

TRANSPORT: ABERDEEN AIRPORT

'WARM MIX' IS A WONDER

The design of a Marshall Asphalt for greater durability and easier application during cold conditions is an important step forward for airport pavement development. **Tyler Bird** reports.

Professional nous has played a big part at Aberdeen International Airport (AIA) amid taxiway-strengthening works carried out during winter nights; Marshall Asphalt – an overlay of which was proposed to rehabilitate a taxiway – is best applied in dry, warm, daylight hours.

The surface course specified for the project already incorporated a polymer modified binder (PMB) to improve durability (see box). But following site trials, the surfacing contractor's materials engineers further developed the asphalt by introducing "warm mix credentials". The result was a Marshall Asphalt of enhanced performance that was readily compactable, and which proved well suited to laying during chilly December nights.

"You could say it adds up to new technology," says director of Airfield Construction Services (ACS), Roy Thomson, ACS being AIA's appointed project manager. The mixture, once placed, showed all the familiar characteristics of a Marshall Asphalt, despite the cold, as well as added benefits that should provide a more durable, long term product.

Thomson is cautious and states that the inclusion of a modified binder – in Aberdeen's case, Enduratherm Z4, a Nynas-branded premium bitumen – might not meet everyone's criteria. "However, the early indicators are good and I'm happy with the results so far," he adds.

AIA's initial design brief was to extend pavement life of the taxiway for a further 12 to 15 years, taking into account present and forecasted airport traffic. The existing pavement quality concrete structure was to receive a 200mm overlay of asphalt to

increase its strength.

Marshall Asphalt has its origins in second world war US airfield construction and a mix design method originally devised by Mississippi's highway department's Bruce Marshall. The method ensures sufficient bitumen and voids are present to result in a durable pavement, as well as mix stability to meet traffic demands, plus workability to allow efficient placement.

Marshall Asphalt has largely stood the test of time, meaning the industry has been disinclined to change the material much technologically. But one development emerged in Scotland three years ago, when ACS oversaw the straight run bitumen binder of a normal Marshall Asphalt mix exchanged for a PMB. The aim was to improve the mix to defer reflective cracking longer and to enhance the material's durability, particularly in early life, when the rate of oxidation is affected during winter working. Reducing the risk of damage from spillage of fuel or de-icing fluids was another objective.

Following this, AIA's design consultant, Amey, specified the use of a PMB in the Aberdeen taxiway's Marshall Asphalt. After that came a proposal –

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Neil Anderson, Leiths

from Scottish construction and civil engineering contractor Leiths – to go further and search for a material that would lend itself to cold weather working.

"As asphalt supplier to principal contractor VolkerFitzpatrick, we were concerned about the supply of material, given the time of year (December 2014), and because it was a nightshift operation," says Leiths technical director Neil Anderson.

He consulted with Nynas, which offered its Enduratherm Z4, a premium PMB binder tailored to produce an asphalt mixture at a temperature 300C lower than the standard 1,700C – in other words, a 'warm' mix binder, rather than a 'hot' one.

Warm mix special products like the Nynas binder are used to reduce mixing and compaction temperatures, thereby saving fuel. Enduratherm Z4's selling point is that, as a heavy duty



Nightshift: The use of polymer and warm mix modified Marshall Asphalt eased the challenge of putting down pavement during wintery nights

"The workability of the material was improved because the warm mix element increased lubricity of the aggregate and bitumen on compaction"

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PMB, it produces exceptional mixtures that remain workable and easily compacted at lower temperatures. The reason for the latter benefit is that compaction can be carried out immediately behind the paver, which is beneficial in winter.

"But what if we used the Enduratherm Z4 and heated the mixture to normal hot mix temperatures?" pondered Anderson. "Would the beneficial characteristics of the warm mix product provide a hot mix asphalt with warm mix benefits? And would that secure us, in cold weather, a longer working window and enhance compaction at lower temperatures?"

These questions were tested in Leiths' laboratory, which is UKAS accredited – inter alia – for mix design and all associated tests; a mix design was completed and offsite trials carried out. The answers were positive.

"The workability of the material was much improved because the warm mix element of the mixture increased lubricity of the aggregate and bitumen on compaction," Anderson notes.

"It is therefore possible to compact and work the Marshall Asphalt at lower temperatures. The 'warm mix' asphalt is more workable than the 'hot mix' at hot mix temperature." All of this had the effect of increasing Leiths' working window, when asphalt operations began.

"Enduratherm Z4 is intended for warm mixtures, but we are very aware that it can provide benefits to a hot mix asphalt too," says Nynas products application manager Dennis Day. "It is marketed for both purposes. That said, this is the first time it has been used in a Marshall Asphalt mixture, exploiting both the binder's polymer and warm mix modifications. Aberdeen represents a very interesting departure from conventional practice."



Taxiway strengthening: The initial warm mix layer is placed atop existing concrete

TACKLING THE TAXIWAY IN MIDWINTER

Marshall Asphalt was required at Aberdeen International Airport to overlay, and thereby strengthen, an existing taxiway's concrete pavement.

Principal contractor VolkerFitzpatrick worked in partnership with all members. VolkerFitzpatrick resident project manager Andy Reynolds was set the task of maintaining both motivation and programme amid difficult working conditions, while ensuring that there was no business interruption throughout the project.

Local contractor Markon (a subsidiary of the Leiths Group) was contracted to plane out tie joints and ramps within a tight timescale, so that the surfacing contractor could then reshape the taxiway

with a new Marshall Asphalt surface.

Each night two Wirtgen planers – one of 2.2m milling width, the other 1m – worked in conjunction with each other to remove the existing surface within a tight timescale.

Rigorous maintenance standards helped ensure that there were no breakdowns or reliability issues during the contract. A robust back-up plan was in place to cover anything going wrong, with extra planers left close by the site and maintenance crews on standby.

A 120t Liebherr crane was present to lift or remove any malfunctioning plant for repair, well away from the taxiway.

The surfacing operation was

supervised by VolkerFitzpatrick and the asphalt was supplied by Aberdeen-based Leiths. Leiths had carried out the mix design and proposed the Nynas-supplied polymer modified warm mix binder Enduratherm Z4 for the Marshall asphalt component of the overlay.

This was laid 50mm thick on two 50mm layers of heavy duty macadam. A bond coat – Nynas Enduramuls 100 – was used between layers. Both supply and laying operations went well, with no untoward issues.

The work, including site trials, took place over a three week period. The project was completed in December 2014 and is being monitored for 12 months, as required under the contract. Early indications are favourable.