

Resperion Frequently Asked Questions



IntegraBase – Frequently Asked Questions; History, Testing, Mix & Pavement Design, Implementation and Performance

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History

How long has this product been in existence?

Chemcrete was invented in 1977, and was immediately put into testing in several countries. Chemcrete was patented in the United States, as well as over 30 other countries. Large scale testing in Europe began in 1979 by a number of national road research authorities. Lab and field tests were carried out in the UK by Tarmac Roadstone Limited. The Danish Road Directorate carried out tests, followed by the Autostrade in Italy. The first 2 years were spent in conducting extensive lab testing and evaluation followed by another two years of road surface trials. The outcome of these rigorous tests and trials produced commendable results and led to governmental approvals and acceptance of the Chemcrete technology in the UK, Italy and Denmark, in which over 200 Chemcrete implementations were carried out.

Is this product same as Chemcrete?

IntegraBase is the successor product to Chemcrete and is basically the same. Resperion has made some minor modifications to the formulation to improve certain performance metrics such as blending optimization and cure time reductions. The name of the company was changed to Resperion when the Company was acquired by its new management.

We have heard that there were cases of Chemcrete not working?

When Chemcrete was first introduced to the market in the 1970's, it was originally used in both wearing courses and in base/binder courses. In some of the wearing course implementations, there were cases where cracking took place. It was soon discovered that since the Chemcrete reaction was dependent on Oxygen, the wearcourse was continuing to react as it was exposed to oxygen. Since the wearcourse was less than 4 Inches (which is now the minimum thickness of a basecourse for IntegraBase,) it became too strong and cracked. As soon as this was discovered, Chemcrete was never used in another wear course. To date, there has never been a problem with an IntegraBase or Chemcrete modified base/binder course.

Where has Chemcrete/IntegraBase been used around the world?

This technology has been used in over 100 projects in countries all over the world. Here are just some of the countries that have used Chemcrete/IntegraBase:

1. North America
 - Kansas, Luisiana, Colorado, California, Texas, Iowa
2. Europe
 - Denmark, Germany, Italy, Turkey, UK, Poland, Russia
3. Asia Pacific
 - Indonesia, Thailand, Philippines, Malaysia, China
4. Middle East/Africa
 - Saudi Arabia, Afghanistan
5. South America
 - Argentina, Mexico

Testing

Are there any tricks to preparing a good modified mix sample, or steps that are imperative to obtaining a good reaction – mixing, curing, etc.?

The modifier should be put into the kettle first, and then the bitumen should be added and then blended. This can cut down on blending time. The most important single step is mixing – “if they don't meet, they don't mate.” Since we are a catalyst, it is imperative that our product be well dispersed throughout the bitumen. It is also important that the temperatures and time limits in the testing instructions are met, to ensure the proper catalytic reaction.

Are there any tests that IntegraBase shouldn't be subjected to?

Accelerated aging tests are not recommended by Resperion because our catalytic reaction is dependent on temperature and oxygen exposure. Any overexposure to high temps and oxygen will continue to drive the reaction of IntegraBase and will have negative results. IntegraBase would never be subject to conditions as those presented in the test, so the test isn't a realistic determination of aging for our product. We also usually suggest to stick with Forced ductility tests, as force is included and it is a more realistic test for a product that increases modulus as we do.

Are there any "controls" that we should not test with such as bitumens, temperatures, aggregates, additives, etc.?

No

What are some Specific IntegraBase tests and their expectations?

Resilient Modulus

- Expect a doubling at 40 deg. C at a lower rate of loading – tripling is not out of the question.

Marshall Stability

- Typically a 25-30% increase

Indirect tensile Strength

- Tensile strength at higher temps usually doubles

Wheel Tracking

- 40 Deg C, half of the depth of the track of the control

Stripping

- We are always better with wet strength. IntegraBase tends to lose a higher percentage after soaking (retained strength ratio), but looking at it relatively, IntegraBase still has a higher wet strength both before and after soaking when compared with an unmodified sample.

Are there certain aggregates or bitumens to be cautious about?

Hydrophilic aggregates should be looked at carefully, as they would be with any unmodified mix. Paraffinic asphalts can be very difficult to work with. These types of asphalts will crystallize at low temperatures – this can be worse than cracking. Again, the same can be said for unmodified mixes.

How much product is required for a full battery of tests?

16oz

What if I don't have a high shear blender to mix the bitumen and IntegraBase?

That is ok, it is just important that the IntegraBase is thoroughly mixed with the bitumen. We have had labs use something as simple as a household blender to mix the liquids together.

Are there any parameters that must be met for a successful road test – i.e. length, width, depth, etc.?

At least one kilometer in length. Stop/start testing can be very difficult to achieve good results for modified asphalts - continuous production is better. Thickness minimum of 10cm. Width doesn't matter.

Mix Design

Can IntegraBase be used with any bitumen?

Yes. The amount of IntegraBase reaction is dependent on the origin of the bitumen. The reaction of IntegraBase with different bitumens is fairly constant – the main difference being the quantity of catalyst required to drive the reaction. The apparent difference is the quantity of catalyst lost in other secondary

reactions; this is the sole reason that it is recommended that at least 2% modifier by weight of bitumen be used. The variable which determines how reactive IntegraBase is with the asphalt is the percentage of tetralin structures contained in the asphalt. All asphalts have tetralin structures, but to varying quantities. The more tetralin in the asphalt, the better the reaction. Napthenic and aromatic asphalts tend to have the highest quantities of tetralin structures – these asphalts are commonly found in the middle east and Venezuela regions. China and Russia tend to have asphalts with the lowest percentage of tetralin structures.

Are there any types of bitumen to avoid?

Parrafinic asphalts can be difficult to work with, regardless of if they are being modified or not. These asphalts can crystallize at cold temperatures causing premature cracking. These types of asphalts are typically found in China, Indonesia and Russia.

Does the 2% of IntegraBase replace 2% of the bitumen, or can it be added on top of the original mix design?

IntegraBase can be added on top, but it doesn't have to be. Since IntegraBase is an oil based product, it can replace 2% of the bitumen without sacrificing any integrity of the bitumen.

What is the optimal void content for an IntegraBase mix – and what are the minimum and maximum percentages?

IntegraBase the same problems that normal mixtures have – below 3% you no have a mastic mixture, as it will consolidate under traffic. Approx 3-7% is ideal.

What is the optimal binder content, and what are the minimum and maximum percentages for an IntegraBase mix?

Same as an untreated mix.

What are the tolerable percentages of IntegraBase, and what can happen on the low and high end?

The majority of the IntegraBase reaction will be achieved from 2%. Lower percentages will work better with some bitumens, but on average, 2% is most suitable for all. There are no problems with using more than 2%, however there will be no benefits, and would just result in a waste of product.

What are the most optimal aggregates to use?

Granite is preferable. Acidic and hydrophilic are the most concerning, as with any mix design. IntegraBase doesn't make any aggregates less suitable. Gradation isn't as important when IntegraBase is being used. Uncrushed, single sized materials are usable with IntegraBase.

Are there any aggregates that IntegraBase doesn't work with?

None other than ones that wouldn't be suitable for untreated asphalt

Are there any special requirements for the use of certain aggregates with IntegraBase – i.e. washing, treating, etc.?

None other than normal practice. Dusting is always important.

Has IntegraBase ever been used with any other additives?

IntegraBase has been used with an SBS in Europe – IntegraBase doesn't affect polymers. PDM from BP has also been used before. Lime has been used for anti-stripping purposes.

Can IntegraBase improve recycled mix (RAP) added to the mix?

It must be a very small percentage of RAP (less than 50%), otherwise you lose the necessary chemistry. We will be ineffective commensurate with the percentage of RAP (i.e. we will be probably be about 15% less than our optimum effect with 15% RAP.)

Pavement Design

Can IntegraBase be used in the wear course?

IntegraBase is only suitable for use in sublayers of pavement structures – base courses and binder courses, and should NEVER be used in wearing courses. Since oxygen is a catalyst in the IntegraBase modification reaction, the use in the wearing course can cause the reaction progress over time, which can lead to premature strengthening of the mix. When IntegraBase is sealed in a sublayer, the reaction will subside with maximum performance improvements in place.

What characteristics of a wear course are important when using an IntegraBase sub layer?

Flexibility. We typically advise using a thin wear course, as we don't want it to be a load carrying member; friction and drainage are the most important thing, to basically serve as a good cover.

Are there any wear courses that should be avoided when using IntegraBase?

No

What kind of sealant or overlay will guarantee sealing off IntegraBase from its catalytic reaction?

All overlays should provide significant protection from oxidation. 19mm of thin film overlay, and any type thickness of thick film should be sufficient.

What instances would it make sense to use an IntegraBase treated binder course?

The new soft base road, with a strong intermediate layer. Carl Monismith in California has been working with this design for a while. This can eliminate reflective cracking, and won't allow cracking to propagate up.

Are there any binder designs that wouldn't lend themselves to using IntegraBase?

No, Monismith's design is the only one currently in use.

Are there any specific requirements of the layers above or below the binder course?

No, it is a function of the base vs. the binder.

What is the minimum reduced thickness of an IntegraBase base course?

4 inches or 10cm

Are there situations where the use of IntegraBase in the base course isn't a good idea?

No, as long as you have 10cm there is no reason it couldn't be used.

What are the requirements for a sub base?

You want good wet strength, and to stay away from plastic soils. The higher the CBR the better off you are. Soil replacement isn't usually too expensive.

Are there any types of sub-bases that should be avoided, i.e. Rubblized PCC, etc.?

None other than plastic soils. Good rubblizing is important, as you don't want large pieces of concrete moving around under your asphalt.

How much moisture is tolerable in the sub base?

Over 7-7.5% water can be a problem. Even for non-plastic soils.

Implementation

Does the plant type matter – Batch vs. Drum?

No, as long as all directions are followed, the plant type bears no difference.

Are there any special requirements for the plant – computerized equipment, space, etc.?

Static mixers are quite helpful and inexpensive (\$1k). This doesn't affect their operation when IntegraBase isn't being used. Other than that, IntegraBase can be used at any plant, regardless of equipment or technology available.

What equipment is required to use IntegraBase at the plant?

A simple pump and meter system is required to dose and deliver the IntegraBase into the bitumen feed line. If temperatures are cold (typically 40 deg. F or less,) heating blankets are suggested to keep IntegraBase at an optimal viscosity for pumping. Resperion will typically provide all of this equipment, along with an engineer to set everything up.

What is the ideal temperature for IntegraBase to be pumped at?

100 deg. F – doesn't take a lot of effort to get it to 90-100. Acceptable range can be above 75 degrees. Anything lower will lead to burned out pumps, etc.

Is it necessary to have a back up pump or meter on hand, or any other equipment?

This is a must, because once a pump or meter is down, you will be unable to dose the product. Pumps are the most important as meters rarely fail. The pump and meter systems that Resperion provides always has a secondary pump in case the first one fails or burns out.

What is the ideal medium to pump IntegraBase from – tote, drum, custom container, etc.?

Drums can be difficult to handle, as they only hold 55galons. However, all work fine for pumping.

Can IntegraBase cause any problems to any of the equipment at the plant?

IntegraBase contains no fines to disrupt the valves or gauges at the plant, such as other modifiers. Our chemicals are very pure (HP- high purity), which don't create buildup on valves, etc.

What is the ideal temperature to mix at, and what are the issues with temps being too high or low?

135°-145°C. If IntegraBase is blended too hot, there could be some odor and light smoke from the light ends burning off. There are no deleterious side effects from the high temperatures though. The only issue with the low temperatures could be the mix losing too much temperature before compaction. IntegraBase improves the compactability of the mix, so the lower temperatures are not as important as they are with unmodified mix.

How long should IntegraBase treated asphalt be mixed for – are there issues with mixing too long or short?

Time is the same as normal mixing.

Is there an odor associated with the mixing of IntegraBase – if so, is there any way to circumvent it?

Above 150°C there can be an odor from some of the ingredients in the product burning off.

Once the IntegraBase mix has been manufactured, are there any options for storage? If so, what are the timelines?

Initially the penetration increases during mixing (asphalt is softer), but with time the asphalt will harden. You don't want to store the manufactured asphalt – it should be laid down the same day it is produced. Trucks can be tarped, float CO₂ between the asphalt and tarp to cut oxygen. Typically 30-40 minutes between mixing and laydown is the optimal cure time.

Are there any special techniques that need to be used during the compaction process?

No – everything is rolled and compacted as normal. Densities are easier to achieve with the IntegraBase modified asphalt as it acts as a lubricant to the mix.

Is there any machinery or tools that should be avoided when working with IntegraBase modified asphalt?

No, although it is important that pavers are used and all traditional methods are followed. Narrow placement areas can be difficult when HMA is placed by hand.

Are there any special requirements for the trucks that transport IntegraBase modified asphalt?

No, no release agents needed. Tarps can be recommended due to the cooler temp of the asphalt.

How long can IntegraBase modified asphalt be exposed to traffic before being surfaced?

It can be left unsealed 30-60 days without a cover, sometimes longer depending on the temperatures. The hotter the temps, the quicker you will want to place a wearing course. It is imperative that it is covered though, as sometimes seals or wearing course are not placed due to budgetary cuts or simply forgetting to do so.

Performance

Please explain in engineering terms how IntegraBase improves the road structure – stress, strain, etc. Please note if there are different explanations for use in binder or base course applications?

The two main reasons: changing the molecular weight of the asphalt, giving it the strength that it has. The aromatic platelets get crosslinked, linking the platelets vertically as well as the traditional horizontal link. This crosslinking eliminates the typical flow of asphalt. Base/binder course doesn't make a difference. When a load is put on a beam (the beam flexes), the top molecules push together, and the bottom molecules pull apart. This puts the top in compression and the bottom is in tension. This is the difference between cracking. If the binder is in compression, it can't crack. IntegraBase keeps the base/binder course in constant compression (or constant stress). It is important to try to put the tension deeper into the road into the basecourse, or better yet, into the subbase, then you can eliminate cracking.

How does IntegraBase modified asphalt hold up to extreme temperatures – both hot and cold?

Temperature swings in the basecourse are quite flat. IntegraBase flattens out the temperature susceptibility curve of asphalt, improving performance on both the high and low end. Freeze/thaw can be troublesome due to the water in the basecourse. The water expands at different temps to break up the asphalt (this is common with all asphalts, and IntegraBase modified asphalt would be better than untreated asphalt.)

Can humidity or dry air affect IntegraBase modified asphalt?

If sealed, the type of air is unaffected

How does IntegraBase modified asphalt perform in these different situations?

a. Constant heavy loads (truck routes)

- Rutting is a huge problem here, our modulus and higher viscosities provide the strength to overcome problems. Since it is shear susceptible, the slower the rate of loading, the higher the apparent viscosity, the less the asphalt will flow in the mix.

b. Repetitive wheel paths (bus lanes, ports)

- Same as above

c. Normal traffic (passenger cars, etc.)

- Light, fast traffic really causes no problems for asphalt. IntegraBase does help with fatigue, increasing the number of ESAL's a pavement can typically handle.

d. Stop and Go traffic (intersections)

- Pushing and shoving are a big problem here, the slow rate of loading is beneficial for our strength. Sliding plate viscometer test can measure shoving. Increased viscosities exponentially improve asphalt's shoving principles.