What Happened to Warm Mix Asphalt?

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Introduction

Construction industry always under pressure

• Reduce energy consumption
  ◦ Higher costs of fossil fuel energy

• Reduce emissions
  ◦ More restrictive environmental regulations

• Improve worker health and safety

• Improve quality
  ◦ Sustainable development
Introduction

Pressure drives innovation.

New technology to answer all the demands:

Warm Mix Asphalt
“Hot-mix asphalt (HMA) consists of a combination of aggregates uniformly mixed and coated with asphalt cement. To dry the aggregates and obtain sufficient fluidity of asphalt cement for proper mixing and workability, both the aggregate and asphalt must be heated before mixing – hence the term hot-mix.”

Asphalt Institute, MS-4, The Asphalt Handbook
Introduction

Warm Mix Asphalt

“... a group of technologies which allow a reduction in the temperatures at which asphalt mixtures are produced.”

NAPA, QIP 125, Warm-Mix Asphalt: Best Practices

Fundamentally no different from HMA.
WMA is produced and placed at temperatures 20 to 50 °C less than conventional HMA

- Remain above 100°C to stay above boiling point of water
Warm Mix Asphalt Technologies

1. Plant foaming
2. Organic or wax additives
3. Chemical additives
4. Hybrids
WMA Implementation Timeline: Europe

1992
- United Nations environment discussions

1996
- Germany review asphalt fumes exposure limits

1997
- Kyoto Accord reduce GHG to 1990 levels

1999
- First application of WMA on public road in Germany
WMA Implementation Timeline: North America

2004
• First trial in United States: Nashville, TN

2005
• First Canadian trials: Alberta, Ontario & Quebec

2007
• Trials in 5 provinces in Canada; 7 processes
Surveys showed the use of WMA expanding through United States

What about long-term performance and durability of WMA pavements?

2014 NCHRP Report with NCAT WMA field performance
A total of 12 WMA technologies were investigated, including:

- Asphalt foaming additives
- Plant foaming units
- Chemical additives
- Organic additives

Compared with HMA control section after 2 to 5 years in service
Outside of lower temperatures for WMA, no substantial differences in the production and laydown practices of WMA and HMA.
Warm Mix Field Performance

- Lab testing of WMA binders and mixtures from the projects showed lower stiffness than the HMA materials.
- Should there be concern of potential effects on pavement rutting and cracking?

MEPDG-Predicted longitudinal cracking in HMA and WMA sections.
Warm Mix Field Performance

- Field data showed equivalent performance of the WMA and HMA pavement sections over several years of service.
- Suggests that these differences in material properties, when present, were not great enough to affect the relative performances of HMA and WMA.
Warm Mix Field Performance

In-service performance of WMA and HMA in all projects was virtually identical

- Little or no rutting
- No evidence of moisture damage
- Very little indication of transverse or longitudinal cracking
Added Benefits of Warm Mix

The same mechanisms that allow WMA to improve workability at lower temperatures also allow WMA technologies to act as compaction aids.
Added Benefits of Warm Mix

• Improved compaction reduces permeability and binder hardening due to aging
• Improves performance in terms of cracking resistance and moisture susceptibility
Warm Mix Asphalt Usage in Canada

WMA placed across Canada up to 2015

Warm Mix Asphalt Usage in United States

The estimated total tonnage of asphalt produced at reduced temperatures with WMA technologies for the 2017

147.4 million tons
Warm Mix Asphalt Usage in United States

Asphalt Pavement Industry Survey on Recycled Materials and Warm-Mix Asphalt Usage 2017

Information Series 138

26% increase from 2016
777% increase from 2009

% Total Tonnage Using WMA

66% of producers use WMA at HMA temperatures:

- Workability
- Compaction
- Anti-stripping
Summary

- Reduced emissions and fuel consumption
- Improved worker conditions
- Improved compaction
- Reduced thermal segregation
- Extended hauls and paving season
- Longer binder life – less binder aging
- A few are Antistrip and Warm Mix
Thank you!

Questions:
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