Warm mix asphalt (WMA) is the generic term for a variety of technologies that allow asphalt mixtures to be produced, transported, placed, and compacted at lower temperatures. WMA technologies typically result in temperatures 30 to 75 degrees Fahrenheit lower than traditional hot mix asphalt (HMA). Because less energy is needed to heat the asphalt mix, in many cases, less fuel is required to produce WMA. Fuel consumption during WMA production may be reduced by 20 percent with proper production plant modifications. It is a proven technology that can:

- Improve compaction that improves pavement performance.
- Reduce fuel or energy usage.
- Improve worker comfort by reducing exposure to higher temperatures, fuel emissions, fumes, and odors.

In addition, WMA technologies allow asphalt mixtures to be hauled longer distances and can extend the paving season due to WMA's ability to maintain workability at lower temperatures. The proper use of WMA may result in reduced overall paving costs.

WMA technologies enhance mixture workability through the addition of additives (organic, chemical, water-based, or hybrids). Asphalt mixtures are primarily composed of aggregates and asphalt binder. Aggregates are hard materials such as crushed stone. Asphalt binder is a dark brown to black, sticky liquid that holds together the aggregates when mixed. Some WMA technologies work by reducing the viscosity, which increases the ability to flow or pour the asphalt binder. This allows the aggregates to be properly coated with asphalt binder at lower temperatures. WMA also improves workability during construction allowing the mixture to be properly transported, paved, and compacted at lower temperatures. Proper compaction provides increased pavement density and is necessary for pavement performance. One drawback of HMA is that, in cooler climates and during long distance truck transport from the plant to the paving site, the HMA mixture temperature drops rapidly and may not retain its workability. WMA technologies help maintain workability at lower temperatures to allow successful placement of WMA mixtures in lower temperatures and longer trucking distances. As a result, WMA technologies may extend the paving season in cold temperature regions and assist night paving at lower ambient temperatures. Night paving is increasingly used on projects, especially large scale projects located in or near cities, to minimize traffic disruption and congestion.

- WMA technologies allow asphalt mixtures to be produced, transported, placed, and compacted at lower temperatures.
- WMA technologies allow for production and placement of asphalt mixtures at temperatures 30 to 75° F lower than conventional HMA technologies.
- WMA technologies fall broadly into one of five general categories: materials processing, organic additives, chemical additives, foaming processes, and hybrid systems that combine multiple technologies.
- WMA technologies improve compaction which leads to improved pavement performance.
- Producing WMA can reduce energy consumption during the manufacture of asphalt mixtures up to 20 percent with proper production operations and plant modifications.
- WMA reduces visible and non-visible emissions, fumes, and odors, improving working conditions.
- WMA reduces carbon dioxide (CO2) emissions through reducing the amount of fuel required to produce asphalt mixtures.
- Recycled asphalt pavement (RAP) can be used with WMA, reducing costs and use of raw materials.
- WMA can be placed and compacted in cooler ambient temperatures, providing an extended paving season.
- WMA can be adapted to various traffic levels, temperatures, and materials required for a given project.
- The first public demonstration of WMA in the United States was in 2004. As of 2009, WMA projects were constructed in more than 40 States, and at least 14 States have adopted specifications that allow WMA.

Better Compaction Improves Performance

Proper compaction is critical to well-performing pavements. One indication of proper compaction is the final density of the asphalt pavement. In fact, most federally funded highways paved with asphalt are accepted based on density. WMA is a compaction tool that can help achieve more uniform density and improve pavement performance.

WMA's ability to improve compaction is versatile. It has been used successfully in a range of pavement thicknesses; and similar to traditional HMA, when properly designed, is durable enough to withstand high traffic demands. WMA has been used in all types of asphalt concrete: dense-graded, stone matrix, and porous asphalt mixtures. Multiple WMA technologies are available, so the choice can be adapted to the temperatures and materials required.

Good for Workers, Good for the Environment

Working conditions are more comfortable with WMA. Both at the production plant and on the construction site, workers experience cooler working temperatures and reduced fumes, haze, and odors. Comments from workers have been highly positive. According to Brad Neitzke Materials Engineer for FHWA, Western Federal Lands Highway Division: "Certainly, warm mix improved working conditions at the paving site. The construction crew's first reaction was to say, 'There's no fumes!' "

With reduced fuel or energy usage, reduced emissions, and combined with the use of recycled asphalt, WMA minimizes negative impacts to the environment by reducing the use of natural resources and improving air quality. In fact, WMA technologies may make it possible for asphalt production and paving to be done on days when the air quality in and around nonattainment areas would typically put a halt to traditional HMA paving.

WARM MIX ASPHALT

WMA technologies were developed in Europe In the mid-1990's in response to the than proposed Kyoto Protocol. Today in the United States, over 40 State highway agencies have developed and adopted WMA specifications. In 2010, of the approximately 360 million tons of asphalt pavement materials produced in the United States, 42 million tons (11.8 percent) were produced using a WMA technology.

Frequently Asked Questions

What makes WMA different from traditional HMA? High production temperatures are traditionally needed to make the asphalt binder fluid during mixing to completely coat the aggregate and also have good workability during hauling, placement, and compaction. WMA technologies use chemicals, waxes, organic additives, water-bearing minerals, water, or a combination of technologies. These technologies allow the asphalt binder to remain fluid at lower temperatures during mixing in order to completely coat the aggregates. It is the use of these technologies that allow the construction of asphalt pavements at lower temperatures.

Does using WMA require plant and mix design modifications? The need for plant and mix design modifications depends upon the type of additive used. Most require relatively simple plant and mix design modifications to introduce the temperature reducing technologies into either the mixture or asphalt binder stream. Some technologies are added to the asphalt binder by the supplier and do not require additional equipment at the plant. Other technologies require more substantial modifications. Technologies involving water-based foaming techniques or mixture additives require additional equipment installed at the plant to measure and deliver the additive.

Does WMA impact plants that produce the asphalt mixtures? HMA plant modifications and/or operational changes are typically needed to utilize WMA technologies effectively and optimize the benefits WMA can provide. By making the necessary operational changes and plant modifications lower mixing temperatures can be successfully used, resulting in reduced emissions and odors. Depending on the production temperature and plant efficiency, a range of 15 to 40 percent reduction of carbon dioxide and other emissions during production have been reported.

Warm Mix Asphalt Pavement in Yellowstone National Park

From "Warm Mix Asphalt Technologies", U.S. Department of Transportation, Federal Highway Administration.