Rosphalt® R50 Installation Guidelines

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Rosphalt®

2018 01 02 R50 guidelines

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ROSPHALT 50 – INTRODUCTION

ROSPHALT® 50 is a super concentrated thermoplastic, polymeric plant mix dry additive, that when mixed with aggregate and liquid asphalt in a Hot-Mix Asphalt (HMA) Plant, per a predetermined Marshall or Superpave mix design, creates a waterproofing/wearing course, that is highly resistant to rutting and shoving. In addition, Rosphalt mixtures can be used in high stress sites where superior performance is necessary, such as ports, toll booths, industrial pavements, race tracks, airports and other sites with heavy vehicle loading. Rosphalt can be used in many applications/locations with use on different substrates, as follows:

Applications:
- Waterproof wearing course
- Rut and shove resistant pavements
- Road and Ramp Interlayer designs

Locations:
- Bridge Decks & Approaches
- Elevated Structures/Highways
- Airport Runways / Taxiways
- Toll Booth Areas
- Parking Garages
- Heavy Traffic Intersections
- Roadways / Ramps

Substrates:
- Concrete
- Asphalt
- Steel
- Composite
- Wood

Overview of Rosphalt Guidelines

These guidelines have been prepared as an aide to mix design preparation for Rosphalt 50 materials. This document references internationally recognized standards and publications, such as those developed by AASHTO, ASTM, Asphalt Institute and others as necessary.

This document is intended only as a guide, specific requirements will vary from region to region. Every attempt has been made to make this document as complete as possible, but it is recommended that designers consult with Chase's expert team to verify specific aspects of the design as necessary. The front page of this document provides necessary contact information for Chase Construction Products.

TEMPERATURE GUIDELINES

Temperature control of the Rosphalt mix is key to a successful installation process. These temperature parameters are given throughout this document, but for convenience are summarized as follows:

Atmospheric Paving Temperature substrate and ambient temps need to be **4ºC (40ºF)** and rising.

Finished Mix Temperature measured in the truck[*1]. This temperature needs to be between **210ºC to 232ºC (410ºF to 450ºF)**.

Mix Temperature at the job site measured in the hopper or at the auger of the paver. At the auger, all mixing has been done, and the material will have the best average temperature. The temperature range is between **177ºC (350ºF)** and the Finished Mix Temperature measured at the plant.

Compaction Temperature temperature of the mat[*1] during the compaction process. This temperature is usually between **100°C to 190°C (212ºF to 374ºF)** [*2]. Changes to this temperature range, as to accommodate tenderness of the mix, should be determined during a Test Strip installation, prior to the start of actual paving.

Traffic Return Temperature surface temperature of the mat when traffic of any type can drive on the material. This temperature is **60ºC (140ºF)**. The use of water to cool the mat for expedience is allowed.

***1** - It is recommended that the temperature be taken with an internal probe but IR gun is acceptable where probe is impractical.

***2** - The majority of the compaction is achieved at the high end of these ranges. Some Rosphalt mixes may exhibit a tender zone and require compaction at lower temperatures. Compaction procedures need to be determined via a paving trial, or through previous experience with Rosphalt mixes. Some finish rolling may be required below these temperatures, to remove marks and other imperfections from the pavement.

COMPONENTS OF A ROSPHALT SYSTEM

Rosphalt 50 Mix Additive

- Rosphalt 50 additive is supplied in 10.2kg (22.5 lbs.) meltable polyethylene bags, Super Sacks (35 units per sack, 714.4kg (1,575 lbs.), or loose bulk material delivered via pneumatic style tankers, depending on the storage capabilities and delivery system used by customers.

- **1 unit of Rosphalt 50** = 20.4kg (45 lbs/ton) (or 2.25% by weight) of 1 U.S. ton of finished mix.

Edge Sealer

- Royston 120-29 Edge Sealer LVOC, cold applied, unless regulations do not permit its use.
- The edge sealer shall be a material that conforms to ASTM D6690 – Type III (see Table 1) placed at a rate of 3 linear meters per liter (40 linear feet per gallon), with a minimum thickness of 0.75mm (30mils), and as approved by the Engineer.

Tack/Bond Coats

Several options exist for tack/bond coats depending upon local regulations. In all cases, 98% coverage of the substrate MUST be achieved to ensure proper bonding.

- Concrete Bridge Decks:
  - Royston 754 Tack Coat LVOC, cold applied, unless regulations do not permit use.
  - PG64-22 grade/AC20 or 100 Pen grade (or greater) is recommended.
- Steel Decks:
  - PG82-22 (or similar – for example 25 Pen grade) is recommended.
- Alternative: Agency specified tack coat.

See further installation information in the deck preparation section.

Product Technical Data Sheets and SDS Sheets are available at the web site – http://chasecorp.com/markets/construction-products/bridge-highway-applications/rosphalt/.

MIX DESIGN

Mix designs for Rosphalt infused mixes are either developed using Marshall or Gyratory compaction methods, based on Agency specifications. In the information provided herein, reference is made to the Asphalt Institute's publication MS-2, for the Marshall and Gyratory compaction methods. It should be noted that the volumetric information in these standards do not apply to designs incorporating the Rosphalt additive, but much of the background information concerning calculation of volumetrics and use of equipment is similar. Information presented in this document overrides information within the Asphalt Institute documents.

Nominal Aggregate size selection

The **Lift Thickness** is based on nominal maximum aggregate size, or as specified by the Agency. Rosphalt mix designs of 9.5mm (3/8") maximum nominal size are recommended for surface courses on most bridges and approaches, based on historical data for waterproofing, as well as rutting and shoving analysis. Specific recommendations are as follows:

6.3mm (1/4") design, applied at a minimum of 25mm (1") to a maximum of 50mm (2.0") per lift. On applications for most bridges, ramps, and approaches, a 6.3mm (1/4") design will provide an effective interlayer (or wearing surface) mix resulting in a superior waterproofing and wearing course system.

9.5mm (3/8") design, applied at a minimum of 40mm (1.5") to a maximum of 65mm (2.5") per lift. On surface applications for most bridges, ramps, and approaches, a 9.5mm (3/8") design will provide a superior waterproofing and wearing course system.

12.5mm (1/2") design, applied at a minimum of 50mm (2") to a maximum of 100mm (4") per lift. 12.5mm (1/2") designs are utilized on a very limited basis, specific to an application. *A 12.5mm (1/2") design may not effectively provide sufficient waterproofing characteristics if care is not exercised to prevent segregation and to ensure all joints are compacted and sealed.*

19mm (3/4") design, applied at a minimum of 60mm (2-3/8") to a maximum of 120mm (4-3/4") per lift. 19mm (3/4") designs are typically used in base applications. A 19mm (3/4") design is not recommended as a single layer for water-proofing applications.

Mix Design Process

The Contractor shall develop a mix design utilizing the Rosphalt 50 additive (treated as part of the binder) in accordance with the Agency specifications and support information from the Rosphalt Guidelines. Chase will supply a sample of the Rosphalt 50 additive for the development of the mix design. Once a mix design has been performed and verified, a copy of the final mix design should be sent to Chase for review. It is recommended that contractors unfamiliar with these materials have a verification performed, prior to submitting a final Job Mix Formula (JMF) to the agency for approval.

Aggregate Gradation

Contractors will use the Agency specifications to produce a JMF. Should there be a conflict between the agency specification and the Rosphalt Guidelines, it will be the contractor's responsibility to contact Chase immediately for project resolution.

Contractors are recommended to start design work using an approved surface course design. Chase recommends using an aggregate structure that satisfies the requirements for a roadway with a minimum traffic loading of 3 million ESAL, as designated in Asphalt Institute MS-2.

Aggregate blends that are most successful in providing the necessary volumetrics and water-proofing properties are those that lie on the maximum density curve. This curve can be approximated by graphing a straight line on a 0.45 power aggregate gradation chart (see Asphalt Institute MS-2 for examples).

The gradation of the blended aggregates should lie within the general requirements of MS-2 as published by the Asphalt Institute. Using these guides, we recommend the following tolerances for mixture nominal sizes of 6.3mm (1/4"), 9.5mm (3/8"), 12.5mm (1/2"), and 19mm (3/4"), as follows:

Aggregate gradation limits for Rosphalt mixtures

Sieve Size, metric (imperial)	Nominal size of aggregate/Percent passing				Gradation Control – on JMF
	6.3mm	9.5mm	12.5mm	19mm	
25mm (1")				100	± 7 %
19mm (3/4")			100	90 – 100	± 7 %
12.5 mm (1/2")		100	90 – 100	Report	± 7 %
9.5 mm (3/8")	100	90 – 100	Report	Report	± 7 %
6.3mm (1/4")	Report	Report			± 7 %
4.75 mm (#4)	90-100	55 – 85	44 – 74	35 – 65	± 7 %
2.36 mm (#8)	37-70	32 – 67	28 – 58	23 – 49	± 4 %
1.18 mm (#16)		Report	Report	Report	± 4 %
600 microns (#30)		Report	Report	Report	± 4 %
300 microns (#50)	7-23	7 – 23	5 – 21	5 – 19	± 4 %
150 microns (#100)		Report	Report	Report	± 4 %
75 microns (#200)	2-10	2 – 10	2 – 10	2 – 8	± 2 %

Volumetric design and additive addition rates

The mix design is produced at a target void level of 1.0% with a Gyratory compactor, or 1.5% with the Marshall method of compaction. Experience has shown that if these void levels are achieved in the laboratory, then field void levels will be in the correct range. (These void levels produce materials that will act as water-proofing layers. For applications that do not require full water-proofing, higher design void levels may be appropriate.)

Rosphalt 50 is added at a minimum of 2.25% (by total weight of the mix) in order to achieve the required properties. The minimum addition rates and the volumetric design parameters are given below.

Note: Assume a G_b (specific gravity) of Rosphalt 50 as 1.000 in the calculations for volumetrics. A combined value of Gb and Pb, should be used for all calculations, based on the combined values of virgin asphalt and Rosphalt 50. Meaning that the total binder % is calculated by adding the amount of virgin

asphalt and the amount of the Rosphalt 50 additive and using this combined value for volumetric calculations. (i.e. 5.5% virgin AC and 2.25% R50 = 7.75% total binder content)

Volumetric mix design parameters

Volumetric parameter	Control requirement	Nominal size of aggregate/Percent passing			
		6.3mm	9.5mm	12.5mm	19mm
Gyratory volumetric requirements					
VMA	Minimum	17%	16.5%	15.5%	14.5%
VFA	Minimum	90.0%	90.0%	90.0%	90.0%
$\%G_{mm}$	@ N_{ini} (6 gyrations)	>87.0%	>87.0%	>87.0%	>87.0%
$\%G_{mm}$	@ N_{des} (50 gyrations)	99.0%	99.0%	99.0%	99.0%
$\%G_{mm}$	@ N_{max} (75 gyrations)	>99.0%	>99.0%	>99.0%	>99.0%
Marshall volumetric requirements					
VMA	Minimum	17.5%	17.0%	16.0%	15.0%
VFA	Minimum	90.0%	90.0%	90.0%	90.0%
%Voids	Marshall (50 blows)	1.5%	1.5%	1.5%	1.5%
Note: It is recommended that the adopted JMF has sufficient VMA to allow for plant fluctuations that occur. Typically, an acceptable mix design should have a VMA 0.5 to 1% above the minimum specified in this table to allow for these typical fluctuations.					

Mixing and compaction temperatures in the design process

In the mixing of Rosphalt materials, it should be noted that the Rosphalt additive is not pre-heated, but rather it is added as a dry powder to the heated aggregate. The steps for producing laboratory mixtures are as follows:

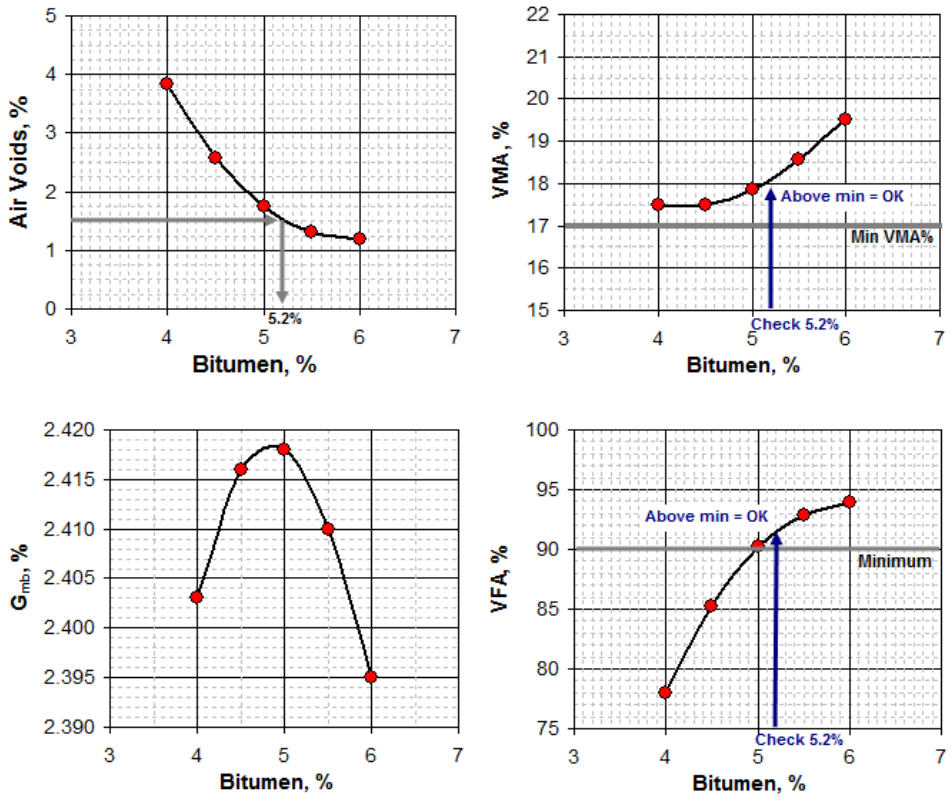
1. Weigh aggregates for batching and heat in oven to 246±5ºC (475±9ºF)
2. Add the aggregates to a preheated mixing bowl, and then add the required portion of Rosphalt additive.
3. Mix the heated aggregates with the Rosphalt additive for 10 seconds.
4. Add the liquid bitumen/binder which should be preheated to 155 ± 5ºC (311 ± 9ºF) to the aggregate/additive mixture, and mix for another 90 seconds. If the mixture is not uniformly coated after this time, continue mixing until the aggregates are completely coated.
5. Verify that the temperature of the finished mix is greater than 199ºC (390ºF). This is the desired temperature for the testing of Rosphalt 50 Mixtures. *Note: If this temperature is not achieved the laboratory environment should be carefully assessed to ascertain were significant temperature is being lost. It is permitted to increase the aggregate temperature to a maximum of 274ºC (525ºF) in order to achieve the final mix temperature.*

Upon completion of mixing, the material shall be conditioned in accordance with AASHTO R30 prior to compaction in either Gyratory or Marshall devices, as described in MS-2.

The compaction temperature to be used with Rosphalt Mixes shall be targeted at 198ºC (388ºF), with an acceptable range of 193ºC-204ºC (379ºF to 399ºF). Marshall specimens shall be compacted with 50 blows per side. Gyratory specimens shall be evaluated at N_{ini}=6, N_{des}=50, and N_{max}=75 gyrations, regardless of class designation or aggregate structure.

NOTE: Verify total asphalt content with use of ignition oven method. For further instruction and guidance please refer to AASHTO T 308 and ASTM D 6307 standards.

Volumetrics of the compacted specimens shall be determined in accordance with the methods developed by the Asphalt Institute. The JMF target asphalt content shall be determined by using the binder content necessary to achieve the air voids criteria (1.5% Marshall, 1.0% Gyratory). This value should be the JMF target. The binder content that conforms to the JMF target is typically at the peak mixture density or slightly higher. The values of VMA and VFA should be checked to make sure they exceed the acceptable parameters given in the tables above, as shown in the example below.



Physical properties to be obtained with the target mix design

Marshall Properties

When the Marshall method of compaction is used the mixture shall have properties as follows:

Stability:	≥ 8,800 N (2,000 lbs.)
Flow:	≥2.5mm (0.1 inch)

Hydraulic conductivity

The material shall be evaluated in accordance with ASTM D5084 for hydraulic conductivity and shall have a level of ≤1.0E-7 cm/sec. (This requirement may be omitted if an alternate void content is being used for design, and water-proofing properties are not required.)

Performance testing

For all projects where the expected traffic levels are expected to exceed 3,000,000 ESALs or if tire pressures are excessive and/or overloaded trucks are expected, it is recommended that performance testing of the mix be conducted with laboratory fabricated specimens prior to placement of materials. Recommended

performance testing is given below, the most current versions of the referenced AASHTO/ASTM test methods should be used when testing is performed:

Sample Preparation for Wheel Tracking Performance and Fatigue Performance
Typical void levels found in the field are between 1% and 2% (98% to 99% compaction), with a maximum of 4% (96% compaction), when used as a water-proofing system. When preparing materials for testing, it is recommended that samples be compacted to 1.5% ± 0.5% air voids, as would be found in the finished compacted mat.

Wheel Tracking Performance
AASHTO T340 - Test Method for Determining the Rutting Susceptibility of Hot Mix Asphalt. The material shall be tested at the corresponding high Performance Grade (PG) temperature for the region of use. When evaluated in this test device the resulting mixture shall have a total deformation of less than or equal to 5mm, when evaluated at the high PG grade temperature for the region of installation.

Fatigue Performance
AASHTO T321 - Standard Test Method for Determining Fatigue Life of Compacted Asphalt Mixtures Subjected to Repeated Flexural Bending. The material shall when evaluated at a strain level of 750 micro-strains at 20^{o}C with a loading frequency of 10Hz have a performance greater than or equal to 250,000 load applications. [*Note: This requirement is more significant for bridge decks which exhibit a large degree of flexure such as orthotropic steel decks.*]

Chase Construction Products can advise on laboratories qualified to conduct the tests described above.

Plant verification
The Contractor shall verify the JMF in the asphalt plant by producing trial batches before any placement is done to verify the design. If necessary, minor modifications to the JMF can be made following plant verification.

AT THE ASPHALT PLANT

Rosphalt mixes can be produced in either batch or drum plants. Drum plants must be of the counter flow, double drum, or double barrel type. **Note: No Parallel-Flow Drum plants can produce Rosphalt.**

The plant must be able to introduce the Rosphalt additive at the proper rate as specified by the approved JMF. The methods of introduction are the same as adding any dry mix additive.

Note: Hi-Tech Asphalt Solutions Inc. feed system for fibers has been found to be a suitable method for adding Rosphalt additives in drum mix plants, where no mineral filler silo has been provided. These systems are available for rental and purchase.

See http://hitechasphaltsolutions.com for further information.

The contractor's plant must be able to produce the material consistently and pass all agency testing requirements specified.

In a **batch plant**, the mix time is a total of 80 seconds, 10 seconds dry with the aggregate and Rosphalt 50 only, and 70 seconds with liquid bitumen/binder added. In a **drum plant**, the mix time is pre-set. Running the TPH (tons per hour) at a reduced rate is recommended to help insure proper mixing.

The use of hot-mix storage silos with batch plants is allowed, and recommended in small pug mill plants, to help expedite Rosphalt mix delivery to the job by running up material ahead of time. The silos must be insulated and/or heated. **Silos are not to be used for overnight storage of finished Rosphalt 50 mix**.

DECK PREPARATION

IMPORTANT: On all structures, new or old, the Agency in charge of the job and the Contractor, will inspect the deck for cleanliness, proper milling, repairs, and dryness, before any Tack Coat, Edge Sealer, or mix with Rosphalt additive ("Rosphalt mix") is applied. The Contractor must repair or correct any discrepancies prior to any part of the installation process, in accordance with agency specifications.

For bridge decks and overhead structures (such as ramps or elevated structures), the substrates must be sound, **meaning no failed or broken substrate materials.** Agency specifications must address corrective action for failed substrate material, prior to application of the Rosphalt mix. Chase will assume no liability for any failed or unstable substrate.

Rosphalt mixes should not be used as a replacement for concrete patching, as the product is not considered to be part of the structural design.

Each agency has its own specifications regarding concretes, such as pre-stressed or poured, patching materials, etc., which may or may not include accelerators. The nominal cure time shall conform to each agency specification. Please refer to the pages of these Product Guidelines, under Tack Coat Applications, for methods for checking moisture in the surface prior to the application of Edge Sealer and Tack Coats. Moisture content must be less than 6%.

Edge Sealer Application

Once the structure has been inspected by the agency and the contractor, and is approved for further work, then the next step is the application of the **Edge Sealer**. This material forms a gasket around the areas it is applied to, thus improving the waterproofing characteristics of the Rosphalt system. This material is applied to all vertical surfaces that the Rosphalt mixture will contact, such as **parapet walls, curbs, roadway terminations, drains, utilities, and joints**.

The application rate is a minimum of 0.75mm (30mils) in thickness, at approximately 3 linear meters per liter (40 linear feet per gallon).

Once the Rosphalt mix is placed and compacted, forming a hot or cold joint, sealing of the top surface of that joint will be required. This particular sealing is done to ensure a watertight seal on the top layer. This sealing application requires a two-inch wide band be centered on the joint, and cover the length of the joint. This same procedure is also to be used on transverse joints. The application rate is approximately 8.5 linear meters per liter (100 linear feet per gallon).

This overbanding of all surface joints (longitudinal and transverse) should be done at the completion of paving, so long as it will not result in any safety related issues.

Tack Coat

Before the application of the Rosphalt mix, a tack coat needs to be applied. Tack Coat will be used on all Rosphalt projects.

A moisture meter should be used to check the moisture content of the deck. A reading of 6% or less is required. The Contractor needs to provide the meter and record readings for future reference, if necessary.

The deck shall have 98% coverage without puddles. Contractor may use any application method available, as long as it meets the application rate. Application rates should be adjusted to provide the required 98% coverage without causing puddling/ponding or over application of the material which could result in bleeding or flushing of the tack coat up through the finished pavement.

For concrete decks, cold applied Royston 754 Tac Coat is recommended, unless Agency specifications deem otherwise. In those instances, a PG64-22 (AC-20/100 Pen) is recommended. The application rate should be 0.3 - 0.7 liters per square meter (0.07 - 0.15 gallons per square yard) without puddling/ponding.

For steel decks, a PG82-22 (25 Pen or similar) tack coat is recommended. The application rate should be 0.2 - 0.45 liters per square meter (0.04 - 0.1gallons per square yard) without puddling/ponding.

For Orthotropic Decks (Steel) Preparation – the surface shall be prepared in accordance with SSPC-SP 10/NACE No. 2 Near White Blast Cleaning requirements (Steel Structures Painting Council Specification – see http://www.sspc.org/standards/spscopes.html#SP10 – or NACE International – see http://web.nace.org/Departments/Store/Default.aspx for copies also available in Chinese and Spanish).

For tack/bond-coat application, use shall be made of a computer-controlled pressure distributor. Pressure distributions that have been found to be suitable are as follows:

- ETNYRE BT-1 as manufactured by E.D. ETNYRE and Company (www.etnyre.com)
- BC-501/CRC as manufactured by Bear Cat Manufacturing (www.bearcatmfg.com)
- MAXIMIZER with EZ-2S or similar distribution System as manufactured by ROSCO Manufacturing (www.leeboy.com)

A hand wand can be used for small areas or areas inaccessible to larger distributor trucks.

Application temperature is generally in the range 135°C to 175°C (275°F to 347°F) for a PG64-22 (AC-20/100 Pen) binder, but will be marginally higher for the stiffer grades used with steel decks. The manufacturer's spraying temperature and viscosity of application should be followed.

Broadcasting small amount of fine, DRY sand is permitted to prevent vehicle tires from picking up or tracking the tack coat material.

PAVING PROCEDURES

IMPORTANT: The ultimate responsibility regarding paving procedures will be the Agency's and Contractor's.

The Contractor, with the Agency's oversight and approval, should submit a detailed Quality Control plan, incorporating both the plant and field operations.

Rosphalt paving is not recommended when the ambient or deck temperature is below 4ºC (40°F). **Should any agency require material to be applied below this recommended temperature, they will assume all risk and liability**. Chase will work with both the agency and contractor for best practices.

Note: Cold weather paving can result in significant problems with compaction efforts. Radiant heaters have been used successfully with Rosphalt mixes on various projects. With these devices, the deck surface can be heated above 4ºC (40°F), typically to 10ºC (50°F), prior to start of paving. However, it is emphasized that considerable care must be taken when working at cold temperatures to ensure a successful pave. If additional advice is required, please contact a Chase representative.

Equipment

Asphalt Trucks

Truck beds need to be clean and free of debris or old clumped asphalt mix. The tarps used to cover the Rosphalt mix must be in excellent condition with no holes and should cover the entire top of the material in the truck. All exposed puckers in the tarp should be tied down to eliminate free flowing air over the hot Rosphalt mix, and the sides of the tarp tied down as well. The tarps must be those specified for covering asphalt.

Heated body trucks, if available, should be used when outside temperatures are below 10ºC (50ºF). **Live floor truck/trailers (Flo Boy)** are also good for transporting Rosphalt mixes.

Pavers

Rosphalt mixes can be paved using a wide variety of asphalt paver brands, either rubber tire ortrack style, with heated and vibrated extensions, in good working condition. The use of automated controls (grade, slope, and joint matching) is recommended. On large tonnage projects, **it is imperative that tires and tracks be kept clean of any excess tack coat picked up during the paving operation**. **Excessive pick up can lead to clumped material falling off and being paved into the new mat which could result in bleed through.**

Suggested maximum speed of the paver is approximately 6 meters per minute (20 feet per minute).

DO NOT WALK on the loose mat until at least one roller pass has been made. Rosphalt mixes are very tender, and foot prints can be very difficult to remove if not rolled immediately.

Holes created when monitoring the depth of the paved mat should be filled in immediately. The material compacts easily and neglecting to do so may result in a blemish or small void in the finished mat.
Hand Work. All handwork (lute, rake, and shoveling) should be kept to a minimum due to compaction and cosmetic reasons. Broadcasting loose material onto the hot mat may be necessary, but should be kept to a minimum.

Transfer (Shuttle) Buggy/MTV can be used in the same fashion and for the same reasons as with conventional asphalt mixes. Rosphalt mixes cannot be wind-rowed (dumped on the ground then picked up and transferred into the paver).

Rollers

Full compaction is required, and can be achieved by utilizing steel drum asphalt rollers in the static mode. Rollers used for the compaction of Rosphalt modified material are smaller in weight to those used for conventional paving mixtures. A minimum of two rollers should be utilized for compaction on all jobs using Rosphalt mixes: one for break down, with a weight of approximately 4 to 10 tons, and one finish roller weighing 2 to 8 tons. On large jobs, additional rollers are advisable to ensure compaction, resulting in a smooth riding surface. A small 1 ton (finish) roller can be used to assist with compaction of transverse joints, transitions and to roll areas which the larger rollers cannot access. Dish soap should be used to help prevent pick-up of materials. The contractor should have a water truck onsite at all times to refill rollers as necessary.

The contractor is responsible for achieving the proper density and air voids as established by their JMF. The contractor is to use whatever test methods necessary to ensure the material is waterproof. Testing of cored material is recommended and is the most accurate way to determine that the proper density has been achieved, where coring is permitted.

NOTE: It is very important that the in place density is verified on site.This can be done using a Thin-Lift Nuclear Density Meter (NDM), or equivalent. This device should be calibrated with cores from a test strip. Record readings at a minimum of 3 locations across the mat every 20 meters (65 feet) to ensure a MINIMUM of 96% density is maintained, and an AVERAGE of 97% to 98% is achieved. It is particularly important to pay detailed attention to the compaction of all joints and edges.

Paving Practices

The means and methods used by the contractors must achieve the density required. The roller operator, the nuclear density technician and the contractor's field manager are responsible to ensure the final pavement meets the density requirements.

The rolling pattern required to compact the mat to a minimum of 96% of the theoretical maximum density should be determined during the paving of a test strip. This pattern may need to be adjusted during the paving process and will be ultimately determined by the close monitoring of the in-place density of the finished pavement.

It is recommended on all jobs, that a test strip is paved prior to the job, in order to establish a rolling pattern, and pull to cores to verify the density of the compacted material. Density of the placed Rosphalt mix can be verified using a Nuclear Density Meter that has been properly calibrated using the cores from the test strip. The NDM should be calibrated using a minimum of 10-cores from a test strip to establish the correlation factor to use.

When compaction (rolling) is completed, lanes may be open to traffic when the Rosphalt mix reaches 60ºC (140ºF) surface temperature or a minimum of 1 hour after rolling.

QUALITY CONTROL

Good contractor quality control is essential for any HMA project. Quality Control of the paving with the Rosphalt mix should ensure the following:

- Desired aggregates are correctly fed to the HMA plant
- Mix production is carried out at the correct temperature
- The correct amounts of Rosphalt additive are used
- The materials are shipped at the correct temperature
- Trucks are clean and suitably insulated for the haul distance (all trucks shall have insulated tarps)
- Lay-down equipment is in good working order for the project
- Site preparation has been adequate
- Tack coat has been applied at the correct rates
- Density of Rosphalt mix is achieved

Chase Construction Products recommends that all contractors develop a detailed Quality Control plan for Rosphalt mixtures that accurately documents, at a minimum, the above items. This document provides key advice for the construction of a Rosphalt mix water-proofing layer. Additional advice can be obtained by contacting Chase representatives.

REFERENCES

American Association of State Highway and Transportation Officials (AASHTO) - Test Specifications. https://bookstore.transportation.org/

ASTM – Annual Book of ASTM Standards – Section 4 – Construction, Volume 04.03 Road and Paving Materials; Vehicle-Pavement Systems, www.astm.org.

Asphalt Institute, MS-2 – Asphalt Mix Design Methods, 7th Edition, Lexington, Kentucky 2014.

Note – Asphalt Institute publications available from http://www.asphaltinstitute.org/.