



# rapfix<sup>®</sup>

## rejuvenators

# Sustainable recycling with enhanced performance



The Rapfix<sup>®</sup> family of rejuvenators are premium quality additives specifically designed to restore the properties of Reclaimed Asphalt Pavement (RAP) binder and enhance the performance of asphalt. They allow maximum use of the highway asset and facilitate its recycling back into high quality materials.

### rapfix<sup>®</sup>

A versatile rejuvenating additive for recycling and treatment of RAP.

### rapfix<sup>®</sup> HF

A bespoke, high flash point additive designed for high RAP content hot-mix asphalts.

#### Flexibility:

Rapfix<sup>®</sup> rejuvenators can be used in many different applications and are formulated to restore aged RAP binder back to its original properties and performance. They help make high RAP content asphalt mixes more workable, easier to compact and result in more durable pavements.

#### ✓ Rapfix<sup>®</sup> enhances the properties of aged RAP binder:

- Aids the redistribution of RAP binder throughout the hot mix asphalt.
- Improves binder flexibility.
- Lowers binder stiffness.
- Improves fatigue resistance.
- Rejuvenated binder meets RTFOT requirements specified in EN 12591 for Paving Grade Bitumen.
- Restores self-healing properties.

#### ✓ Rapfix<sup>®</sup> produces durable, long lasting asphalts:

- Improves workability and compaction.
- Lower void content, more durable materials.
- Aids hand working.
- Improves the materials resistance to ageing.
- Built in moisture resistance as standard.
- Enhanced crack resistance
- Longer fatigue life.

## Features & Benefits

### ✓ Convenient

- Easy to pump, even at low temperatures.
- Add anywhere in the recycling or asphalt production process.
- Suitable for mobile plants/recycling or fixed asphalt plants.

### ✓ Safe

- High Flash Point.
- Not labelled.
- Rejuvenated asphalt can be recycled.

### ✓ Economical

- Low dosage required.
- Maintains performance at high mixing temperatures.
- No heating needed for additive handling.
- Lower mixing temperatures may be used.
- Can be used in 100% RAP processes.



### ✓ Availability

- 1,000 litre IBC's / totes.
- Steel 200 litre drums
- Bulk by road tanker.

### ✓ Storage

- Shelf life is minimum 2 years.
- Store in clean bulk storage tanks, heating is not required.

### ✓ Quality

- Manufactured in the U.K. in an ISO 9001 accredited facility.
- Produced to established Macismo Product Specifications.

### ✓ Health, safety & the environment

- Always use in accordance with the relevant Safety Data Sheet.
- Macismo is committed to the use of sustainable materials.

# Bespoke additives for asphalt producers

## Cost effective

Rapfix® rejuvenators are a cost-effective solution for asphalt producers looking to maximise the use of RAP. They are low viscosity and easy to handle meaning wastage is eliminated.

Rapfix® rejuvenators functionality ensures that 100% of the RAP binder is made active and utilised in the finished asphalt resulting in reduced virgin bitumen demand.

Gives users flexibility for bespoke dosages to match the recycling conditions and so there is no quality give away.

Low Rapfix® dosage is required for high performance materials.

Typical dosage of Rapfix® in the finished asphalt batch is approximately 0.2 – 1.5%.

Actual Rapfix® dosage will be determined by:

- % RAP in the mix.
- RAP binder quality.
- Virgin binder grade available.
- Local plant behaviour.

Precise dosage should be determined by the end user with local materials; however, Macismo International's technical department can offer guidance.



## Rapfix® development

Macismo International Ltd. has developed Rapfix rejuvenators in-conjunction with recognised institutions and Universities across Europe.

Development work focused on proving the end performance of the asphalt by utilisation of recognised European and U.S. procedures.

## Quality

Rapfix® products are manufactured in ISO 9001 accredited facilities to recognised Quality Control protocols.

Rapfix® products are supplied to established specifications.



## Typical properties

Rapfix® products are brown / dark brown free-flowing liquids, pumpable down to -20°C.

Property	Rapfix®	Rapfix® HF
Flash Point	145°C	210°C
Dynamic Viscosity @ 25°C	51 cP	62 cP
Density @ 25°C	0.870	0.880

Values shown are typical and not part of any Specification.

## Binder rheology and ageing

In order to investigate the rheological effect of Rapfix® additives on mixtures containing RAP, testing was initiated to show binder rheology at various states of ageing.

Asphalt mixtures containing 40% RAP and Rapfix® HF additive were subjected to Short-Term Ageing (STA) and Long-Term Ageing (LTA) to AASHTO R30 protocols. This was compared to virgin materials as well as 40% RAP materials with no additive.

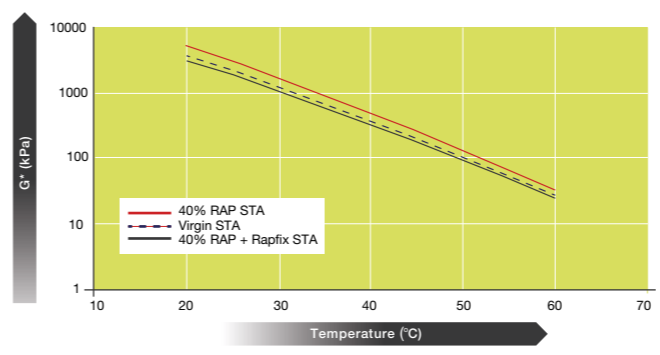
Binder was recovered from these materials (EN 12697-3) and tested by Dynamic Shear Rheometer to establish its rheological behaviour.

## Controlling binder rheology

Rapfix® additives can improve the stiffness profile of aged RAP binder so it performs similar to virgin materials.

Graph shows binder stiffness between 20-60°C, it demonstrates that STA RAP binder incorporating Rapfix has:

- High temperature stiffness similar to Virgin materials (STA), demonstrating resistance to deformation.
- Low temperature stiffness that is lower than Virgin materials (STA) demonstrating greater flexibility and longer fatigue life.



Rheological data of Short Term Aged (STA) samples

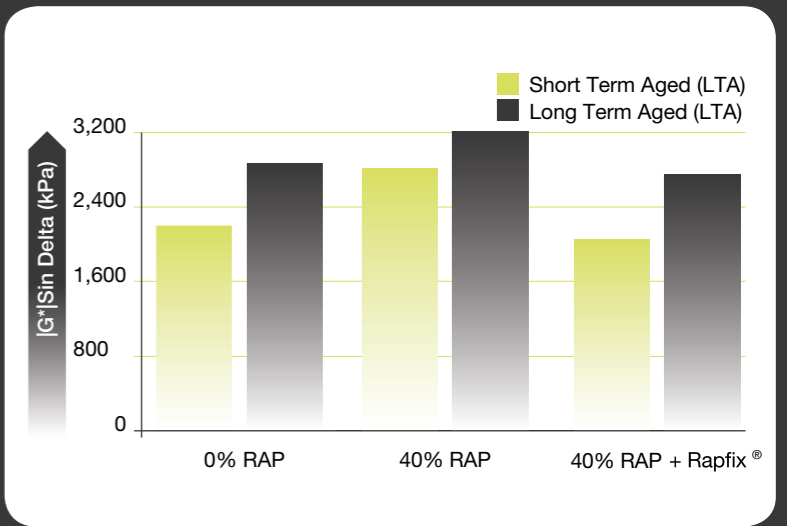
# Rejuvenated binder rheology

## Anti-ageing additives

Rapfix® provides asphalt producers with assurance that ageing will be controlled by managing the binder rheology and in-service behaviour.

Recovered binder from LTA samples was recovered and tested to the AASHTO TP5 Binder Fatigue Parameter  $|G^*| \sin \Delta @ 20^\circ\text{C}$ . This was done to demonstrate that Rapfix®HF additive could provide long term performance in materials with significant RAP contents.

Graph shows  $|G^*| \sin \Delta @ 20^\circ\text{C}$  Binder Fatigue Parameter. Rapfix®HF significantly reduces the binder fatigue susceptibility. Aged binder stiffness is reduced to the same degree as virgin materials or better.



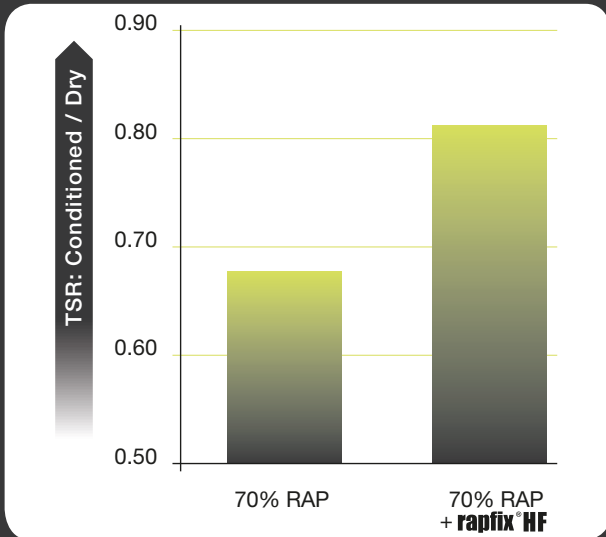
Binder Fatigue Parameter of recovered binders



## Improved moisture resistance

Rapfix® rejuvenators impart enhanced resistance to moisture as standard into asphalt mixtures. Their unique formulation ensures that asphalt made with any type of RAP material exhibits superior adhesivity to the rejuvenated bitumen.

Graph shows indirect tensile strength ratio of soaked specimens / dry specimens. Asphalt containing Rapfix® exhibits +20% boost in moisture resistance.



**EN 12697-12; Water Sensitivity AC 16 binder course containing 70% RAP.**

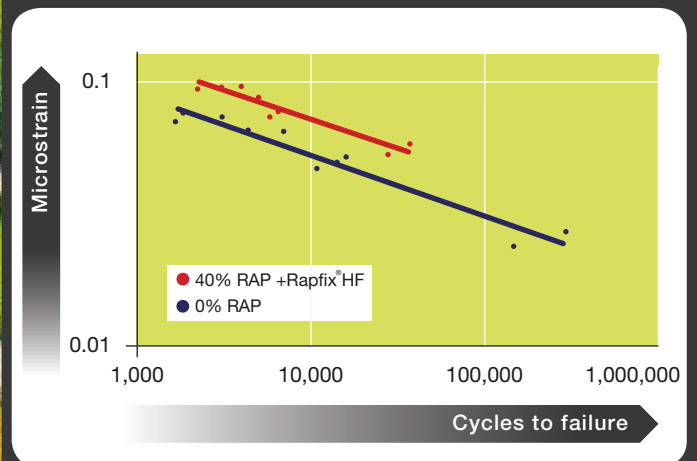
## Focussed performance



## Long term solution

To demonstrate that asphalts containing Rapfix® could outperform virgin materials, Indirect Tensile Fatigue Testing was undertaken (BS DD ABF).

Graph shows that asphalt containing 40% RAP and Rapfix® additive has a fatigue life that is twice that of the same asphalt using just virgin materials.



**BS DD ABF Fatigue of AC 16 binder course.**

**macismo**  
asphalt innovations

Macismo International Limited, Blackpole Business Centre, Blackpole Road, Worcester, WR3 8SQ

+44 1905 454993 • [info@macismo.com](mailto:info@macismo.com) • [www.macismo.com](http://www.macismo.com)

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