EXTENDED STOCKPILE WORKING TIMES: PLANT MIX FOAM BITUMEN

Introduction
The Scenic Rim Regional Council in Southern Queensland needed to repair small isolated sections of failed pavement throughout their road network. Much of the repair work was caused by flood damage or was upgraded as part of the QRA betterment program. The use of foam bitumen pavement was considered to provide resilience in any future flood events. Due to the isolation and the reality of repair work on functioning roads the council only requires approximately 100-150t a day. To allow for the excavation of the failed road and placement of the foam bitumen stabilised material and compaction. All under traffic control. The work was also to be performed over a month when the construction resources were available for the council.

The current version of MRTS08 March 2018 states that the working time (time from production to compaction and trimming) shall not exceed 8 hours unless approved by the Administrator in the Annexure MRTS09.1. The working time can also be increased by performing Test Method Q136B which can be used to prove that the working time can be extended to 16 hours.

Small production runs are costly and can prohibit the use of Plant Mix Foam Bitumen (PMFB) being a viable solution.

To achieve the objectives, it was hypothesised that the foam bitumen could meet the requirements of the Council after being stockpiled for a much longer period than the current version of MRTS09 allows.

Using a KMA 220, 1500t of foam bitumen was produced with 2.9% C170 Bitumen and 1% Hydrated Lime binders and 20 tonnes was stockpiled to one side. Samples of the foam bitumen produced were taken for the testing required by MRTS09 for 3, 7 and 14-day modulus testing. The rest of the test stockpile was covered by tarpaulins and sampled again for the modulus testing at 3, 7, 14, 21 and 28 days.

The tests show that the material can be stockpiled for up to 28 days and still fulfil the design intent of the council for their repair work with a 14-day soaked modulus of 1941 MPa and 65% retained modulus. Being able to produce a month’s worth of foam bitumen in 1 day and stockpile it for when it is required allows HSA to more efficiently produce the material and reduce the cost. This also allows the Council to access the material when they require it and reduces the possibility of a breakdown holding up production while gaining from the unquestioned quality and process benefits of larger PMFB runs.

Keywords: Plant-mixed, foam, bitumen, pavement, flood resilience

The Scenic Rim Regional Council in Southern Queensland needed to repair small isolated sections of failed pavement throughout their road network. The use of foam bitumen pavement was considered to provide resilience in any future flood events. Due to the isolation and the reality of repair work on functioning roads the council only requires approximately 100-150t a day.

To allow for the excavation of the failed road and placement of the foam bitumen stabilised material and compaction. All under traffic control. The work was also to be performed over a month when the construction resources were available for council use.

Keywords: Plant-mixed, foam, bitumen, pavement, flood resilience

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The Scenic Rim Regional Council in Southern Queensland needed to repair small isolated sections of failed pavement throughout their road network. The use of foam bitumen pavement was considered to provide resilience in any future flood events. Due to the isolation and the reality of repair work on functioning roads the council only requires approximately 100-150t a day. The work was also to be performed over a month when the construction resources were available for council use.
Aims
Produce a quality PMFB product that fulfils the design intent of the Scenic Rim Regional Council in their repair works. The design requirement is an equal or greater than 50% retained modulus and greater than 1200 MPa soaked resilient modulus.

Provide a cost-effective solution to the council for ongoing requirements.

To achieve the aim, it was hypothesised that the foam bitumen could meet the requirements of the Council after being stockpiled for a much longer period.

Method
To produce the PMFB a KMA 220 purpose-built exsitu PMFB batch plant was mobilised to Bromelton Quarry in Josephville. PMFB had already been produced by the plant under MRTS09 previously by Hiway Stabilizers Australia (HSA) using the Bromelton Quarry road base. With an average 14 day-soaked moduli of 4945 MPa and retained modulus of 69% supplied to other projects.

Using a KMA 220, 1500t of foam bitumen was produced with 2.9% C170 Bitumen and 1% Hydrated Lime binders and 20 tonnes was stockpiled to one side. Samples of the foam bitumen produced were taken for the testing required by MRTS09 for 3, 7 and 14-day modulus testing. The rest of the test stockpile was covered by tarpaulins and sampled again for the modulus testing at 3, 7, 14, 21 and 28 days. Due to the moisture lost while in the stockpile the foam bitumen’s moisture content was tested using Q102A and water added to bring the product up to 60-80% Relative Moisture Ratio (RMR) when compared to the optimum moisture content tested on the day of production. Test blocks (i.e. pats) were then produced and tested as per the TMR specification and testing manual.

Results
The results of the stockpile testing can be seen in the following graphs 1, 2 and 3:

The tested soaked modulus started at 4883 MPa at 14 days curing sampled straight out of the KMA and pats made within the allowable working time. When sampled at 3 days out of the stockpile the 14-day modulus dropped by approximately 40% but was still at 2822 MPa which is still much greater than the 1800 MPa required by TN179 and the 1200 MPa required by the council set out in the project objectives.

The soaked modulus then steadily decreased with increasing stockpile storage before sample preparation until it reached 1941 MPa at 28 days sitting in the stockpile - a result that is 39.75% of the initial result but again above the required limits. The retained modulus remained consistently at approximately 65% throughout the testing except for the outlying 83% result at 3 days which may have been caused by sampling resulting in grading and/or binder variation or a deviation in strict following of the test method, but regardless it is an unexpected superior result relative to typical rather than a problem.

The third graph shows the rate of increase in the soaked modulus over the 14 days cured. The PMFB that has been stockpiled follows the same trend over time as the material sampled on the day of production but to a lesser extent with the increase in modulus being reduced over time while being
cured. This is consistent across all the stockpiled PMFB with the starting point at 3 days cured less with greater time in stockpile.

The test reports for the pats made on the day of production and 28 days stockpiled PMFB can be found in the appendix.

**Discussion**

The tests show that the material can be stockpiled for up to 28 days and still fulfil the design intent of the council for their repair work. Being able to produce a month’s worth of foam bitumen in 1 day and stockpile it for when it is required allows Hiway Stabilizers to more efficiently produce the material and reduce the cost to the Client of the ex-bin material. This also allows the client to access the material when they require it and reduces the possibility of a breakdown holding up production while gaining from the unquestioned quality and process benefits of larger PMFB runs.

These results are possible due to the processing knowledge working together with the Bromelton Quarry Management Team and HAS collaboratively working together combined with the high-quality road base sourced from Bromelton Quarry which is extremely suited to the incorporation of hydrated lime and foam bitumen. To note the Smectite percentage from the petrographic samples is ≤1%. While the results achieved after sustained stockpile storage prior to utilisation are remarkably good for this project, further testing would be required to expand any assessment to other quarries and material sources.

**Conclusion**

Stockpiling of ex-situ PMFB for up
to 28 days allows HSA to produce the product efficiently providing an attractive cost point. This allows us to pass the savings on to the client facilitating them to be able to repair more of their road network, for reduced cost.

The results are currently only specific to Bromelton Quarry work undertaken for Scenic Rim Council and are contingent on process methodologies, materials and stockpile management.

The grading specified was a minimum Mod C under MRTS 05 TMR Specifications.

UM1 Feed stockpile moistures were kept below the minimum specification requirement.

The value proposition for SRC and TMR is worth noting for future projects in the area that is geographically economical for the PMFB operation in the quarry to serve.

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References