Warm Mix Asphalt

TxDOT Experience

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Why Warm Mix?
(Industry Perspective)

- It’s good for the environment
- It’s good for the mix
- It’s better for paving
- It’s safer for the crew
- It saves me money; therefore it saves you money
WARM MIX BENEFITS

- Reduced energy consumption
- Better performance of mixtures
- Reduced green-house gas emissions
- More effective compaction
- Safer working conditions
Challenges

- Extra Cost (who is going to pay for it?)
  - Allow or Require
- Generic Specification Development
- Mix Design Impacts
- Unfamiliarity
- Long Term Performance
- What’s in it for TxDOT
Getting Comfortable

- Build projects using WMA
  - Collect data

- Research WMA mixes
  - Collect more data
  - Include a control section if possible
  - Follow-up on projects

- Develop and modify
  - Specifications
  - Test procedures
  - Approval process for WMA suppliers
TxDOT Experience with Warm Mix Asphalt
2.4+ million tons (94 projects) of WMA were placed by May of 2011.
Approximately 2 million tons placed in 2012.
Actual tonnage could be significantly higher (no official documentation).
1. **Warm Mix Asphalt (WMA).** Warm Mix Asphalt (WMA) is defined as HMA that is produced within a target temperature discharge range of 215°F and 275°F using Department approved WMA additives or processes. The Department’s approved list of WMA additives and processes is located at [http://www.dot.state.tx.us/txdot_library/publications/producer_list.htm](http://www.dot.state.tx.us/txdot_library/publications/producer_list.htm).

WMA is allowed for use on all projects and is required when shown on plans. The maximum placement or target discharge temperature for WMA may be set at a value less than 275°F when shown on the plans.

Department approved WMA additives or processes may be used to facilitate mixing and compaction of HMA produced at target discharge temperatures greater than 275°F; however, such mixtures will not be defined as WMA.
1. **Mixing and Discharge of Materials.** Notify the Engineer of the target discharge temperature and produce the mixture within $25^\circ$F of the target. Monitor the temperature of the material in the truck before shipping to ensure that it does not exceed $350^\circ$F (or $275^\circ$F for WMA) and is not lower than $215^\circ$F. The Department will not pay for or allow placement of any mixture produced at more than $350^\circ$F.

When WMA is required, produce the WMA within the target temperature discharge range of $215^\circ$F and $275^\circ$F. Take corrective action any time the discharge temperature of the WMA exceeds the target discharge range. The Engineer may suspend production operations if the Contractor’s corrective action is not successful at controlling the production temperature within the target discharge range. Note that when WMA is produced, it may be necessary to adjust burners to ensure complete combustion such that no burner fuel residue remains in the mixture.
WMA Technologies
- Approved List

- **Foaming admixtures:**
  - Advera
  - Aspha-Min
  - Astech PER

- **Plant modification:**
  - Double-Barrel Green
  - Terex WMA System
  - Ultrafoam GX
  - HydroFoam IEQ
  - Maxam
  - Almix Warm Ware

- **Chemical binder additives:**
  - Evotherm
  - Rediset WMX
  - Rediset LQ 1106
  - Cecabase RT
  - QPR QualiTherm

- **Chemical mixture additives:**
  - Sasobit
Foaming Device - Plant Modification
Documented WMA Tonnage (By Technology)

- Foaming Process: 1,408,210 Tons
- Chemical: 336,218 Tons
- Unknown: 459,098 Tons
WMA TEMPERATURE BASICS

Temperature °F

Allowed

Required

150 175 200 225 250 275 300 325 350

WMA

HMA as compaction aid

Foam

Chemical

150 175 200 225 250 275 300 325 350
Reduced Fumes & Emissions

HMA
Temp = 320°F

WMA
Temp = 270°F
Lower fumes and emissions (~30-90%)
Asphalt consists of two main fractions: "asphaltenes" which are the hard brittle component, insoluble and not affected by oxidation and the highly reactive sub-fractions: "maltenes". These maltenes are oily and resinous in appearance.
GHG Emissions

HMA Plant

27.9% Reduction

CO2 eq (lbs./ton of mix)

45.1
32.5

HMA
WMA
Jointed Concrete Pavement with Rubber Joint Seal Material under HMA
Mixture Quality

More effective asphalt
Decreased binder aging
Absorption

HMA

WMA
Hamburg-One Year Cores
Effective Asphalt

HMA

WMA
Contractor Savings

10% to 20% reduction in fuel costs

25% to 35% less energy
Paving Benefits

Compaction aid for stiffer mixes
Cool weather paving
Longer haul distances (general note)
Compaction

- More effective compaction
Combined Technologies

- WMA with 15% RAP and 5% RAS

Over a 23% reduction in emissions
Benefits of Warm Mix Asphalt

- More Durable Pavement
  - Less oxidized + less absorption = better fatigue life
  - Less thermal segregation
- Better in-place densities and/or less compactive effort
  - Improved fatigue life
  - Lower permeability
  - Better bonus for contractor
- Improved Ride Quality
  - Less swelling of rubberized crack seal
  - Less bumps from thermal segregation
- Wider Paving Window
  - Winter Paving & Night Paving
- Reduced Emissions, Smoke & Odor
- Direct Energy Savings ~ $0.50 – $1.00/ton
- Better environment for workers
- Facilitates the use of RAP & RAS