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# Warm-Mix Asphalt: Best Practices

## 2nd Edition

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### Chapter 1

<b>Introduction</b> .....	5
Background .....	5
A Short History of WMA .....	6
Purpose and Methodology .....	9

### Chapter 2

<b>WMA Technologies</b> .....	11
<b>Chemical Processes</b>	
CECABASE® RT .....	12
Evotherm™ .....	13
HyperTherm™/QualiTherm .....	14
Rediset™ WMX .....	15
<b>Foaming Processes</b>	
Accu-Shear™ .....	17
Advera® WMA .....	17
AQUABlack™ WMA System.....	20
AquaFoam .....	20
Aspha-min® .....	21
Double Barrel® Green .....	22
Eco-Foam II .....	23
LEA (Low Emission Asphalt) .....	24
Meeker Warm Mix.....	25
Terex® WMA System.....	26
Tri-Mix Warm Mix Injection System .....	28
Ultrafoam GX2™ System .....	29
WAM Foam.....	29
<b>Organic Additives</b>	
Astech PER® .....	31
Sasobit® .....	31
SonneWarmix™ .....	33
Thiopave™ .....	33
TLA-X™ Warm Mix.....	36

### Chapter 3

<b>Benefits of WMA</b> .....	37
Compaction Aid .....	37
Cold-weather Paving .....	37
Longer Haul Distances .....	38
Use of Higher Percentages of RAP .....	39

Less Restriction and Potentially More Paving Hours in Non-attainment Areas .....	40
Specific Plant Concerns .....	40
Specific Pavement Rehabilitations .....	40
Reduced Fuel Usage.....	41
Reduced Emissions.....	41
Improved Working Conditions.....	43

## Chapter 4

<b>Production and Placement Practices .....</b>	<b>45</b>
Maintaining Adequate Baghouse Temperatures.....	45
Remove Veiling Flights .....	46
Increase Air Flow.....	46
Duct Heaters .....	46
Install Variable Frequency Drive (VFD) on Drum Drive or Slinger .....	46
Insulate Baghouse and Ductwork.....	47
Drying Aggregate .....	47
Increase Aggregate Retention Time.....	47
Insulate Dryer Shell .....	48
Install VFD on Drum Drive.....	48
Reduce Stockpile Moisture Content .....	48
Burner Performance .....	51
RAP and RAS Recycling.....	51
Placement Changes .....	52
Compaction .....	52

## Chapter 5

<b>Summary of Experience and Future Research Needs .....</b>	<b>53</b>
Mix Design.....	53
Guidance for Selection of Production Temperatures .....	54
Long-Term Performance.....	54
New-Product Approval.....	56
Quantification of Benefits .....	57
RAP and WMA .....	57
Summary .....	57

<b>References .....</b>	<b>59</b>
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## Background

The United States Clean Air Act was passed into law in 1970. The first Earth Day was held that same year. Since that time, U.S. industries have worked to become better environmental stewards. The asphalt pavement industry has proven to be a leader, not just in implementing government-mandated technologies but also in seeking innovations to promote a cleaner planet and better working conditions for employees.

Members of the National Asphalt Pavement Association (NAPA) have taken the lead in a number of initiatives that have made asphalt plants better neighbors and enhanced working conditions for those involved in the production and construction of asphalt pavements. The asphalt industry has responded to a variety of government regulations, economic factors and changes in public attitudes. For example,

- Responding to the Clean Air Act of 1970, improvements in emission control technologies were developed. Wet scrubbers were developed first. The currently favored technology, baghouse filtration, has greatly reduced particulate emissions from asphalt plants.
- Rising oil prices and tightened supply during the two oil shortages of the 1970s spurred the development of new methods for reclaiming and recycling asphalt pavements. Improvements in milling machines and new methodologies for incorporating reclaimed asphalt pavement (RAP) and reclaimed asphalt shingles (RAS) have made recycling an industry standard, and asphalt is now the most recycled material in the U.S.
- Concerns about working conditions for paver operators have led to the development of engineering controls for highway-class asphalt pavers and best-practices guidance.
- Concerns about working conditions for crews involved in milling operations have led to the successful Silica/Milling Machine Partnership.
- Questions from the public about the impact of asphalt plants on communities provided the impetus for development of NAPA's Diamond Achievement Commendation.

In 2002, NAPA identified new technologies in Europe that held the promise of reducing production and construction temperatures. Research at the National Center for Asphalt Technology (NCAT) and elsewhere had previously shown that lowering the plant mix temperature even by 10 °F (6 °C) can markedly reduce the production of emissions from asphalt mixtures (Lange and Stroup-Gardiner 2007). A study tour of NAPA leaders was quickly put together. Following the study tour, NAPA and its partners in agencies and academia began to pursue the research and development work necessary for implementation.

Warm-mix asphalt (WMA) represents a group of technologies which allow a reduction in the temperatures at which asphalt mixes are produced and placed. These technologies tend to provide complete aggregate coating at lower temperatures and act as compaction aids. The mechanisms which allow better coating and compaction vary from one technology to another.

Conventional hot-mix asphalt (HMA) is typically produced at temperatures from 280 °F to 320 °F (140 °C to 160 °C). WMA is produced at 212 °F to 280 °F (100 °C to 140 °C).

So what is significant about WMA? Improvements in coating and compaction provide a number of potential paving benefits for asphalt contractors and their agency partners. Reduction in production temperatures provides a number of benefits related to sustainable development and improved working conditions. The range of potential benefits includes:

- Paving benefits
  - Compaction aid,
  - Ability to pave in cool ambient temperatures without sacrificing quality,
  - Ability to haul asphalt pavement mixtures longer distances and/or durations and still have the necessary workability to place and compact the mix,
  - Ability to incorporate higher percentages of RAP, while producing the mixture at reasonable temperatures, and facilitating placement and compaction,