



Binder Excellence...

New Crumb Rubber Technology

Bitumen Rubber History

Tosas introduced Bitumen Rubber in the mid 1980's. Tosas' Arm-R-Shield has been used for more than 30 years in Southern Africa. Bitumen rubber is the most durable of modified bitumen products available to engineers.

Bitumen rubber is best known for its crack reflection prevention properties. Using bitumen rubber, means less maintenance interventions are required to keep roads in a good condition.

Although the input cost is higher, the life cycle cost is reduced by using Bitumen Rubber. Bitumen Rubber, due to its high viscosity, is handled at approximately 195-200°C. It is suitable for use in both asphalt and seal applications. In Gauteng the largest amount of bitumen rubber was used in during the Gauteng Freeway Improvement Projects from 2009 to 2011. Typically Winter Grade versions were

traditionally used by JRA, Tshwane and Ekurhuleni for the maintenance of the urban streets.

Good experience with Bitumen Rubber Grit Seals provided excellent alternatives for re-graveling in Roodepoort. The construction work done on various sites in the late 1990's are still performing well despite the ever-increasing traffic due to the urbanization in the West Rand.

Introduction of New Crumb Rubber Technology

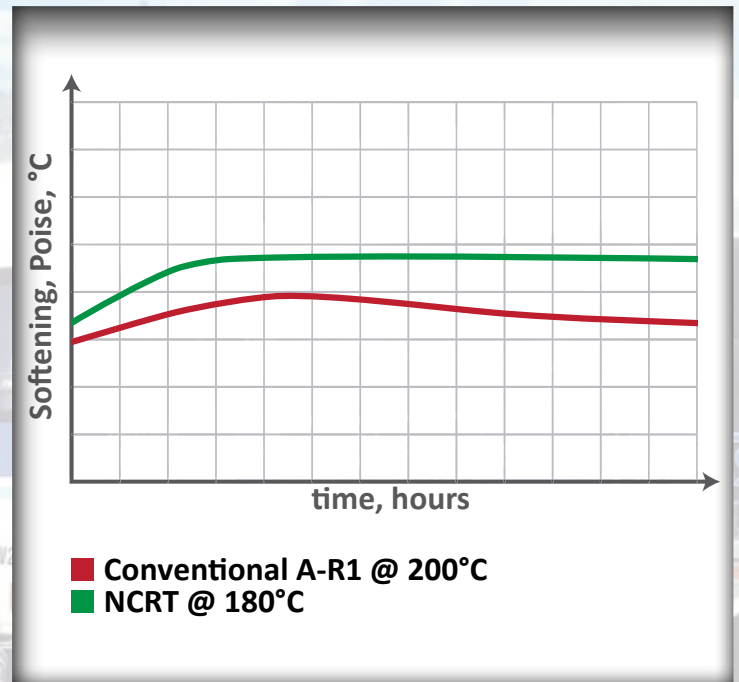
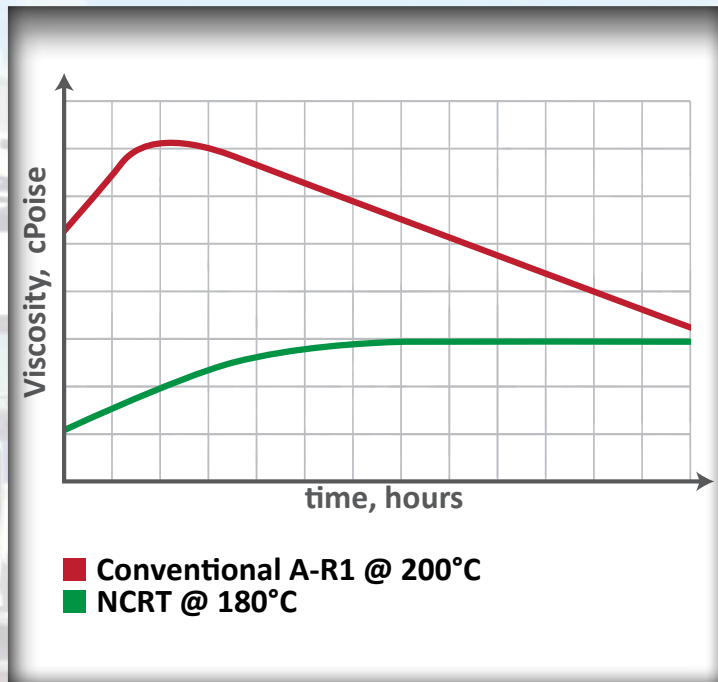
The limited shelf-life of conventional bitumen rubber due to high temperatures at which the product is handled and applied made bitumen rubber a difficult product to use in both asphalt and seal applications. With the development of the New Crumb Rubber Technology these limitations have been eliminated and it makes the bitumen rubber concept more user-friendly and less risky.

Asphalt Experiences with NCRT since 2012

1. First plant trial with NCRT- 22 March 2012
 - Much Asphalt partnered with Tosas to pave a plant trial
 - Location: Much Asphalt - Roodepoort plant
 - Mix type Bitumen Rubber Asphalt Semi Open (BRASO)
 - Comparative plant trial evaluated NCRT relative to Conventional Bitumen Rubber
2. Observations:
 - Improved shelf-life confirmed
 - Identical performance observed
 - NCRT allowed ~30°C reduction in asphalt mix temperature
 - Reduced volatiles organic components (VOC's) clearly observed at lower mixing and paving temperatures
3. Second trial with NCRT - 28 November 2012
 - BRASO with NCRT showed ease of compaction
 - Wider compaction window at lower temperatures



New Crumbed Rubber Technology vs. Conventional Bitumen Rubber



IMPROVED DURABILITY DUE TO REDUCED AGEING IS EXPECTED WITH NCRT

Lower production, mixing and paving temperatures protect bitumen from unnecessary ageing.

Better durability due to reduced ageing is expected.

If bitumen rubber has been performing well, NCRT will perform better.

Improved flexibility due to improved shelf-life makes NCRT a much more user-friendly.

Time dependence of the bitumen rubber product properties is no longer an issue:

Once NCRT is reacted, physical properties remain constant and the risk to everyone reduced.



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Relative Differences in Asphalt Applications

CONVENTIONAL BITUMEN RUBBER

Binder Manufacturing Temperature

200 °C

Asphalt Mixing Temperature

175-180 °C

Asphalt Paving Temperature

135 °C Minimum

Shelf-life

**4-8 hours @ 190-200 °C
(12-15 hours)**

NEW CRUMB RUBBER TECHNOLOGY

Binder Manufacturing Temperature

180 °C

Asphalt Mixing Temperature

140-150 °C

Asphalt Paving Temperature

100 °C Minimum

Shelf-life

7 days @ 150 °C

NCRT is a much more environmentally-friendly, more durable and user friendly alternative to conventional bitumen rubber.



NCRT Sprayed Seal Applications 2014

- Bloemfontein City wanted bitumen rubber seal on aged and cracked road
- Establishment was too expensive for limited volume required
- NCRT blended in Wadeville
- Sprayed over three days in Bloemfontein
- Subsequently more roads like Curie Avenue sealed with NCRT

NCRT Experiences To Date

New Crumbed Rubber Technology developed achieved improvement objectives:

- Reduced production temperature
- Reduced viscosity only possible with warm mix additive
- Warm mix additive increases the softening point

- Warm mix additive improves compactibility
- Warm mix additive provides better rut resistance
- Improved shelf-life
- Reduced odour and VOC's