**MacRebur Ltd**
Unit 3, Broomhouses Industrial Estate,
Lockerbie, DG11 2RZ
Telephone: +44 (0)1576 204 318
Email: info@macrebur.com

**www.macrebur.com**

# Technical Data
# Effect of MR on Asphalt Deformation Resistance

## Importance to Roads

Deformation resistance is widely recognised as a key engineering property of asphalt used for road construction and surfacing.

Higher deformation resistance is an indicator of reduced potential for asphalt rutting, asphalt shearing and asphalt shoving, primarily under slow moving and heavy loads.

## Methods of Evaluation

Deformation resistance can be measured directly in the laboratory, using one of a range of available wheel tracking devices.

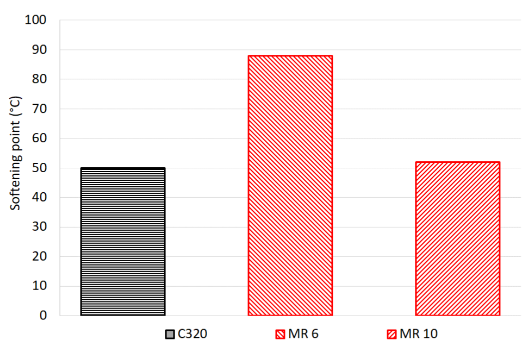
The contribution of the bituminous binder to deformation resistance can also be indirectly evaluated in the laboratory by various bitumen properties. Higher viscosity, higher softening point, lower penetration and higher Performance Grade (PG) are all indicators of a bituminous binder that will produce more deformation resistant asphalt.

Higher asphalt mixture modulus or stiffness is also generally associated with greater deformation resistance.

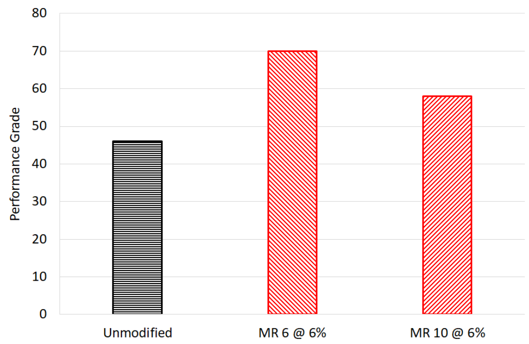
## Effect of MacRebur

MacRebur MR 6 and MR 10 significantly improve the deformation resistance of asphalt mixtures compared to unmodified (penetration or viscosity grade) bitumens.

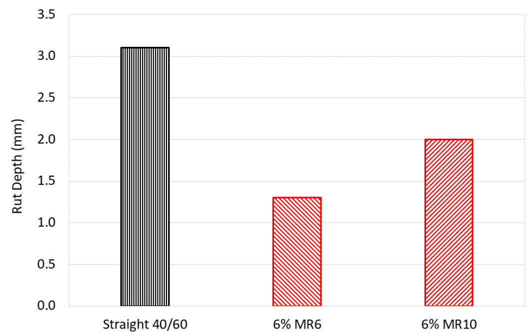
Testing in Australia demonstrated an increase in bituminous binder softening point, compared to unmodified C320, which is similar to 50-70 penetration bitumen.



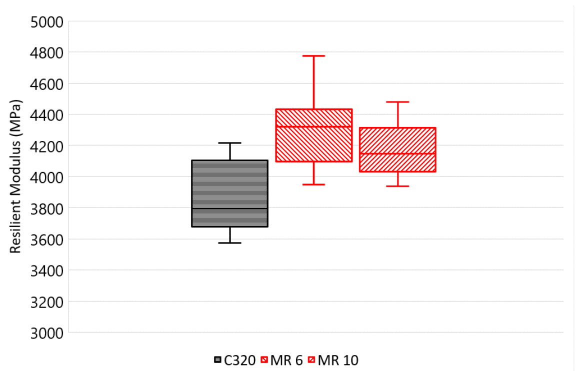

MR 6 and MR 10 increased the US high temperature PG rating by MSCR under Extreme traffic, of 100-150 penetration bitumen.




Asphalt testing of British SMA 10 mixtures demonstrated a decrease in wheel track rutting potential for MR 6 and MR 10 modified asphalt.




Similarly, testing of Australian dense graded asphalt indicated a significant increase in stiffness for MR 6 and MR 10 modified mixtures.



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# Technical Data

# Effect of MR on Asphalt Fracture Resistance

## Importance to Roads

Fracture resistance is widely recognised as a key engineering property of asphalt used for road construction and surfacing.

Higher fracture resistance is an indicator of reduced potential for asphalt cracking, either from the top-down or from the bottom-up, resulting from either environmental or traffic induced cyclic tensile stress.

## Methods of Evaluation

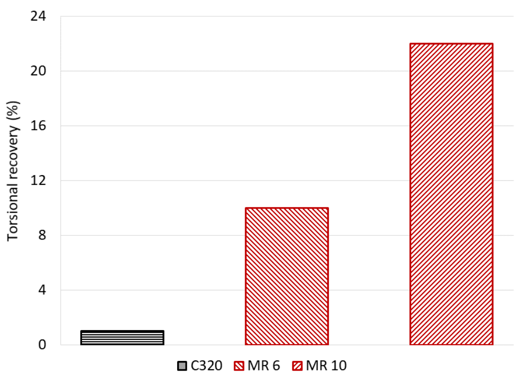
Fracture resistance can be measured directly in the laboratory, using one of a range of monotonic or repeated load tests, usually using either flexural beam or indirect tensile cylinder samples.

The contribution of the bituminous binder to fracture resistance can also be indirectly evaluated in the laboratory by various bitumen properties. Higher torsional recovery, elastic recovery (in the MSCR protocol) and force ductility (at low temperature) are all indicators of bituminous binder contribution to asphalt fracture resistance.

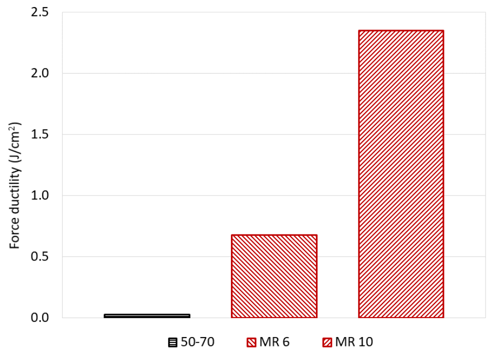
## Effect of MacRebur

MacRebur MR 6 and MR 10 significantly improve the fracture resistance of asphalt mixtures compared to unmodified (penetration or viscosity grade) bitumens.

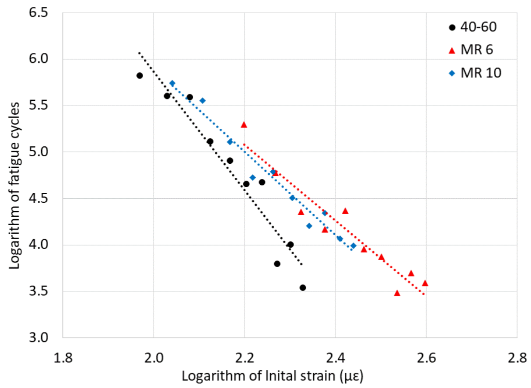
Testing in Australia demonstrated an increase in bituminous binder torsional recovery, compared to unmodified C320, which is similar to 50-70 penetration bitumen.



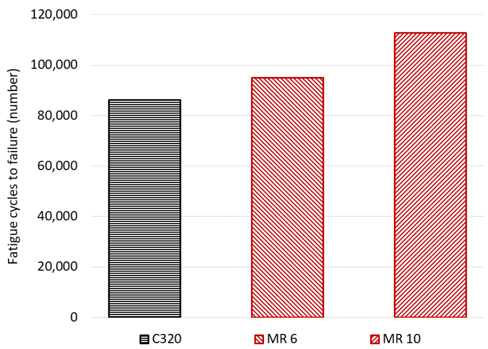

MR 6 and MR 10 increased the force ductility (at 25°C) of 50-70 penetration bitumen.




Asphalt testing of British SMA 10 mixtures demonstrated an increase in fatigue life of indirect tensile cylinders, as a function of initial strain magnitude, for MR 6 and MR 10 modified asphalt.




Similarly, testing of Australian dense graded asphalt indicated an increase in the flexural beam fatigue life of MR 6 and MR 10 modified mixtures.



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MACREBUR®
The Plastic Road Company

# Technical Data
# Effect of MR on Marshall Properties

## Importance to Roads

The Marshall properties, namely Stability and Flow, are inherent elements of the Marshall asphalt mix design method developed in 1939. Many countries still use the Marshall method for asphalt mix design and specification, meaning that Stability and Flow are broadly understood.

Although Marshall properties are not directly related to asphalt performance, they do provide a relative measure of the stiffness (Stability) and ductility (Flow) of an asphalt mix. When the same aggregate sources and volumetric composition is used, the Marshall properties become useful indicators of the contribution of different bituminous binders to asphalt performance.

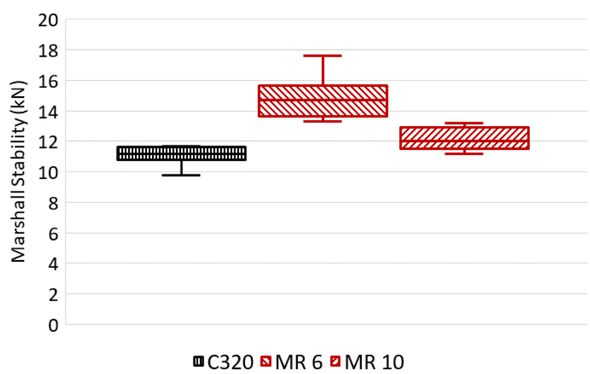
## Methods of Evaluation

The same aggregate sources and mix designs were used to produce samples of nominally identical asphalt, except for the inclusion of conventional (unmodified) or MacRebur modified binder. Multiple sub-samples were tested for Marshall Stability and Marshall Flow and the replicate results were compared using simple statistical methods.

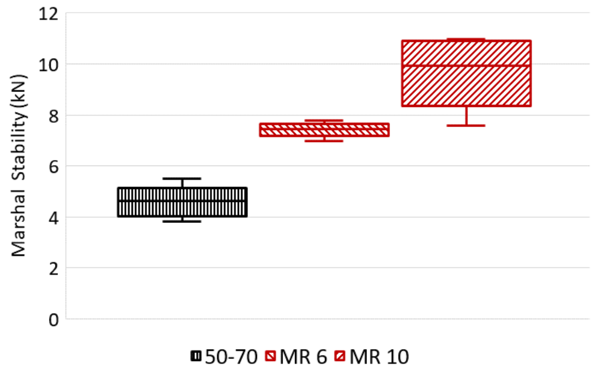
## Effect of MacRebur on Stability

MacRebur MR 6 and MR 10 significantly increased the Marshall Stability of asphalt mixes, compared to otherwise nominally identical unmodified (penetration or viscosity grade) bitumens.

In Australia 6% of MR 6 and 6% of MR 10 increased the Stability from approximately 11 kN to 15 kN and 12 kN, respectively, compared to C320 (similar to 50-70 penetration grade). The asphalt was a typical 14 mm dense graded mix for road surfacing and six replicates were tested




Similarly, in the UK, six replicates of a 10 mm sized dense graded mix for road surfacing was evaluated. The Stability increased from approximately 5 kN to around 7 kN and 10 kN, for the MR 6 and MR 10 modified mixes.




## Effect of MacRebur on Flow

The same studies also compared the Marshall Flow values. For both the Australian 14 mm dense graded mix and the British 10 mm dense graded mix, the Flow values were not significantly different for either of the MacRebur modified products, all with averages around 3 mm to 4 mm, which are typical values for common dense graded road asphalt mixes.