

Resperion's IntegraBase asphalt modifier makes it possible to improve lower-performing performance-graded asphalt binders to the point where they can meet stringent PG specifications for Superpave mixes. Not only can IntegraBase improve the PG specifications, but it also improves the resilient modulus and fatigue resistance of the asphalt, further improving rut resistance and flexibility for base and binder courses.

## Historical Asphalt Grading

Asphalt cements have historically been graded by two empirical tests; penetration and viscosity. These tests were developed over time using experiences with asphalt pavements. These tests attempt to repeat past successes, and avoid past failures. Empirical tests work as long as all of the conditions at the time of the test development remain unchanged.

Unfortunately, this is not true of our asphalt pavements today. Penetration and viscosity tests were developed in an era of less traffic and significantly lower pavement loadings. Trucks of yesteryear were limited to 72,000 lb. and rode on bias ply tires with tire pressures of 75 psi. Today, truck weights exceed 80,000 lb and radial tires are inflated to 125 psi. A 10% increase in truck weight results in a 40% increase in stresses applied to the pavement. These factors, along with the numbers of heavy trucks traveling roads across the globe, subject asphalt pavements to stresses, which result in rutting and premature failure.

## Superpave Performance Grading (PG) System

The Superpave PG system was developed as part of the Superpave research effort to more accurately and fully characterize asphalt binders for use in HMA pavements. The PG system is based on the idea that an HMA asphalt binder's properties should be related to the conditions under which it is used. For asphalt binders, this involves expected climatic conditions as well as aging considerations. Therefore, the PG system uses a common battery of tests (as the older penetration and viscosity grading systems do) but specifies that a particular asphalt binder must pass these tests at specific temperatures that are dependant upon the specific climatic conditions in the area of intended use.

Superpave performance grading is reported using two numbers – the first being the average seven-day maximum pavement temperature (in °C) and the second being the minimum pavement design temperature likely to be experienced (in °C). Thus, a PG 58-22 is intended for use where the average seven-day maximum pavement temperature is 58°C and the expected minimum pavement temperature is -22°C. Notice that these numbers are pavement temperatures and not air temperatures.

## The IntegraBase Effect

It is the aim of every asphalt formulator to be able to take the most economic source of asphalt and enhance the high temperature properties and comply with low temperature requirements in fulfilling PG targets. IntegraBase makes the achievement of this objective a reality while providing for additional technical benefits at a minimal cost.

The following table illustrates that blending IntegraBase with asphalt binder can result in a two to three grade improvement in the upper and lower temperature performance, although these results may vary based on the properties of the asphalt binder used. The unmodified asphalt binder used in this test was an Egyptian 60/70 pen:

	Unmodified	IntegraBase Modified
Actual PG Grade	58-04	75-16
PG Classification	58-04	70-16



**IntegraBase Modified PG**

# IntegraBase Modified PG

IntegraBase also provides for a large increase in Resilient Modulus and fatigue life - in most cases, IntegraBase will improve the Resilient Modulus by 100% and the fatigue life by 50%. With this additional pavement strength generated through the use of the IntegraBase modifier, it is possible to reduce the maximum strains which develop in the pavement due to wheel-loads. This translates into a superior-performing pavement that will be resistant to both pavement deformation and pavement cracking.

Additionally, the improved pavement strength and elasticity will increase the number of standard axle loads which can be carried by the IntegraBase modified pavement throughout its useful lifetime; this can result in substantial life-cycle savings in terms of pavement longevity and decreased maintenance.

## Polymer Modified PG vs. IntegraBase Modified PG

Polymer modification, which is a commonly used system to change the properties of asphalt binders, can increase the cost of the binder anywhere from 30% to over 100%. This increase can make a significant impact on the cost of the hot mix asphalt (HMA,) typically raising the price 25% to over 50%. Because of the large increase in cost, the use of Polymer Modified asphalt is limited to use as a wear course modifier in high stress or extreme climate applications. The use of Polymers in base/binder applications wouldn't be cost effective, nor could it match the benefits of IntegraBase from Resperion. The following table summarizes up how Polymer Modified PG compares to IntegraBase modified PG:

	Polymer Modified PG	IntegraBase Modified PG
<b>Price</b>	Very expensive – can increase costs as much as 100% depending on concentration and polymer.	Quite inexpensive – under 10% increase in cost. Cost can be offset by thickness reduction of base/binder course.
<b>Dosing &amp; Mixing</b>	Polymers are very sticky, which make them difficult to pump and can lead to clogged valves and messy equipment. Polymers also require higher mixing temperatures which increase costs and raise environmental issues.	IntegraBase's low-viscosity makes it easy to add via the asphalt feed line without any sticky mess. IntegraBase can be blended at lower temps, decreasing production expenses.
<b>Hauling</b>	PMA (Polymer Modified Asphalt) will stick to truck beds if no release agents are used. Tarps must also be used so the PMA does not cool off and the mixture doesn't dry out.	The same hauling procedures for unmodified asphalt can be used with IntegraBase modified asphalt. Release agents are not needed, nor are tarps, unless weather dictates to do so.
<b>Laydown &amp; Compaction</b>	Laydown and compaction can be very difficult due to the sticky characteristics of PMA. There are strict minimum temperatures that must be met for: PMA delivery, surface temperature, and the paver screed; any deviation will result in compaction problems and PMA sticking to construction equipment.	In spite of the higher strength of the IntegraBase modified mix, the workability of the material in terms of compactability and obtaining optimum density is superior to that of PMA and even unmodified mixes due to the lubricating effects of IntegraBase.

Not only is IntegraBase cost effective, increasing the cost of a typical mix by less than 10%, rational pavement design techniques confirm that base and binder course layers constructed with IntegraBase can be reduced in thickness by up to 40%, while achieving an equal or greater number of equivalent standard axle loads (ESAL's) as conventional materials. Since the cost of the materials saved exceeds the cost of the MMC by a wide margin, Resperion enables you to build the same road for less money.

## About IntegraBase

Resperion's IntegraBase is a multi-metallic catalyst (MMC) in asphalt soluble form. When mixed with asphalt cement and aggregates, this catalyst initiates a series of chemical reactions which ultimately cross link the asphalt molecules and consume the catalyst; this reaction creates an Organic Metallic Complex, the strongest bond in all of Chemistry. The new higher-molecular-weight materials created are extremely resistant to heat and heavy loads. They also exhibit superior water resistance and anti-stripping properties. Hence, when using the Resperion modifier, other common additives such as rubber, lime and anti-stripping agents may not be required as the benefits of those additives have already been provided. IntegraBase has been specifically formulated to ensure that all of the increase in performance properties is achieved by the time the road surface is ready for use.

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