



**Much
Asphalt**

TOGETHER WE CAN



WARM MIX ASPHALT (WMA)

What is WMA?

Warm Mix Asphalt (WMA) is manufactured at substantially lower temperatures than Hot Mix Asphalt (HMA), resulting in a significant range of benefits during production and paving.

While HMA is generally manufactured at temperatures between 140°C and 160°C, WMA has been typically produced at temperatures between 120°C and 140°C in South African trials. But temperatures as low as 100°C have been recorded. Based on continuously graded asphalt mix types, trials have shown quality performance to be equal or even superior to that of HMA.

WMA technology revolves around altering the consistency of the bituminous binders to make them more fluid at lower temperatures. This enables mixing, paving and compaction at lower temperatures.

The stringent quality assurance measures applied to HMA in South Africa also apply to production and paving of WMA and essentially the same methods of paving and compaction are used.

HISTORY

The first WMA was paved in Germany around 1997. Today the USA, several countries in Europe, and China are leading the global field in WMA production, based on environmental, health, economic and engineering benefits that make WMA a more attractive option than HMA.

Since the first trial in South Africa near Durban in November 2008, WMA has also achieved rapid acceptance locally.



*Double barrel RA twin drum with foaming capabilities
(located at Much Asphalt Benoni)*

BENEFITS

ENVIRONMENTAL

Lower mixing temperatures for WMA reduce fuel consumption, conserving non-renewable fossil fuels, reducing greenhouse gas emissions and saving cost. Research has shown that lowering the production temperature can also significantly reduce carbon dioxide and nitrous oxide emissions.

In addition to the mixing temperature, fuel consumption is affected by other factors such as the moisture content of the aggregates and RA, the efficiency of the mixing plant, and changes in operating temperatures required to produce different asphalt products.

Reuse of by-products

Some WMA additives, such as Fischer-Tropsch waxes, are waste materials produced in the Fischer-Tropsch process and their use in WMA production reduces waste materials as well as limiting the need to produce other WMA specific additives.

Recycled asphalt (RA)

WMA processes are well suited to the use of mixes containing higher percentages of reclaimed asphalt than HMA, with the positive spin-offs of reducing the burden on waste disposal sites, reducing the need for non-renewable resources such as aggregates and bitumen, and reduced costs all round.

It is believed that the softer binder resulting from the lower WMA production temperatures could rejuvenate the aged binder in the RA and improve the mix's overall fatigue properties. WMA mixes containing up to 40% RA have been successfully produced and paved in trials in South Africa, but percentages more than double this have been achieved in Germany.

HEALTH

Workers and communities

Lower production and paving temperatures reduce emissions of aerosols, fumes and dust, resulting in improved conditions for both workers and neighbouring communities.



Reduced fuel consumption

Lower mixing temperatures for WMA reduce fuel consumption, conserving non-renewable fossil fuels, reducing greenhouse gas emissions and saving cost.

Smoke and smells are eliminated because the light oils in bitumen never reach boiling point.

A reduction in mix temperature of 30°C in South Africa's hot summer months is very welcome on a paving site.

Plant sites

The lower emissions from WMA production opens the door to locating asphalt plants closer to urban road networks, reducing haulage distance, fuel usage, the impact of haulage on our road networks, and cost. Emission control is a very significant overhead cost at all asphalt plants that, if reduced or even omitted through the use of WMA production, could positively impact asphalt prices in the future.

Health Safety and the Environment (HSE)

Although WMA is manufactured and paved at significantly lower temperatures than HMA, the same HSE standards are applicable to both.

ENGINEERING AND ECONOMIC

Workability

Maintaining a low viscosity at lower temperatures allows the mix to flow freely through storage, transfer and placement equipment and makes it easier to work by hand.

The improved workability improves mix cohesion and aids compaction.

Cooling

Because of WMA's lower mixing and compaction temperatures, there is less difference between the WMA and the ambient and road temperatures. So WMA takes longer to cool from mixing to compaction temperature than HMA, providing a longer compaction window.

This allows a longer period for compaction to take place, improves density, and the asphalt can be stored for longer, hauled longer distances and used in colder temperatures.

Binder aging

WMA's lower mixing temperatures cause less aging of the binder during mixing and paving than HMA. This is expected to improve flexibility and resistance to fatigue and thermal cracking in the asphalt.



WMA exiting the mixing drum

WMA TECHNOLOGIES

WMA technologies aim to enable acceptable aggregate coating and mix workability at lower temperatures by lowering the viscosity of the binder. Commercially viable technologies currently in use can be divided into three broad categories:

Water technologies

- a. Binder foaming systems where water is injected into the hot binder, causing it to expand significantly into foam, which reduces its viscosity and enhances its ability to coat aggregate at lower temperatures;
- b. Water carrying chemical additives, which introduce moisture into the mix, causing it to vaporise and create foam. Natural and synthetic zeolites are mineral additives used to introduce water into the mix to reduce binder viscosity;
- c. Systems where moist fines are introduced to the heated coarse aggregate and binder, causing the moisture to vaporise and forming foam.

Chemical additives

These technologies reduce the internal friction of the mix, enabling it to be compacted at lower temperatures.

Rheological modifiers

These are products that modify the rheological properties of the binder, reducing its viscosity at mixing and paving temperatures and improving aggregate coating and compaction. At road temperatures the binder stiffens, improving rutting resistance.

Application of WMA technologies

Technologies, designs and applications will have to be evaluated using different materials, in different conditions, before implementation. Specifications will have to be based on performance related parameters as there are many technologies with different chemical and mechanical modifications to the rheological properties of the binder and product behaviour.



WMA going into hot storage bin

WMA AT MUCH ASPHALT

Much Asphalt's 300 tonne per hour warm mix asphalt plant in Benoni, built by Astec in Tennessee, USA, pioneered the use of foam technology for the manufacture of warm-mix asphalt (WMA) on a large scale in South Africa.

The Double Barrel Green System, commissioned in 2010, eliminates the need for additives through the use of small quantities of water that come into contact with the hot bitumen, generating steam and in turn causing foaming of the bitumen. The volume of the bitumen is drastically increased and the viscosity of the binder is reduced, improving coating of the aggregates and enhancing its distribution in the mix.

The new plant has reduced energy costs and the carbon footprint at Much Asphalt's biggest and busiest plant.



Foaming equipment



Twin drum system

In 2011 Much Asphalt's Coedmore branch in KwaZulu-Natal commissioned a foam generator from Ammann of Switzerland designed to link into the existing 160 tonne/hour batch plant to produce WMA. This was the first WMA system designed for use with an existing batch plant in South Africa.

This installation formed part of an investment in WMA technology at all Much Asphalt plants in South Africa. Chemical and rheological WMA technologies can be used at all Much Asphalt's plants as the binder is modified in advance. Zeolite technologies can also be incorporated at all plants with slight plant modifications.

Much Asphalt will continue to look at design methods and specialised testing results to evaluate the performance criteria of WMA for our clients.



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