CUSTOMER CONNECT

Better Roads, Better Life

Hindustan Colas Private Limited

Quarterly News Letter

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“CUSTOMER CONNECT”

The Quarterly Newsletter of Hindustan Colas Private Limited aims at strengthening exchange of information and experience sharing amongst its customers. The success of this communiqué is largely dependent on feedback and information inflow from our customers and we thank them for their continued support.

The aim of the Superpave Performance Grading system and asphalt binder specifications is to ensure acceptable performance of flexible asphalt pavements in three distinct temperature or seasonal regimes, each associated with a different distress. The assurance of acceptable performance comes with the following requirements:

- The asphalt binder must be part of a valid asphalt-aggregate mixture design.
- The HMA layer must be configured in a valid pavement structural design.
- The pavement must be constructed without any deficiencies

In order to assure performance of pavements, specific grade of bitumen needs to be used in the project location. Based on the current specifications, bitumen is selected on the results of tests run under set conditions. Many of the tests used in the paving industry are only empirical in nature. The volume of traffic and more importantly the traffic loads have been increasing on highways. The use of old empirical tests cannot effectively evaluate the new materials such as polymer-modified bitumen that is increasingly being used to construct our roads. Recent development in the performance grading system will provide us adequate information in selecting the most cost-effective bitumen to maintain the highway system. Multi Stress Creep Recovery and specification are improvements to the Performance Graded system that will allow for better characterization of the high temperature performance related properties of the bitumen.

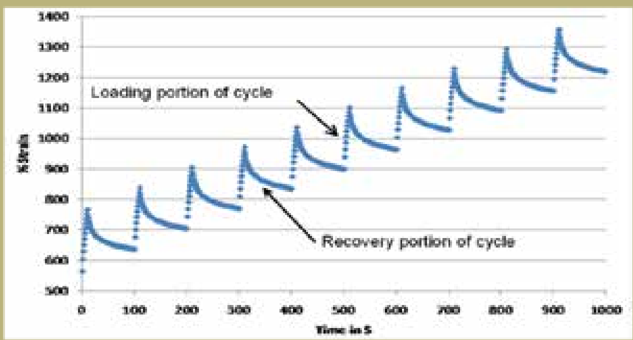
One of the objectives in the development of the superpave binder specification was the use of performance-related criteria specific for a distress and related to climate and traffic loading. This implies that the test measurements should be made at temperatures and loading rates consistent with conditions existing in the pavement. Based on this, the high temperature criteria stays the same for $G^*/\sin\delta$ (1.00 kPa for unaged and 2.2 kPa for RTFO-aged binder) regardless of the location of the pavement, but the test temperature where this criteria must be met is derived from the actual pavement temperature.

While this concept worked well for conventional speed, moderate traffic volume pavements, it needed some refinement for pavements that had slow speed loading and high traffic volumes. Rather than change criteria and/or test conditions to reflect a change in loading time and traffic volume, the architects of the PG system elected to simply adjust for traffic speed and volume by “grade-bumping” or testing at higher temperatures than indicated by the climate. So, for a standard traffic asphalt pavement the designer might use PG 64-22 bitumen, but a high volume highway pavement might require PG 76-22 bitumen – even though the pavement temperature will likely never get above 64°C. This was simply to ensure that stiffer bitumen would be used in high volume and/or slow loading conditions. One problem with grade bumping in the PG system was that PG 76-22 bitumen would have its performance-related properties determined at a temperature that would be at least 12°C hotter than the highest pavement temperature that would be experienced. Such high specified testing temperatures in some instances will enable us to manufacture binders that are very highly modified and thus difficult to use at reasonable temperatures.

Another objective of the PG system was that the performance-related properties that defined the performance grade of bitumen would be blind to modification. In other words, all binders of the same performance grade would be expected to perform the same in the same traffic/environmental conditions regardless of how they were produced. While the $G^*/\sin\delta$ parameter did capture viscous and elastic effects, it was unable to adequately capture the benefits of elastomeric modification because of the relatively small impact of the phase angle (δ) on the overall value of $G^*/\sin\delta$. As a result, the additional test, Multi Stress Creep Recovery (MSCR) test came into existence.

MSCR test and specification:

The MSCR test uses well-established creep and recovery test concept to evaluate the binder’s potential for permanent deformation. Using Dynamic Shear Rheometer (DSR), a one-second creep load is applied to the asphalt binder sample. After the 1-second load is removed, the sample is allowed to recover for 9 seconds. Figure 1



The material response in the MSCR test is significantly different that the response in the PG test. In the PG system, the high temperature parameter G*/Sin δ, is measured by applying an oscillating load to the binder at very low strain. Due to the low strain level, the PG high temperature parameter doesn't accurately represent the ability of polymer binders to resist rutting. Under the very low levels of stress and strain present in dynamic modulus testing, the polymer network is never really activated. In the PG specification the polymer is really only measured as a filler that stiffens the asphalt. In the MSCR test, higher levels of stress and strain are applied to the binder, better representing what occurs in an actual pavement. By using higher levels of stress and strain in the MSCR test, the response of the asphalt binder captures not only the stiffening effects of the polymer, but also the delayed elastic effects (where the binder behaves like a rubber band).

Advantages / Improvements in MSCR:

- Jnr is better correlated with rutting potential than G*/sin δ
- The MSCR test results from just the one test can be used with modified and unmodified bitumen, thereby eliminating the need for additional tests to properly characterize the high temperature performance of modified binders.
- There is now criteria to eliminate the binders that are overly stress sensitive, would previously have passed the PG criteria and potentially been susceptible to rutting in the field.
- MSCR Recovery is faster/easier to determine and does a better job of characterizing polymer modified binders.
- The MSCR test is conducted at the actual pavement temperature, regardless of traffic loading.

The biggest change in the specification is the naming of binder performance grades. All binders will have numerical grades based on the environment in which they are intended to be used. Following the numerical grade will be a letter designation that identifies the traffic loading (Volume and /or speed) where the binder is expected to perform.

Standard S Grade	Traffic < 3 million ESAL's
Heavy H Grade	Traffic > 3 million ESAL's
Very Heavy V Grade	Traffic > 10 million ESAL's
Extreme E grade	Traffic > 30 million ESAL's

The numerical grade tells user the temperature at which testing is conducted. The letter designation tells the user the criterion for judging if the bitumen meets the specification. An example of the new grade is PG 64-22S. Changes from AASHTO M320 Table 1 are as follows:

- Determination of the value of G*/sin δ RTFO aging is replaced by the determination of Jnr at 3.2 kPa shear stress using the MSCR test.
- A stress sensitivity calculation which determines the percent increase in Jnr as the stress level increases from 0.1 to 3.2 kPa is also required. The percent increase in Jnr at 3.2 kPa must be less than or equal to 75% of the Jnr at 0.1 kPa. The requirement to keep the percent increase in Jnr below 75% is to insure that the binder will not be overly stress sensitive to unexpected heavy loads or unusually high temperatures.
- Determination of the value of G*/sin δ after Pressure Aging Vessel (PAV) aging remains the same but the criterion changes to a maximum value of 6000 kPa for any letter grade designation other than "S".

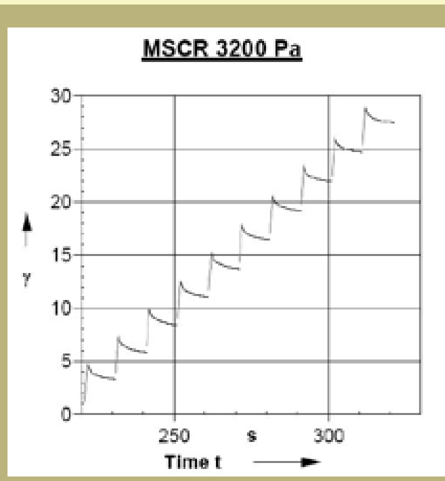
The following table shows the minimum % recovery values from the MSCR test for ranges of Jnr values to evaluate for delayed elastic response.

Jnr @ 3.2 kPa	Minimum % Recovery
2.0 - 1.01	30%
1.0 – 0.51	35%
0.5 – 0.251	45%
0.25 – 0.125	50%

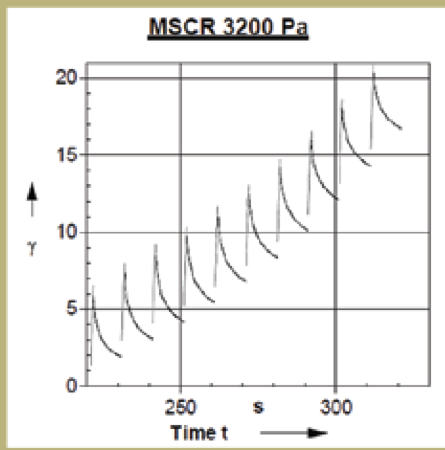
MSCR test results Hincol Product Grades:
MSCR test was performed on our PMB40, RW4560, CRMB60 and VG40 sample and it is evident that modified bitumen has the ability to sustain under high traffic and high temperature conditions.

The following table shows the results obtained on Hincol bitumen grades from MSCR test at 64°C on RTFOT aged binder.

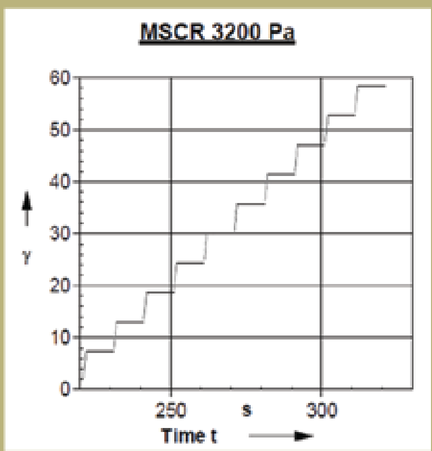
The values mentioned are for the regularly supplied bitumen. However, based on the requirements of the customer, Hincol shall be able to provide guidance and manufacture on what binder is best suited for the project region's climate and traffic conditions.



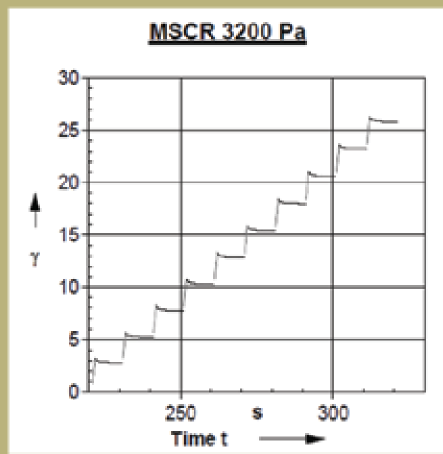
PMB 40



RW4560



Bitumen VG40



CRMB 60

We look forward to enhanced contribution from our customers to further enrich this newsletter. We also welcome suggestions, recommendations and critics that will help us serve you better. You may send your feedback and contributions to us at: **customerconnect@hincol.com** or visit **www.hincol.com**

Alternatively, you may also post us information at:

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