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MTC CIR Workshop: Comments on Sustainability

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Topics to be discussed:

1) CO_{2e}
2) FHWA and Our Activities in Sustainability
3) Recycling AND Preservation!
4) Useful Resources

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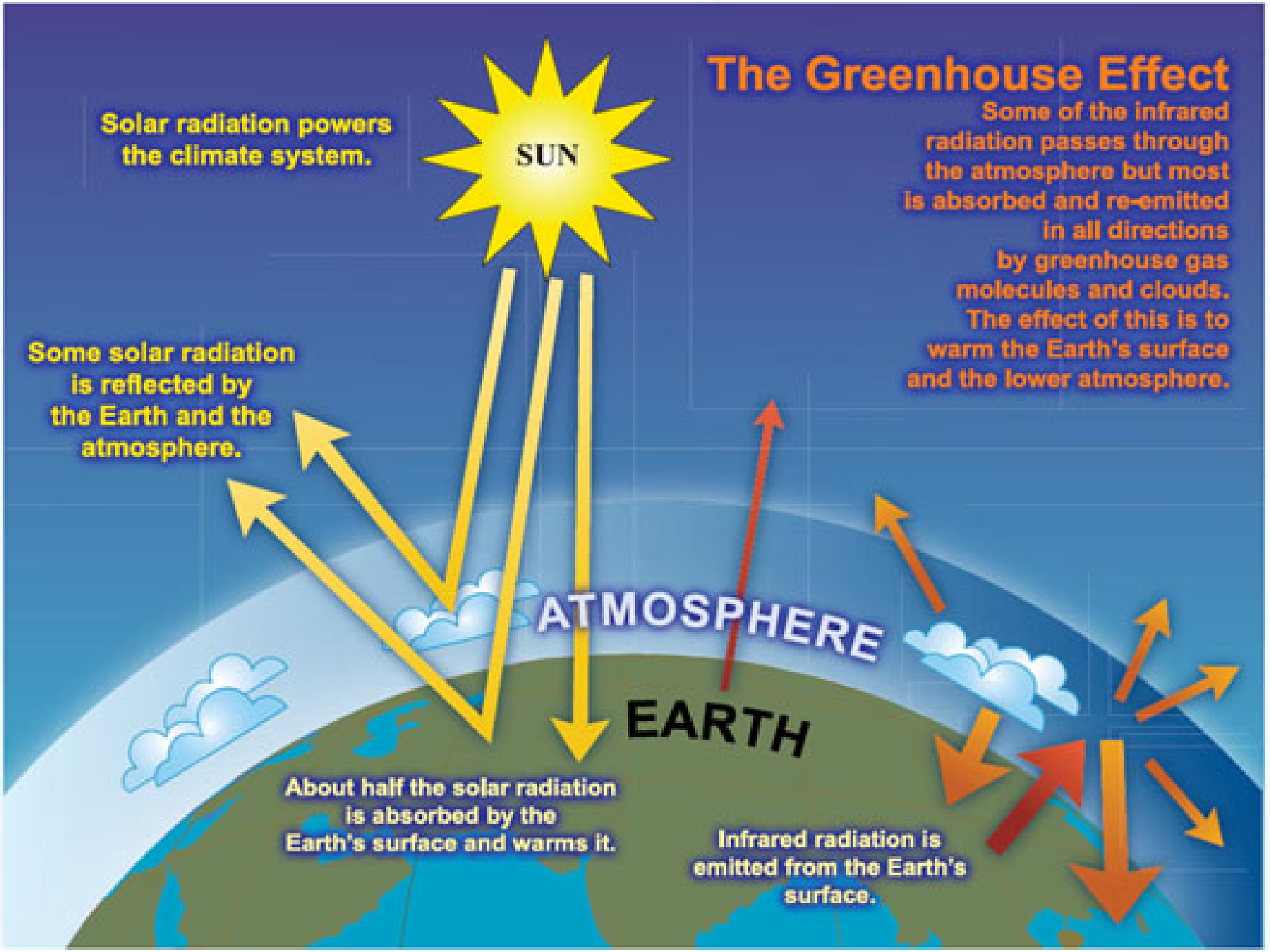
Green House Gases?

- **Greenhouse gases have a warming effect by trapping heat in the atmosphere that would otherwise escape to space.**
- The 12/8/09 EPA endangerment finding covers emissions of:
  - **Carbon Dioxide (CO_2),**
  - **Methane (CH_4),**
  - **Nitrous Oxide (N_2O),**
  - **Hydrofluorocarbons (HFCs),**
  - **Perfluorocarbons (PFCs), and**
  - **Sulfur Hexafluoride (SF_6)**
- **www.epa.gov/climatechange/endangerment.html**
- **http://www.epa.gov/climatechange/endangerment/downloads/Endangerment%20TSD.pdf**


The Greenhouse Effect
Some of the infrared radiation passes through the atmosphere but most is absorbed and re-emitted in all directions by greenhouse gas molecules and clouds. The effect of this is to warm the Earth's surface and the lower atmosphere.
Solar radiation powers the climate system.
SUN
Some solar radiation is reflected by the Earth and the atmosphere.
ATMOSPHERE
EARTH
About half the solar radiation is absorbed by the Earth's surface and warms it.
Infrared radiation is emitted from the Earth's surface.

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Gas	GWP
CO_2	1
CH_4*	21
N_2O	310
HFC-23	11,700
HFC-32	650
HFC-125	2,800
HFC-134a	1,300
HFC-143a	3,800
HFC-152a	140
HFC-227ea	2,900
HFC-236fa	6,300
HFC-4310mee	1,300
CF_4	6,500
C_2F_6	9,200
C_4F_{10}	7,000
C_6F_{14}	7,400
SF_6	23,900

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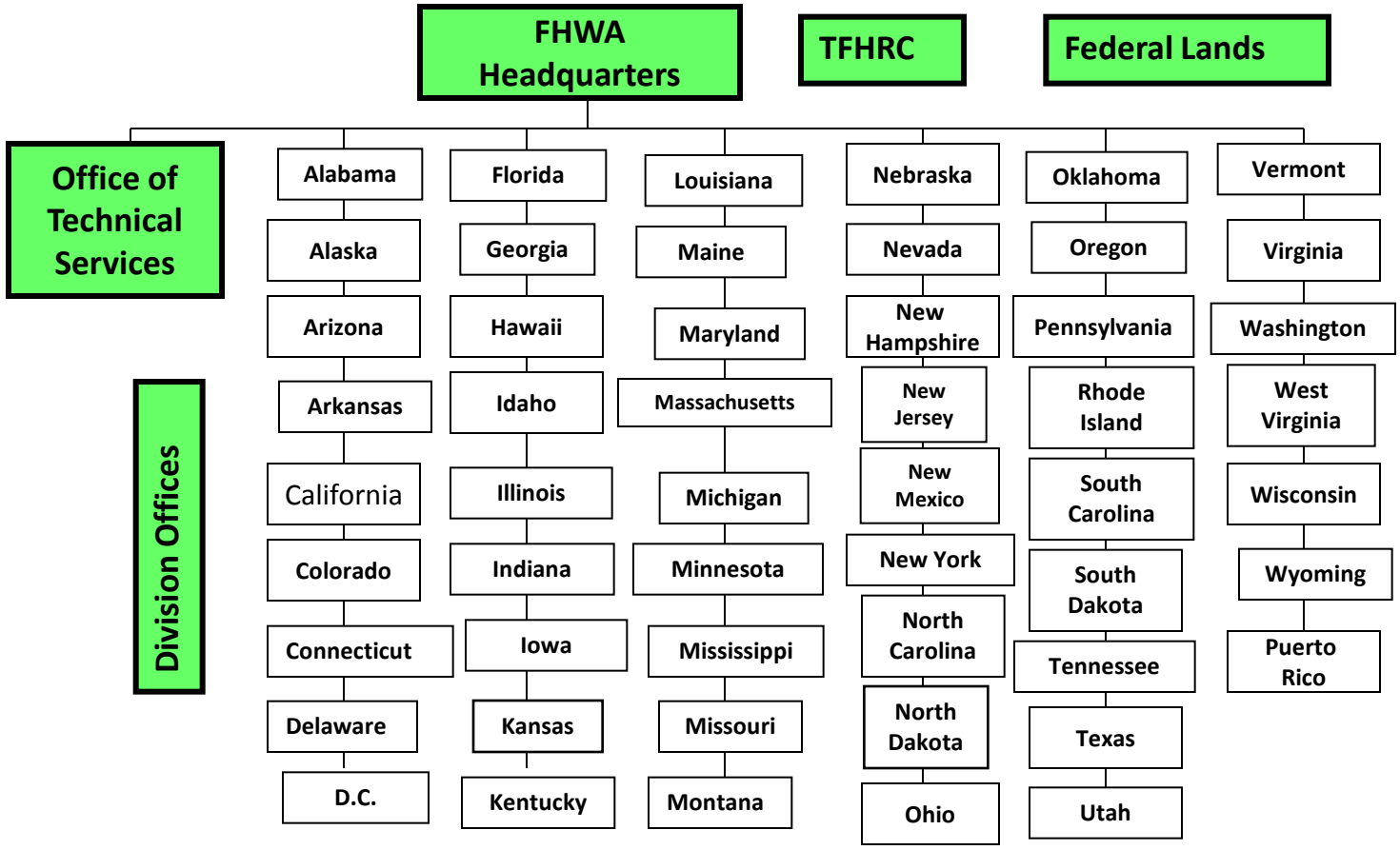
FHWA Organization



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FHWA Recycling/Reuse Contacts

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Early 1900's

Drivers for Better Roads…

- **Farm to Market (Rural)**
  - Unimproved road ~22¢/ton of freight/mile
  - Improved road ~12¢/ton of freight/mile
    45% savings!
  - Strain on a horse pulling a cart is 5x greater on unimproved surface versus a hardened
- **Horse Manure & Urine (Urban)**
  - In NYC horses left behind 2.5 million lbs of manure and 60,000 gallons of urine each day!
  - Kansas City home of 1 horse/7.4 people, had a "rich equine flavor"

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We've Come a Long Way.....

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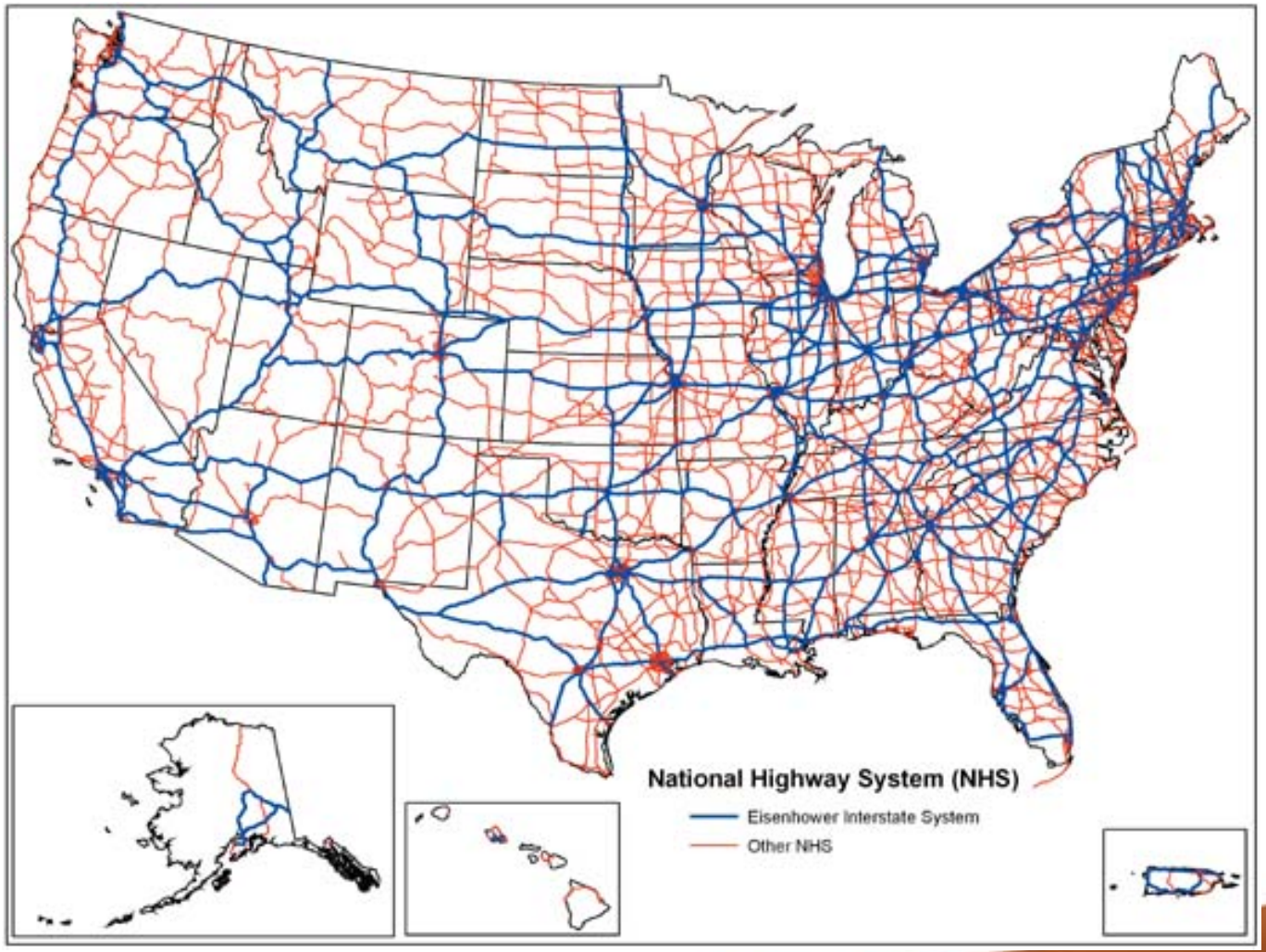
4 Million Miles of Roads

600,000 Bridges



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Statistics We Should Know:

Federal = 3%

State = 20%

Local = 77%

2/3 are Paved (1/3 Unpaved)

94% of Paved have an Asphalt Surface

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Society Depends on Our Public Infrastructure

SOCIAL INTERACTIONS

ECONOMIC TRANSACTIONS

INFRASTRUCTURE

Roads, Bridges, Airports, Water Systems, Wastewater Systems,
Gas, Electric, Telephones, Waterways, Coastal Facilities, Parks, Etc.

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FHWA's "3 E's"

- **ENGINEERING**
  - Use Good Engineering Design to Assure Long-Life Pavements.
- **ECONOMICS**
  - Use Life-Cycle Cost Analysis for Project Selection.
- **ENVIRONMENT**
  - Consider Recycling First
  - Be Good Stewards of the Environment

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FHWA Recycled Materials Policy

- FHWA recognize the need to increase our highway industry's overall use of recycled materials
- Forge partnerships among government, industry, and academia
- Continue to strengthen the relationship between FHWA, US EPA, and State DOT/DEQ
- **www.fhwa.dot.gov/legsregs/directives/policy/recmatmemo.htm**

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Key Points of FHWA Recycling Policy

- Recycled materials should get first consideration in overall materials selection.
- Recycling can offer engineering, economic and environmental benefits.
- Engineering and environmental properties are important.

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Key Points of FHWA Recycling Policy

- Life Cycle Cost benefits assessment is warranted for economic consideration.
- Restrictions prohibiting recycled material that are without technical basis should be removed.
- RCRA applies to Federal-Aid projects
  – Resource Conservation and Recovery Act

www.epa.gov/epawaste/inforesources/online/index.htm

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WHY FHWA Promotes Recycling?

- Environmental Enhancements and Stewardship
- Economic Savings Potential
- Performance Enhancements
- Saving “Non-Renewable” Resources
- Cooperative Partnerships with Industry
- Just “Darn Good” Practice

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EPA Mantra

- REDUCE
  - Consume Less If Possible.
- RECYCLE
  - Reuse Previously Produced Materials.
- REUSE
  - Incorporate Materials Used in Other Manufacturing Processes Into the Work.

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Many Ways to Go Green:

- Recycled Materials (RAP, RAS)
- Warm-Mix Asphalt (WMA)
- In-Place Recycling (CIR, HIR, FDR)
- Reuse of Industrial By-Products
  - Foundry Sands
  - Fly Ash
  - Slag
  - Tire Recycling
- Long-Life Pavements <Reduce Materials>
- Pavement Preservation <Reduce>
- Permeable Pavements
- Sustainability Measures

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TECHNOLOGY APPLICATIONS

- **RECYCLING**
  - Reclaimed Asphalt Pavement
  - Recycled Concrete Aggregate
  - In-Place Recycling
- **REUSE**
  - FLY ASH / COAL ASH
  - TIRE RUBBER
  - SHINGLES
  - SLAG
  - FOUNDRY SAND
- **Warm-Mix Asphalt**

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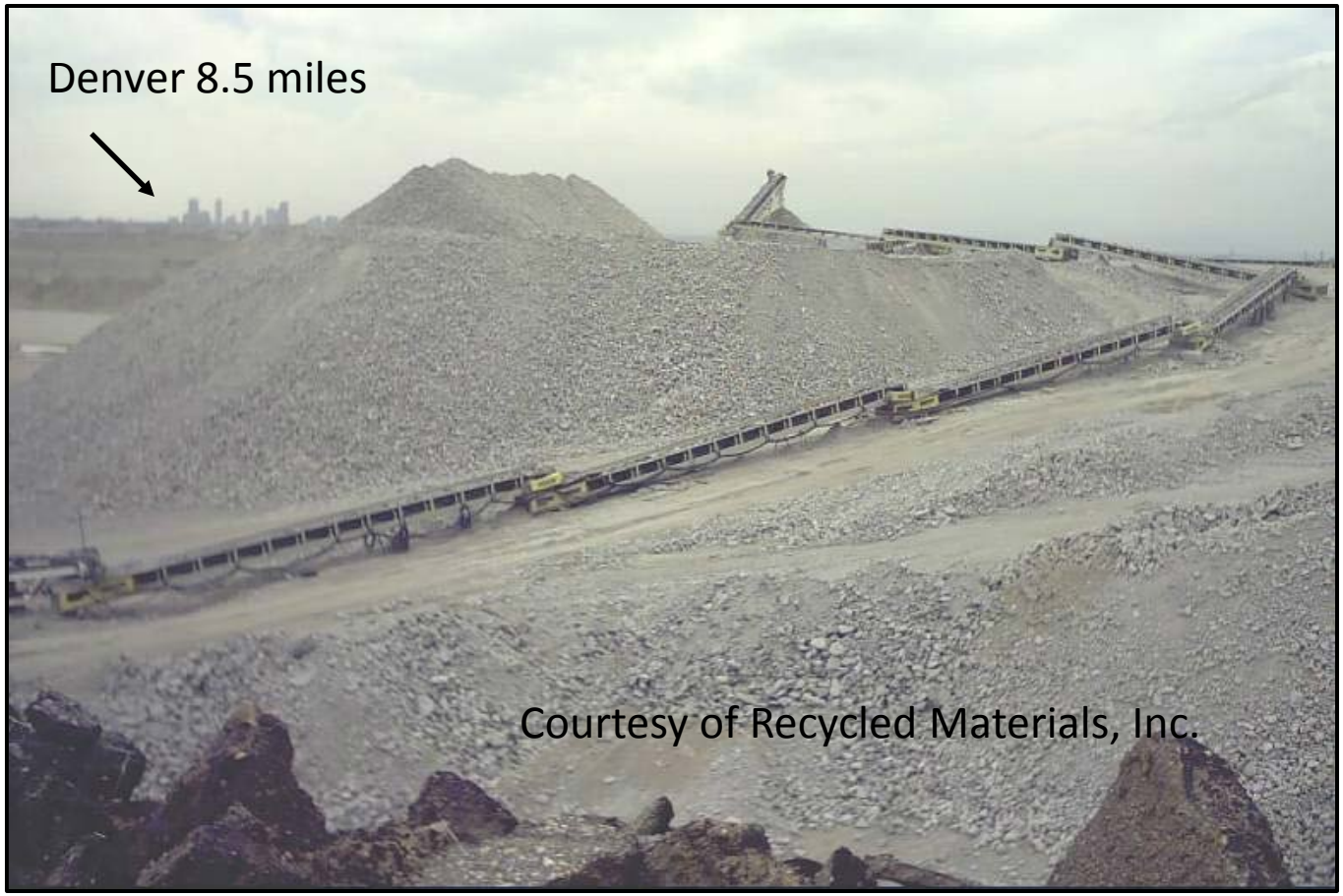
Worlds Largest "Urban Quarry"



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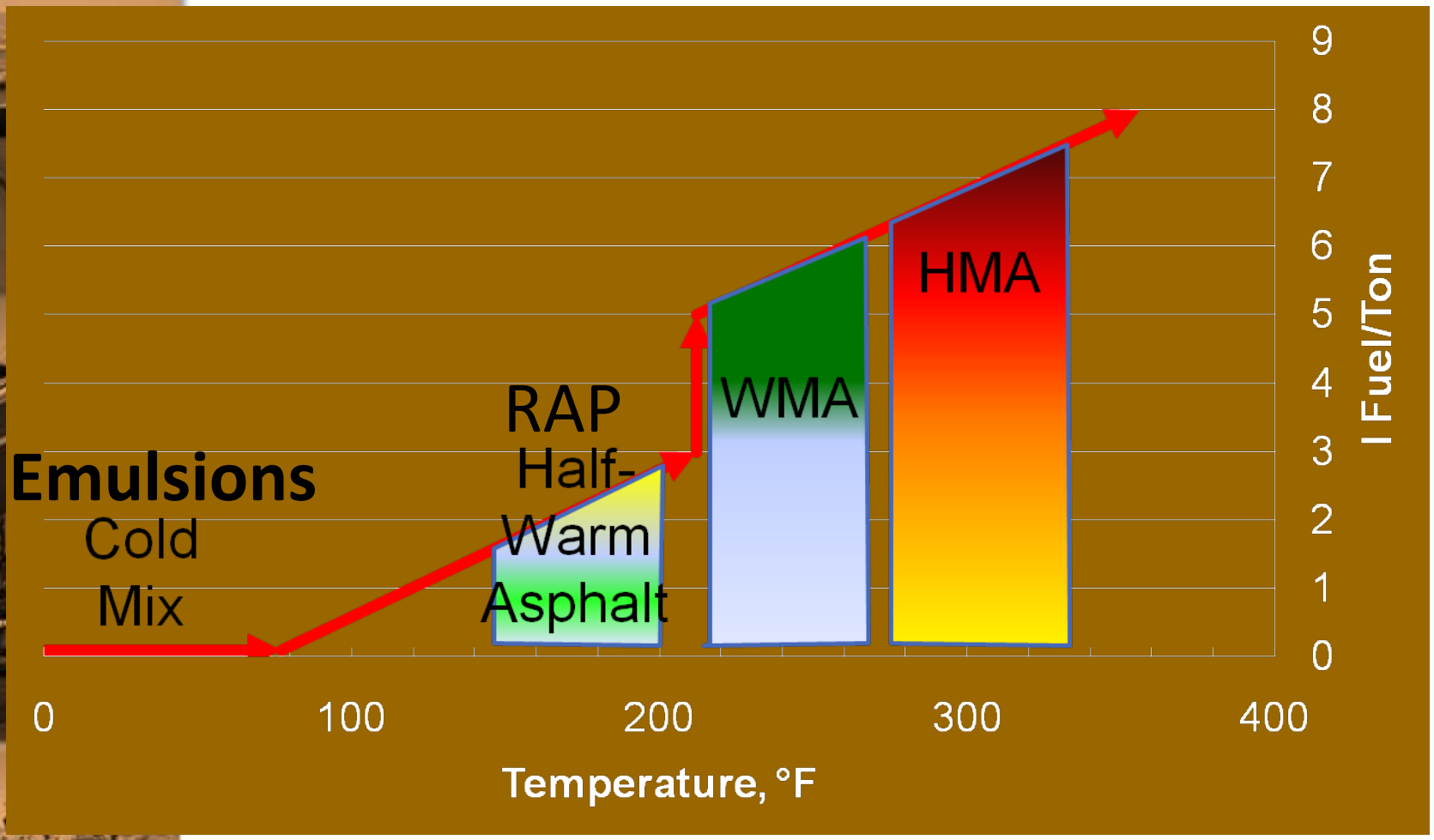
Energy Use Comparisons



Courtesy of NAPA/COLAS

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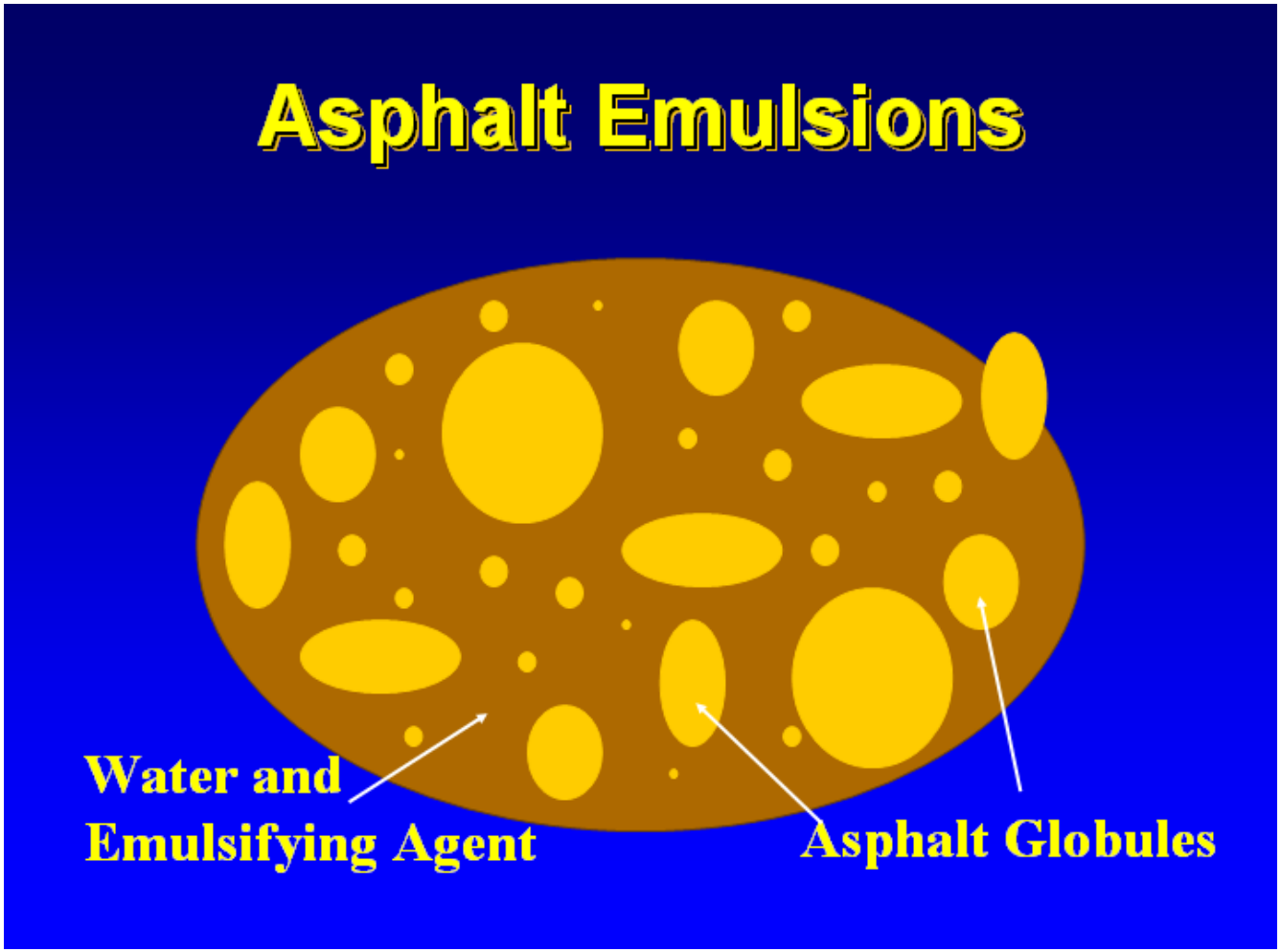
Emulsions



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FHWA / ARRA WORKSHOPS

- 2008 – Salt Lake City, UT
- 2009 – Minneapolis, MN
- 2010 – Harrisburg, PA
- 2011 – Atlanta, GA

http://www.pavementpreservation.org/conferences/regional-in-place-recycling-conferences/

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Reuse of Industrial Byproducts

Millions of Tons per Year used in Highway Applications

Byproduct Materials Produced	Production (million metric tons)	Recycled in Highway Applications (million metric tons)	Applications
Blast Furnace Slag	14	12.6	Concrete
Coal Bottom Ash	14.5	4.4	Asphalt, Base
Coal Fly Ash	53.5	14.6	Cement Production, Structural Fill
Foundry Sands	9 to 13.6	?	Flowable Fill, Asphalt
Cement Kiln Dust	12.9	8.3	Stabilizer
Bottom Ash	8	Small Amounts	Asphalt, Base
Nonferrous Slags	8.1	?	Base, Asphalt
Steel Slags	?	7.5	Base, Asphalt, Concrete
Recycled Asphalt Pavement	41	33	Asphalt, Base
Reclaimed Concrete	?	?	Base, Concrete

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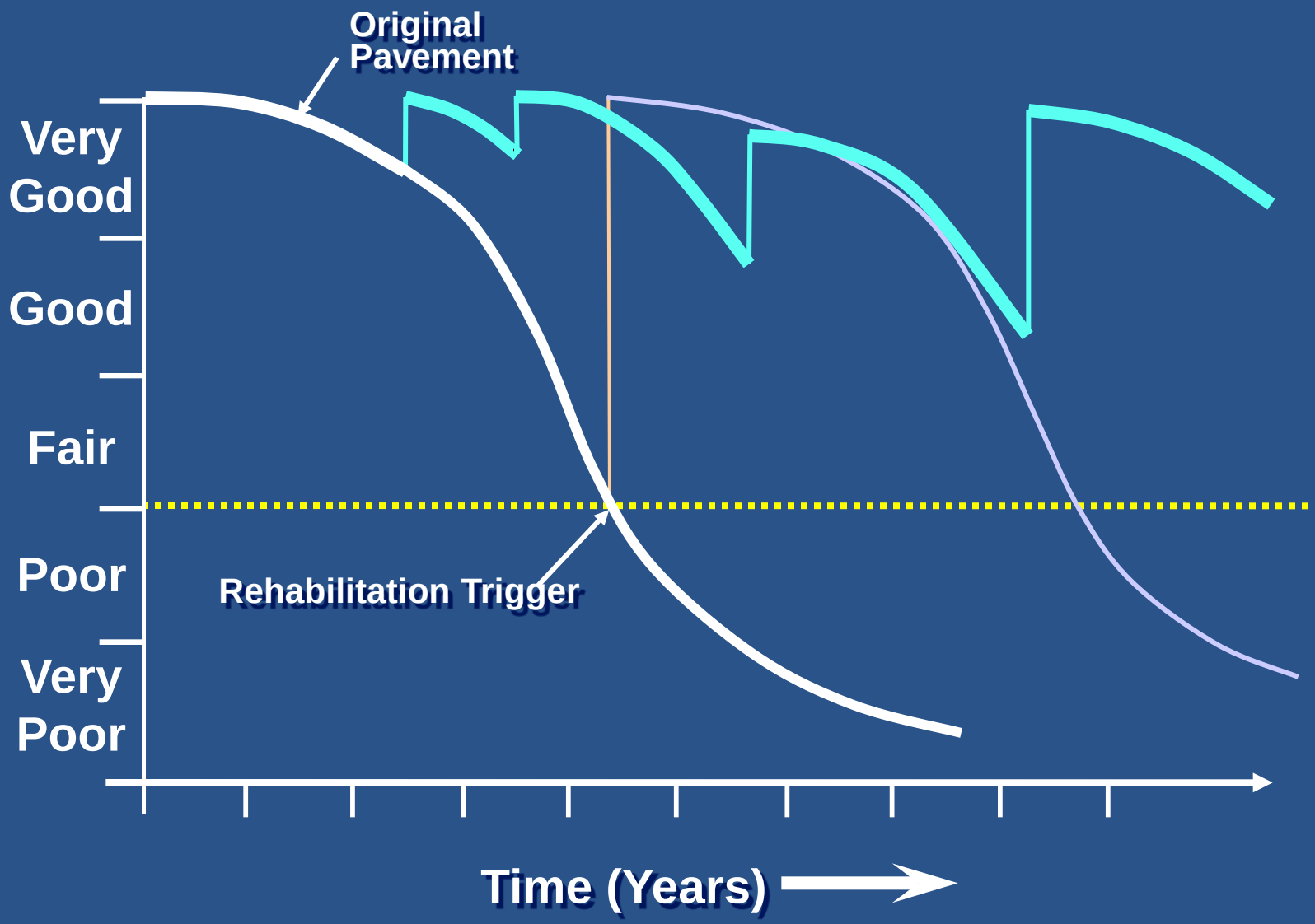
The Pavement Preservation Concept



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Cost of Delaying Maintenance

Timing Belt Replacement: $400

Engine Replacement: $2,500

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Cost of Delaying Maintenance

Teeth Cleaning: $75

Root Canal: $1,000

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FHWA Web-Based Resources

- www.fhwa.dot.gov/pavement/recycle
- www.fhwa.dot.gov/preservation

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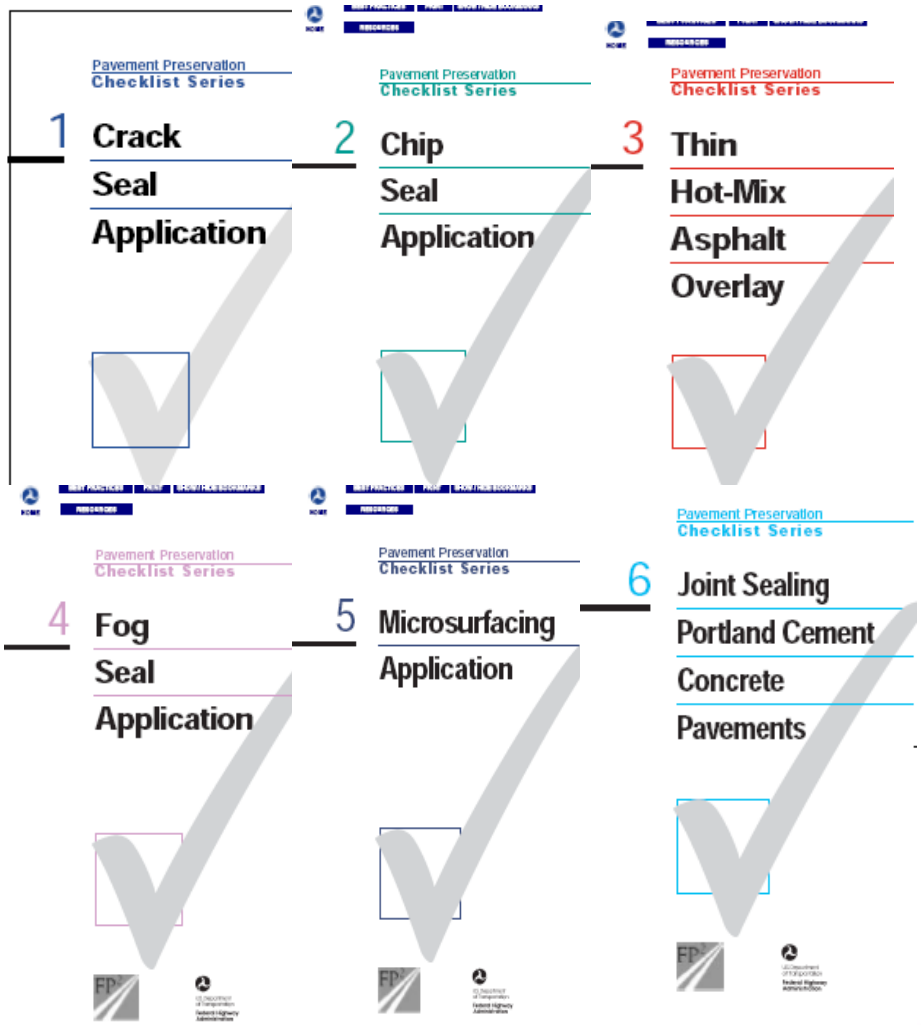
PRODUCTS / Resources

14 CHECKLISTS

CD's/DVD's

COMPENDIUMS



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National Center for Pavement Preservation
www.pavementpreservation.org

A Quick Check of Your Highway Network Health

by Larry Galehouse, Director,
National Center for Pavement Preservation
and
Jim Sorenson, Team Leader,
FHWA Office of Asset Management

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NHI Preservation Training – *FREE!!!!*

- 131110 – Pavement Preservation Treatment Construction
  – WEB-BASED
  - HMA Treatments
  - PCC Treatments
  - HMA Overlay Inspection

TCCC:
https://fhwaapps.fhwa.dot.gov/tccc/

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Other Organizations

- Recycled Materials Resource Center
  www.recycledmaterials.org

- National Center for Pavement Preservation
  www.pavementpreservation.com

and Industry Associations!

ncpp
National Center for Pavement Preservation

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Key Websites – 1/2

- **FHWA Pavement Recycling –**
  http://www.fhwa.dot.gov/pavement/recycling/index.cfm
- **FHWA INVEST Tool:** "Infrastructure Voluntary Evaluation Sustainability Tool"
  http://www.sustainablehighways.org/
- **Asphalt Recycling and Reclaiming Association**
  http://www.arra.org
- **Pavement Recycling and Reclaiming Center**
  http://prrcenter.org (Cal Poly Pomona)

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Key Websites – 2/2

- **FHWA Every Day Counts Warm Mix Asphalt**
  http://www.fhwa.dot.gov/everydaycounts/technology/asphalt
- **Recycled Materials Resource Center - http://www.recycledmaterials.org**
- **Green Highways Partnership**
  http://www.greenhighways.org
- **USEPA Resource Conservation Challenge**
  http://www.epa.gov/osw/conserve/rrr/imr/index.htm

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Recommended Reading

- http://www.recycledmaterials.org/tools/uguidelines/index.asp

User Guidelines for Byproducts and Secondary Use Materials in Pavement Construction

- http://www.dot.state.co.us/Publications/PDFFiles/epagrant.pdf

MATERIALS RECYCLING AND REUSE – FINDING OPPORTUNITIES IN COLORADO HIGHWAYS, October 2007

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Challenge for YOU!

- Do
  - Look at your current specs/regulations
  - Overcome your own hurdles
- Act
  - Partner with DOT/ DNR / EPA & Industry
  - Create reuse/recycle programs
  - Make use of the resources noted in this presentation!

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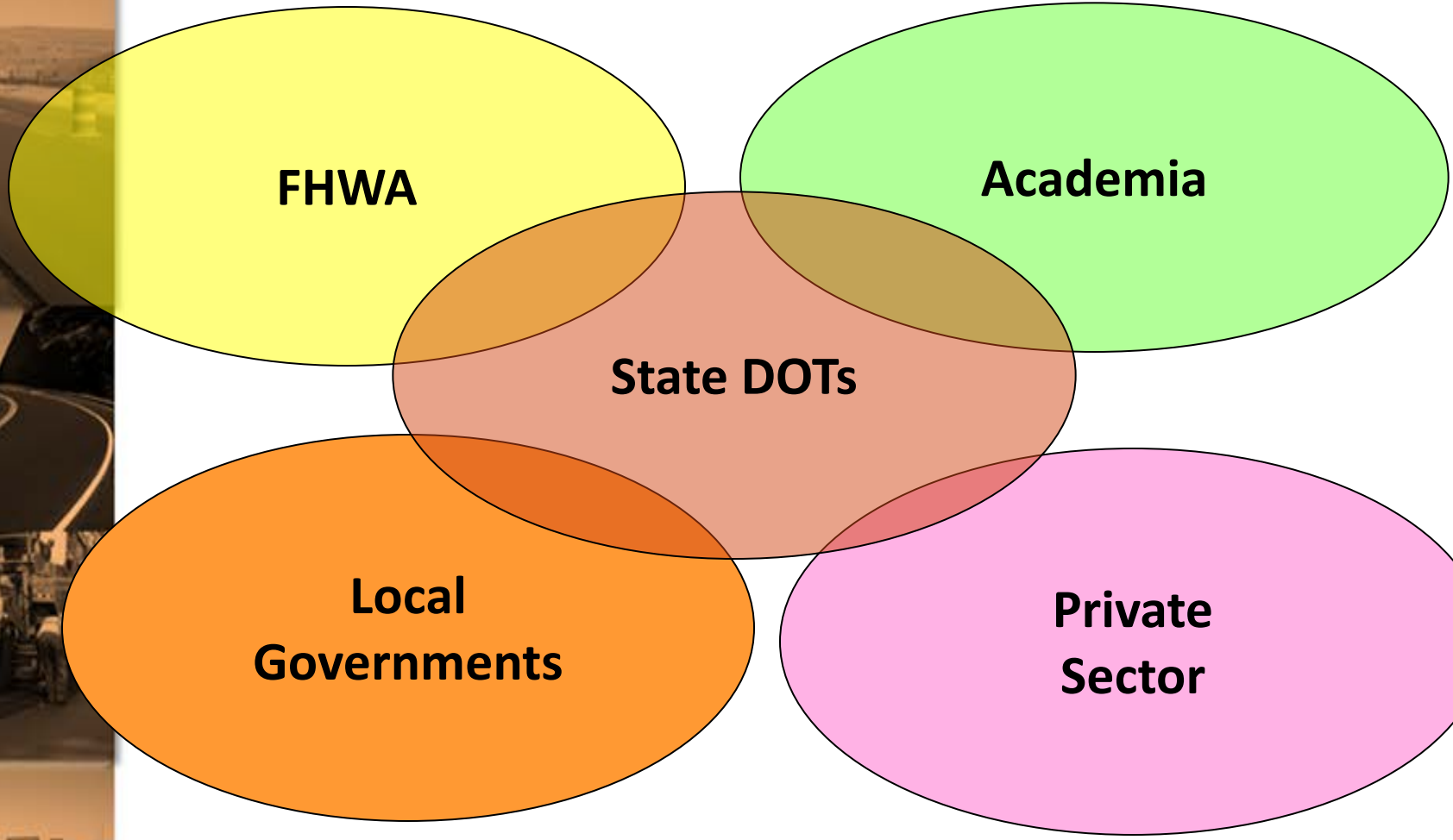
Partnerships Are Required



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Partnerships are Required

- 1 FHWA
- 52 State DOTs (including DC and PR)
- 3,034 County governments;
- 35,933 Municipal, Town and Township governments.
- 4,140 Colleges and Universities
- ____ contractors/industry reps.

UNITED WE STAND….

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FHWA Supports Pavement Recycling!

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It's Good to be GREEN!

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THANK YOU!

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