The State of RAP

in America

ASTEC
An Astec Industries Company

Traditional RAP Wisdom Says…

3 Factors Determine RAP Percentage Used

3

How Much RAP Does the Producer Have?

2 How Much RAP Does the DOT/County/Agency Allow?

City of Phoenix
PUBLIC WORKS DEPARTMENT

#1

How Much RAP is your competition using?

4?

How much can your plant handle?

Nope…see number #1!

RAP is like money in the bank…

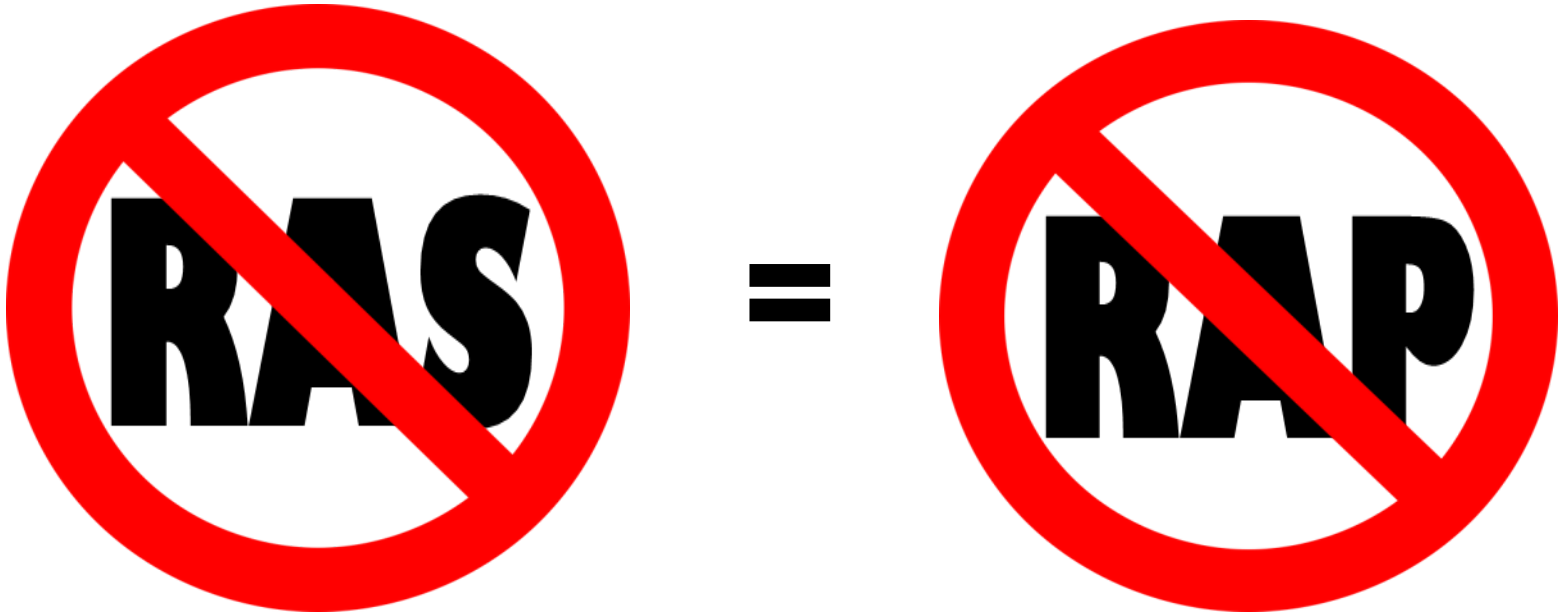
RAP/RAS Pavement Failures…

…and Some Pavement Failures Blamed on RAP/RAS

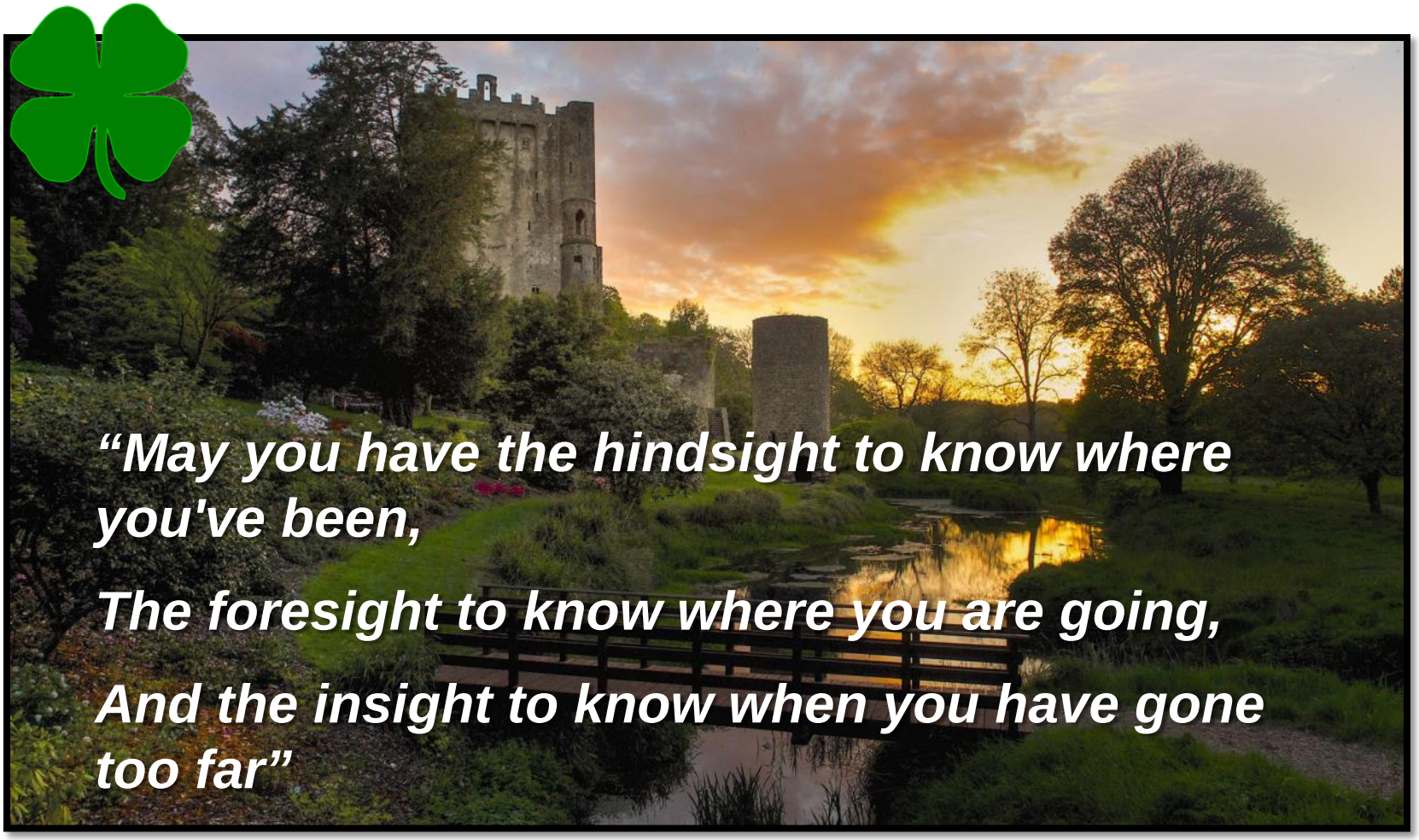
RAP and RAS - Different Binders

Most shingles contain air-blown asphalt cement which is substantially harder than the normal asphalt binder used in a standard HMA mix.

A Growing State DOT Perspective



An Old Irish Blessing



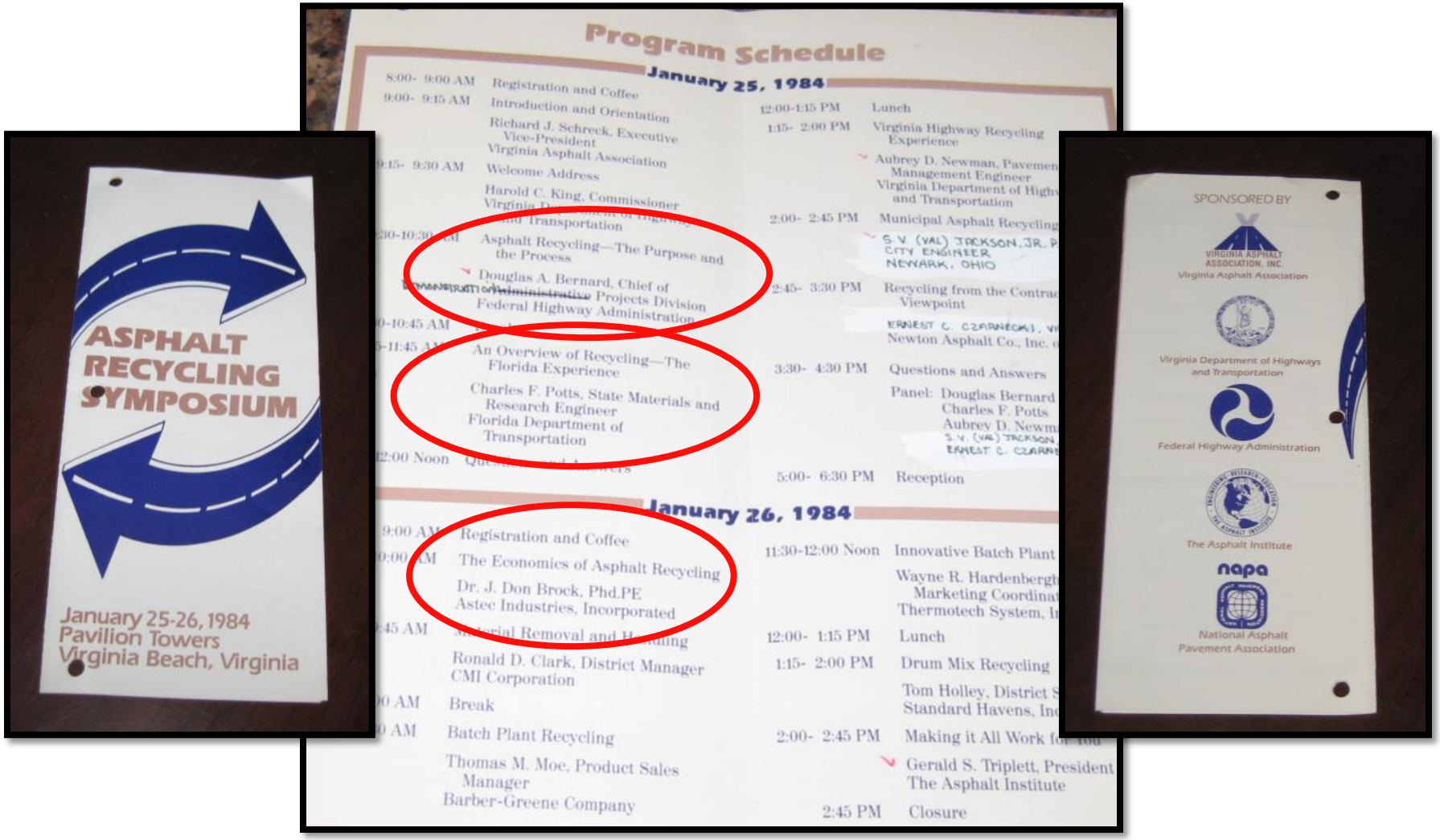
RAP in America

Where We've Been…

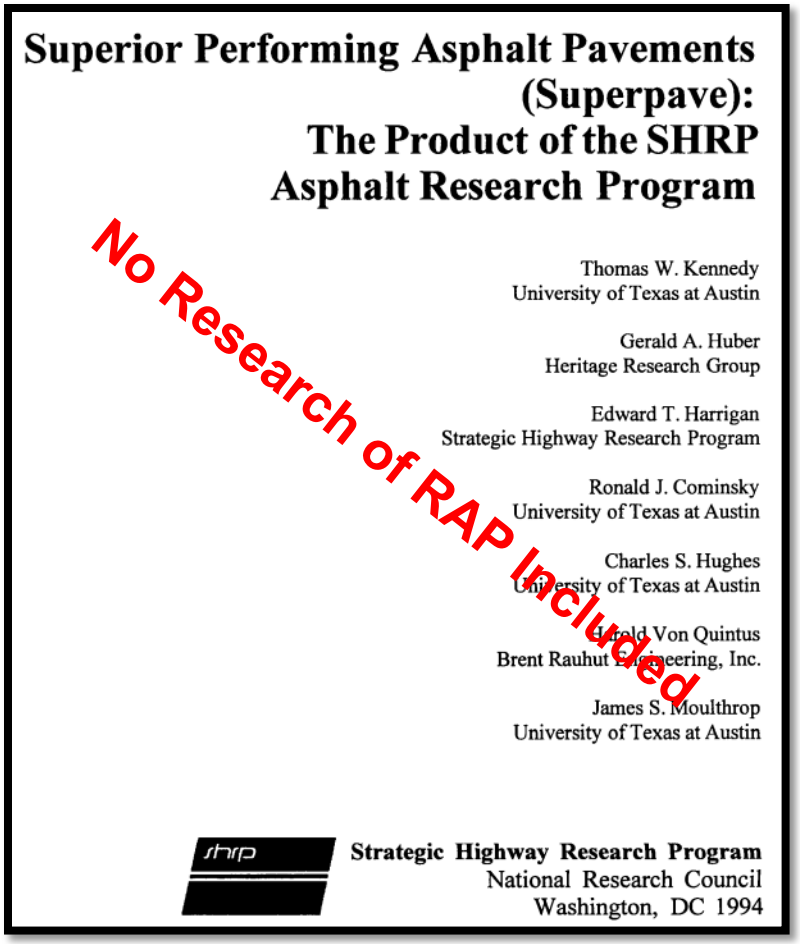
Where We Are…

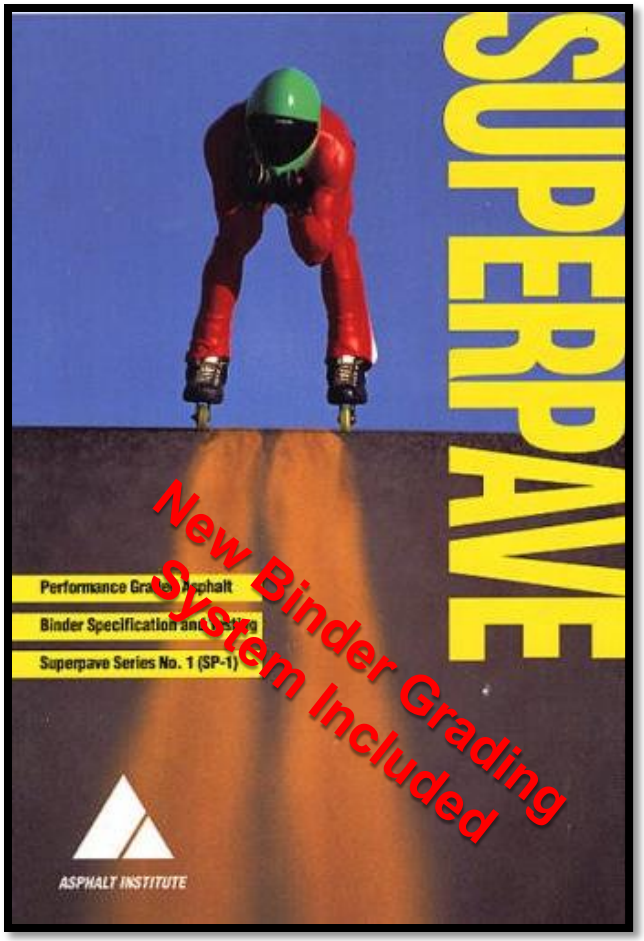
Where We Are Going…

33 Years Ago


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

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
shrp
Strategic Highway Research Program
National Research Council
Washington, DC 1994
No Research of RAP Included


SUPERPAVE
Performance Graded Asphalt
Binder Specification and Testing
Superpave Series No. 1 (SP-1)
ASPHALT INSTITUTE
New Binder Grading System Included

17 Years Ago

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% to 25% RAP:** Virgin binder grade should be decreased one grade—to soften the blend—on both the high and low temperature scales.
- **Over 25% RAP:** Blending charts should be used to determine required PG grade.

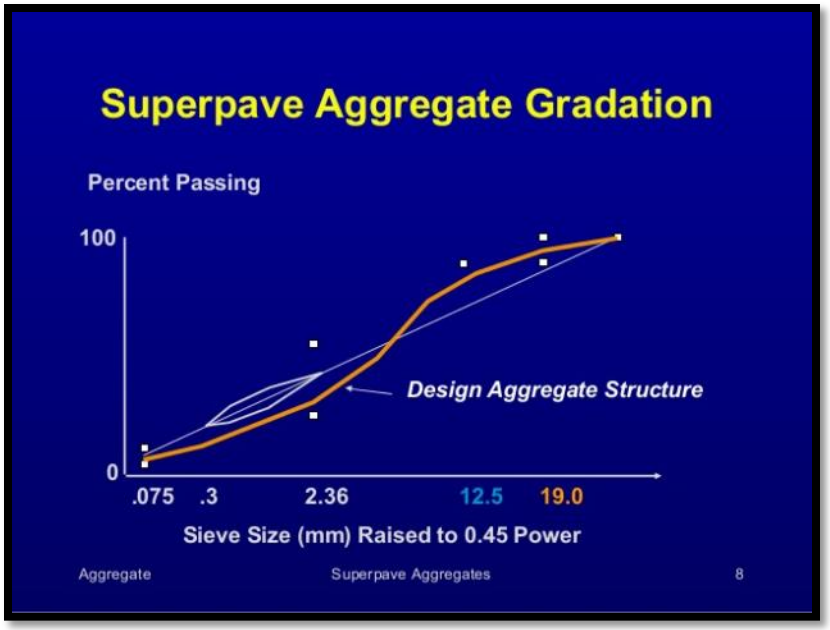
10 Years Ago

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



SUPERPAVE Mix Issues Impacting RAP Mix Performance

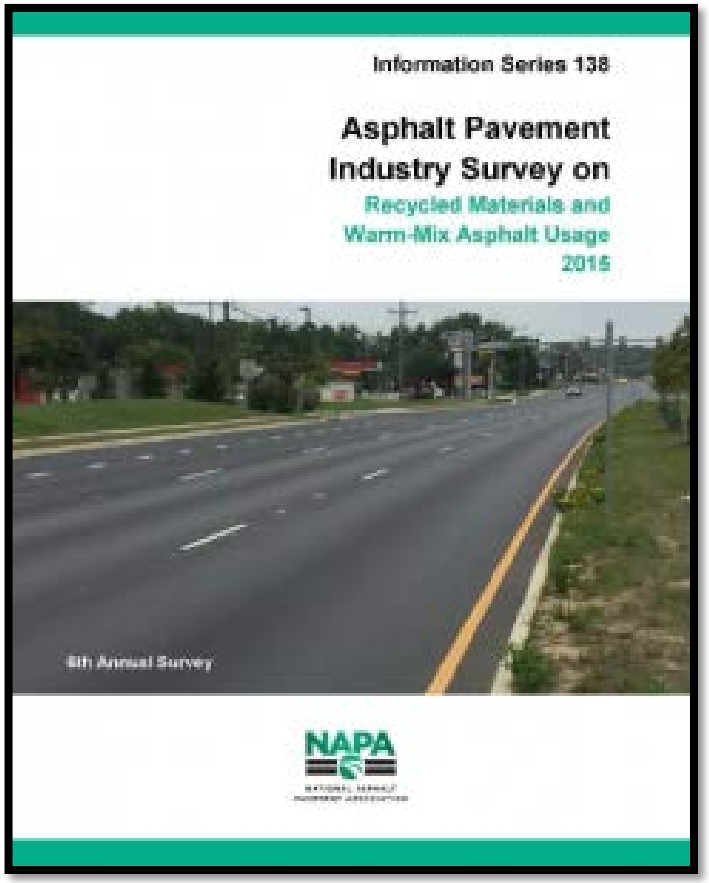
- High compaction/gyration levels yielded “dry” mixes.
- Coarse graded mixes that avoided “Restricted Zone” resulted in increased permeability, low binder contents.
- Use of high viscosity(stiff) PG binders made mixes too stiff.

3 Years Ago

Turner-Fairbank Highway Research Center High RAP ALF Study

- Focus on fatigue cracking of high RAP mixes (20%, 30% and 40%)
- Three year completion; 2 ALF units for 2 years of loading allows simultaneous loading
- Unmodified binder for all lanes, but 2 different grades
- Use of WMA technology that does not change PG grade
- 10 kip single wheel = 20 kip equivalent axle
- 4-inch total asphalt thickness

Where We Are…



NAPA's Latest Asphalt Pavement Industry Survey on Recycled Materials and Warm-Mix Asphalt Usage

Survey responses are 42% of the estimated total tons for the 2015 construction season.

2015 Survey Highlights - RAP

- **+99%** of RAP from old pavements put into new pavements.
- **+74** million tons of RAP used in asphalt mixes in 2015.
- **3%** increase over 2014 and **+32%** increase over the 2009 usage.
- **1%** decrease in respondents using RAP (from 100% to 99%).
- A few producers reported **landfilling RAP** in 2015.
- Estimated 2015 savings from RAP usage; **3.7 million tons** of binder and **+70 million tons** of aggregate (**over $2.4 billion**).
- Estimated **+85 million tons** of stockpiled RAP yearend 2015.
- **23%** of RAP used fractionated, **24%** of RAP mixes used softer binder, and **3%** of RAP mixes used some type of rejuvenator.

2015 Survey Highlights - RAS

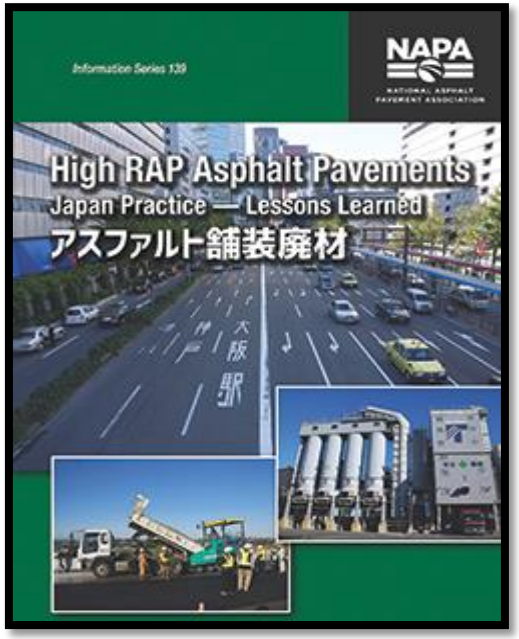
- RAS **decreased almost 2%** to an estimated 2 million tons in 2015.
- 2015 RAS still **175%** more than 2009.
- 2015 RAS usage reduced the need for **386,200 tons of binder** and nearly **965,500 tons of aggregate**, for a total saving of **$194 million**.

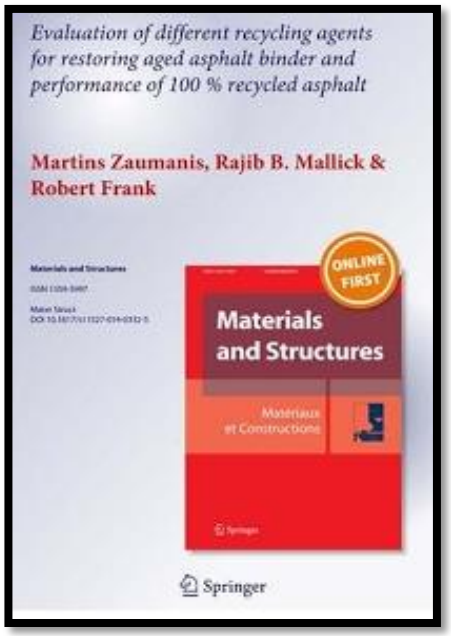
2015 Survey Highlights - WMA

- **119.8 million tons** produced in 2015 using **WMA** technologies.
- This was an increase of **5%** increase over 2014, and a **614%** increase from the 2009 construction season.

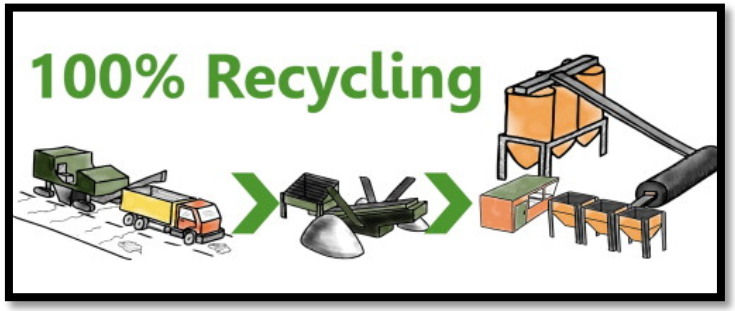
- WMA technologies used in **33%** of all mixes produced in 2015.
- **Plant foaming** most widely used technology for WMA **(+72%).**
- At **+25%,** chemical additives are the second most used WMA technology.

World View on Recycling is Different

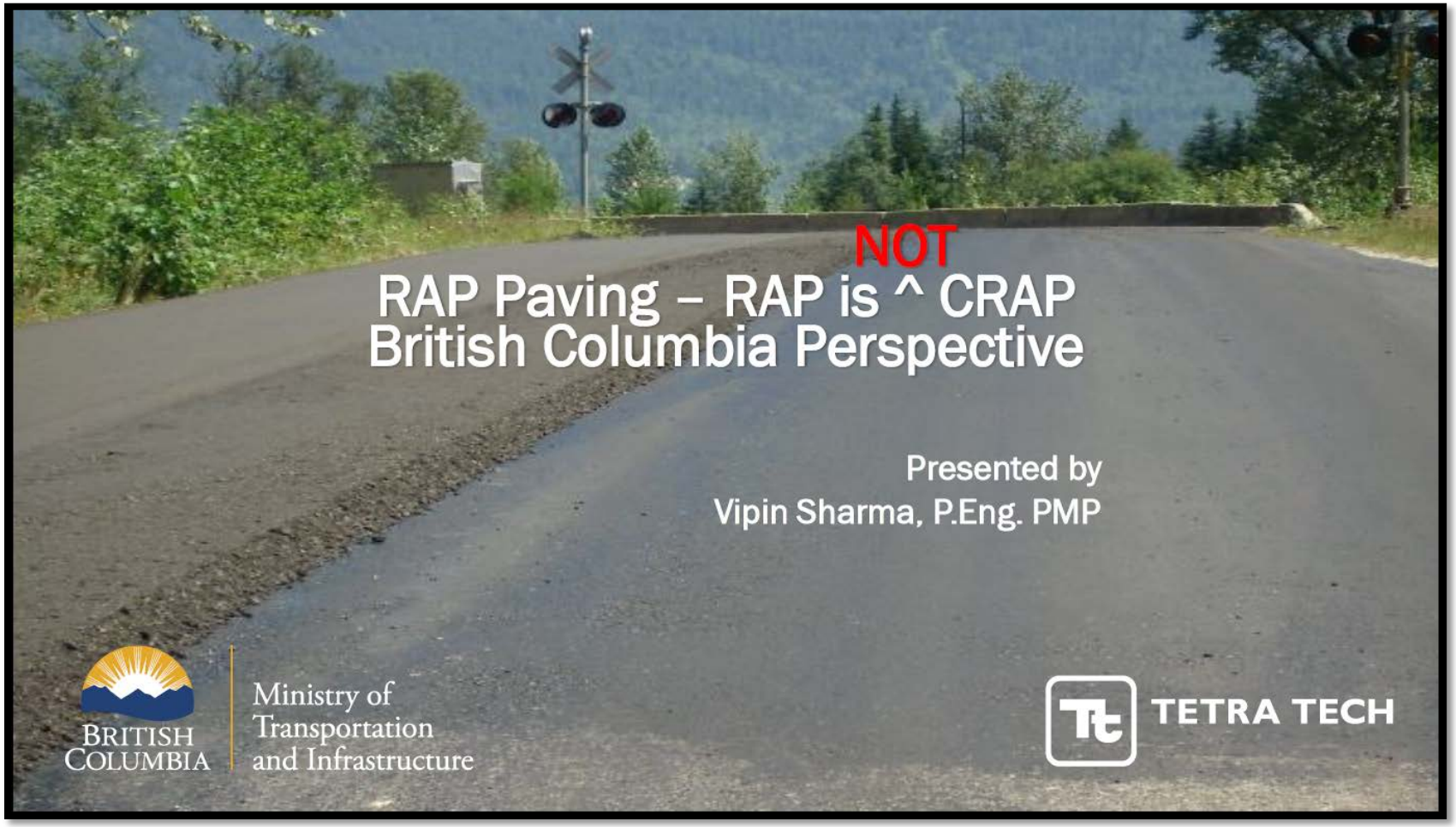




ASPHALT RECYCLING UK LTD



British Columbia View of RAP is Different



Where We Are Going…

REthinking

Asphalt Recycling In America

RAP in America – Breaking Ranks

Separating RAP and RAS

Recycled Asphalt Pavements (RAP)

- Aged HMA Binder
- Absorbed Binder
- Processed Aggregates

Recycled Asphalt Shingles (RAS)

- Very Hard Air-Blown Binders
- Very High Melting Point
- Deleterious Materials Issues
- How to Soften RAS Binders

RAP in America – Breaking Ranks

Fractionation vs Crusher Run

Fractionation provides gradation controls necessary for higher RAP percentages

Crusher run aggregates in HMA were outlawed by most states years ago due to lack of gradation control

RAP in America – Breaking Ranks

Rural Producer vs Urban Producer

Little RAP
vs
Mountains
Of RAP

RAP in America – Breaking Ranks

DOT's vs Municipalities

Greening the Streets of New York

Asphalt pavement is a mixture of stone, gravel, or sand and liquid asphalt. All of those things, if extracted from worn-down New York City streets, are sustainable. Thanks to the City's roadway resurfacing program, asphalt pavement used on these streets can be recycled into new asphalt and repurposed for locations throughout the five boroughs.

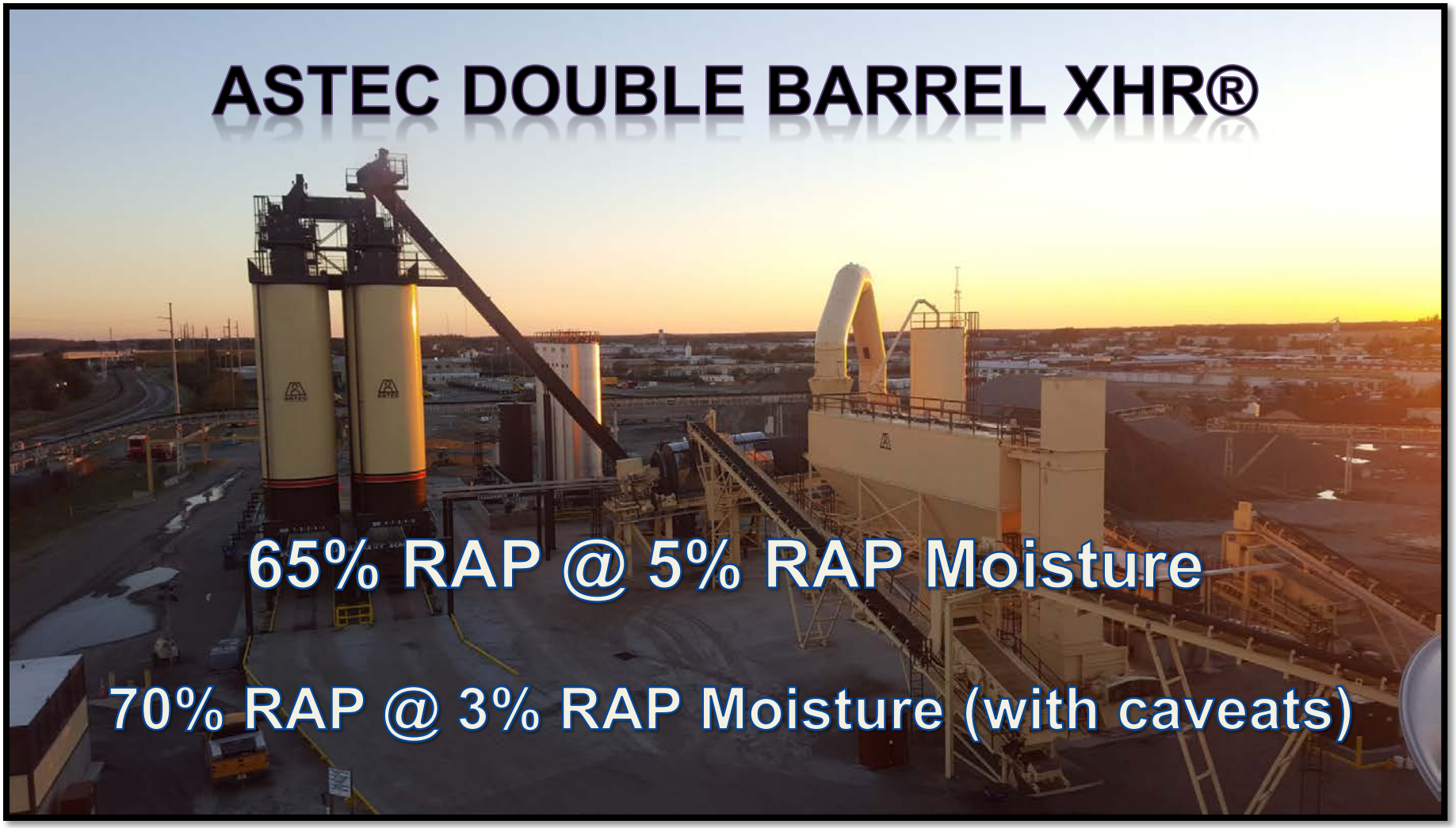
Right now, the NYC uses a minimum of 30% recycled asphalt pavement (RAP) to create new asphalt according to Local Law 71. DDC, together with Green Asphalt, wants to make that 100%.

RAP in America – Breaking Ranks

Batch Plant vs Older Drum vs Modern Technology

Plant type, design and technology have a significant impact of the amount of RAP that be incorporated into mixes they produce.

RAP in America – Breaking Ranks



RAP in America – Breaking Ranks

HMA/WMA vs Cold Central Plant

RAP in America – Breaking Ranks

HMA/WMA vs Cold Central Plant

Thank You!

Richard J. Schreck
Technical Services and Applications Director
Astec, Inc.
(804) 356-1864
rschreck@astecinc.com