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

Documented WMA in Texas

- 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)

WMA Specification Language SS 3224

1. **Warm Mix Asphalt (WMA).** Warm Mix Asphalt (WMA) is defined as HMA that is produced within a target temperature discharge range of 215ºF and 275ºF 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.

   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 275ºF 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 275ºF; however, such mixtures will not be defined as WMA.

WMA Specification Language SS 3224

1. **Mixing and Discharge of Materials.** Notify the Engineer of the target discharge temperature and produce the mixture within 25°F of the target. Monitor the temperature of the material in the truck before shipping to ensure that it does not exceed 350°F (or 275ºF for WMA) and is not lower than 215°F. The Department will not pay for or allow placement of any mixture produced at more than 350°F.

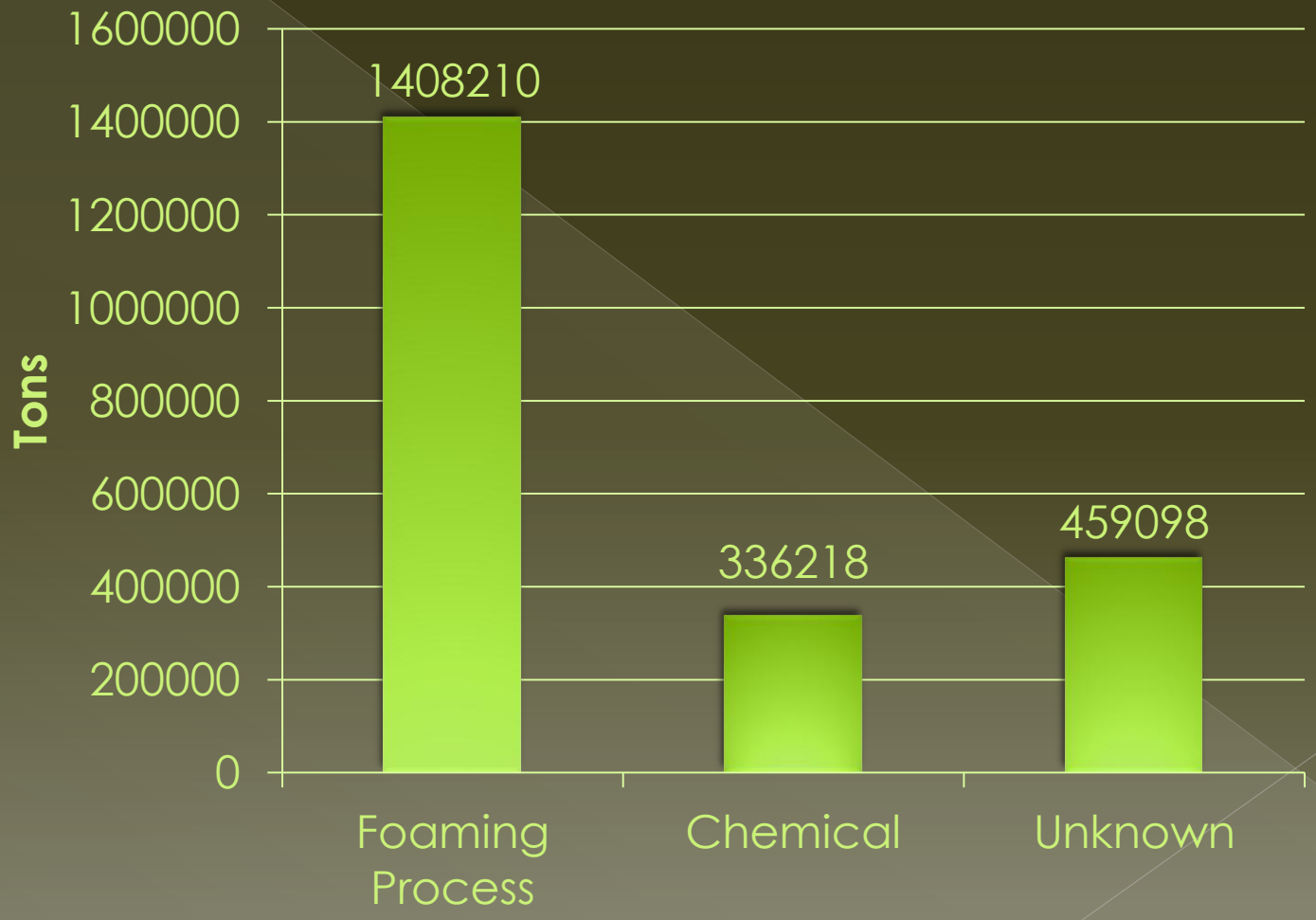
   When WMA is required, produce the WMA within the target temperature discharge range of 215ºF and 275ºF. Take corrective action any time the discharge temperature of the WMA exceeds the target discharge range. The Engineer may suspend production operations if the Contractor's corrective action is not 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

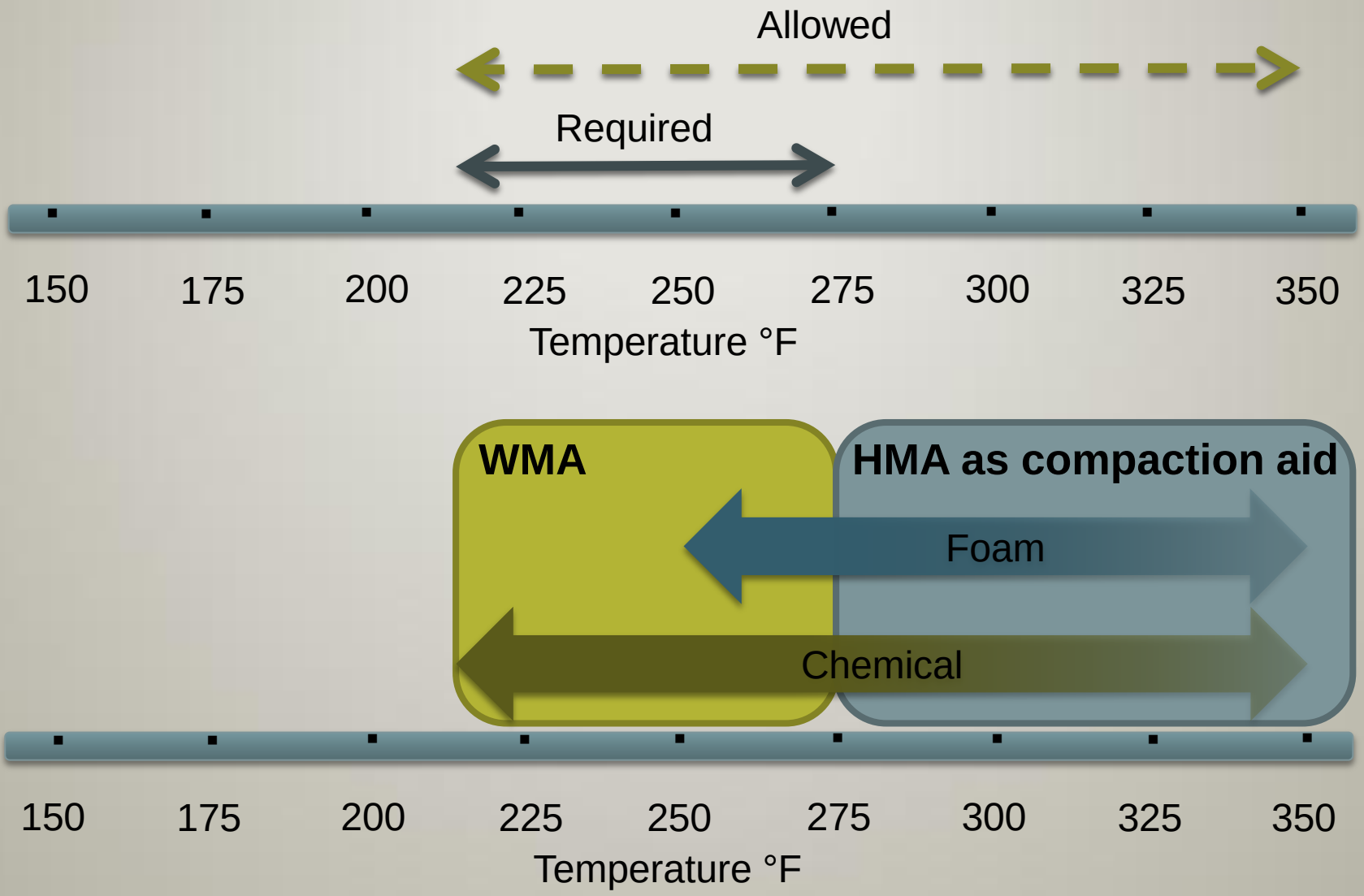
- **Foaming admixtures:**
  - Advera
  - Aspha-Min
  - Astech PER
- **Plant modification:**
  - Double-Barrel Green
  - Terex WMA System
  - Ultrafoam GX
  - HydroFoam IEQ
  - Maxam
  - Almix Warm Ware
- **Chemical binder additives:**
  - Evotherm
  - Rediset WMX
  - Rediset LQ 1106
  - Cecabase RT
  - QPR QualiTherm
- **Chemical mixture additives:**
  - Sasobit

Foaming Device - Plant Modification

Documented WMA Tonnage (By Technology)



WMA TEMPERATURE BASICS



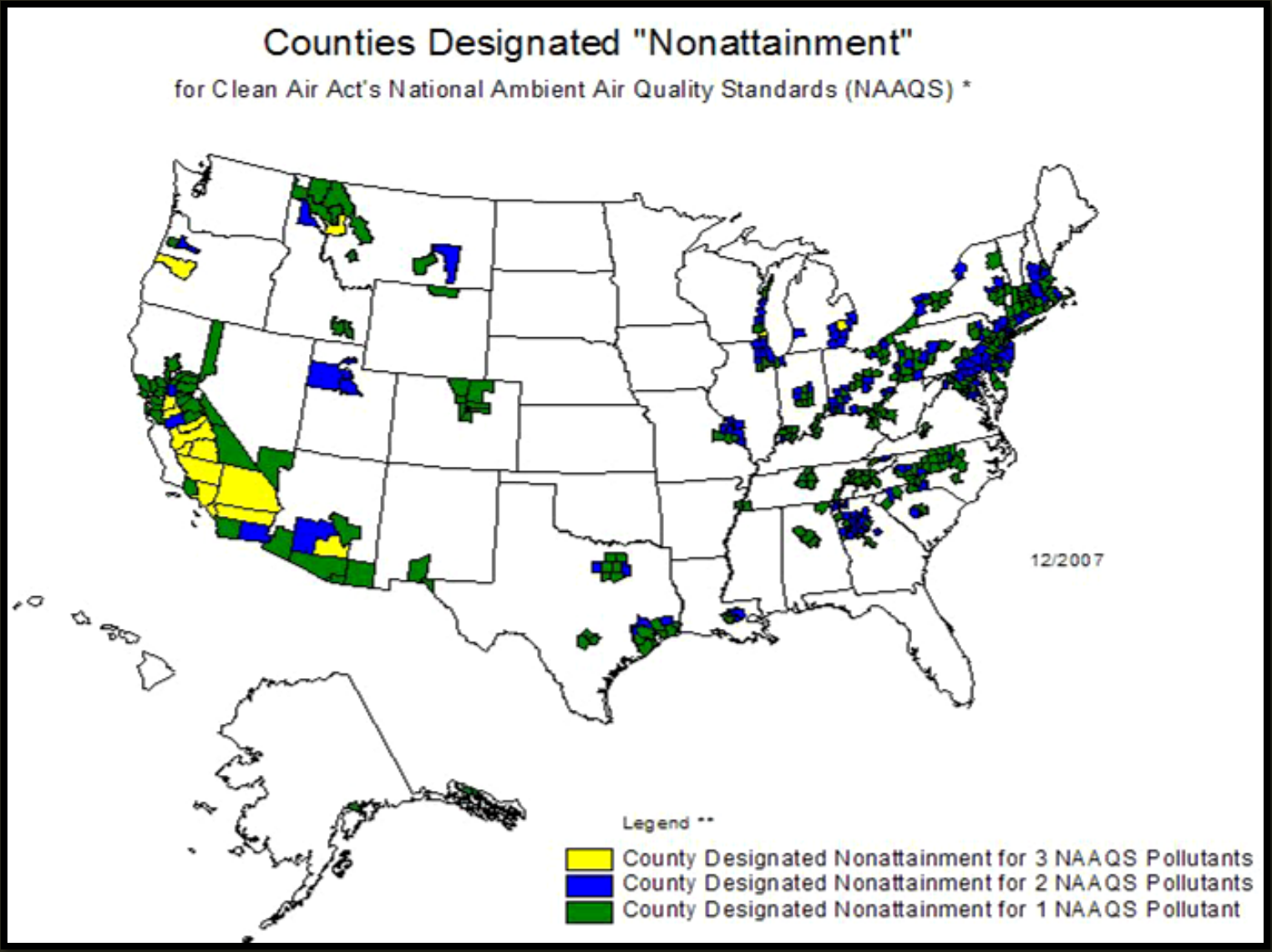
Reduced Fumes & Emissions

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:

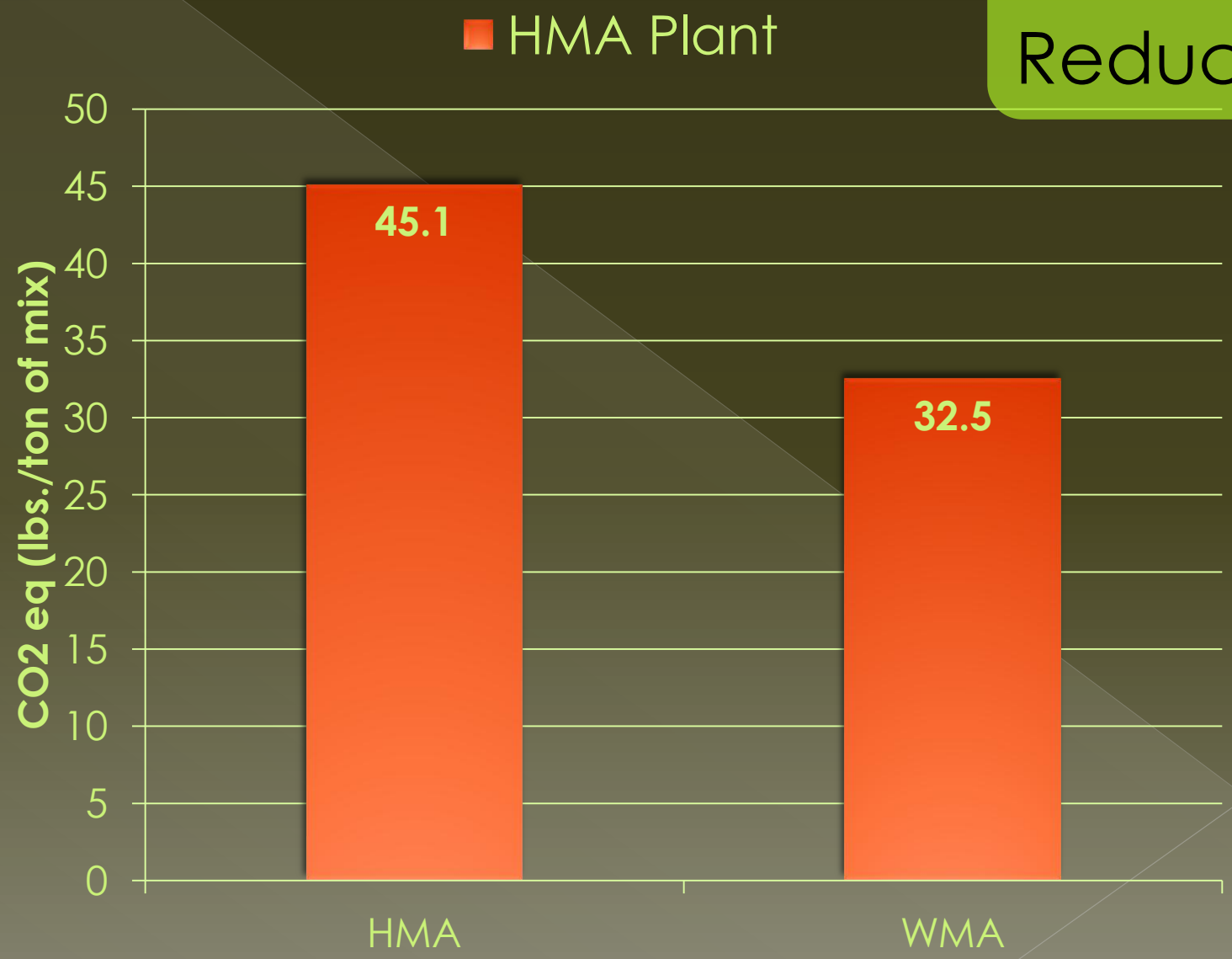
“maltenes” These maltenes are oily and resinous in appearance



CURRENT NON-ATTAINMENT AREAS

GHG Emissions

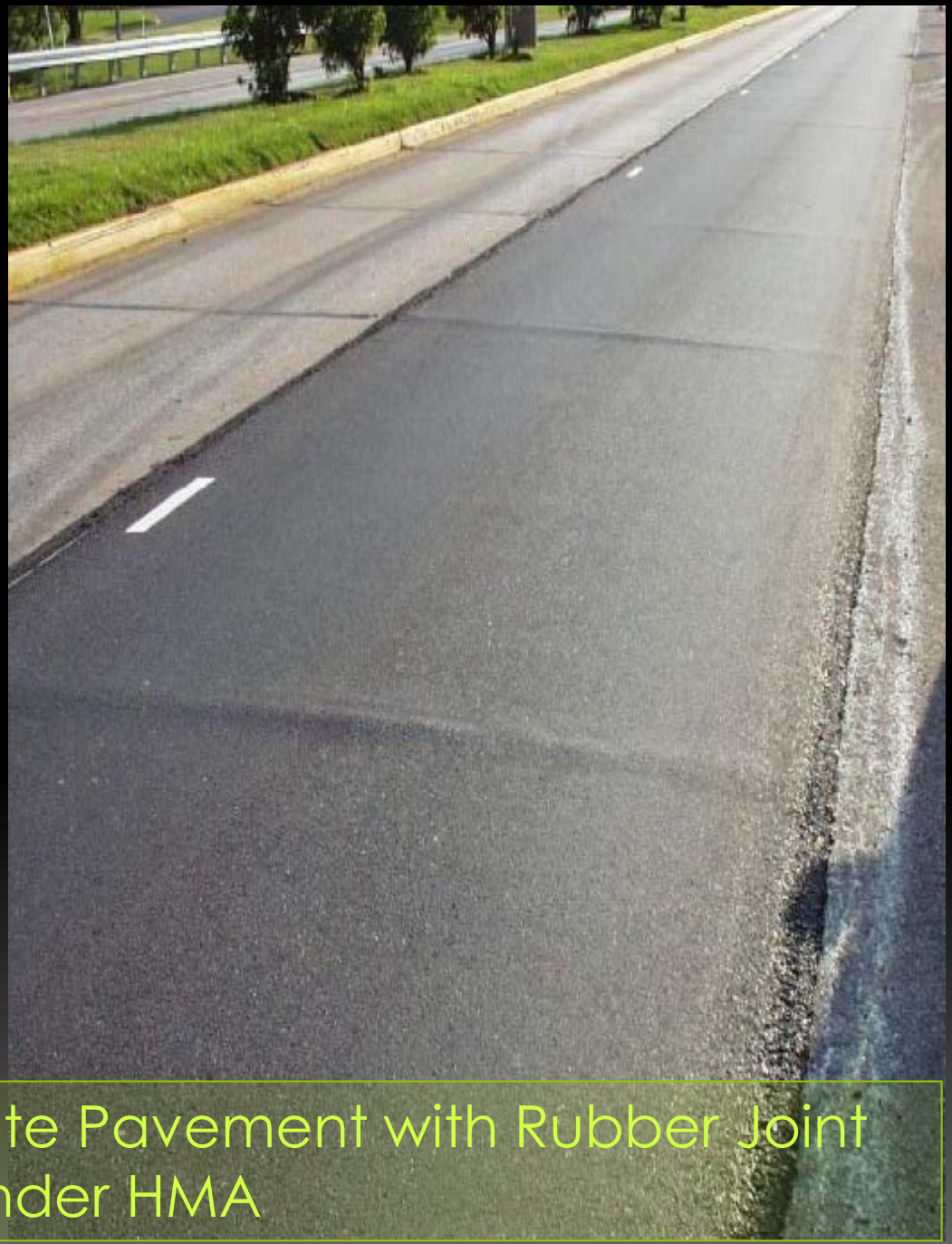
27.9% Reduction



HMA

WMA

TXDOT SAVINGS



Jointed Concrete Pavement with Rubber Joint Seal Material under HMA

Mixture Quality

More effective asphalt
Decreased binder aging

Absorption

HMA

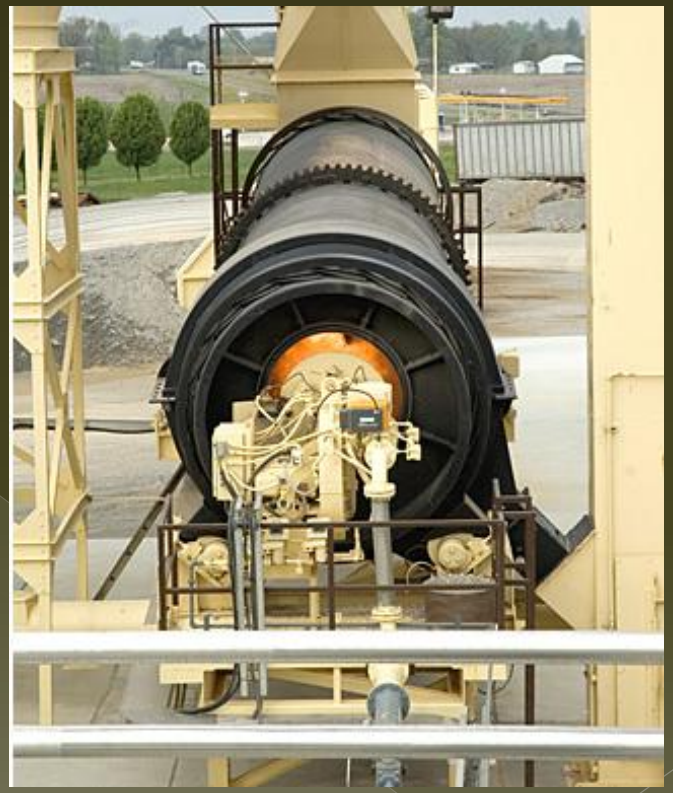
WMA

Hamburg-One Year Cores

Effective Asphalt

Contractor Savings

10% to 20%
reduction in fuel costs



25% to 35%
less energy

Paving Benefits

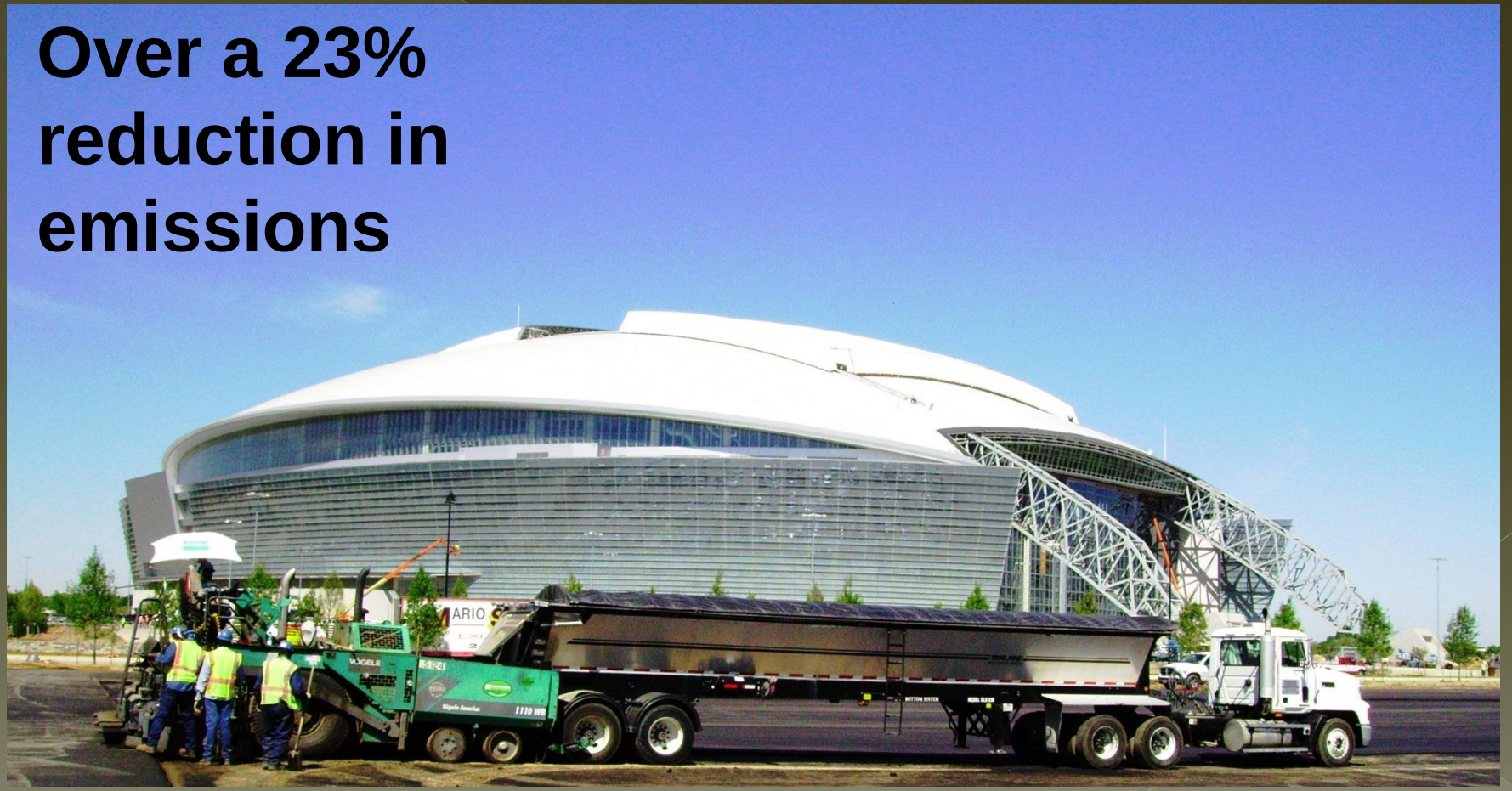
Compaction aid for stiffer mixes
Cool weather paving
Longer haul distances (general note)

Compaction

- More effective compaction

Combined Technologies

- **WMA with 15% RAP and 5% RAS**



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