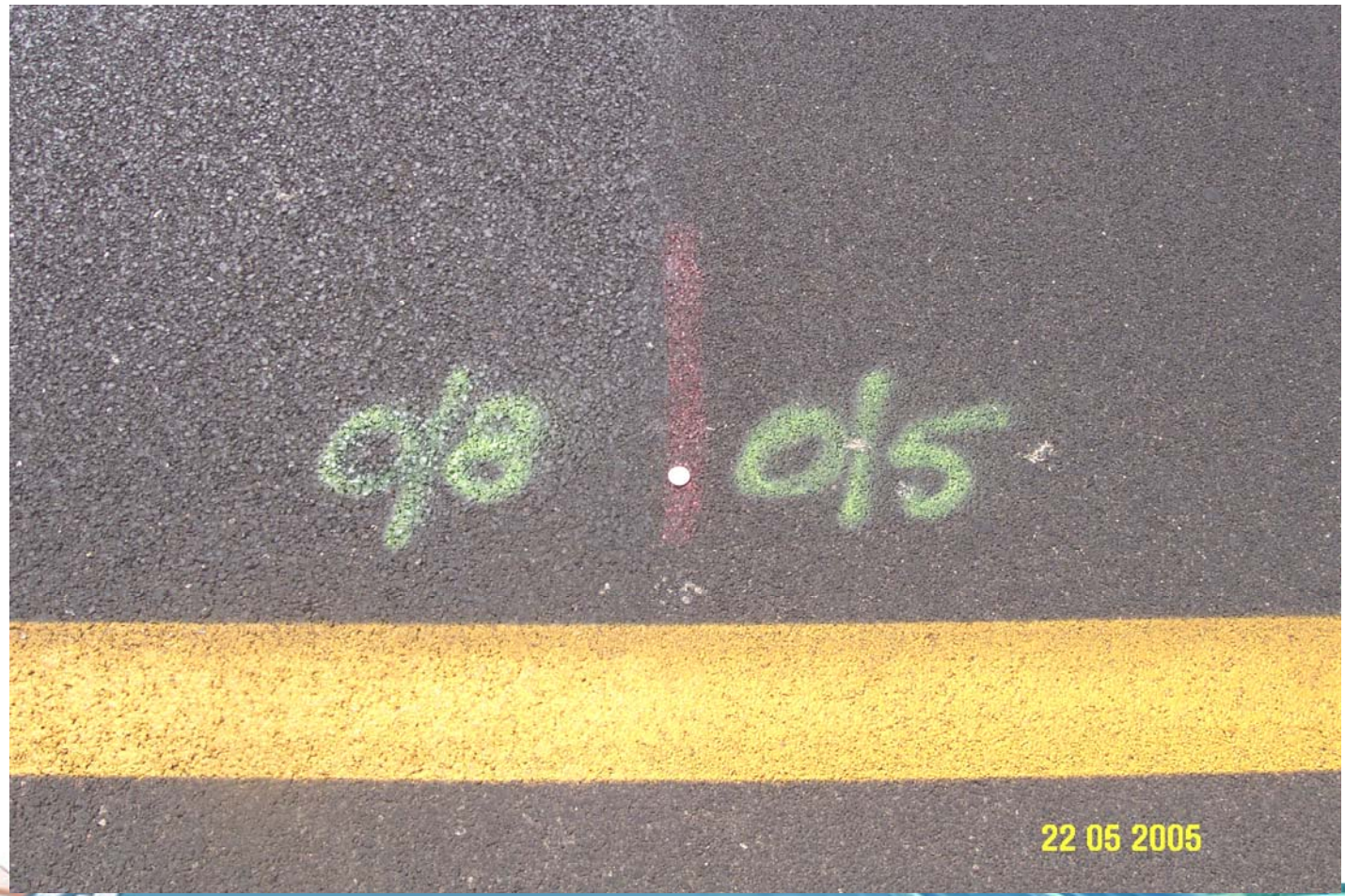


First use of SMA0/5 in Tel Aviv, (Rd #2040), 10/2003

Netevey Ayalon Rd. – Test Section, 2004



Netevey Ayalon Rd. – Test Section, 2004

SMA0/5 in Bernstein St., Ramat Gan, 2004

Noise Reduction: 5.5 dBA

SMA0/5 in Hagilad-A.H.S. Jct. Ramat Gan, 2005

Ideas for future developments

1. Optimization of SMA thin layers,
2. Use of SMA for noise reduction purposes,
3. Implementation of “Zebra” Mixtures (Limestone/Basalt, Limestone/Bauxite, etc.),
4. Investigation of Modified bitumens in the asphalt plant using modified fibers, asphalt rubber, etc.

Thank you