U.S. Department of Transportation
Federal Highway Administration

EDC Summit

Technology & Innovation Plenary

The Innovations

- Warm Mix Asphalt (WMA)

- Precast Bridge Elements

- Geosynthetic Reinforced Soil

- Safety Edge

- Adaptive Traffic Control Technology

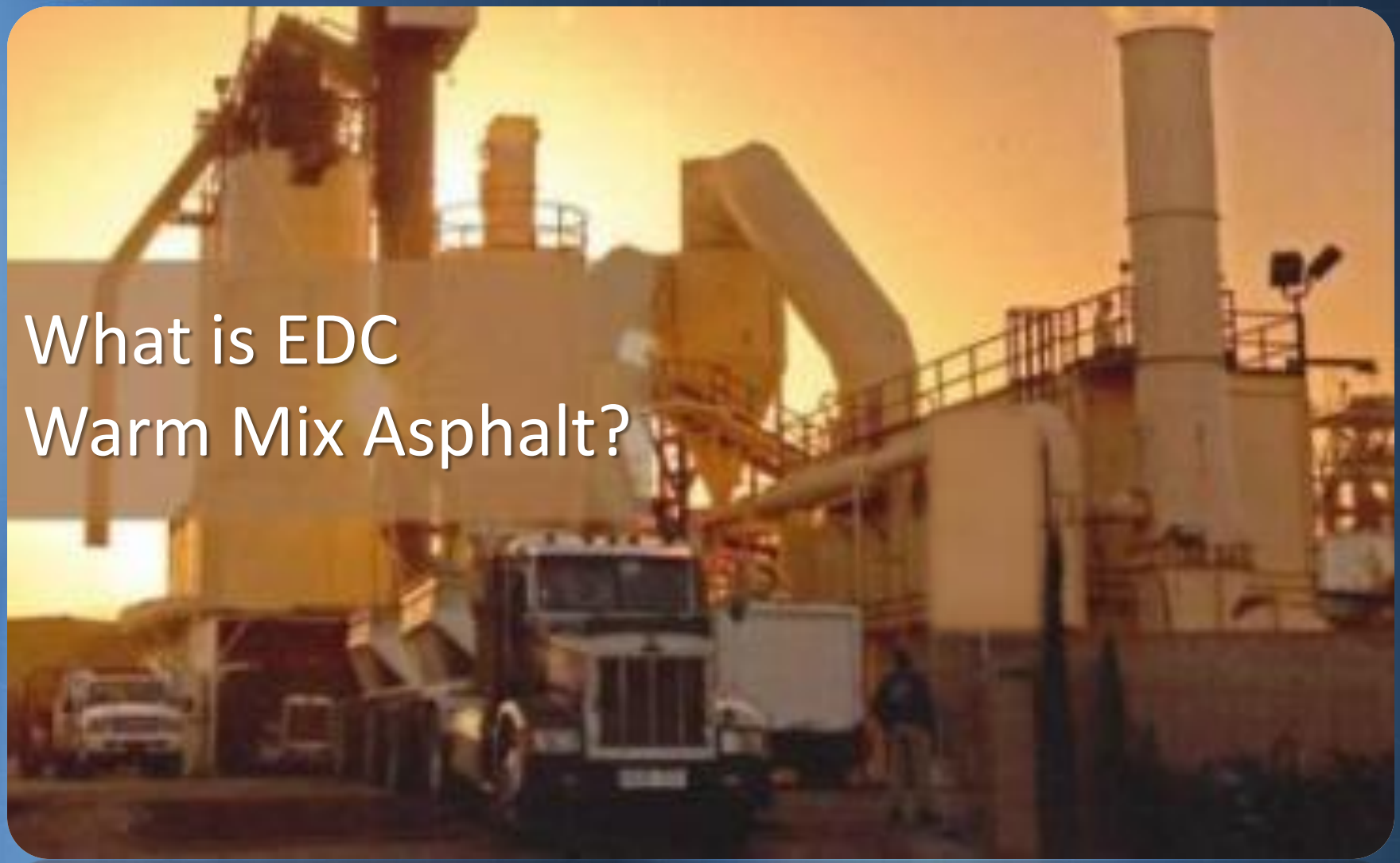
Our Visit Today

Part 1:	Part 2:	Part 3:	Part 4:
What is the EDC Technology & Innovation?	Current State of the Technology	Barriers to Implementation	State-based Technology Discussions

Part 1:

Technology and Innovation

Plenary Session


What is EDC
Warm Mix Asphalt?

Q. Which project is which?

A: Hot-Mix Asphalt (HMA)?

B: Warm Mix Asphalt (WMA)?

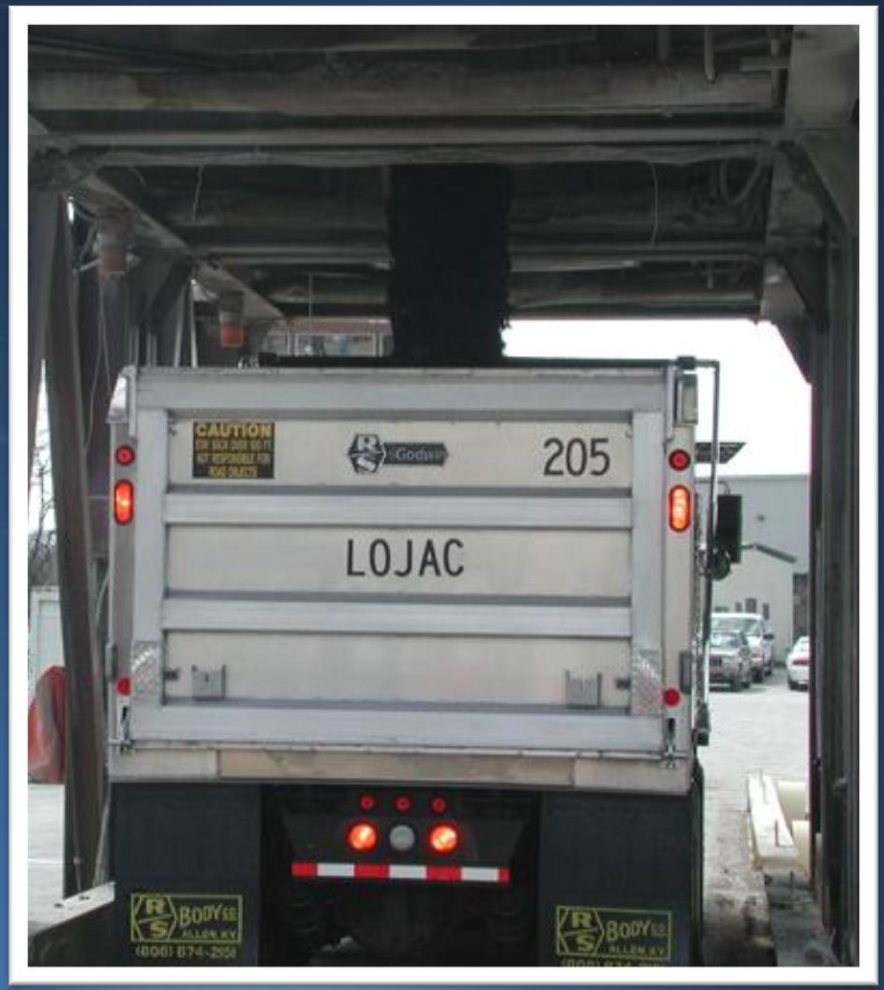
Project No. 1

Project No. 2

Warm Mix Asphalt

- **Definition:** Warm Mix Asphalt (WMA) is the general term used for technologies that allow producers of asphalt pavement material to lower the temperatures at which the material is mixed and placed on the road.
  - Reductions of 50 to 100 degrees Fahrenheit have been documented.

Warm Mix Asphalt (WMA)



Hot Mix Asphalt at 320°F

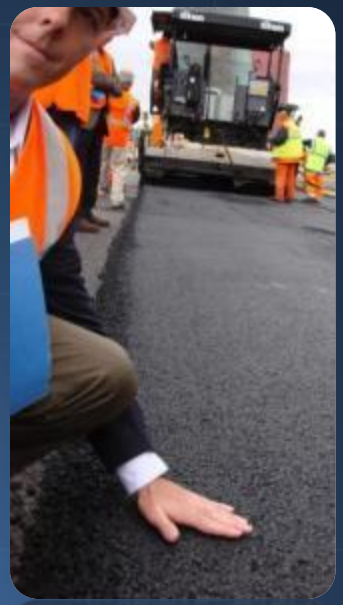
Warm Mix Asphalt at 250°F

Warm Mix Asphalt (WMA)

Investigation and Implementation Premise

Although there are many factors driving the development and implementation of WMA technologies globally, in order for WMA to succeed in the US, *WMA pavements must have equal or better performance when compared to traditional HMA pavements.*

Brief WMA History…



- 1995 Preliminary Lab Experiments
- 1997 German Bitumen Forum
- 2000 Euroasphalt & Eurobitume Congress
- NAPA 2002 European Scan Tour
  - Germany and Norway
- NAPA 2003 Annual Convention
  - San Diego, CA
- 2004 First public demonstration in US
  - World of Asphalt – Nashville, TN
- 2005 WMA Technical Working Group Established
- 2007 AASHTO FHWA International Scan Tour
- 2008 First US International Conference on WMA

*Warm Mix Asphalt: European Practice**

Reported Reductions in Plant Emissions (%) with WMA

Emission	Norway	Italy	Netherlands	France
CO_2	31.5	30–40	15–30	23
SO_2	NA	35	NA	18
VOC	NA	50	NA	19
CO	28.5	10–30	NA	NA
NO_x	61.5	60–70	NA	18*
Dust	54.0	25–55	NA	NA

Reported as NO_2
NA—not available

*Warm Mix Asphalt: European Practice, FHWA-PL-08-007, February 2008

Factors Driving Development of Warm Mix Asphalt

1. Improvement in field compaction… less variable … better performance!!!

2. Environmental and sustainable development concerns, “Green Highway Construction”
   a. Reduction in energy consumption (fossil fuels)
   b. Reduction in CO_2 and other emissions
3. Worker comfort … reduced fatigue
4. Extension of paving season and potential for longer haul distances

Memorable Message

- **I.C. = I.P.**

  Improved Compaction = Improved Performance

- **F.E.W. key benefits…**
  - Fuel
  - Emissions
  - Worker Comfort

**Advantages will only be realized by optimizing production operations and utilizing best practices

Q. How many WMA technologies are available in the US market today?

A. 9

B. 14

C. 20+

How Many WMA Technologies are Available in the US?

Currently Twenty Two (22) Technologies Marketed and Available in the US.

U.S. Department of Transportation
Federal Highway Administration

Every Day Counts
innovation ingenuity imagination invention

KOLO VEIDEKKE

ASPHALT INNOVATIONS™
A MeadWestvaco Business

Thiopave
Technologies for Sulphur Enhanced Road Construction

AESCO SINCE 1960 MADSEN SINCE 1916

TEREX Roadbuilding

TARMAC INTERNATIONAL, INC.

EUROVIA

Mathy Tech. & Eng. Services and
Paragon Technical Services, Inc

MEEKER

lea-co

sasol reaching new frontiers

GENCOR INDUSTRIES INC.

ceca ARKEMA GROUP

PQ Corporation

AKZO NOBEL

Currently Twenty Two (22) Technologies Marketed and Available in the US.

MAXAM™ Maxam Equipment, Inc.

Stansteel® ON TARGET EVERY TIME!

sonneborn REFINED PRODUCTS

Reliable Asphalt Products

ASTEC

Lake Asphalt of
Trinidad and Tobago

iTERCHIMICA CHIMICA INNOVATIVA PER LE PAVIMENTAZIONI STRADALI

More to come …

Many other technologies are also used Internationally.

Warm Mix Asphalt (WMA)

General Technology Categories:

- Materials Processing
- Organic Additives
- Chemical Additives
- Foaming Processes
- Hybrid Systems (combination of technologies)

Economics of WMA

- Fuel Savings
  - Ex. Reducing production temperatures from 325ºF (HMA) to around 265ºF (typical WMA) will save ½ to 1 gallons of fuel per ton of mix
  - Cost savings of approximately 45¢ to 90¢ per ton of mix

Economics of WMA

- Start up costs:
  - Foaming Systems… range in price from ~ $35,000 to $80,000

  - Additive Systems… most require the addition of a pneumatic or volumetric pumping system. Range in price from ~ $7,500 to $60,000

Economics of WMA

- WMA Technology (Operating) Cost:
  - Foaming Systems… water is basically free. If a liquid antistrip is needed, this adds ~ $1 to $2 / ton
  - Additive Systems… $1.75 to 2.50 / ton of mix
  - This does NOT include fuel savings Net cost ~ Zero to $1.50 / ton

U.S. Department of Transportation
Federal Highway Administration

WARM MIX ASPHALT
"INNOVATION IN PRACTICE"

In 2007, Bruce participated in the FHWA WMA International Scan

Innovation takes…

- Leadership
- Partnership
- Sharing Risk

- In 2009, Bruce worked with Industry to make WMA a reality in Maine…

Bruce A Manzer Inc
Asphalt Paving - Phillips, ME

From left: Manzer QC Manager Jeramy Parker, Prof. Mingjiang Tao (WPI), Lab Manager Donald Pellegrino (WPI) and graduate student Karen O'Sullivan (WPI).

Looks like Hot Mix Asphalt, but cooler!

And, so far…

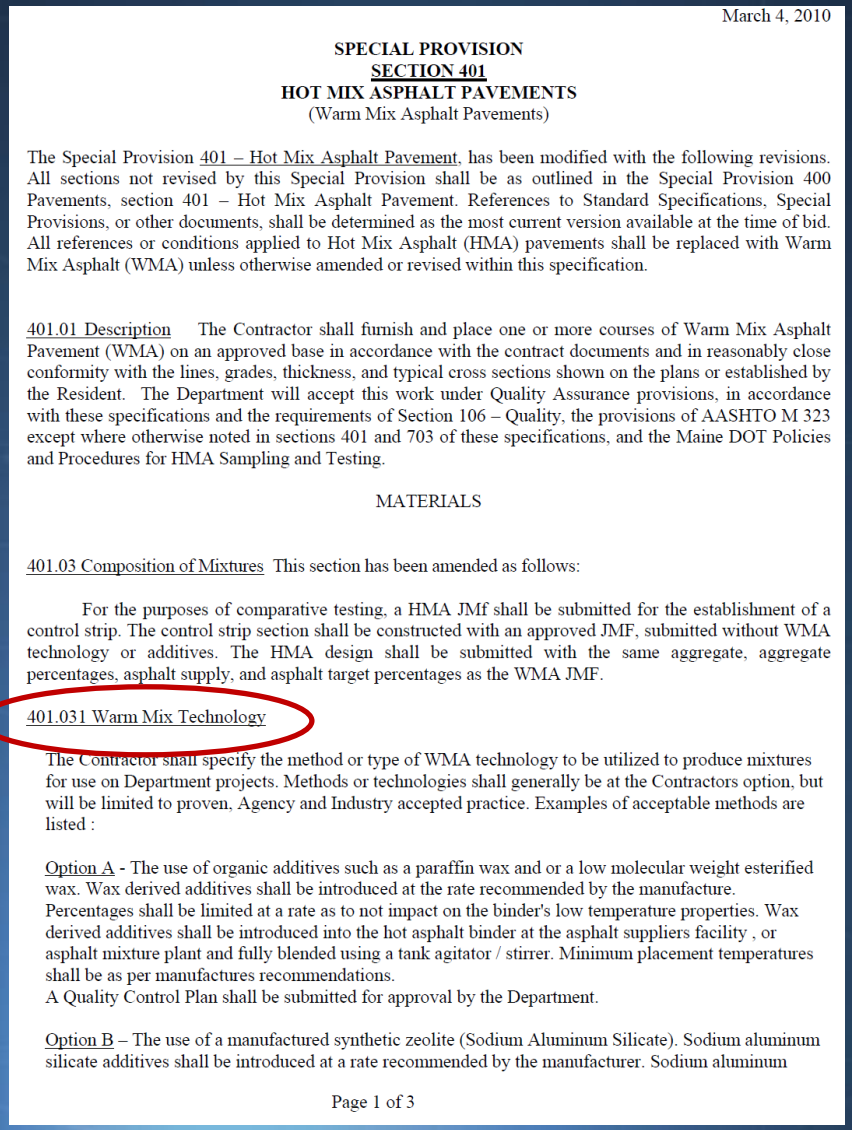
"The pavement weathered well during its first Maine Winter, there are no obvious problems so far."

– Wade McClay,

Maine DOT

Maine: What about today?

- Special Provision for WMA
- Control Strip for HMA
- WMA is contractors option but limited to proven agency & industry accepted practices
- QC plan required



March 4, 2010

SPECIAL PROVISION
SECTION 401
HOT MIX ASPHALT PAVEMENTS
(Warm Mix Asphalt Pavements)

The Special Provision 401 – Hot Mix Asphalt Pavement, has been modified with the following revisions. All sections not revised by this Special Provision shall be as outlined in the Special Provision 400 Pavements, section 401 – Hot Mix Asphalt Pavement. References to Standard Specifications, Special Provisions, or other documents, shall be determined as the most current version available at the time of bid. All references or conditions applied to Hot Mix Asphalt (HMA) pavements shall be replaced with Warm Mix Asphalt (WMA) unless otherwise amended or revised within this specification.

401.01 Description The Contractor shall furnish and place one or more courses of Warm Mix Asphalt Pavement (WMA) on an approved base in accordance with the contract documents and in reasonably close conformity with the lines, grades, thickness, and typical cross sections shown on the plans or established by the Resident. The Department will accept this work under Quality Assurance provisions, in accordance with these specifications and the requirements of Section 106 – Quality, the provisions of AASHTO M 323 except where otherwise noted in sections 401 and 703 of these specifications, and the Maine DOT Policies and Procedures for HMA Sampling and Testing.

MATERIALS

401.03 Composition of Mixtures This section has been amended as follows:

For the purposes of comparative testing, a HMA JMf shall be submitted for the establishment of a control strip. The control strip section shall be constructed with an approved JMF, submitted without WMA technology or additives. The HMA design shall be submitted with the same aggregate, aggregate percentages, asphalt supply, and asphalt target percentages as the WMA JMF.

401.031 Warm Mix Technology

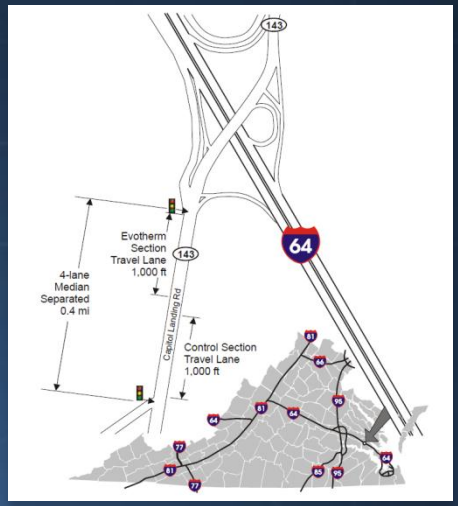
The Contractor shall specify the method or type of WMA technology to be utilized to produce mixtures for use on Department projects. Methods or technologies shall generally be at the Contractors option, but will be limited to proven, Agency and Industry accepted practice. Examples of acceptable methods are listed :

Option A - The use of organic additives such as a paraffin wax and or a low molecular weight esterified wax. Wax derived additives shall be introduced at the rate recommended by the manufacture. Percentages shall be limited at a rate as to not impact on the binder's low temperature properties. Wax derived additives shall be introduced into the hot asphalt binder at the asphalt suppliers facility , or asphalt mixture plant and fully blended using a tank agitator / stirrer. Minimum placement temperatures shall be as per manufactures recommendations.
A Quality Control Plan shall be submitted for approval by the Department.

Option B – The use of a manufactured synthetic zeolite (Sodium Aluminum Silicate). Sodium aluminum silicate additives shall be introduced at a rate recommended by the manufacturer. Sodium aluminum

Page 1 of 3

A Brief Overview of VDOT & WMA



- Three WMA trial sections constructed in 2006
  - HMA Control Sections
- Evaluated over 2 year period
- No significant distresses in first 2 years of service
- Major Conclusions:
  - *WMA & HMA expected to perform equally*
  - *Some WMA technologies may contribute to a reduced rate of in-service binder aging*
- Based on previous studies of the trial sections, VDOT has implemented changes to the *Road and Bridge Specifications* to permit the use of approved WMA processes

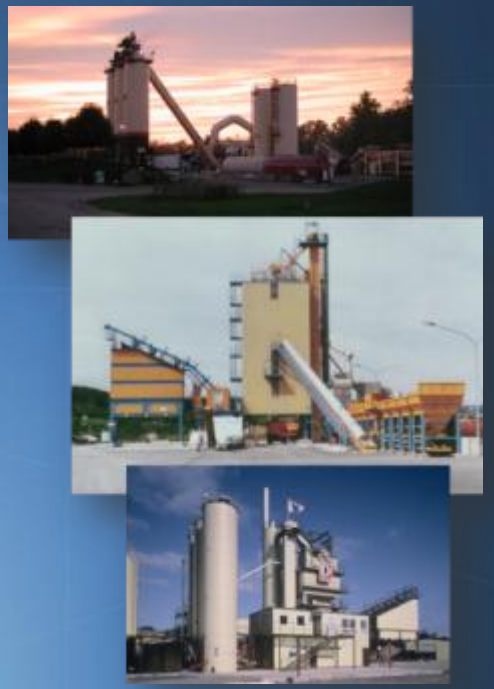
Diefenderfer & Hearon. Performance of Virginia's Warm Mix Asphalt Trial Sections, FHWA/VTRC 10-R17, February 2010.
http://www.irfnet.ch/files-upload/knowledges/10-r17.pdf

Memorable Message

- **I.C. = I.P.**

  Improved Compaction = Improved Performance

- **F.E.W. key benefits…**
  - Fuel
  - Emissions
  - Worker Comfort



**Advantages will only be realized by optimizing production operations and utilizing best practices

U.S. Department of Transportation
Federal Highway Administration

Home

The Beginning…