# A Report of FHWA-AASHTO European Study on Quiet Pavement: Findings about Asphalt Pavements

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U.S. Department of Transportation
Federal Highway Administration

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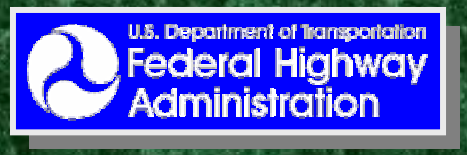


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# Team Members

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**David Newcomb**, NAPA Vice Pres. Research & Technology

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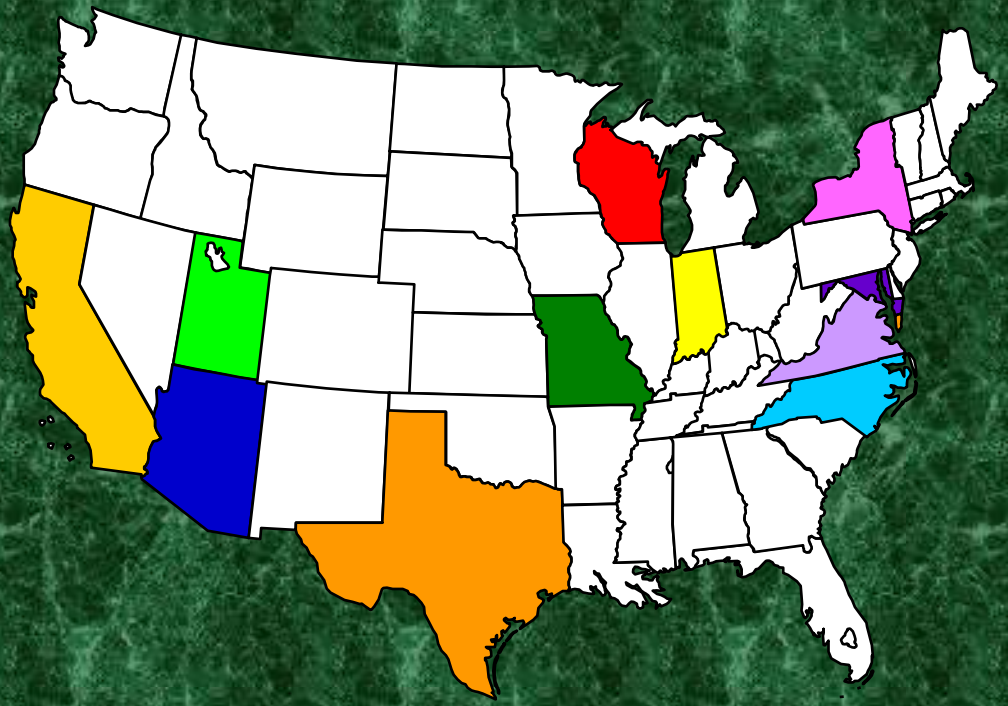
# SCAN TEAM
## Home States



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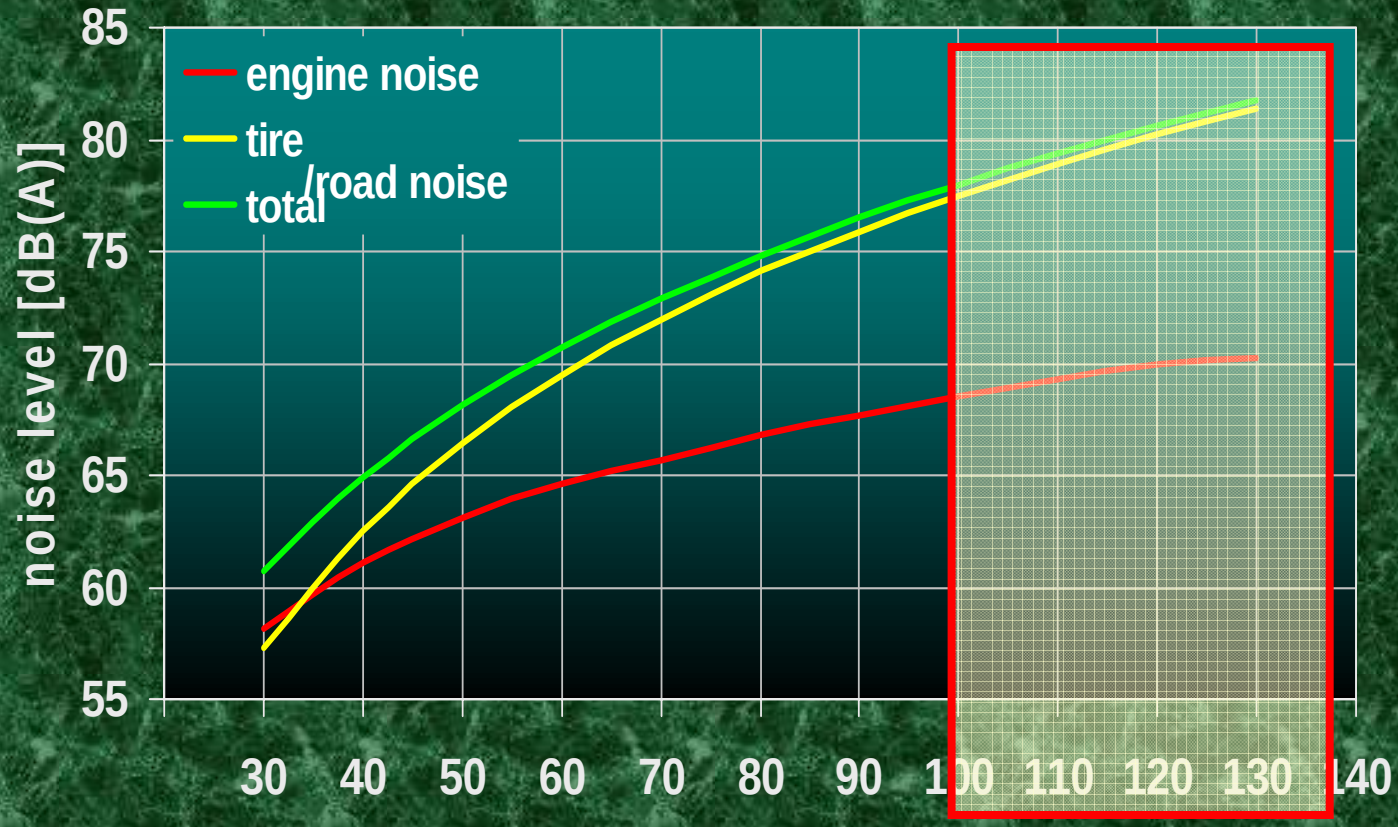
# Tire/road noise is dominant




Dr. Erik Vos, Scientic Manager
Dutch Road Administration
Ministry of Transport


EUROPE
Countries Visited
Greenland (DENMARK)
Jan Mayen (NORWAY)
Greenland Sea
Denmark Strait
Reykjavik
ICELAND
Norwegian Sea
Arctic Circle
Barents Sea
Murmansk
Tromsø
Kiruna
White Sea
Arkhangel'sk
NORWAY
Luleå
Oulu
Umeå
FINLAND
Trondheim
SWEDEN
Gulf of Bothnia
Tampere
Lake Ladoga
Tórshavn
Faroe Islands (DENMARK)
Gävle
Turku
Helsinki
St. Petersburg
RUSSIA
SHETLAND ISLANDS
Bergen
Oslo
Stockholm
ÅLAND ISLANDS
Gulf of Finland
Tallinn
ESTONIA
Rockall (U.K.)
ORKNEY ISLANDS
HEBRIDES
Stavanger
Moscow
North Atlantic Ocean
Aberdeen
Göteborg
Gotland
Rīga
LATVIA
Glasgow
Edinburgh
North Sea
Baltic Sea
Belfast
UNITED
DENMARK
Copenhagen
Malmö
Oland
LITHUANIA
Vilnius
Vitsyebsk
Smolensk
Mahilyow
Minsk
Kaliningrad
RUSSIA
Bornholm
Dublin
Irish Sea
Isle of Man (U.K.)
IRELAND
Gdańsk
BELARUS
Hrodna
Homyel'
Hamburg
Bremen
Berlin
Poznań
Warsaw
Brest
Kiev
Cardiff
NETH.
Amsterdam
POLAND
Łódź
Rivne
London
Celtic Sea
Essen
Leipzig
Cologne
Wrocław
English Channel
Guernsey (U.K.)
Jersey (U.K.)
BEL.
Bonn
GERMANY
Frankfurt am Main
Prague
Kraków
L'viv
UKRAINE
Paris
Luxembourg
LUX.
CZECH REPUBLIC
Brno
SLOVAKIA
Chernivtsi
Mykolayiv
Stuttgart
Bratislava
Chişinău
Strasbourg
Munich
Budapest
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Geneva
Ljubljana
Zagreb
Bucharest
Constanța
Black Sea
MASSIF CENTRAL
Lyon
Milan
Venice
Turin
Bordeaux
BOSNIA AND HERZEGOVINA
Belgrade
Varna
Bilbao
Genoa
CROATIA
Toulouse
MONACO
Serbia
Sarajevo
BULGARIA
Sofia
Andorra la Vella
Marseille
Ligurian Sea
Florence
Adriatic Sea
Podgorica
Skopje
İstanbul
Porto
PYRENEES
ITALY
F.Y.R.O.M.
Zaragoza
ANDORRA
Corsica
Rome
Tirana
Thessaloniki
Bursa
PORTUGAL
Madrid
Barcelona
VATICAN CITY
ALB.
Naples
TURKEY
Lisbon
Balearic Sea
Sardinia
Tyrrhenian Sea
Aegean Sea
SPAIN
Valencia
GREECE
Izmir
Athens
Sevilla
BALEARIC ISLANDS
Cagliari
Ionian Sea
Gibraltar
Málaga
Palermo
Sicily
Rhodes
Mediterranean Sea
Strait of Gibraltar
Ceuta (SPAIN)
Alborán Sea
Algiers
Melilla (SPAIN)
Oran
Tunis
Cretic
Rabat
Casablanca
MOROCCO
ALGERIA
TUNISIA
Valletta
MALTA
Scale 1 : 19,500,000
Lambert Conformal Conic Projection, standard parallels 40°N and 56°N
0 300 Kilometers
0 300 Miles
802637AI (R01083) 6-99

# Denmark May 3-5, 2004






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# The Netherlands May 6-7, 2004



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# The Netherlands May 6-7, 2004

## Innovation Program on Noise Mitigation (IPG)

## IPG is a corporate project from:

- Dutch Ministry of Transport, Public Works and Water management
- Dutch Ministry of Environmental Affairs

## Goal

- Reduce traffic noise significantly, focus on:
  - Source related measures
  - To implement and not to invent

# The Netherlands May 6-7, 2004

## Roads to the Future (RtF)

## Road Surface of the Future

- The road is made in a new way
- It is modular
- It can be adapted to specific requirements

**Projects:**

- Modular (quiet) road surface
- Intelligent road surface
- Dynamic road surface

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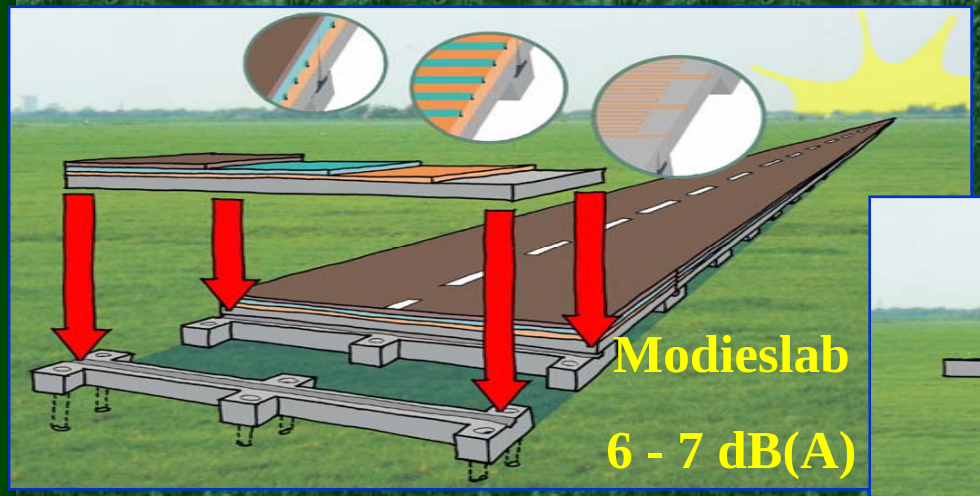
# Results

1. **The Very Silent Sound Module**
   - Helmholtz resonators, modular very thin silent asphalt top layer
2. **The Rollable Road**
   - Helmholtz resonators, two thin rollable asphalt top layers, flexible layers
3. **Modieslab**
   - prefab two layer porous concrete slabs
4. **The Adhesive Road/at present The Rollpave**
   - rollable porous asphalt, adhesive geostatic support layer

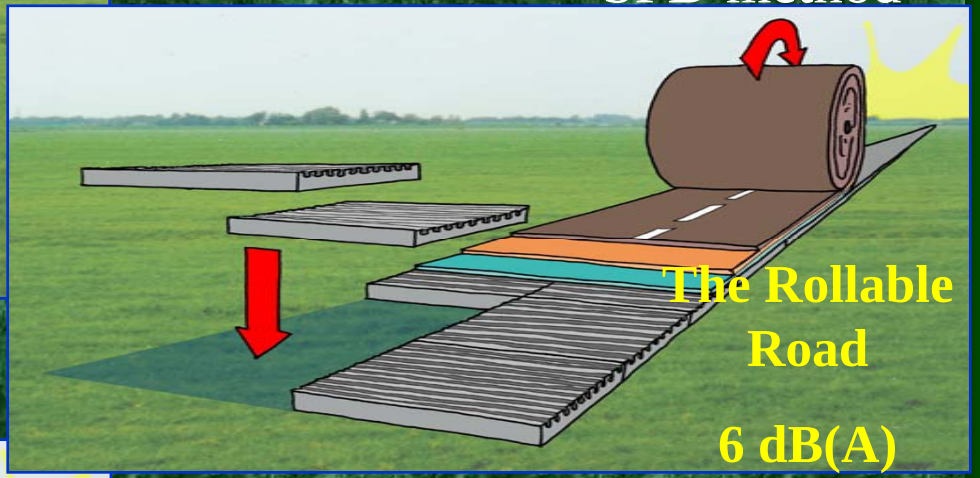
# Measured noise reductions

- 100 km/h
- reference is DAC
- SPB-method



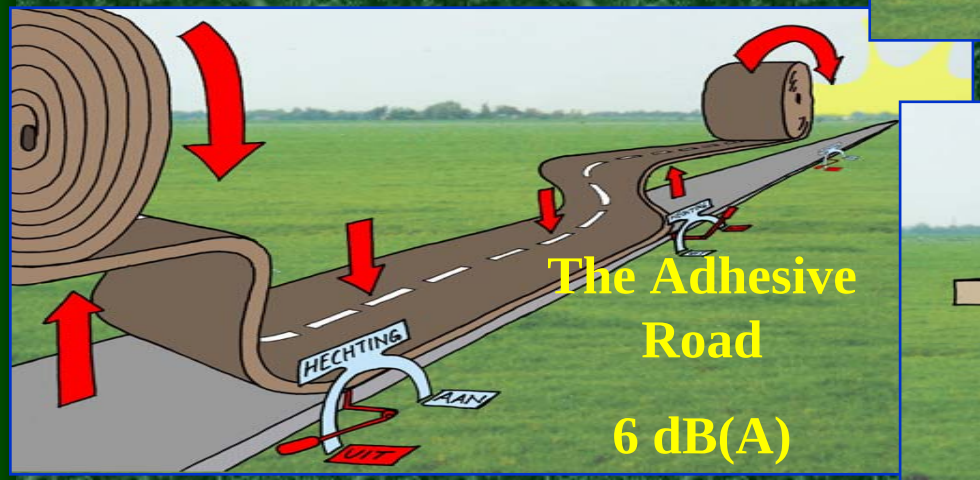
**Modieslab**

**6 - 7 dB(A)**



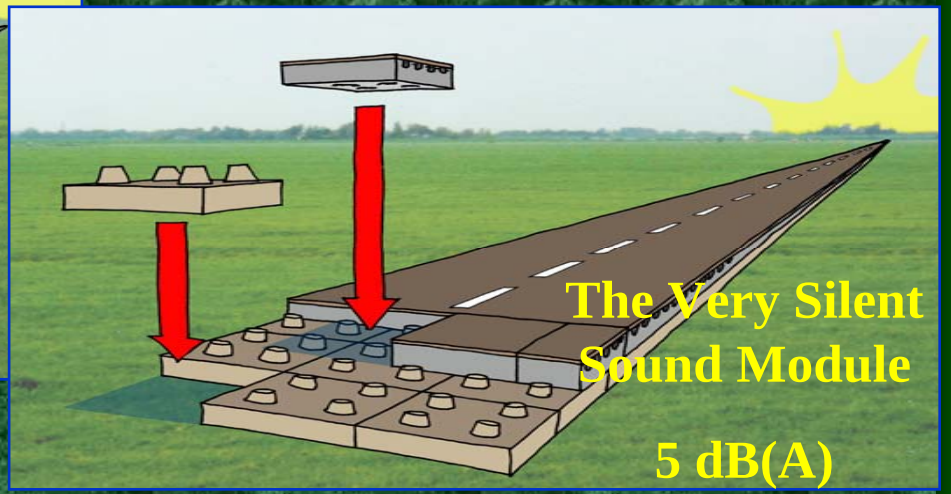
**The Rollable Road**

**6 dB(A)**




**The Adhesive Road**

**6 dB(A)**



**The Very Silent Sound Module**

**5 dB(A)**

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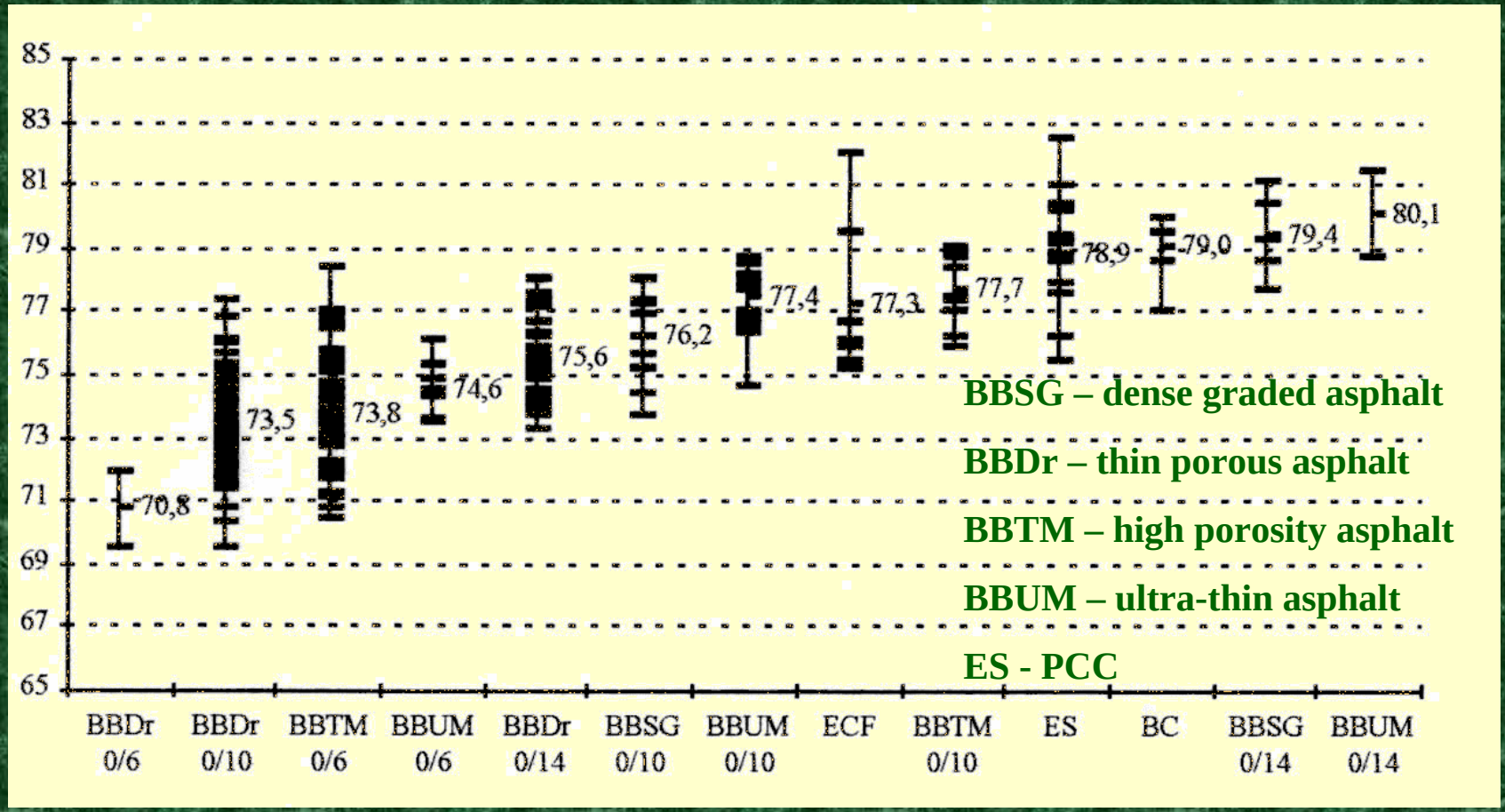
# France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70,8
73,5
73,8
74,6
75,6
76,2
77,4
77,3
77,7
78,9
79,0
79,4
80,1
BBSG – dense graded asphalt
BBDr – thin porous asphalt
BBTM – high porosity asphalt
BBUM – ultra-thin asphalt
ES - PCC
BBDr 0/6
BBDr 0/10
BBTM 0/6
BBUM 0/6
BBDr 0/14
BBSG 0/10
BBUM 0/10
ECF
BBTM 0/10
ES
BC
BBSG 0/14
BBUM 0/14

# Italy May 12, 2004

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# Italy May 12, 2004


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# United Kingdom May 13-14, 2004

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# Key Findings

- Smaller aggregate size asphalt surface mixes using a dense or semi-dense gradation is the technique used by many EU countries to obtain low-noise pavement surfaces. These mixes are used for low to medium speed traffic applications.
- Porous asphalt systems using single-layer and double layer systems are used or planned to be used by several EU countries for significant noise reductions on high-speed facilities or facilities with significant truck traffic.

# Key Findings

- Recycling of porous asphalt was performed using a hot-in-place process in Italy to renew a porous layer.
- Safety performance of low-noise surfaces has been maintained or enhanced compared to traditional pavement systems in all countries reviewed.

# Key Findings

- Durability of low-noise pavement systems varies from 7-15 years depending on the pavement system and the experience level of the owner agency.
- Low-noise pavement surfaces typically do not provide a structural contribution to the pavement. However, some countries utilize a fractional structural contribution. Concept similar to “perpetual pavement”.

# Key Findings

- There is a gradual move to performance based specifications, “lowest and best”. If the contractor is required to warranty the pavement for several years, they must be responsible for design and inspection.

- There are no real field tests for acceptance with regard to noise with the exception of a permeability test. Performance is assumed based on experimental sections and past experience but is not tested on the project for compliance.

# Key Findings

- There was no special equipment or training required for construction of the quiet pavement systems.
- U.S. should do additional work in the asphalt binders for porous asphalts to improve durability of the porous asphalt pavements.

# Key Findings

- Issues surrounding porous asphaltic concrete surfaces must be further investigated including: clogging, safety, skid resistance, black ice in cold weather, snow removal, winter maintenance, durability of the surface, recycling of modified asphalt binders, cleaning, environmental impacts of cleaning, the failure modes, and acoustical durability.

# Key Findings

- Extensive use of SMA type surfaces used in Europe should be reviewed for comparison to performance and maintenance issues on SMA's in the US.
- Increased use of 9.5mm SMA surface can provide significant noise reduction compared to traditional dense graded 12.5mm or 19mm dense graded HMA.

# IMPLEMENTATION:

- Interesting pavement technology for application in the United States:

✓Thin asphalt layers (4.75mm and 6mm) dense, semi-dense and open asphalt surfaces for application on low-speed facilities.

✓ Double layer porous asphalt systems for high-speed facilities or roadways with high truck traffic.

✓Investigate variable density materials (expanded clay, slag, etc.) in asphalt concre

# Available!

## The Roadmap to Quiet Highway

SQDH web site

FHWA Report

U.S. Department of Transportation
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# Mark your Calendars

## A-SH!-PHALT 2005

Early November 2005

Lafayette, IN

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