



The Advantages of HMA Recycling – Part A

BUILT TO **CONNECT**

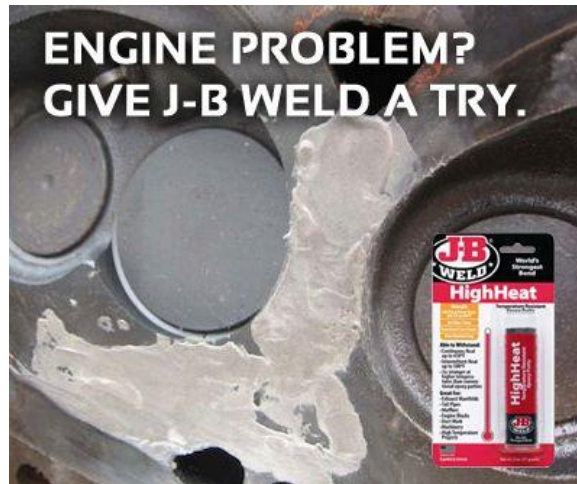
Richard J. Schreck
Technical Services and
Applications Director
Astec, Inc.



Two Part Presentation...



Part A



Why is Asphalt so Recyclable?



Asphalt Concrete is a combination of aggregates mixed with, and bound together by, a liquid asphalt binder.



The bond is mechanical in nature and no chemical reaction takes place between the aggregates and the asphalt binder.

Six Benefits of Asphalt Recycling



- It saves money...
- It is better for the environment...
- It reduces other wastes in landfills...
- It conserves other natural resources...
- Better durability and longevity of recycled asphalt mixes over conventional mixes...
- Many uses beyond just road paving...

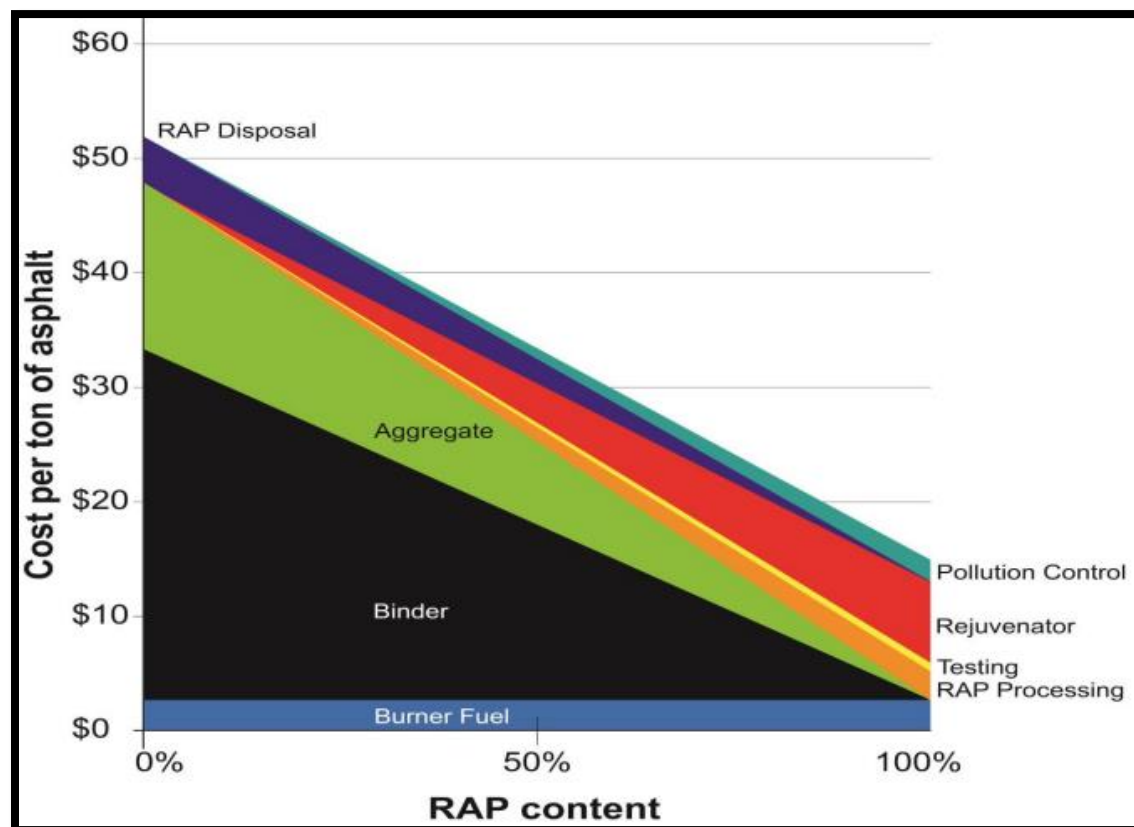
ASPHALT



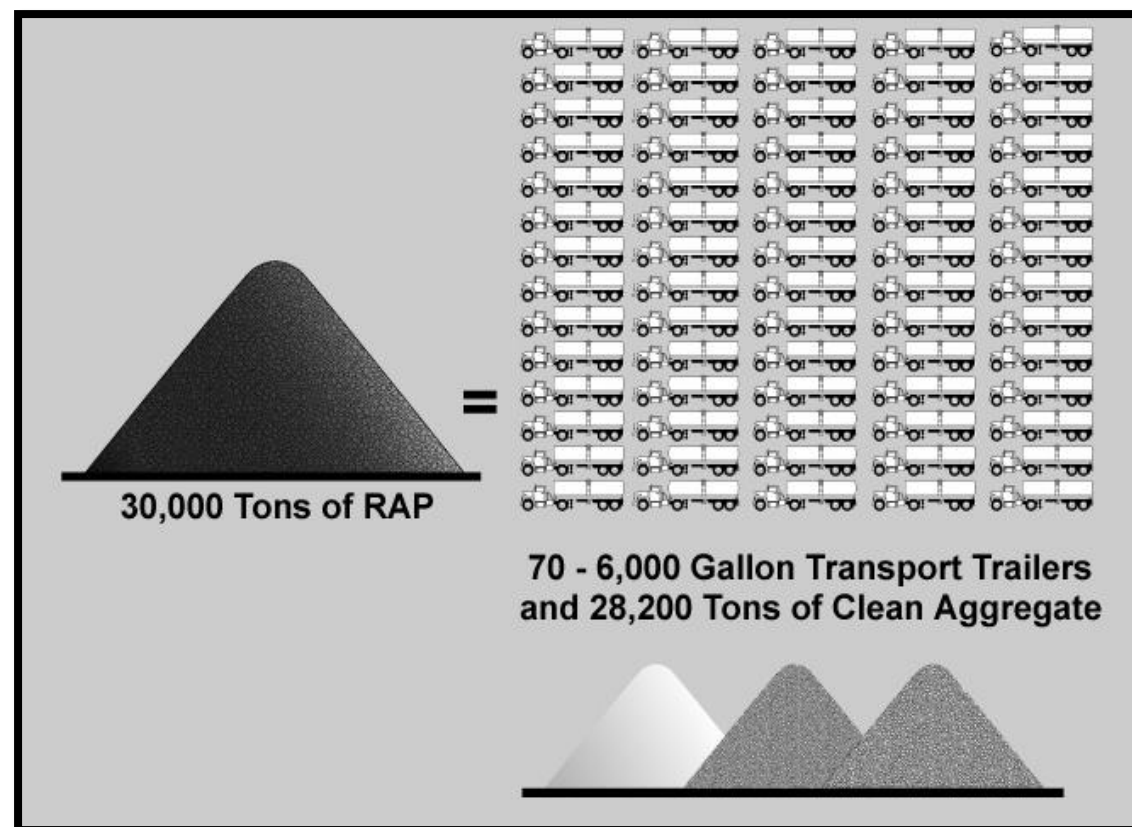
Cost Savings of Asphalt Recycling



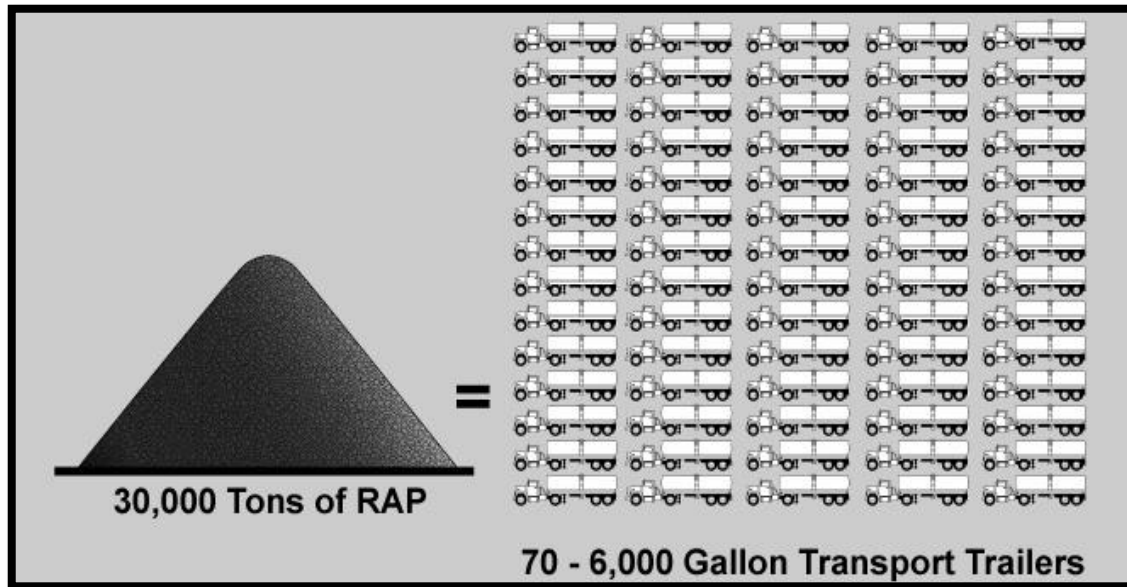
Cost Comparison of Virgin and Recycle Materials



RAP is Worth the Material it Replaces

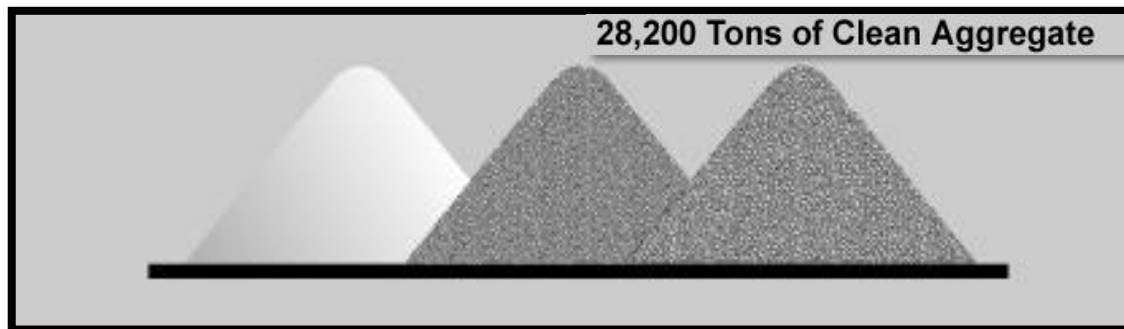


RAP is Worth What it Replaces



**Asphalt Binder Weighs 8.085# per Gallon
(8.328 (Water SG of 1.00)/1.03 = 8.085#/gal.)**

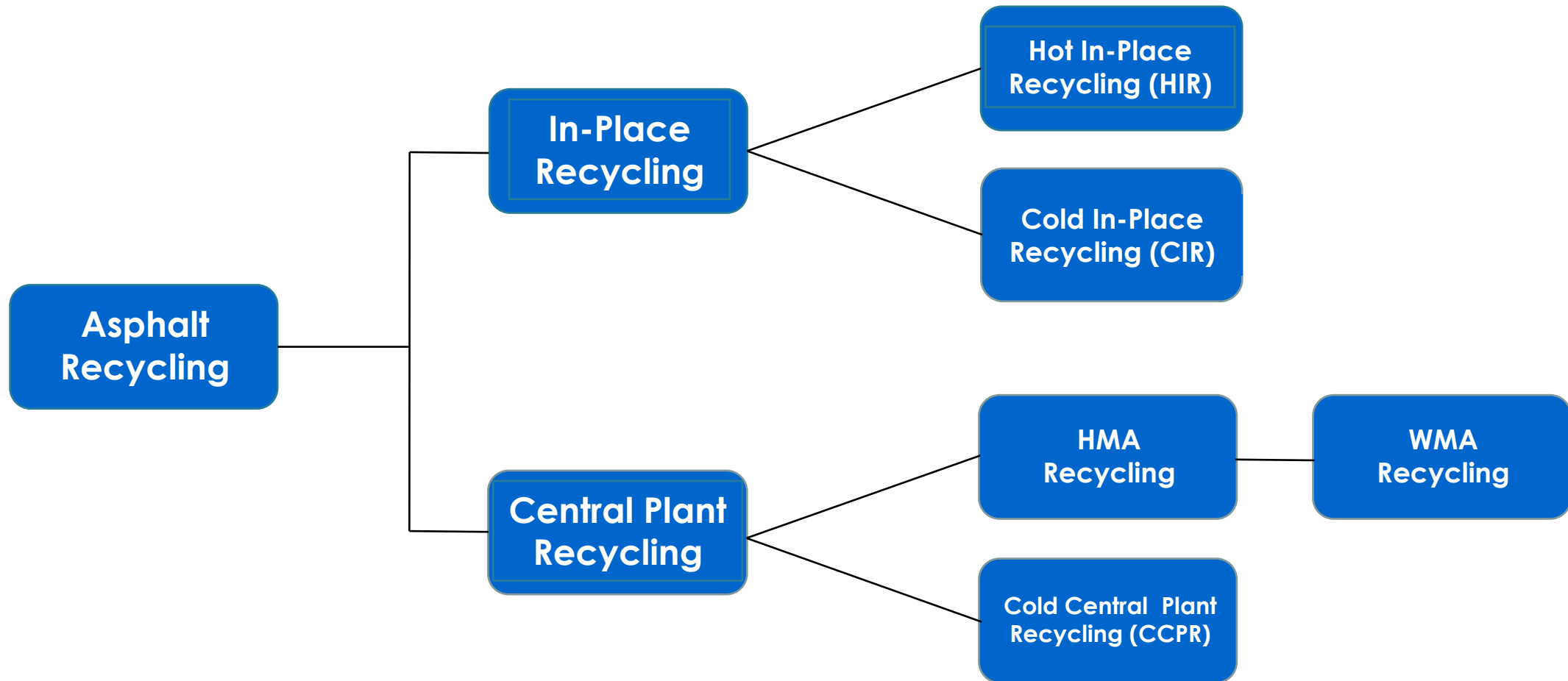
**70 Transport Trailers x 6,000 gal. = 420,000 gal.
420,000 x 8.085# = 3,395,700#/2000 = 1,698 Tons
1,698 Tons x \$700 = **\$1,188,600****



**28,200 Tons of Aggregate x \$25 per ton =
\$705,000**

\$705,000 + \$1.19 Million = \$1.9 Million

Categories of Asphalt Recycling



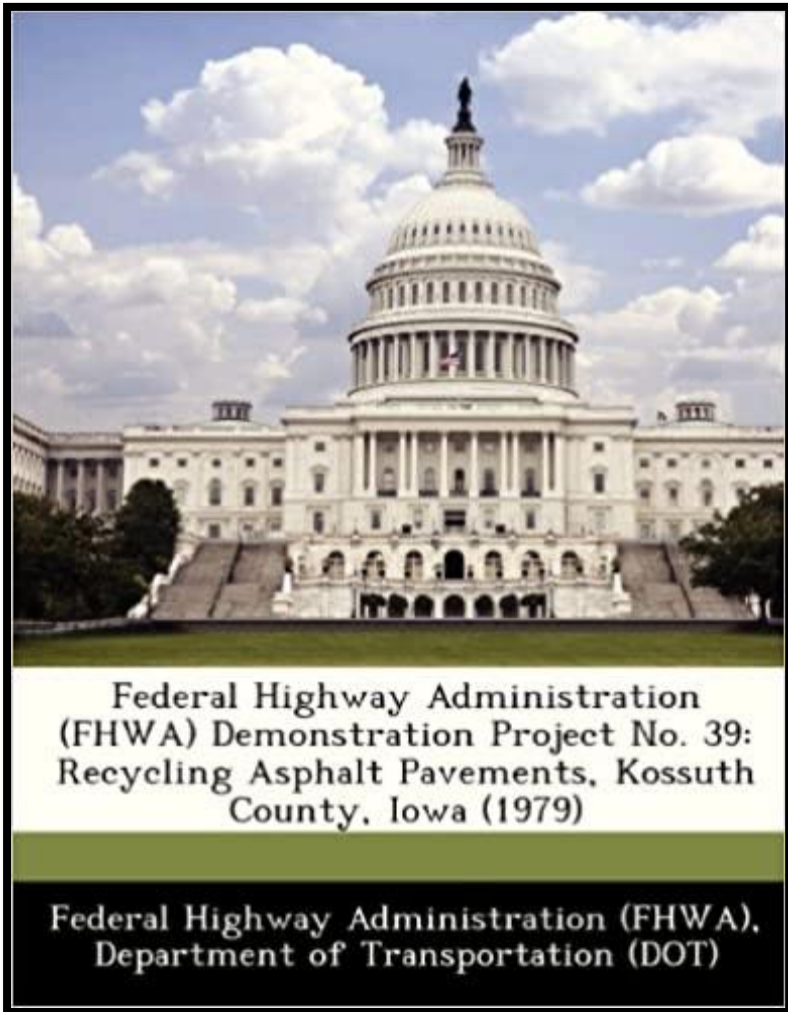
45 Years ago...



FHWA Demonstration Project 39 – Asphalt Recycling

“The pressing need to conserve energy and minimize costs in highway construction requires that special effort be made to identify and make the maximum use of procedures that will result in reduced energy usage and minimum cost.”

These are the experimental projects initiated by various states between 1978 and 1983 to recycle pavement materials.”



FHWA Demonstration Project 39



Report Number	Report Title	Location	Report Date
	Tamworth Cold Recycling Project	Tamworth, NH	
FHWA-DP-39-3	WA DOT's First Asphalt Recycling Project – Renslow to Ryegrass	Ellensburg, WA	July 1978
FHWA-DP-39-5	Pavement Surface Recycling on Parks Highway Willow, Alaska	Anchorage, AK	February 1978
FHWA-DP-39-7	Construction Milling Bituminous Surface (Milling as Shoulders)	Ellendale, ND	September 1978
FHWA-DP-39-8	Evaluation of Recycled Bituminous Pavements (Cold Recycling)	Elkhart County, IN	August 1978
FHWA-DP-39-10	“Evaluation of Recycled Concrete Pavements”	Kossuth County, IA	February 1979
FHWA-DP-39-14	Evaluation of Recycled Asphaltic Concrete	Chester, VA	August 1977
FHWA-DP-39-16	Pavement Recycling Project (Road Oil Semi Hot Recycling)	Gila Bend, AR	October 1978
FHWA-DP-39-17	Recycling Asphalt Concrete on Interstate 80	Gold Run, CA	April 1979
FHWA-DP-39-18	Recycling of Bituminous Shoulders	Fergus Falls, MN	March 1979
FHWA-DP-39-19	Recycling of Asphalt Concrete Pavements	Palm Beach County, FL	January 1980
FHWA-DP-39-23	Recycling of Asphalt Concrete Pavements (US 98)	Panama City, FL	November 1979
FHWA-DP-39-28	Hot Mix Recycling Durango-Hesperus	Durango, CO	May 1980
FHWA-DP-39-29	Bituminous Concrete Pavement Recycling Route US 130	North Brunswick, NJ	July 1980
FHWA-DP-39-31	Hot Recycling of Asphaltic Concrete Pavement, Wildcat to Pine Creek	Beaver, UT	October 1980
FHWA-DP-39-32	1980 Pavement Recycling Program	Springfield, MO	January 1981
FHWA-DP-39-33	Recycling Asphalt Pavements in the State of New Hampshire	NH	April 1981
FHWA-DP-39-34	Evaluation of a Recycled Asphaltic Concrete Pavement	Dallas County, MO	August 1982

39 Years Ago...



Program Schedule			
January 25, 1984			
8:00- 9:00 AM	Registration and Coffee	12:00-1:15 PM	Lunch
9:00- 9:15 AM	Introduction and Orientation	1:15- 2:00 PM	Virginia Highway Recycling Experience
	Richard J. Schreck, Executive Vice-President Virginia Asphalt Association		✓ Aubrey D. Newman, Pavement Management Engineer Virginia Department of Highways and Transportation
9:15- 9:30 AM	Welcome Address	2:00- 2:45 PM	Municipal Asphalt Recycling
	Harold C. King, Commissioner Virginia Department of Highways and Transportation		✓ S. V. (VAL) JACKSON, JR. P.E. CITY ENGINEER NEWARK, OHIO
9:30-10:30 AM	Asphalt Recycling—The Purpose and the Process	2:45- 3:30 PM	Recycling from the Contractors Viewpoint
	✓ Douglas A. Bernard, Chief of Administration, Projects Division Federal Highway Administration		ERNEST C. CZARNECKI, VICE PRESIDENT Newton Asphalt Co., Inc. of Virginia
10:30-10:45 AM	Break	3:30- 4:30 PM	Questions and Answers
10:45-11:45 AM	An Overview of Recycling—The Florida Experience		Panel: Douglas Bernard Charles F. Potts Aubrey D. Newman S. V. (VAL) JACKSON, JR. ERNEST C. CZARNECKI
	Charles F. Potts, State Materials and Research Engineer Florida Department of Transportation	5:00- 6:30 PM	Reception
11:45-12:00 Noon	Questions and Answers		
January 26, 1984			
8:00- 9:00 AM	Registration and Coffee	11:30-12:00 Noon	Innovative Batch Plant Retrofit
9:00-10:00 AM	The Economics of Asphalt Recycling		Wayne R. Hardenbergh, Sales Marketing Coordinator Thermotech System, Inc.
	Dr. J. Don Brock, Phd.PE Astec Industries, Incorporated	12:00- 1:15 PM	Lunch
10:00-10:45 AM	Material Removal and Handling	1:15- 2:00 PM	Drum Mix Recycling
	Ronald D. Clark, District Manager CMI Corporation		Tom Holley, District Sales Engineer Standard Havens, Inc.
10:45-11:00 AM	Break	2:00- 2:45 PM	Making it All Work for You
11:00-11:30 AM	Batch Plant Recycling		✓ Gerald S. Triplett, President The Asphalt Institute
	Thomas M. Moe, Product Sales Manager Barber-Greene Company	2:45 PM	Closure



29 and 23 Years Ago...



Superior Performing Asphalt Pavements (Superpave): The Product of the SHRP Asphalt Research Program

Thomas W. Kennedy
University of Texas at Austin

Gerald A. Huber
Heritage Research Group

Edward T. Harrigan
Strategic Highway Research Program

Ronald J. Cominsky
University of Texas at Austin

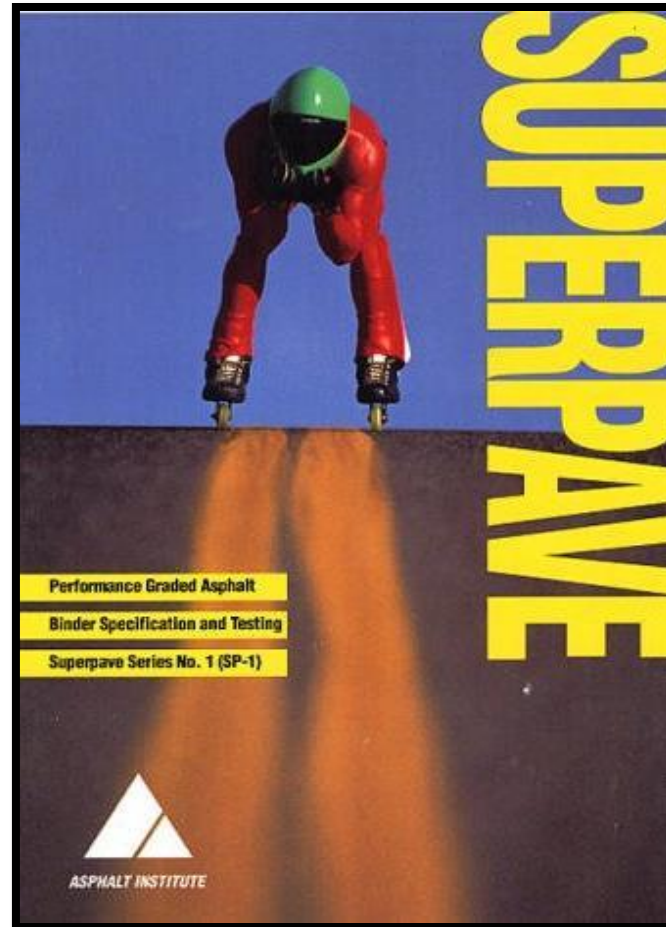
Charles S. Hughes
University of Texas at Austin

Harold Von Quintus
Brent Rauhut Engineering, Inc.

James S. Moulthrop
University of Texas at Austin



Strategic Highway Research Program
National Research Council
Washington, DC 1994



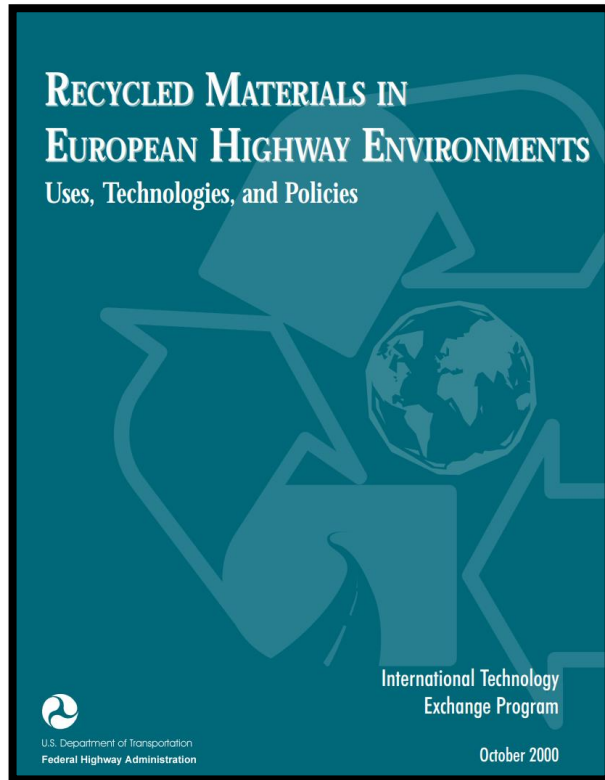
FHWA Superpave Mixtures Expert Task Group “developed” a tiered approach for RAP usage.

- **0 to 15% RAP:** No change in the virgin binder grade.
- **15.1% to 25% RAP:** Virgin binder grade should be decreased one grade on both the high and low temperature scales to soften the blend.
- **Over 25% RAP:** Blending charts should be used to determine required PG grade.

No Research of RAP Mixes

New Binder Grading System

23 Years Ago FHWA Scanning Tour...



- European countries visited all had recycling policies promoting sustainability as well as pervasive public culture about recycling.
- Generally, recycling occurs when it is economical to do so.
- Factors in the marketplace are dominate, but are supported by government policies and regulations such as bans on landfilling, landfill taxes, natural aggregate taxes, and, in some cases, subsidies to assist recycling efforts.

“The United States needs to change the negative image about using recycled materials and provide incentives (or disincentives) for contractor to use recycled materials and to work with contractors.”

22 Years Ago...



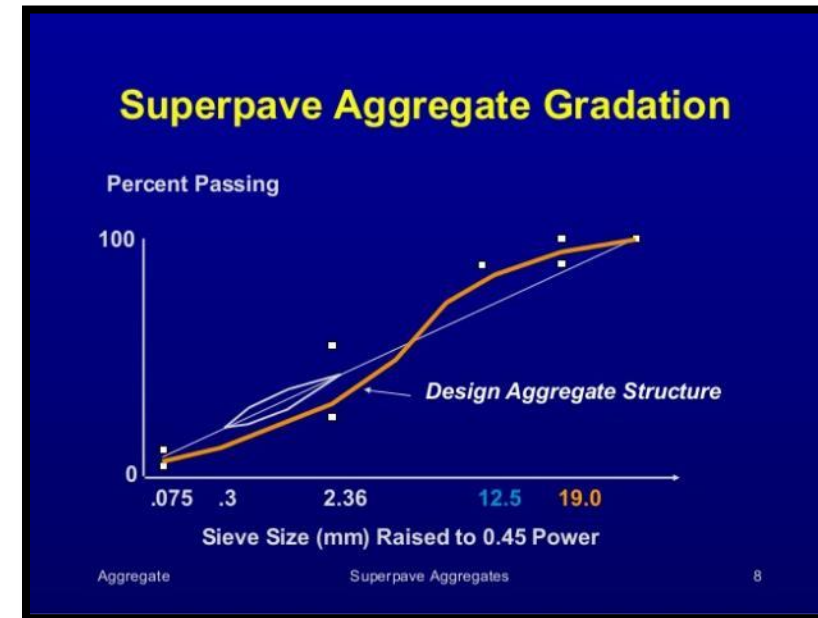
SUPERPAVE Mix Issues Impacting RAP (and Other) Mix Performance

Current AASHTO N_{design} Table

Traffic Level	Compaction Level	
	N_{initial}	N_{design}
< 0.3	6	50
0.3 to < 3.0	7	75
3.0 to < 30.0	8	100
> 30.0	9	125

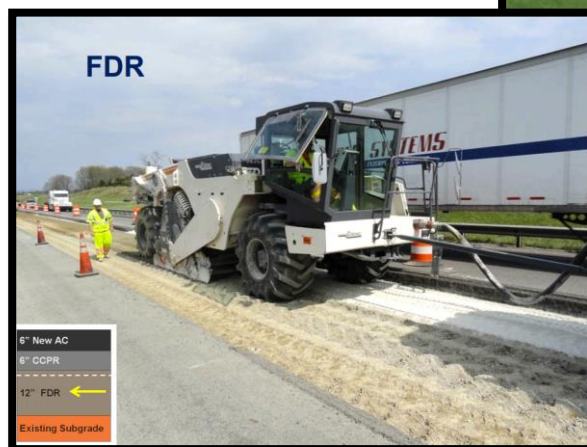
Some States use different N_{design} Tables

Superpave Mix Design 10



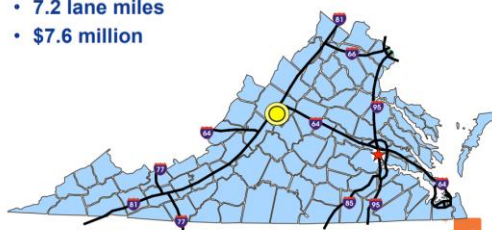
- High mix design compaction/gyration levels yielded “dry” (low AC) mixes.
- Coarse graded mixes that avoided “Restricted Zone” resulted in increased permeability, low binder contents.
- Use of high viscosity(stiff) PG binders in conjunction with increased gyration levels for heavy duty pavements made mixes brittle and susceptible to early fatigue.

14 Years Ago...

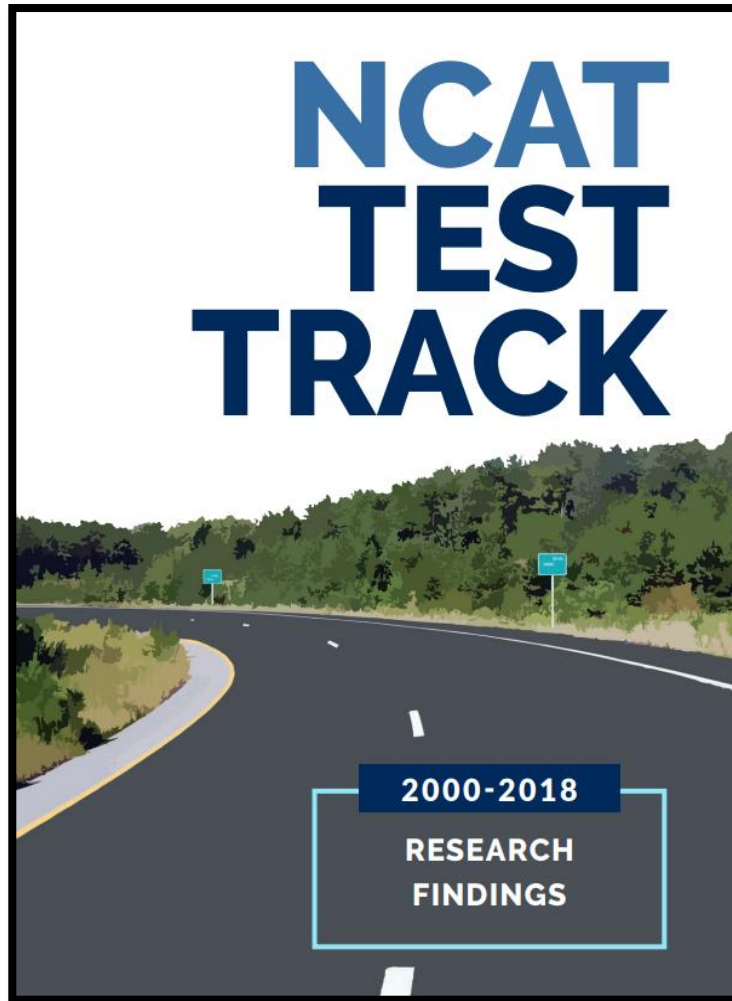


I-81 Pavement Recycling Project

- AADT = 23,000 (28% trucks)
- 7.2 lane miles
- \$7.6 million

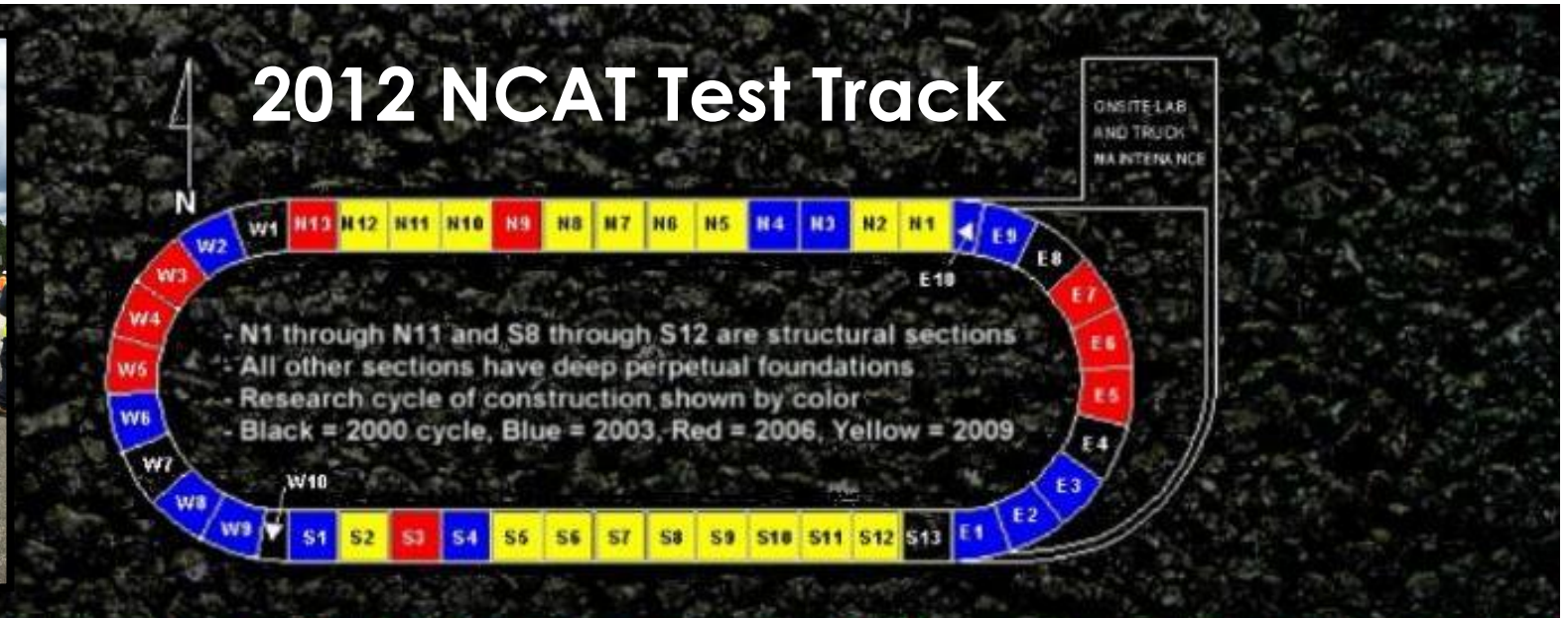


5 to 13 Years Ago NCAT Test Track...



- **6 20% and 45% RAP test sections built in 3rd cycle and trafficked through 4th cycle.**
- After 20 million ESALs, *practically no rutting, little raveling and only small amounts of low severity surface cracking.*
- **45% RAP** mix with **softer binder** provided better resistance to raveling and cracking.
- *No rutting or cracking benefit using polymer-modified binder in the 20% or 45% RAP mixes.*
- **Additional 50% RAP test sections in 2009** performed better than companion virgin test section in all performance measures.

11 Years Ago...



N3	N4	S12
6-inch AC	4-inch AC	4-inch AC
5-inch CCPR	5-inch CCPR	5-inch CCPR
6-inch Agg Base	6-inch Agg Base	8-inch FDR
Subgrade	Subgrade	Subgrade

6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
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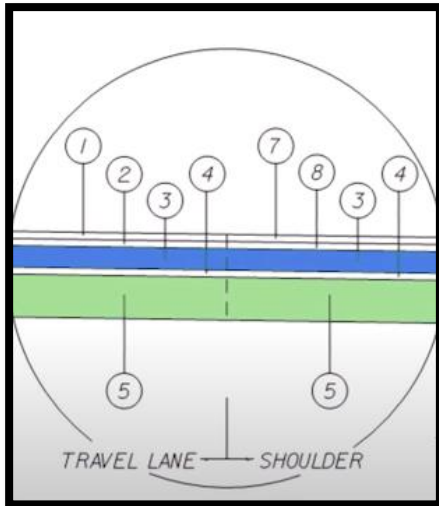
9 years Ago Japan Scanning Tour...



- NAPA's contractor members, state DOTs, NCAT, NAPA staff, and the State Asphalt Pavement Associations representatives.
- **Japanese government concluded in 1992 RAP mixes were as good as virgin mixes.**
- Legislation requiring recycling construction waste fully implemented in Japan.
- Japan government **mandates** 65% RAP in surface mixes and 80% RAP in bases.
- Batch plants only in Japan.
- Proprietary rejuvenators in high RAP mixes.



7 Years Ago...



**Asphalt
Recycling Wins
I-64
Reconstruction
in Tidewater
Virginia and
uses 18"
Recycled
Materials**

PAVEMENT DESIGN (NEW ROADWAY)

- ① 2" Asphalt Concrete, SMA-12.5 PG76-22 (220 LB/SY)
- ② 2" Asphalt Concrete, SMA-19.0 PG76-22 (220 LB/SY)
- ③ 6" Cold Central Plant Recycling Material (CCPRM)
- ④ 2" Open Graded Drainage Layer - Asphalt or Cement Stabilized
- ⑤ 12" Cement Treated Crushed Concrete
- ⑦ 2" Asphalt Concrete, SM-12.5D (220 LB/SY)
- ⑧ 2" Asphalt Concrete, IM-19.0A (220 LB/SY)



Today It's All About Sustainability



From mix production to placement on the road, to rehabilitation through recycling, asphalt minimizes impact on the environment.

Low energy consumption for production and construction, low emission of greenhouse gases, and conservation of natural resources make asphalt the environmental pavement of choice.





Asphalt and Circular Economy



“Nevertheless, probably the greatest impact can be achieved by re-using and recycling reclaimed asphalt from existing roads to build and maintain new roads. **The 100% re-usability and recyclability of asphalt has made it a highly re-used road construction material in the world,** and it has already been demonstrated possible to build certain types of roads with 100% of only reclaimed material.”



100% RAP Mixes Are Here!



ULTIFOAM

Closed loop asphalt recycling solution

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ULTIFOAM is a closed loop asphalt recycling solution. It is a solution that allows for the recycling of asphalt planings.

Where sustainability and waste management are the priority, ULTIFOAM offers the ultimate in closed-loop road reconstruction. By using proven foamed bitumen and cold paving technology, ULTIFOAM enables road arisings to be used in sub-surface reconstruction. As a result it offers savings in both transport and disposal costs. It also offers major environmental benefits from reductions in the use of energy and primary aggregates.

ULTIFOAM is only available for installation by our own expert Contracting division who evaluate each site to make sure our clients get the right solution and then deliver it to the highest industry standards.

Where can ULTIFOAM be used?

Closed loop asphalt recycling on major projects

ULTIFOAM technology has been used successfully on major projects like A11 Fiveways to Thetford, to allow local or on-site reprocessing of asphalt planings and use in construction of new roads.

Local asphalt recycling for highway maintenance

ULTIFOAM allows local authorities to recycle asphalt planings from their road network and use them elsewhere in road reconstruction. This improves sustainability and reduces disposal costs.

Closed loop asphalt recycling on secure sites

Using site-processed recycled asphalt planing can help reduce transport requirements and simplify logistics when resurfacing secure sites like runways.

AGGREGATE INDUSTRIES

FOAMIX™
Low Carbon Recycled Asphalt

TYPICALLY DELIVERS C.45% CARBON REDUCTION

FOAMIX®

Foamix® asphalt is a hybrid between Asphalt and Hydraulically Bound Material (HBM). Manufactured as a cold mix, it contains a high recycled content asphalt resulting in a low manufacturing carbon footprint. Manufactured to a high level of control and incorporates up to 92% recycled materials, reclaimed filler/additives, plus bitumen, cement and water.

Using our fleet of [Sitebatch Technologies](#) mobile mixing plants, Foamix offers a cost-effective, sustainable solution to our customers for the construction, repair and maintenance of new or existing pavements whilst maximising the use of locally sourced recycled materials. It is laid and compacted like normal asphalt, only cold, without the need for any specialist paver or labour.

With the ability to encapsulate tar-bound RAP for safe reuse in the local road network, Foamix offers our clients a more sustainable solution that eliminates costly disposal charges associated with hazardous waste at licensed tips.

What's in Your Asphalt?



Thank You!

QUESTIONS?



BUILT TO **CONNECT**