Overview of Warm Mix Asphalt

SAME Lunch Meeting
January 8, 2013
Our Members

Asphalt Suppliers and Producers, Laydown and Treatment Contractors, and Consultants
The Hawaii Asphalt Paving Industry (HAPI) represents asphalt pavement producers and laydown contractors in the State of Hawai'i as well as industries related to pavement preservation. Formed in 1989, HAPI's purpose is to provide engineering promotion and education to advance the continuing use of asphalt pavement and pavement treatments throughout the State of Hawai'i. HAPI collects and disseminates technical data and guidelines, sponsors educational and technical seminars, and is available to assist architects, engineers and contractors responsible for the design and construction of asphalt pavements and pavement treatments. HAPI and its member firms constantly strive to improve the quality of asphalt paved roads.
Goal

We are always on the lookout for new technologies and improved methods

• Modified Asphalt Binders – stiffer pavements
• Micro Surfacing – slurry seal for high volume roads
• Warm Mix Asphalt
What is Asphalt Pavement?

Approximately (by weight):
- 5% Asphalt Binder
- 95% Aggregate
What is Warm Mix Asphalt (WMA)?

Warm mix asphalt (WMA) represents a group of technologies which allow a reduction in the temperatures at which asphalt mixes are produced and placed.

- Hot mix asphalt (HMA) produced at 280°F to 340°F
- WMA is typically produced from 215°F to 275°F
- The job mix design is the same for HMA and WMA.
Where Did WMA Come From?

• **1996** - the German Ministry of Labor and Social Affairs concerned about workers exposed to asphalt fumes.

• Other European countries looking at greenhouse gas reduction targets per 1997 Kyoto treaty on climate change.

• In **2002** - scanning tour to Denmark, Germany, and Norway was done by the National Asphalt Pavement Association’s (NAPA) leaders.
Brief History of WMA in US

• **2004** - First WMA field trials in Florida and North Carolina
• **2005** - NAPA-FHWA WMA Technical Working Group formed
• **2005** - Field trials continue in Florida, as well as Indiana, Maryland, New Hampshire, Ohio and Texas
• **2006** - Field trials continue in California, Michigan, Missouri, South Carolina, Texas, Virginia, and Wisconsin
• **2006** - A Missouri contractor converts a production pavement job to warm mix based on the success of their trial
Brief History of WMA in US

2007:
• American Association of State Highway and Transportation Officials (AASHTO) and FHWA European scanning tour
• 20,000 tons of warm mix asphalt placed near Yellowstone

2008:
• Documented field trials in 32 states to date
• Texas introduces first WMA specification
• Thirteen WMA technologies marketed in the United States
WMA increasingly gaining widespread acceptance across the nation

- 2009: 19.2 million tons
- 2010: 47.2 million tons (148% increase)
- 2011 and 2012: tonage not available
- Over 30 technologies available
Today - Implementation of WMA

WMA Deployment by State

- WMA is fully deployed
- WMA implementation plan is underway, more than 20 projects built
- WMA experimental projects are being evaluated
International Warm Mix Asphalt Conference

• 1\textsuperscript{st} Conference in 2008
• 2\textsuperscript{nd} Conference in 2011
• Next conference may just be “Asphalt Pavement”
No HMA or WMA

National Asphalt Pavement Association (NAPA) – website change in late 2011
• Was “www.hotmix.org”
• Now “www.asphaltpavement.org”

Changed the name of their magazine
Benefits of WMA

- Reduced Fuel Usage
- Better Work Environment
- Improved Compactability
- Long Haul Distances
- Overlaying a Crack Sealed Pavement
- Cold Weather Paving

Slides showing benefits are courtesy of NCAT.
Reduced Fuel Usage

HMA  WMA
Better Work Environment

Lower Temperatures and Less Fumes

HMA

WMA
Improved Compactability

- Improves workability and ease of compaction
- Compaction is important to long term performance of mixture
- Use as a compaction aid without lowering temperatures
Long Haul Distances

- Haul times with WMA from 1 to 3 hours reported
  - Generally successful in achieving target density
  - Crusting / lumps of mix less than with HMA

- Remote locations on Neighbor Islands (i.e. Princeville)
Overlying a Crack Sealed Pavement

- Overlying pavements with joint/crack sealant typically results in bump
- Bumps do not roll out, results in poor ride and lack of adequate density
- WMA has been used to solve this problem
Overlaying a Crack Sealed Pavement
Cold Weather Paving

- Several example projects using WMA to pave in near freezing temperatures have been reported
WMA Technologies

• Chemical additives
• Organic additives
• Foaming Process

All technologies help to coat the aggregate with binder at a lower temperature.
Chemical Additives

The use of chemical additives relies on a variety of different mechanisms to help the asphalt binder coat the aggregate at lower temperatures and produce a lubricity effect to improve compaction.
Organic additives (waxes) cause a **decrease in the asphalt binder’s viscosity** when heated above the melting point, **allowing mixing and coating**. The increased workability at mixing and compaction temperatures acts to improve compactability.
Foaming introduces a small amount of water to the hot asphalt binder. When the water is dispersed into the hot asphalt, it turns into steam, which results in an expansion of the binder phase by approximately 5 to 10 times. This increase in the binder improves the coating of the aggregate and compaction.
Over 30 Technologies Currently Available
WMA Technologies - Costs

- **Additives**
  - About $3.00 a ton
  - Hawaii is about 1,200,000 tons/year
  - Cost would be approximately $3.6 million

- **Foaming**
  - Initial equipment cost of about $60K
  - On-going cost is minimal
    - Water
    - Maintenance
Implementation in Hawaii

- Only HDOT allows the use of WMA
- All 4 plants on Oahu - Foaming
- Neighbor island plans not equipped yet – need demand
- Cost – not seeing benefits yet
- Production concerns
- Locations in Hawaii
Farrington Highway (2006)
Fort Weaver Rd. H-1 On-Ramp (2009)
Ala Moana Blvd. (2011)
Mokapu Road
(1st project to specify WMA)
HAPI Resources

- Monthly Newsletter
- Website
- Pavement Design Guide
Featured Project

CONTRACTOR: GOODFELLOW BROTHERS
PAVING SUB-CONTRACTOR: GRACE PACIFIC CORPORATION
PROJECT: NIMITZ HIGHWAY AND ALA MOANA BOULEVARD RESURFACING REPLACEMENT, FORT STREET TO KALAKAUA AVENUE
CLIENT AGENCY: STATE DEPARTMENT OF TRANSPORTATION, HIGHWAYS DIVISION

The use of warm mix asphalt (WMA) in Hawaii continues with the resurfacing of Ala Moana Boulevard, which is one of a handful of WMA projects in the State.

WMA is a relatively new way of producing asphalt that is better for the environment and for the workers who construct the pavement. WMA is the same conventional hot mix asphalt (HMA) but is produced and placed at temperatures 50°F to 100°F lower than HMA. The benefits of WMA include reduced fuel usage, reduced emissions, improved working conditions, compaction aid, and higher use of reclaimed asphalt pavement (RAP).
About Grace Pacific Corporation (www.gracepacificcorp.com)

Grace Pacific Corporation is a locally owned and operated company which originated in 1931 as Grace Brothers. In 1984, Grace Brothers acquired Pacific Concrete and Rock, a quarry and ready-mix operator on Oahu, and the combined companies were renamed as Grace Pacific Corporation.

Growth continued with expansion of its product lines to include hot mix asphalt manufacturing and the production of crushed basalt, limestone, and sand aggregate. The paving division expanded in the late 1980’s with the establishment of hot mix asphalt plants and paving operations on Maui and the Big Island. Expansion continued with the purchase of an aggregate quarry on Molokai in 1994. The acquisitions of Hawaiian Bitumuls Paving and Precast Company, Niu Construction on Kauai, and SUN Industries in the early 2000’s as well as new affiliations with Maui Paving, GPRM Prestress, Asphalt Hawaii and MidPac Petroleum since the mid 2000’s has enabled Grace Pacific to expand its construction-related services and diversify its business interests.
Calendar of Events:


Warm Mix Asphalt . . . . A Paradigm Shift
By Jon M. Young, Executive Director - HAPI

“As the United States goes green, asphalt is keeping pace with the times. Warm mix is an important step in sustainable development, simultaneously conserving natural resources, reducing the carbon footprint of the industry, and improving the quality of the pavement that Americans rely on”. ¹ Although relatively new to the islands, the use of warm mix asphalt is in our future.

What is Warm Mix Asphalt?²
Caldwell Announces Cabinet

Posted on December 29, 2012 | HAPI News

Mayor-elect Kirk Caldwell announced Saturday his appointments in the Mayor's Office, Managing Director's Office, and for the directorships of city agencies. Follows are the reports from the local media: KHON2 KITV4 Hawaii News Now Honolulu StarAdvertiser (subscription required)

Read more →
HAPI Newsletters

Each month HAPI distributes a newsletter via email. Our executive director provides HAPI updates and industry news to keep you apprised of new developments. Each issue features a project by one of our members, with a brief insight into their company, as well as a calendar of upcoming local and national events. Occasionally, a technical bulletin, related to the featured project will also be included at the end of the newsletter.

If you are interested in receiving a copy of our newsletter please complete our contact form to indicate your interest in joining our mailing list.

December 2012

Executive Director Message: Our December newsletter presents our updated website, which improves our ability to fulfill our mission of providing engineering promotion and education.
Our library offers a comprehensive collection of articles, reports and videos on the following subjects: Asphalt Industry, Asphalt Pavements, Asphalt Binders, Emulsions, Recycling and Sustainability, Construction, and Pavement Preservation. The library also includes a link to On-line Periodicals and key Correspondences.

**Asphalt Industry**
- Benefits of Asphalt Brochure (NAPA – )
- A New Transportation Commitment for America [SR-197] (NAPA – Dec 2007)

**Asphalt Pavements**
- Asphalt Rubber Plant Certification Program (Rubber Pavements Association – Mar 2011)
- Effects of Asphalt Mixture Properties on Permanent Deformation Response (Adrian R. Archilla and Luis G. Diaz – 2010)
- Fuel-resistant asphalt makes airport pavements more spill-resistant (Asphalt Institute: John Davis - Feb 22, 2012)
Welcome

Welcome to the HAPI Asphalt Pavement Guide. Provided by the Hawai‘i Asphalt Paving Industry (HAPI), this is an informational resource on asphalt pavement, hot mix asphalt (HMA), and related subjects. It contains a general overview of all HMA aspects and in-depth information on recommendations and practices for Hawai‘i. It is intended to assist those who work with asphalt pavement and HMA in any way including architects, engineers, contractors, students, and homeowners.

This Guide was extensively updated in 2012 with the latest information, new sections, new pictures, and new videos. The original HAPI Asphalt Pavement Guide was written in 2003.

How to use this Guide
Updated Pavement Guide

- Design Catalog
- General Guidance
- Pavement Types
- Materials
- Design Factors
- Mix Design
- Structural Design
- Construction
- Pavement Evaluation
- Rehabilitation and Maintenance
Any particular mix design is specific to the material with which it was designed. In other words, a mix design is unique to its asphalt binder grade and aggregate source. Therefore a mix design produced from a quarry on the Big Island may not be appropriate for HMA produced using aggregate from a quarry on Kaua‘i. This does not, however, imply that either aggregate source is better; they are just different.

Depending upon the specifying agency/owner, mix design requirements can vary. The typical specifications and procedures are listed below by agency/owner:

- **HDOT.** HDOT requires the pavement contractor to develop a mix design. Contractors typically use the Marshall Method because of its simplicity and reliable results. Once the mix design is submitted to HDOT, they verify it at their laboratory. For Superpave mixes, contractors must use the Superpave mix design method and HDOT’s verification also uses the Superpave mix design method. Mix designs are almost always intended to produce one of the standard State mixes.

- **Counties.** Counties require the pavement contractor to develop a mix design. Contractors typically use the Marshall Method because of its simplicity and reliable results unless a Superpave mix is specified in which case the Superpave mix design method would be used. Often times, a pre-existing HDOT-approved mix design can be used or one the contractor knows will work well for the given material and application. In general, it costs around $3,500 and takes 1 month to develop a new mix design.

- **Private owners.** Requirements vary. Generally, contractors are allowed more freedom to select their own mix design, however it generally comes from an existing HDOT or County mix design or one that they know works well for the given material and application.
Questions
Thank You!

www.hawaiiasphalt.org