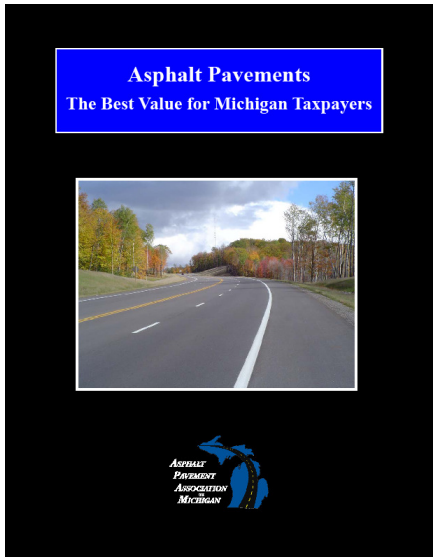
Asphalt Pavements – The Best Value for Michigan Taxpayers

Asphalt Pavement Association of Michigan
Okemos, Michigan

Asphalt Pavements – The Best Value for Michigan Taxpayers



Asphalt Pavements – The Best Value for Michigan Taxpayers

The latest information on why asphalt offers superior benefits in terms of:

- economics
- performance
- environmental sustainability

Economics

- Asphalt pavements offer the lowest life cycle cost
- Asphalt pavements provide the most cost effective option for rebuilding Michigan's highways

Performance

- Asphalt pavements are smoother than concrete pavements
- Perpetual pavements constructed of asphalt virtually never need to be reconstructed
- Asphalt is the quietest pavement surface and can mitigate noise problems cost – effectively

Environmental Sustainability

- The Asphalt industry is America's recycling leader.
- Perpetual pavements are the ultimate in sustainability.
- Asphalt pavements have the smallest carbon footprint of any pavement type.

Economics

- Asphalt pavements offer the lowest life cycle cost

Asphalt Pavements Offer the Lowest Life Cycle Cost

Pavement Life – Cycle Cost Studies Using Actual Cost Data

Published by the Asphalt Pavement Alliance -2005

- **A synthesis of LCCA studies in 3 states**
- **Interstate highways - Similar Traffic and age, maintained to same standards**
- **Used actual Agency costs and maintenance records**
- **Included initial construction cost plus all maintenance and rehabilitation cost**

Asphalt Pavements Offer the Lowest Life Cycle Cost

3 State studies based on actual construction and maintenance costs:

Ohio Study 1995

- 5 locations on interstates highway
- I-71, I-75, I-275, I-475
- Adjacent pavements – same traffic
- Pavement age – 19 to 38 years

Asphalt Pavements Offer the Lowest Life Cycle Cost

3 State studies based on actual construction and maintenance costs:

Ohio Study 1995

- Ohio study conclusion:
  - HMA pavement generally was 25 to 70% more economical PCC pavement.

Asphalt Pavements Offer the Lowest Life Cycle Cost

3 State studies based on actual construction and maintenance costs:

Kansas Study 2002

- **Rural interstate pavements (I-35, I-70, I-135)**
- **21 pavement sections**
  - **218 miles of PCC**
  - **262 miles of HMA**
- **Initial construction 1959 to 1977**
- **25 to 43 years old at time of study**
- **"Many" of the PCC sections reconstructed, only 4 HMA sections reconstructed.**

Asphalt Pavements Offer the Lowest Life Cycle Cost

3 State studies based on actual construction and maintenance costs:

Kansas Study 2002 Conclusions

- HMA on I-70 had an average life cycle cost of $1.89 million (per 4-lane mile)
- PCC on I-70 had an average life cycle cost of $3.22 million

Asphalt Pavements Offer the Lowest Life Cycle Cost

3 State studies based on actual construction and maintenance costs:

Iowa Study 1998

- **Interstate Highway – I -80 in three counties**
  - **27.5 miles of PCC**
  - **12.5 miles of HMA**
- **Adjacent pavement sections - same traffic**
- **Constructed in early 1960's**
- **Study period – 1962 to 1994**
- **Pavement age - 29 to 32 years old**

Asphalt Pavements Offer the Lowest Life Cycle Cost

3 State studies based on actual construction and maintenance costs**:**

- Iowa - I -80 in Iowa County results:
  - The PCC section studied had life cycle costs of $272,000 (per 2-lane mile)
  - The adjacent HMA section had life cycle costs of $157,528
  - **The HMA pavement section was more economical by 42%**

Asphalt Pavements Offer the Lowest Life Cycle Cost

3 State studies based on actual construction and maintenance costs:

Iowa Study Conclusions

- **The results of the Iowa study indicate:**
- The HMA sections provided more than 22 years of service without the need for reconstruction or rehabilitation.
- The HMA sections had a lesser rate of increase in cost for maintenance than the adjoining PCC pavements.

Asphalt Pavements Offer the Lowest Life Cycle Cost

3 State studies based on actual construction and maintenance costs**:**

LCCA Study Synthesis Overall Conclusion

- **Asphalt pavements have the lowest life cycle cost**

LTTP Info - Asphalt Pavement Performance

Summarizes two reports on asphalt pavement performance based on data obtained from the Long Term Pavement Performance (LTPP) database.

The LTPP program is a 20-year study of in-service pavements across North America.

Evaluated various designs of new and rehabilitated pavement structures, using different materials and under different loads, environments, subgrade soil, and maintenance practices.

Expected Service Life and Performance Characteristics of HMA Pavements in LTPP (APA, Lanham, Maryland. February 2005)

A total of 372 test sections, 109 sections were older than 20 years and showed little or no distress.

Six distress types or performance indicators:

- fatigue cracking,
- longitudinal cracking in the wheel paths,
- longitudinal cracking not in the wheel paths,
- transverse cracking,
- rutting,
- roughness (as measured by the IRI)

Conclusion:

- **The majority of the asphalt pavements included in the LTPP database have served for 20 years or more before requiring structural rehabilitation.**

Performance Trends of Rehabilitated AC Pavements, Publication No. FHWA-RD-00-165

Pavement test sections where an HMA overlay was placed on an existing asphalt pavement.

Conclusion:

Majority of the HMA overlays have served for 15 years or more before requiring rehabilitation.

There are “a number of test sections where the overlays have only nominal levels of distress after more than 20 years of service”.

Economics

- Asphalt pavements offer the most cost effective option for rebuilding Michigan's highways

Asphalt Pavements Offer the Most Cost-Effective Option for Rebuilding Michigan's Highway Infrastructure.

A 2008 study completed for the Michigan Transportation Asset Management Council

Table C-1: Statewide average estimated costs per lane mile.

	Concrete	Asphalt	Difference	%
Reconstruction	$564,088	$327,763	$236,325	**72.1%**
Rehabilitation	$292,298	$121,421	$170,877	**140.7%**

Source: Michigan Transportation Asset Management Council Cost Report, 1/05/09 (data obtained from Figure 12, pg. 16)

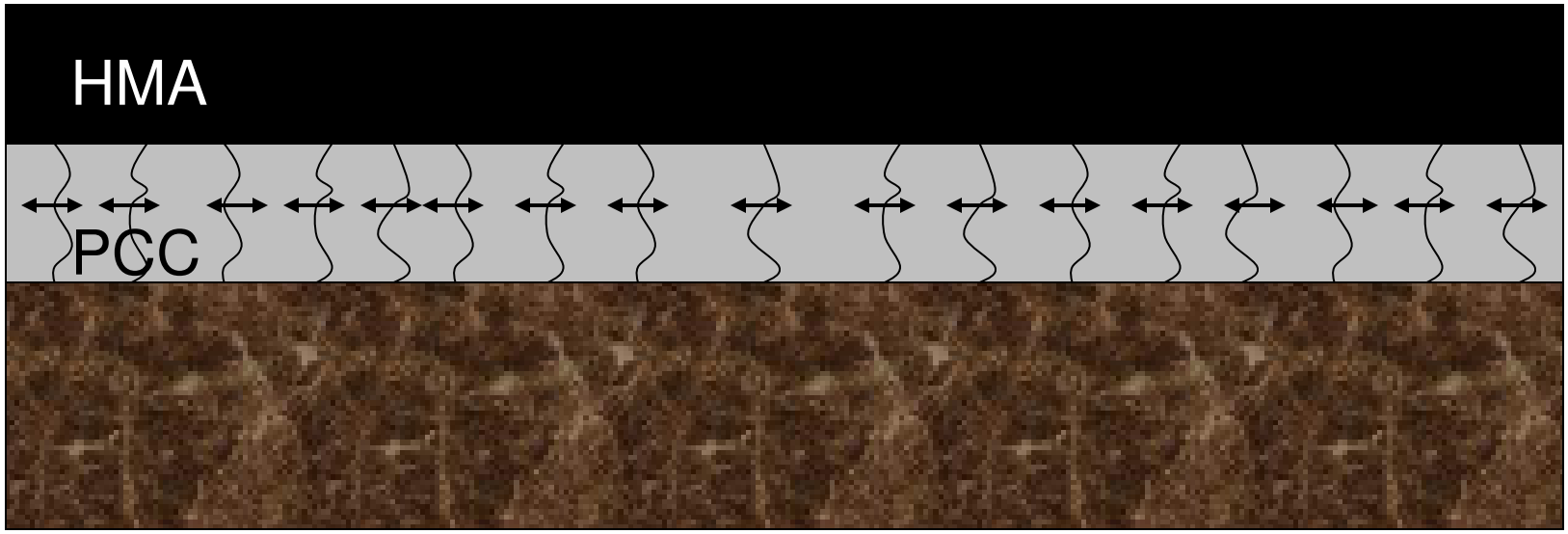
APAM Rubblization Study

2009 APAM Study

Reviewed the relative cost and service life of rubblization/ HMA overlay vs. concrete reconstruction.

- Freeway reconstruction with concrete is approximately $4M per mile.
- Rubblize and overlay a freeway with HMA is approximately $1.8M per mile.

Rubblization



Smaller Pieces =
Smaller Movement =
No Cracking

APAM Rubblization Study

Table C-2: Comparison of costs and service life for concrete reconstruction and rubblize/HMA overlay.

	Concrete Reconstruction	Rubblize/HMA Overlay	Difference	% of HMA
Construction Cost	$4,075,362	$1,770,308	$2,305,054	130
Service Life, years	26	20	6	30
Life Cycle Cost (NPV)	$4,230,110	$2,036,106	$2,194,004	108
Life Cycle Cost (EUAC)	$228,530	$133,091	$95,439	72
EUAC = equivalent uniform annual cost.				
Construction costs are in $ per route mile (2 lanes x 2 directions).				
Service life, as defined by MDOT, is "the anticipated life of a rehabilitation or new/reconstruction, including additional pavement life provided by the anticipated future preventive maintenance."				

Concrete reconstruction costs twice as much but only provides 30% more service life.

LCCA - the rubblize and HMA overlay option is 50% less than the life cycle cost for concrete reconstruction.

MDOT Rubblization Facts

Over 300 miles of rubblization projects have been completed on the MDOT system since 1988.

The vast majority are performing well.

Of projects completed, only one 4-mile section of I-75 has been dug out and reconstructed.

(It was MDOT's first rubblization project, constructed in 1988 and reconstructed in 2007.)

Performance

- Asphalt pavements are smoother than concrete pavements

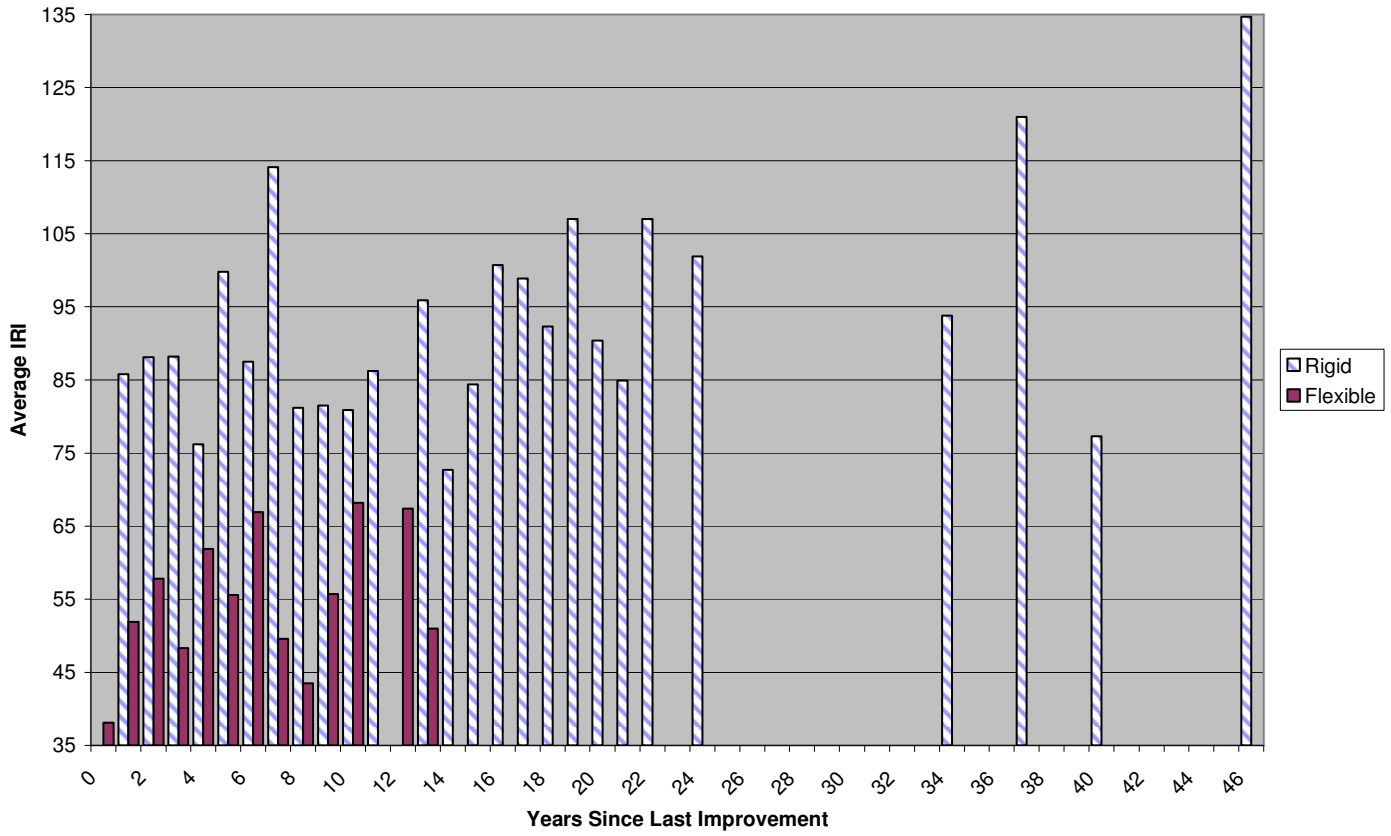
Asphalt Roads are Smoother

2008 - APAM conducted a ride quality study on the MDOT system

- Measured the ride quality of 963 miles of roadway
- Concrete, asphalt, and composite pavements
- Roughness measurements using a high-speed profiler

2008 APAM Ride Quality Study

Figure 1: Comparison of average pavement roughness over time for asphalt (flexible) and concrete (rigid) pavements.



International Roughness Index, (IRI), vs. “years since last improvement.”

2008 APAM Ride Quality Study

The conclusions from the study are:

- **Asphalt pavements were 36% smoother than the concrete pavements.**
- In every age category, asphalt pavements were smoother than the concrete pavements – 16 to 56% smoother.

MDOT Office Memorandum

Considerations to Improve Ride Quality on MDOT's Freeway System, dated November 21, 2008.

Presents options for improving ride quality on MDOT's freeway system, including:

- Include ride quality as a consideration in selecting and scoping projects for the Call for Projects.
- Increase the use of HMA single course overlays.
- Develop a strategy to reduce composite pavements.

Data Example:
Trunkline NHS: Freeways:

Concrete pavements are 50% of the lane mileage (VMT wtg)

Asphalt pavements are 21%

Good ride quality:

- **88% on the asphalt pavements**
- **54% on the concrete pavements**

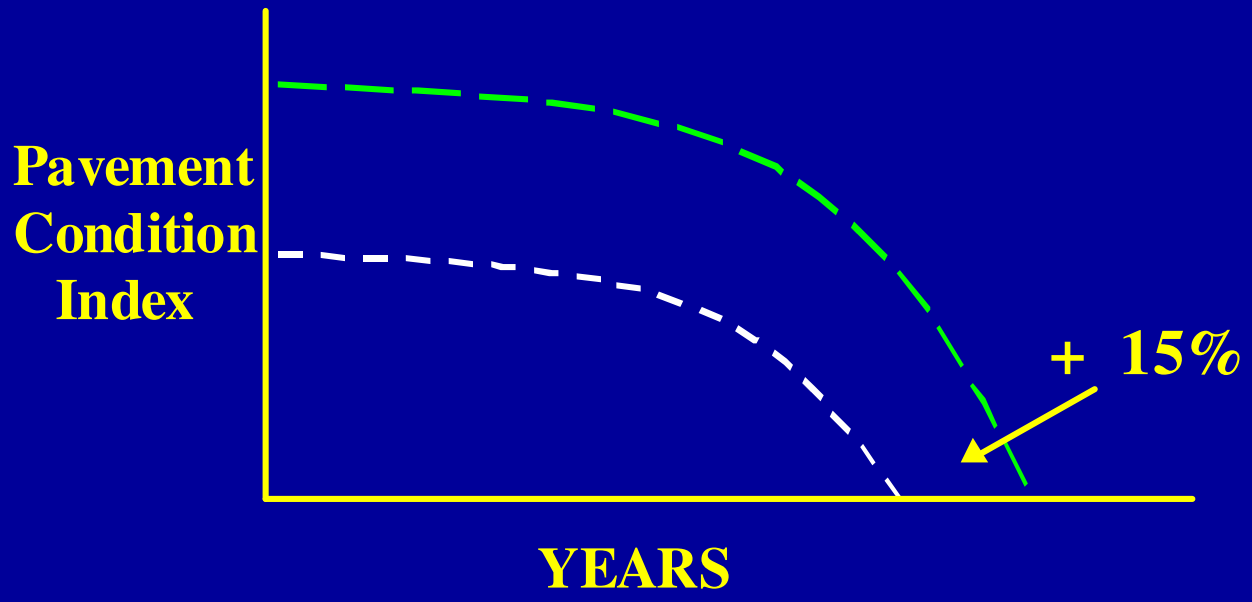
Poor ride quality:

- 3% of asphalt
- 10% of concrete pavement

Smooth Roads Last Longer

ASPHALT PAVEMENT ASSOCIATION OF MICHIGAN

NCHRP 1-31 estimated 15% increase in pavement life for 50% increase in smoothness



At WesTrack

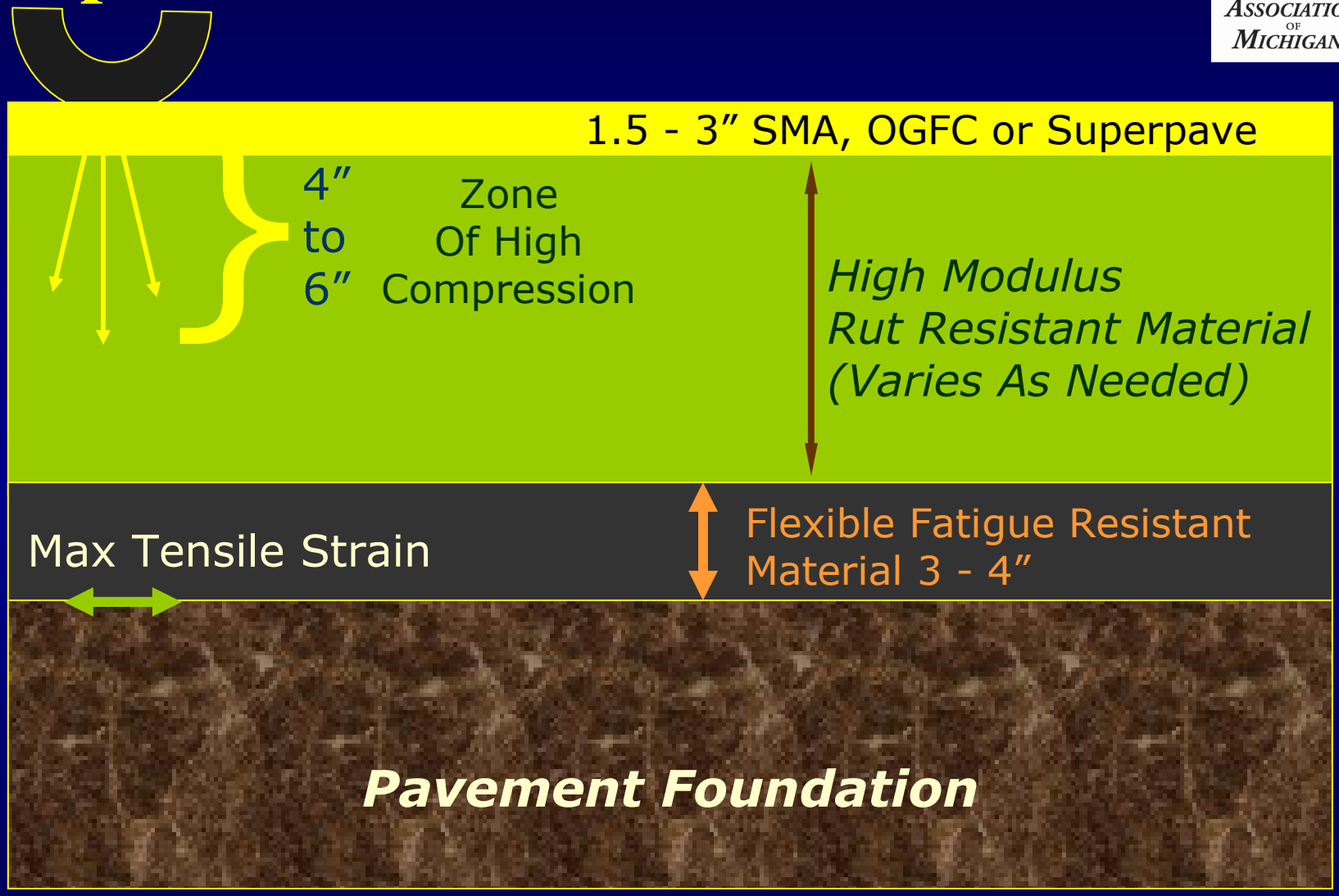
ASPHALT PAVEMENT ASSOCIATION OF MICHIGAN

The average IRI number decreased by 10%, resulting in a 4.5% increase in miles/gallon

Performance

- Perpetual pavements constructed of asphalt virtually never need to be reconstructed

Perpetual Pavement



Perpetual Pavement Rehabilitation

Asphalt Pavement Association of Michigan

Possible Distresses

- ***Top-Down Fatigue***
- ***Thermal Cracking***
- ***Raveling***

Solutions

- ***Mill & Fill***
- ***Thin Overlay***

Performance

- Asphalt is the quietest pavement surface and can mitigate noise problems cost – effectively

Asphalt – the Quietest Pavement Surface

Asphalt can be used to mitigate noise problems cost-effectively.

- NCAT has tested approximately 244 pavement surfaces in 10 states:
  - Different Superpave gradations,
  - Micro surfacing,
  - Nova Chip,
  - SMA, and open graded friction courses
- 43 PCC pavement surfaces tested

Asphalt – the Quietest Pavement Surface

The following are average noise values obtained from the NCAT testing:

- HMA Pavements
  - Open graded (fine gradations) mixes – 93 db (A)
  - Dense graded HMA – 97 db (A)
  - **SMA mixes – 96db (A)**
  - Open graded (coarse gradation) mixes – 97db (A)

- PCC Pavements
  - Diamond ground – 98.1 db (A)
  - Longitudinally tined – 98.8 db (A)
  - Longitudinally grooved – 101.6 db (A)
  - Transverse tined – 102.6 db (A)

Asphalt – the Quietest Pavement Surface

Asphalt Pavement Association of Michigan

Conclusions from the NCAT testing:

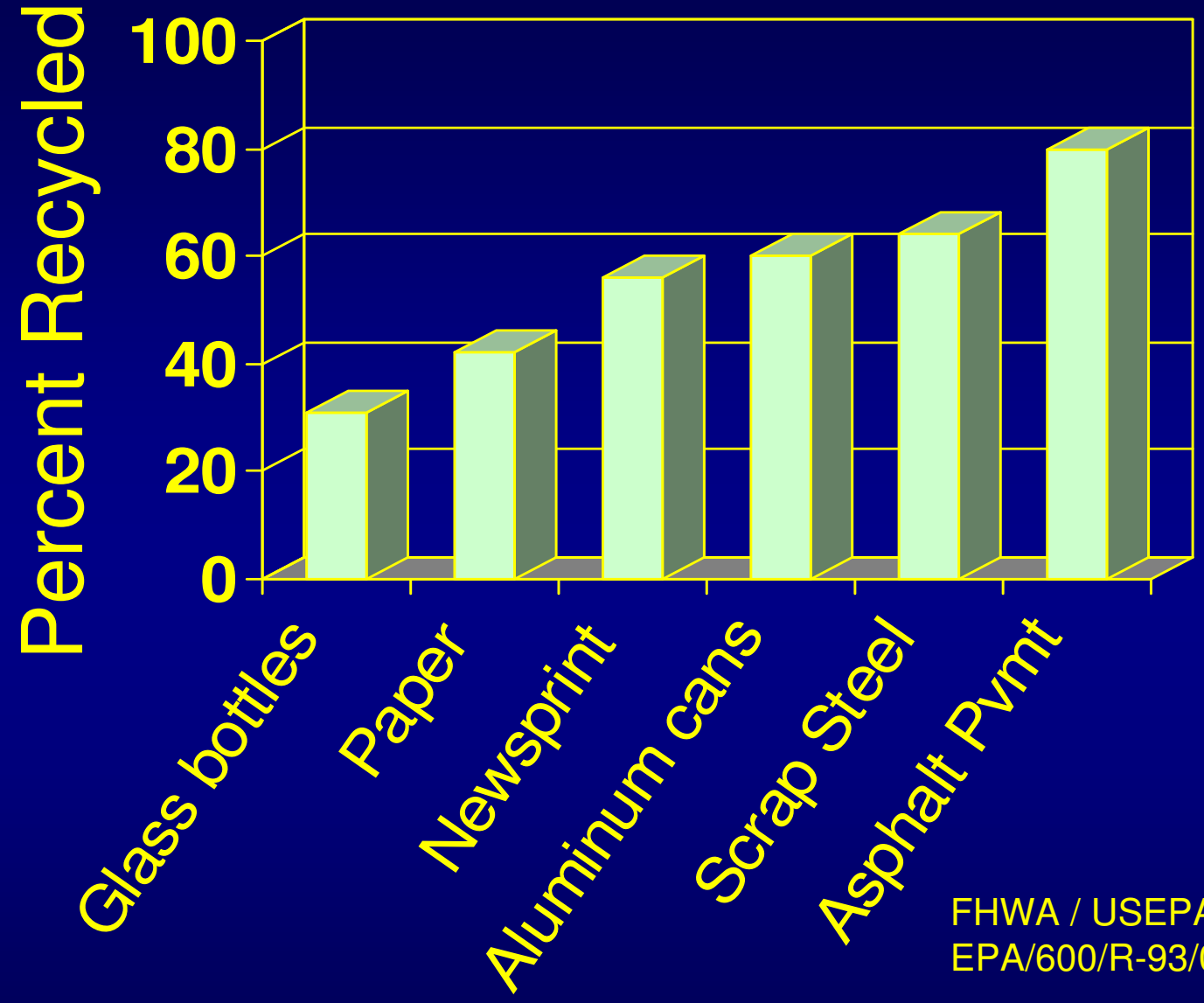
- 2.8db difference between SMA mixes (96db) to longitudinally tined concrete (98.8db)
- 3 dB (A) increase represents a doubling of the traffic volume.
  - A significant difference in the sound that affected residents hear.

Environmental Sustainability

- The Asphalt industry is America's recycling leader.

Recyclability

- Asphalt is the No. 1 recycled material
- 1995 FHWA Report to congress
  - 90 Million tons reclaimed
  - 80% recycled
- Asphalt Pavements are 100% recyclable
  - Can re-use binder
  - Return on investment



FHWA / USEPA Report to Congress, EPA/600/R-93/095.

ASPHALT PAVEMENT ASSOCIATION OF MICHIGAN

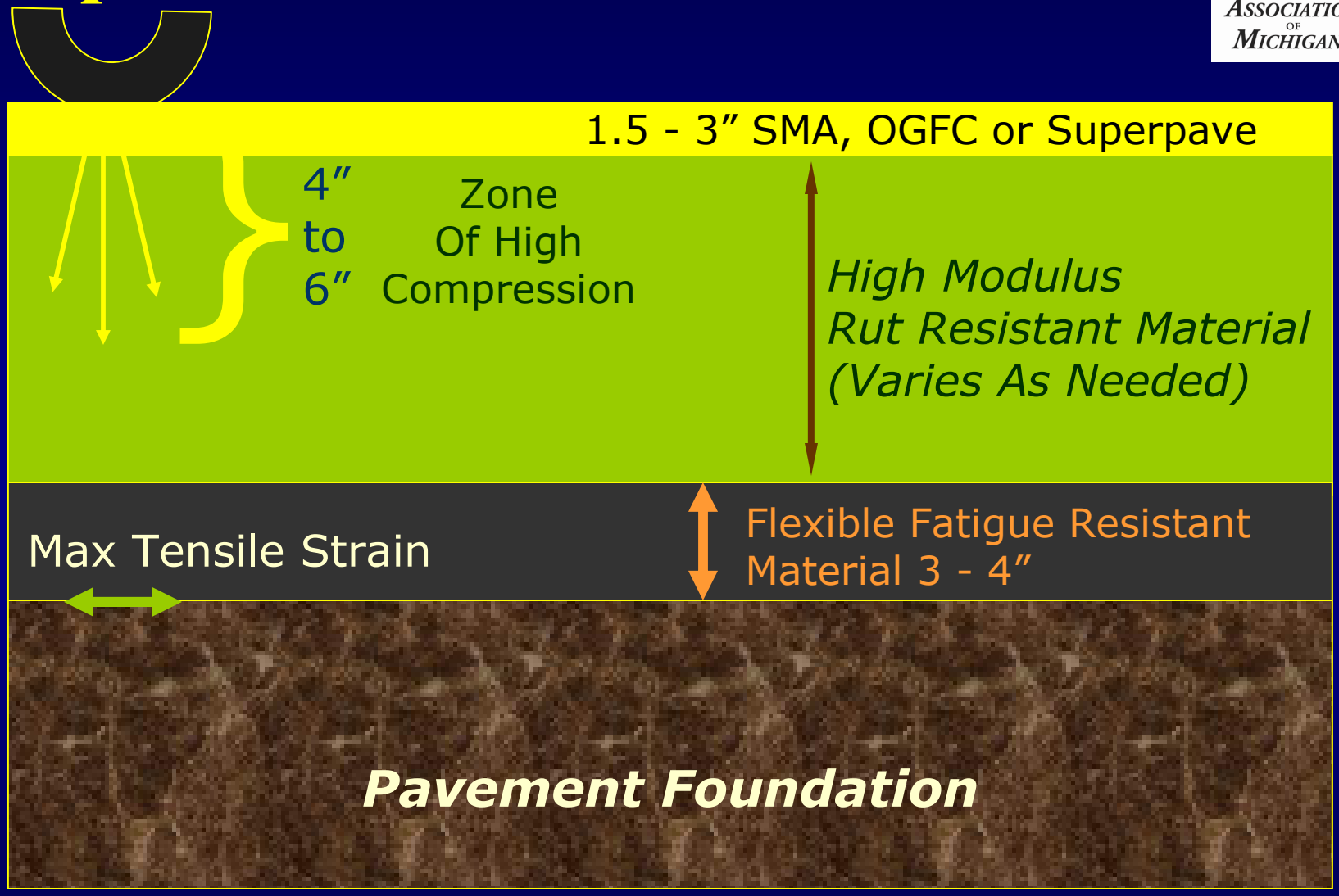
HMA – The Sustainable Choice

SMOOTH | DURABLE | SAFE |

Environmental Sustainability

- Perpetual pavements are the ultimate in sustainability.

Perpetual Pavement



Perpetual Pavement

The Ultimate in Sustainable Design and Construction

- Use less raw materials
- Base stays intact
- Easy rehabilitation
- Road becomes permanent asset

Environmental Sustainability

- Asphalt pavements have the smallest carbon footprint of any pavement type.

Asphalt Pavements Have the Smallest Carbon Footprint of any Pavement Type

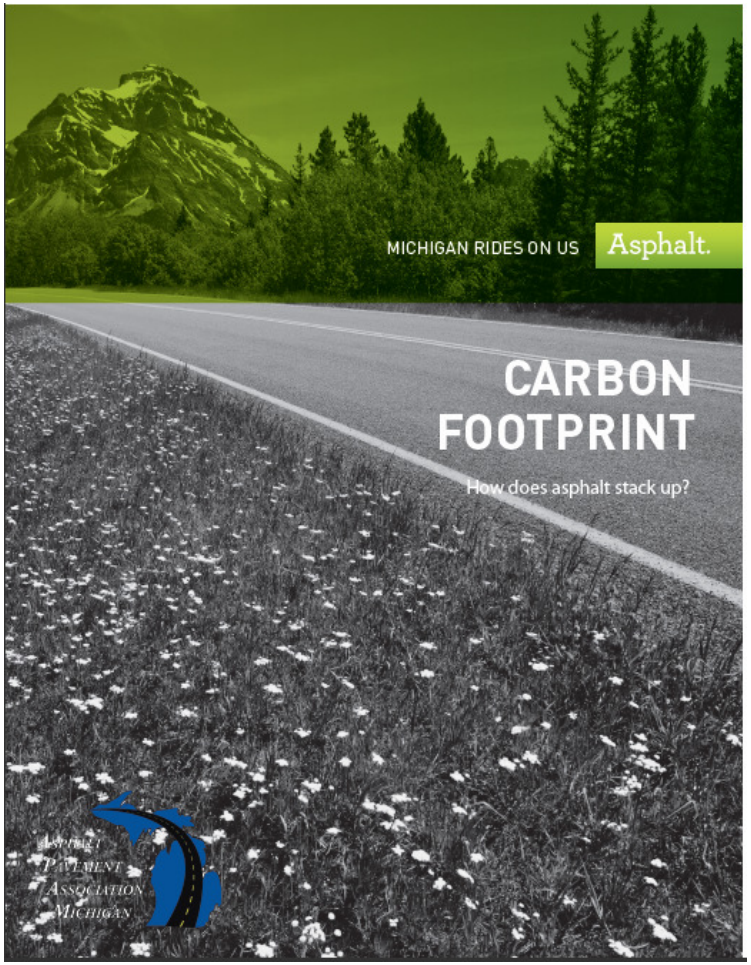
Asphalt pavements require about 20 percent less energy to produce and construct than other pavements.

Production of portland cement is the third largest source of greenhouse gases in the United States.

About 5% of all CO2 comes from cement production.

An average of one ton of CO2 is produced for each ton of portland cement manufactured.

Carbon Footprint Brochure



Carbon Footprint of HMA and PCC Pavements

2009 paper examined the carbon footprint of asphalt and concrete pavements in Ontario, Canada

- typical residential, collector, and freeway pavements

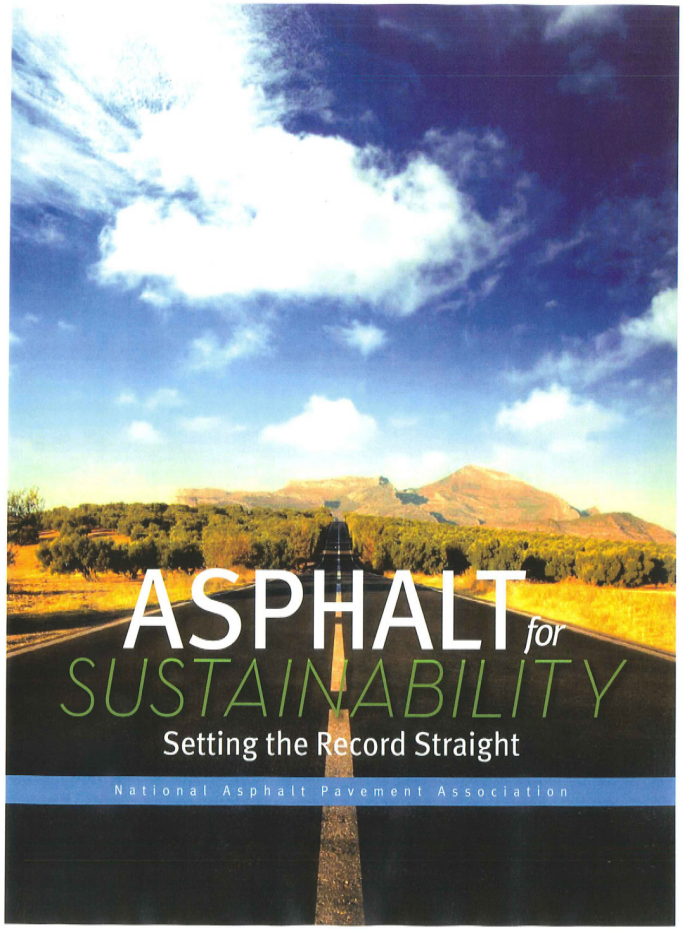
The Results:

- **"the greenhouse gases emitted for the initial construction of an asphalt pavement, measured in terms of carbon dioxide equivalents, is only 22 percent to 25 percent of the greenhouse gases of a typical concrete pavement."**

When computed on a 50 year life cycle basis,

- "the asphalt pavement options only produce about 30 percent of the greenhouse gas emissions of comparable concrete pavements."

NAPA Sustainability Report



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- economics
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- environmental sustainability

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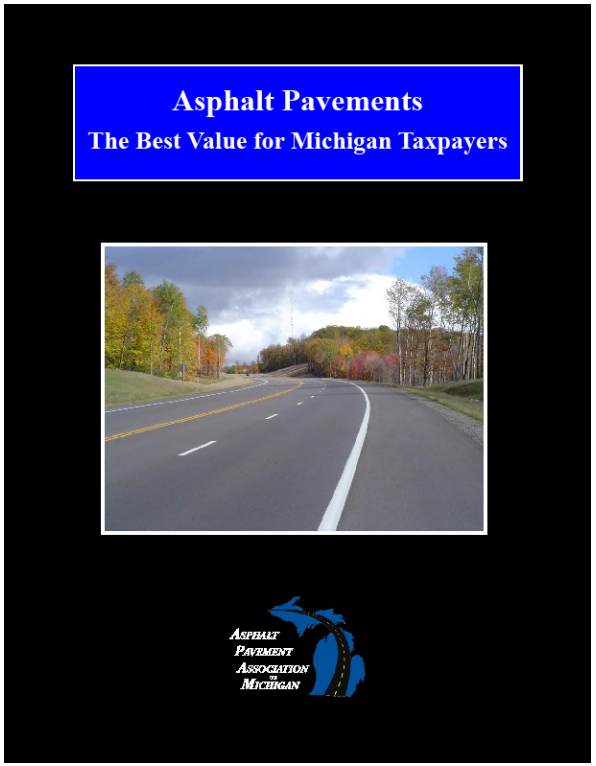

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