

# Effect of rejuvenation on performance properties of recycled asphalt pavement

This study investigated the effect of rejuvenation agents on the performance properties of 30% recycled asphalt mixes, with the aim of encouraging the use of higher quantities of recycled asphalt pavement (RAP). Three performance tests were used to determine the effect on reflective cracking resistance, mix stiffness and deformation properties.

## RECYCLED ASPHALT PAVEMENT

RAP material is generated from milling the surface layer of existing hot-mix asphalt (HMA) pavements and can be used to replace a proportion of virgin aggregate and binder to produce new asphalt surfacing mixes. This presents significant economic and environmental savings to the paving industry, particularly for higher RAP percentages.

## EFFECT OF RAP ON HMA MIXES

Asphalt binder becomes aged during manufacturing and construction as well as over the service life of the pavement, causing the pavement to deteriorate. The use of higher percentages of RAP can result in stiff, more brittle mixes which are susceptible to reflective cracking.

The allowable percentage of RAP material in a recycled mix is currently limited to 15%. Demonstrating a high level of pavement performance through the use of rejuvenation agents is required in order to encourage the use of high quantities of RAP and establish this as a standard practice.

## TESTING METHODOLOGY

Performance testing was conducted on four HMA mixtures containing different rejuvenation agents and one control mix. The mixes consisted of:

1. HMA with 30% RAP and no rejuvenation agent (control)
2. HMA with 30% RAP and fatty acid oil derivative asphalt additive
3. HMA with 30% RAP and modified alkylamidopolyamine additive
4. HMA with 30% RAP and polyol ester performance additive
5. HMA with 30% RAP and naphthenic/hydrocarbon oil regeneration additive

Performance tests were conducted using an asphalt mixture performance testing (AMPT) machine to form a comprehensive testing methodology including:

- Overlay testing – reflective cracking resistance
- Dynamic modulus test – mix stiffness
- Wheel tracking test – permanent deformation or rutting

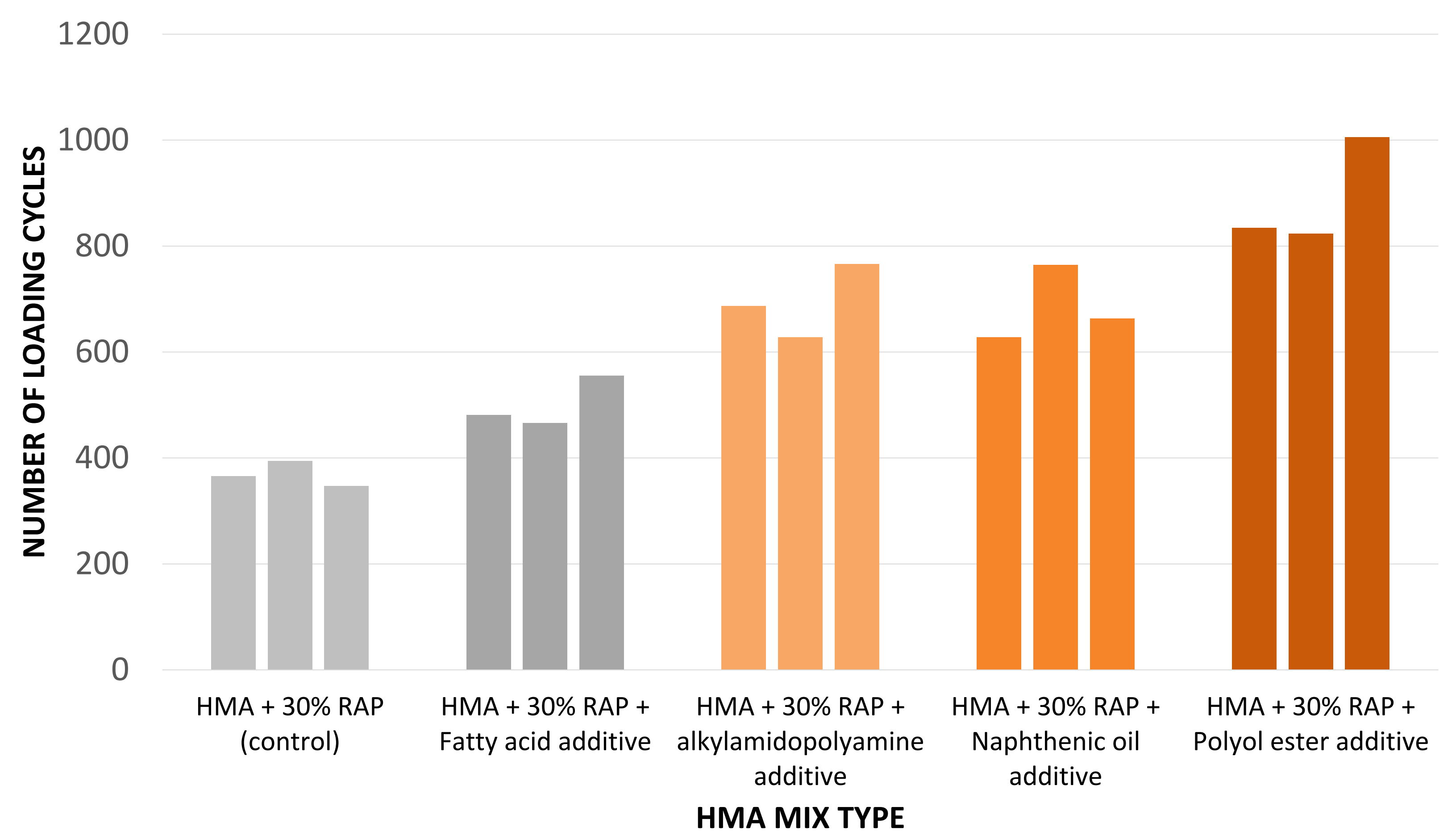
## KEY FINDINGS

These findings can be used to support the use of higher quantities of RAP for HMA pavement surfacing applications by validating the mechanical performance of rejuvenated mixes.

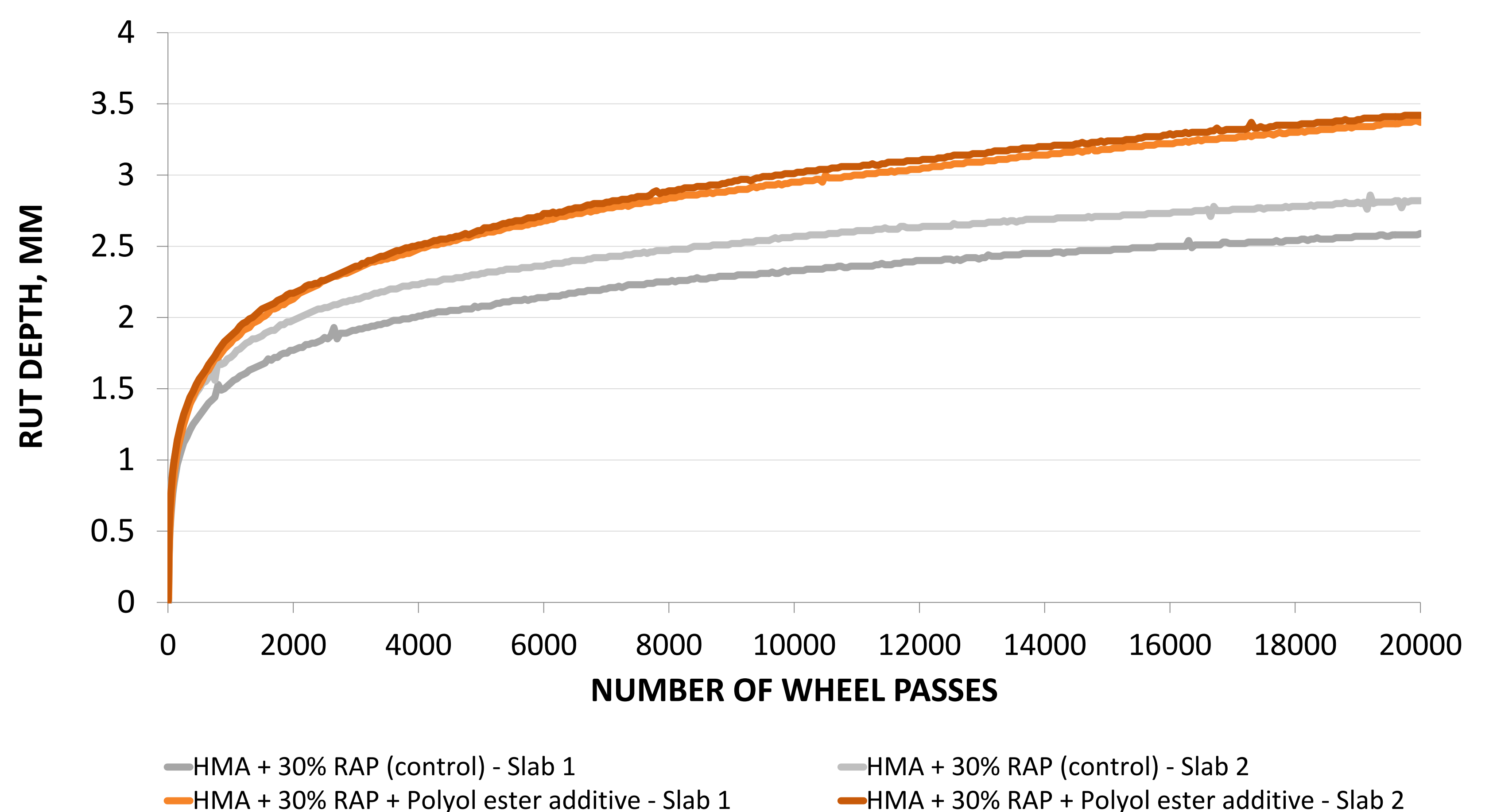
Compared to the control, the addition of the polyol ester rejuvenator:

- Improved the resistance of the mix to reflective cracking
- Reduced mix stiffness
- Reduced the resistance of the mix to permanent deformation or rutting. However, observed rut depths were within allowable limits.

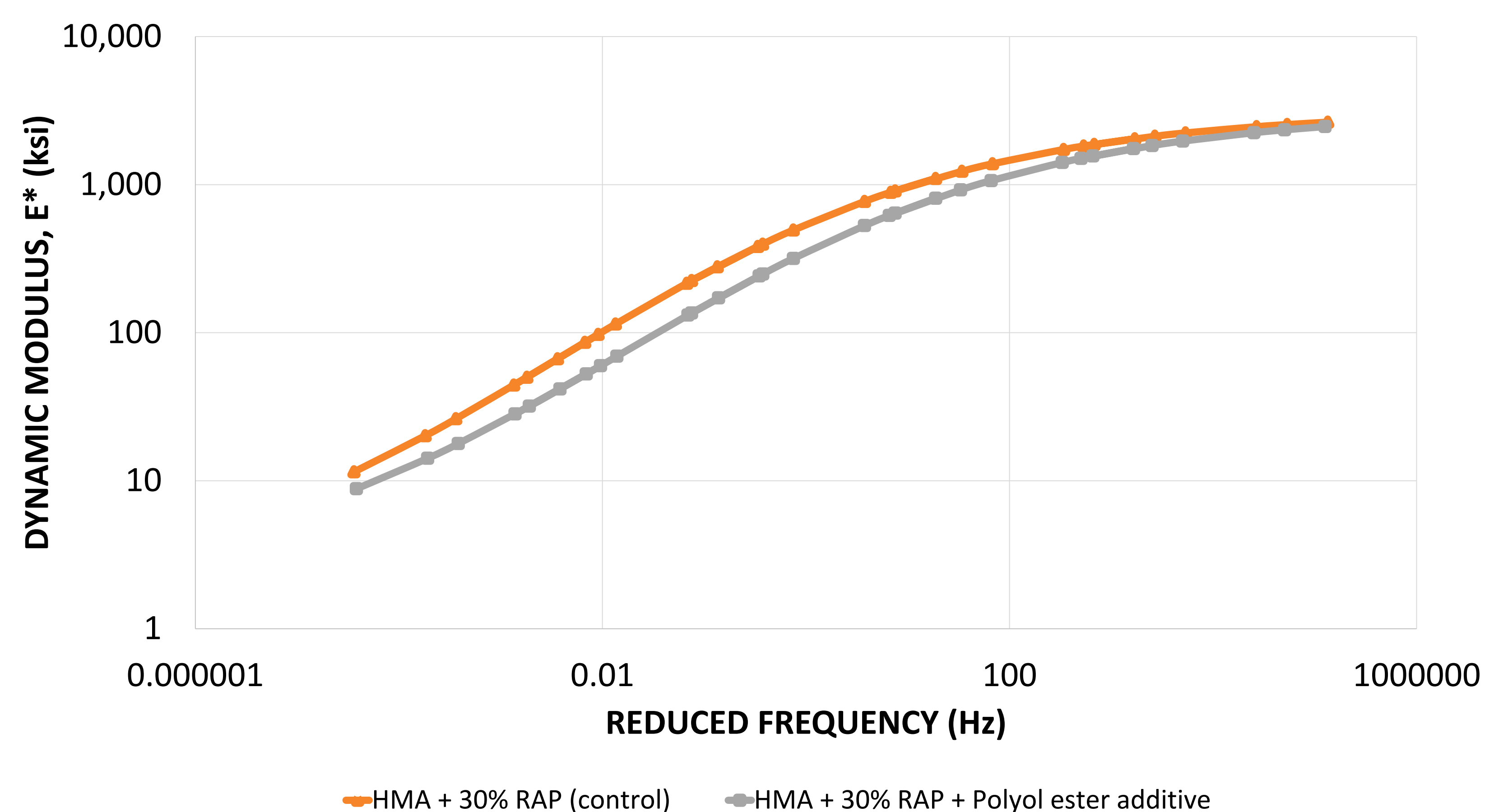
## Overlay test results



## Wheel tracking results



## Dynamic modulus test results



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