Emulsion Sampling & Inspection

For Chip Seal Operations

Asphalt Emulsions

Asphalt Emulsions

An asphalt emulsion is basically a combination of three ingredients;

Asphalt Binder/Cement

Water

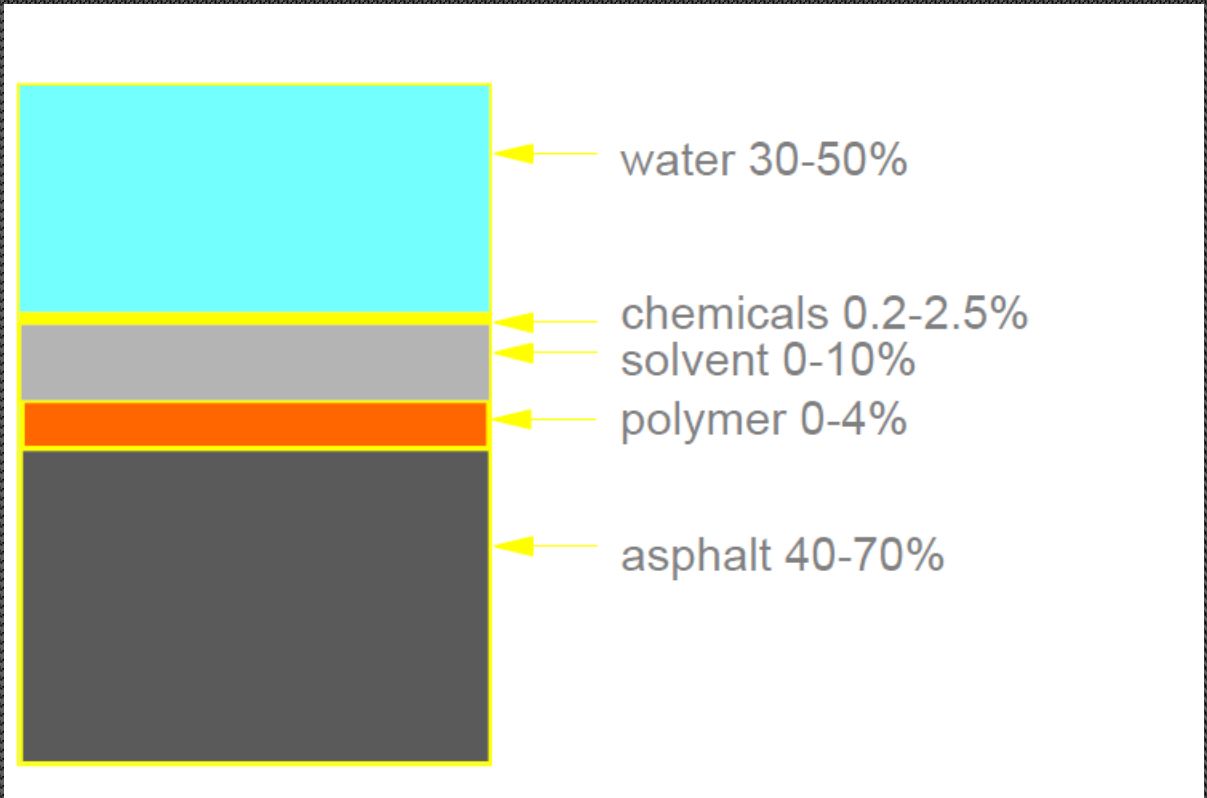
Emulsifying agent.

Emulsified asphalt is simply a suspension of small asphalt cement globules in water, which is assisted by an emulsifying agent (such as soap).

The emulsifying agent assists by imparting an electrical charge to the surface of the asphalt cement globules so that they do not coalesce.

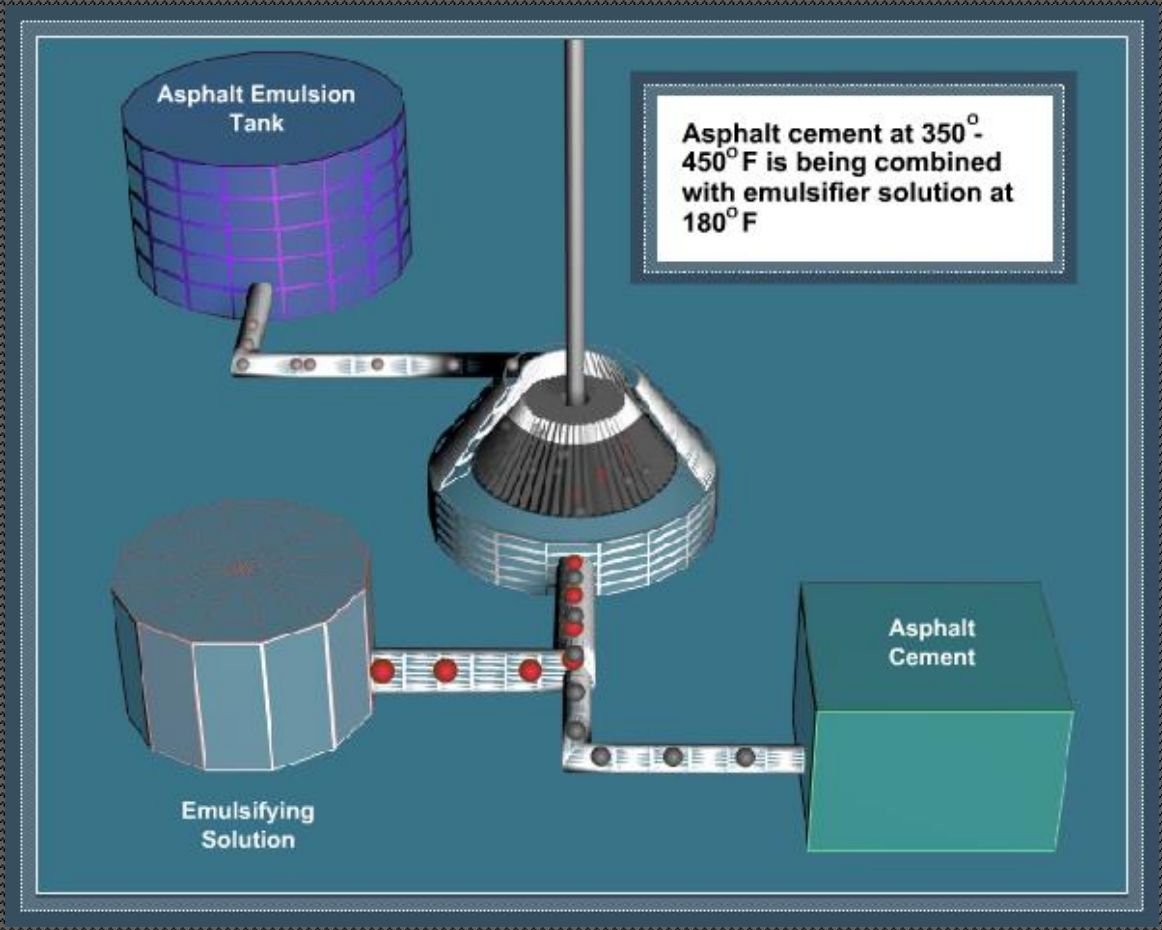
Emulsions are typically either anionic (asphalt droplets are negatively charged) or cationic (asphalt particles are positively charged).

Asphalt Emulsions

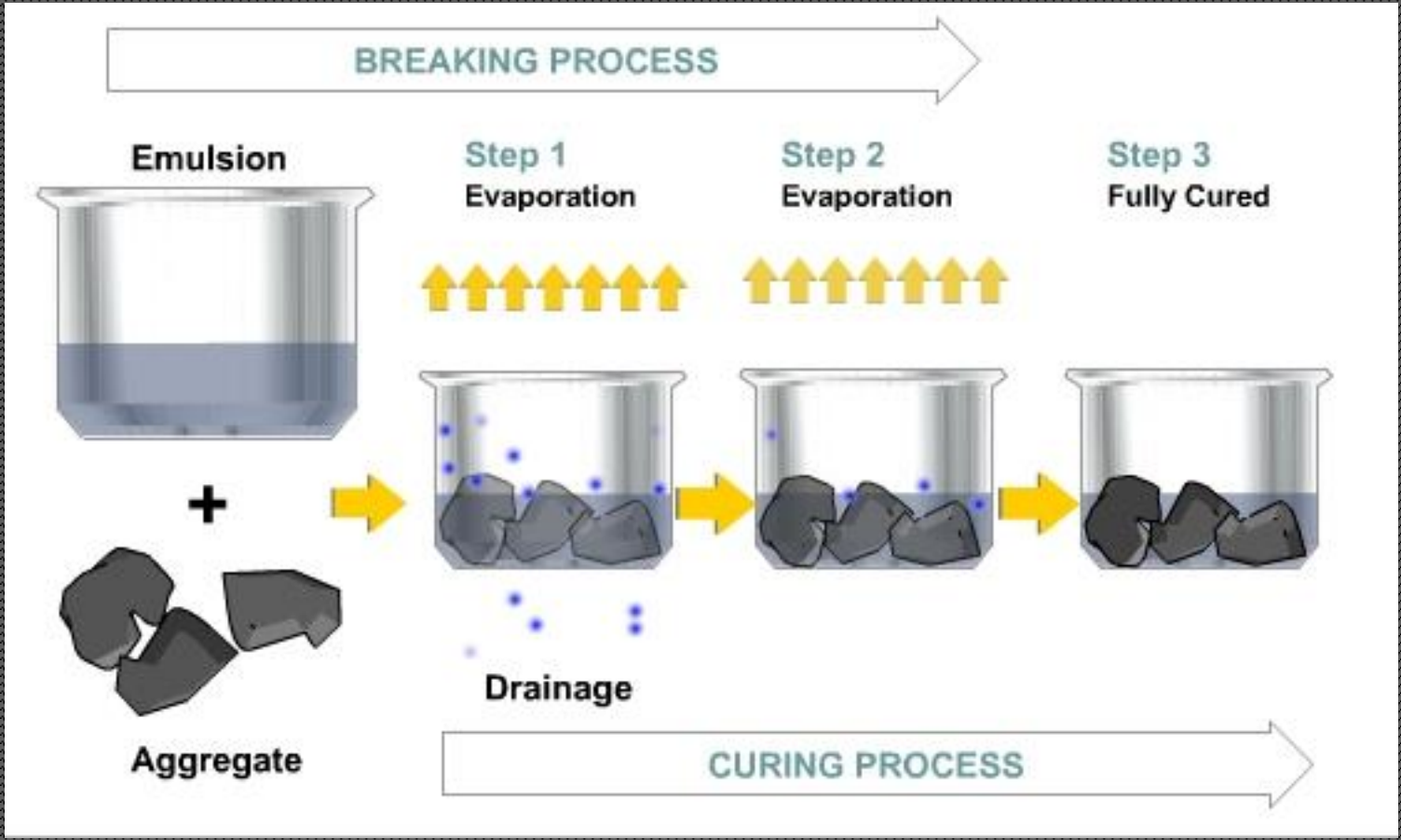


This is more representative of a CRS-2P

Asphalt Emulsions



Asphalt Emulsions



Emulsion Plant

halt Emulsions Ind., LLC

AMINE
BASED
SURFACTANT
AMINE
BASED
SURFACTANT
DRIVERS
STAY 2 FEET
1 2 3 4 5 6

Chip Seal Emulsions

There are basically 2 types of emulsions used in chip seals. Which are;

CRS-2L

CRS-2P

Chip Seal Emulsions

CRS – 2L/P → Latex or Polymer Modified

Cationic

Rapid

Setting

Viscosity Type

CRS-2P Is a polymer modified PG grade of Asphalt Binder that has been emulsified.

CRS-2L Is a latex modified emulsion, normally of a “neat” or unmodified PG grade of Asphalt Binder. (i.e. PG-58)

Asphalt Emulsions

- Typical Emulsion Applications, per grade

Sealing (CRS-1, CRS-2,)

Slurry Surfacing (CQS, CQS-1h, Microsystems)

Fog Seal (SS-1, CSS, CSS-R, CMS, CMS-R)

Tack Coating (CRS-1,CSS, non-tracking).

Agriculture (Straw coating). (SS-1, CMS, specialty emulsions).

Chip Seal (CRS-2L, CRS-2P)

Storage and Handling of Asphalt Emulsions

Storage and Handling of Emulsions

Recommended Asphalt Emulsion Storage Temperatures

	Minimum Temperature °F (°C)	Maximum Temperature °F (°C)
CRS-2L/P	125° (50°)	185° (85°)

There may be instances where a tanker has been dropped off near the project. The temperature of material in those tankers needs to be closely monitored.

In this case a shipment needs to be used in its entirety or be taken to a location where it can be pumped off into a storage tank and kept at the appropriate temperature.

Repeated heating and pumping can cause pre-mature breaking or destabilization.

Storage and Handling of Emulsions

- Material shall be a minimum of 155° F and not exceed a maximum of 170° F in the suppliers tank when delivered within two hours of scheduled delivery time.

- Total rejection of shipment may be imposed for deliveries with a temperature factor in the suppliers tanker with a varying heat factor of 5° F less than the required minimum of 155° F or 5° F greater than the maximum of 170° F.

- When loaded for delivery at the mentioned temperature, it will minimize the need for re-heating by chip seal crews.

Storage and Handling of Emulsions

Never mix emulsions from different producers. Not all same charge emulsions are necessarily compatible due to possible differences in base asphalt, emulsifiers and pH.

- AASHTO T40

4.1 Because of the numerous types and grades of bituminous materials that are alternately shipped and stored in the same or similar containers, the opportunity for contaminating these containers with residues, precipitates, or cleaning solvents is ever present.

Troubleshooting

Other factors that affect material performance

We don’t want to immediately fault a material without factoring in many other variables that affect performance,

- ✓ Weather
- ✓ Fines in aggregate
- ✓ Improper aggregate ±
- ✓ Mishandling by the contractor
- ✓ Poor storage procedures by the contractor
- ✓ Temperature excesses
- ✓ Contamination of the material
- ✓ Improper application

Once we have eliminated some of these issues we can begin to look at the material itself.

Weather (temperature)

Ambient Air Temperature

Should be at least 50°F (10°C) and rising for emulsions.

Roadway Surface Temperature.

Roadway temperature should not be less than 70°F nor more 130°F. Excessively high pavement temperatures inhibit the binder's ability to secure the aggregate in place.

There are times when it is too hot to apply an emulsion chip seal. If the ambient temperature will reach or exceed 100°F on the day of application, the pavement temperature could approach 185°F

Weather (humidity)

Evaporation and Humidity

Evaporation – The process of conversion of liquid water into vapor form is called evaporation. Evaporation is a critical function of the breaking process of an emulsion. Humidity directly affects the rate of evaporation.

Relative Humidity – The amount of water vapor in a given volume of air divided by the amount of air in that volume is called humidity. It depends on the temperature as higher temperature can increase the rate of evaporation and thus the amount of water vapor in the air. At a given temperature, there is a maximum amount of water vapor that air can hold and when the maximum capacity is reached the process of condensation begins.

If an emulsion is seen to break too slowly, humidity (>50%) must be taken into consideration. It is said that Cationic emulsions are less likely to be adversely affected by high humidity levels, however this is highly dependent on the compatibility of the emulsion chemistry and the emulsion to aggregate relationship.

Weather (rain)

Rain

Chip seals should not be applied when raining or when rain is threatened. Chip seals should not be applied when inclement weather is predicted within a few days of placement.

Any inclement weather immediately before, during or after the placement will contribute to the failure of the chip seal.

Chip seals should not be applied to wet surfaces, regardless of the cause. Wet pavement will affect the bonding of the binder to the pavement surface

Weather (wind)

Wind

Wind can accelerate the curing/breaking of emulsions and also distort any spray patterns when applying emulsion/binder material.

Excessive wind can cause the emulsion to cure/break before the aggregate is embedded into the emulsion. As a result, excessive aggregate loss is usually experienced.

Fines in aggregate

Excessive fines/dust in the aggregate can have a sponging affect or soak up the liquid and cause pre-mature curing/breaking.

Contamination

Emulsions are chemical systems, they should never be mixed with other types of emulsions, they should never be mixed with other chemicals.

Rust, dirt, grass or other foreign material should be excluded. This is especially important for cationics as they can break by reacting with these materials.

For emulsions cleanliness is very important. A sloppy operation will produce problems. When an emulsion comes in contact with air it can begin to break.

Distributors/tankers should be clean and flushed between loads. New material should not be pumped in on top of old material, especially different grades.

Poor Equipment Maintenance

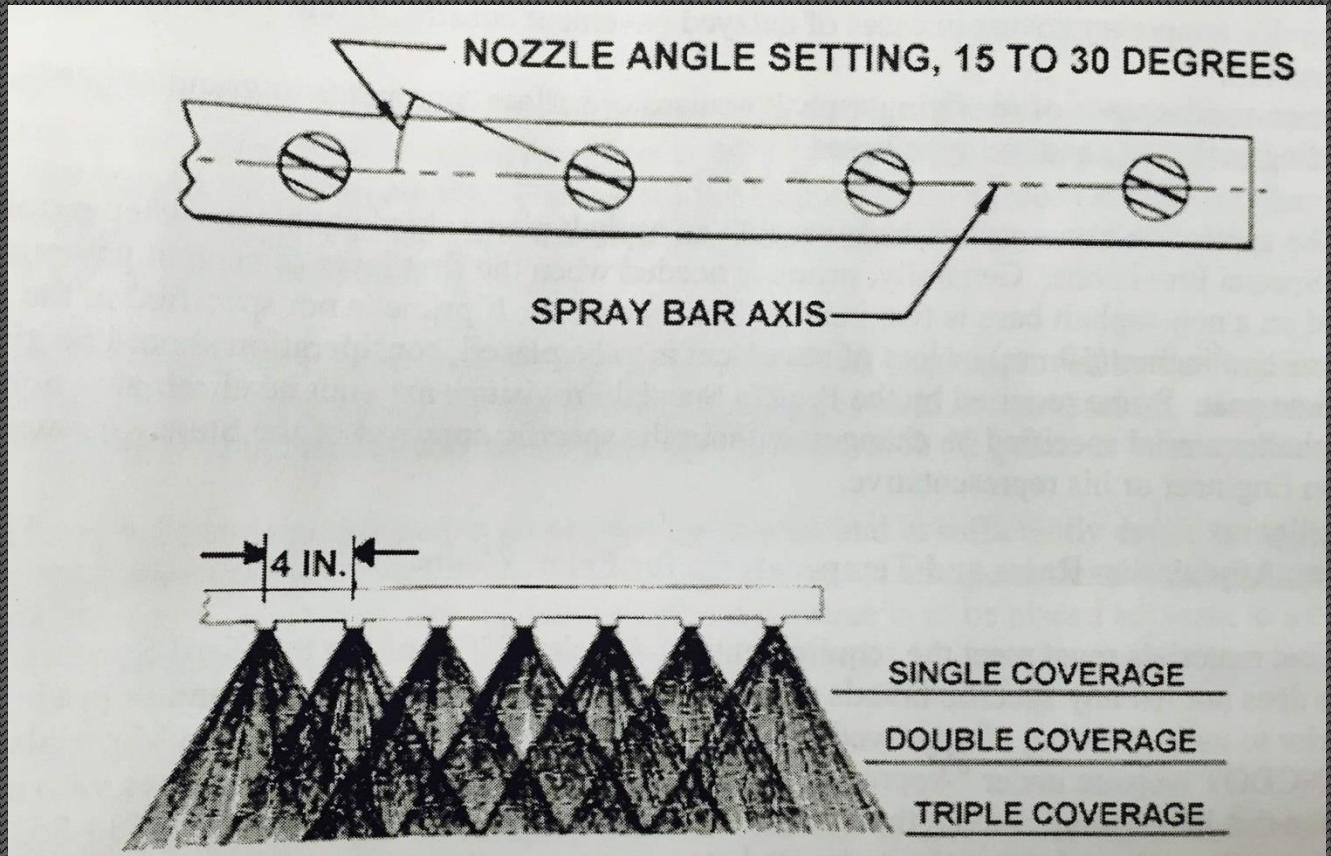
Application

Application

The following are factors that can influence the performance or expectations of an emulsion.

- Improper nozzle alignments
- Improper application rates
- Clogged nozzles
- Excess aggregate
- Wet aggregate (more than damp)
- Wet roadway surface
- Speed of the equipment (too fast)

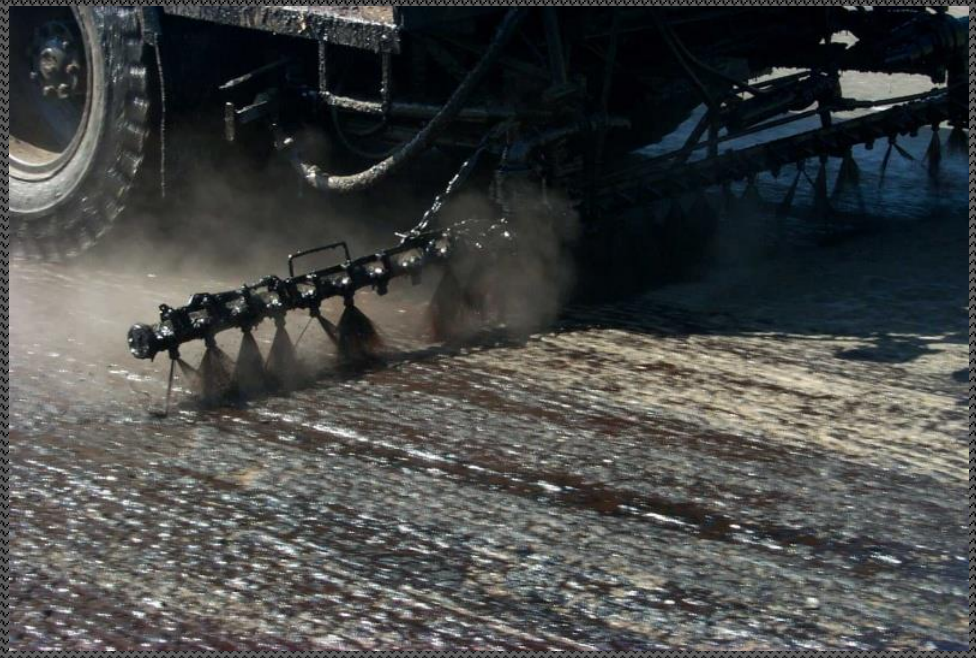
Application - Nozzle alignment



Proper Nozzel Angle Setting

Application - Nozzle alignment

Good



Poor

Verify application rates and the speed of the distributor when spraying.

Application

Do not wait until after the emulsion has broken or dried to spread the aggregate. The emulsion is brown when it is sprayed and turns to black when it has broken or dried.

Ready for aggregate

Looks black from back here could be a little late

Dilution

While there are some grades of emulsion that are designed to be diluted, chip seal emulsions are not.

Seeing a distributor truck parked at a fire hydrant or near a source of water adding water to the tank is unacceptable.

Aggregate Spreader

The aggregate in the chip spreader should be damp, not wet.

The chip spreader must be able to spread an even coating of aggregate one chip particle thick over the entire binder sprayed surface.

Ensure that all gates in the spreader open correctly.

Ensure that the spreader is not leaving piles of aggregate and is not spreading too thick a layer. Too thick a layer can result in the aggregate being crushed under rollers or by traffic compromising the final chip seal.

Verify that the spreader has been calibrated.

Application

A chip seals service life is highly dependent on the bonding obtained from the proper embedment and orientation of the chips

Careful consideration must be given to using steel rollers as they may crush the aggregate. If steel rollers must be used then their drums should be rubber clad.

A pneumatic (rubber tire) roller is the preferred method for rolling or embedding the aggregate.

Challenges

Dealing with contractors and producers can be very challenging. Contractors will always blame the material and Producers will always cite mishandling. The challenge is discovering the truth.

In my experience the most challenging people to deal with are those who often have the most experience. Just because you've done it x amount of years doesn't always mean its always been done right or that you have the "Best Practices". People often take being checked or inspected personally.

Field Sampling

Material Related Problems

If you suspect that there is a problem with the material itself, and you have ruled out all other factors then a sample of the material must be obtained and submitted to the emulsions laboratory at the Materials and Tests Unit.

It is **critical** that you obtain a sample from both the contractor's distributor truck tank (provided that a shipment of emulsion has been delivered and offloaded to the distributor) and the asphalt producer's tanker, whether at delivery or if the tanker has been dropped off at the project, plant or some other site.

It is also critically important to understand why you are collecting the field sample so that you can communicate that information to the personnel a M&T This helps to decide what pertinent tests to run. (For example; It's running into the ditch, It's not breaking at all or It's clogging up the nozzles).

Sampling

AASHTO -T40

5.1 Whenever practicable, bituminous materials shall be sampled at the point of manufacture or storage, and at such time as to allow the tests controlling acceptance or rejection to be made in advance of the shipment.

5.2 When the samples cannot be taken at the point of manufacture or storage, they shall be taken from the shipment immediately upon delivery.

7.1.2 Sample containers for emulsified bituminous materials shall be wide-mouth jars or bottles made of plastic, or wide-mouthed plastic-lined cans with lined screw caps, or plastic-lined triple-sealed friction-top caps.

Field Sampling Procedure

1. Coordinate sampling with contractor or supplier.

2. Use appropriate safety equipment and precautions for hot liquids. (safety glasses and leather gloves)

3. Allow a minimum of 4 L (1 gal) to flow before obtaining a sample(s)

4. Sample emulsified asphalt at delivery, (if possible). Sample container should be filled to its neck.

5. Sample emulsified asphalt via the sample valve of the delivery tanker trailer before it is pumped into the distributor, or take sample via the distributor sample valve spray bar or application device.

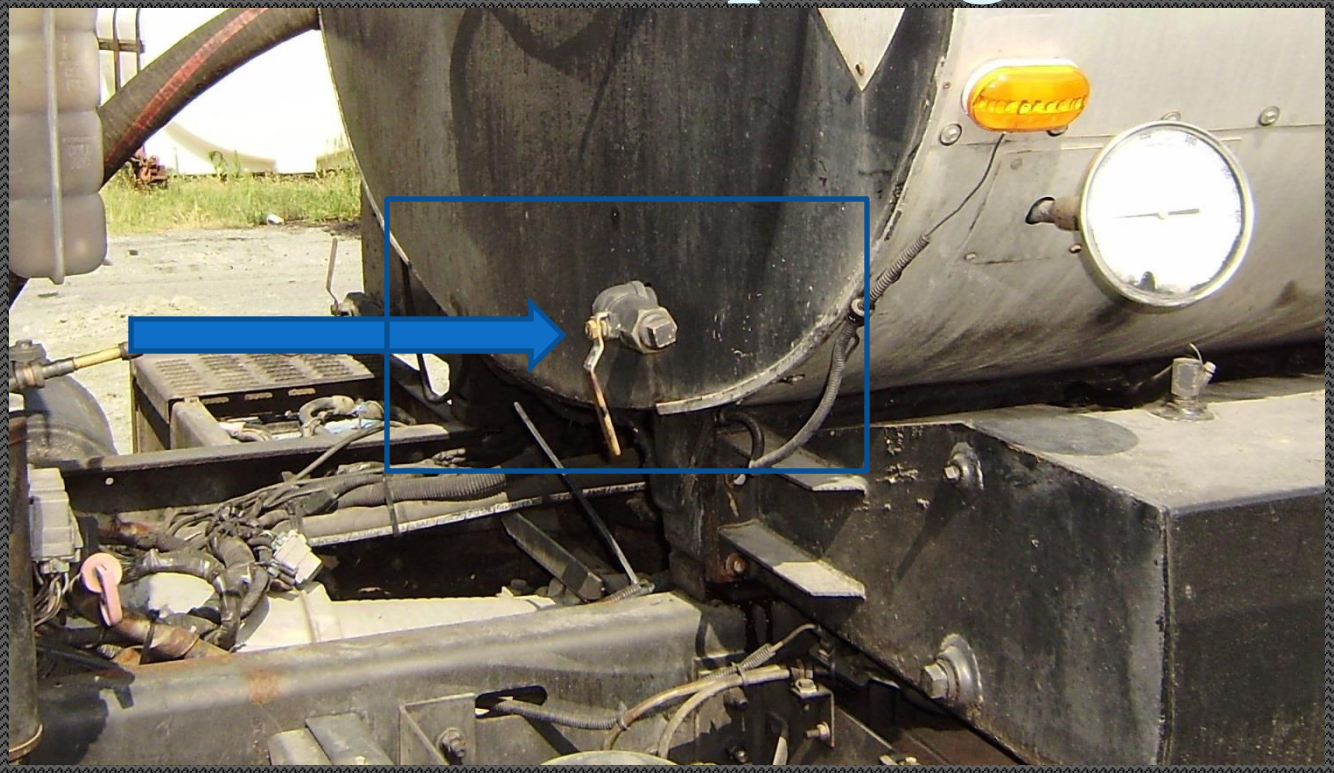
Field Sampling

Tanker-trailer

Distributor

Sampling valves

Distributor Sampling



Ideally the sample should be taken at the sample valve. If there is no sampling valve on the distributor then the sample may be obtained by unscrewing one of the nozzles on the spray bar, or a valve where the hand-sprayer is located. When collecting a sample via the nozzle, DO NOT allow the emulsion to be sprayed into the plastic container.

Tanker Sampling

Sampling from the tanker can be somewhat difficult if the sampling valve is clogged. Using a propane torch on the pipe of the valve will unclog the pipe (this also applies to the distributor)

Tanker Sampling

If there is no sampling valve on the tanker, then a sample can be taken from the outlet where the pumping hose is connected. This can be very difficult due to the size of the outlet.

There may be more than one valve that controls the flow of emulsion at pumping an upper valve and a lower valve. If there are two you will need to make sure the upper valve and lower valve are closed.

With both valves closed open the upper lower valve one or two turns. Then hang your bucket to collect the overflow. Then slowly open the lower valve until you have a manageable flow.

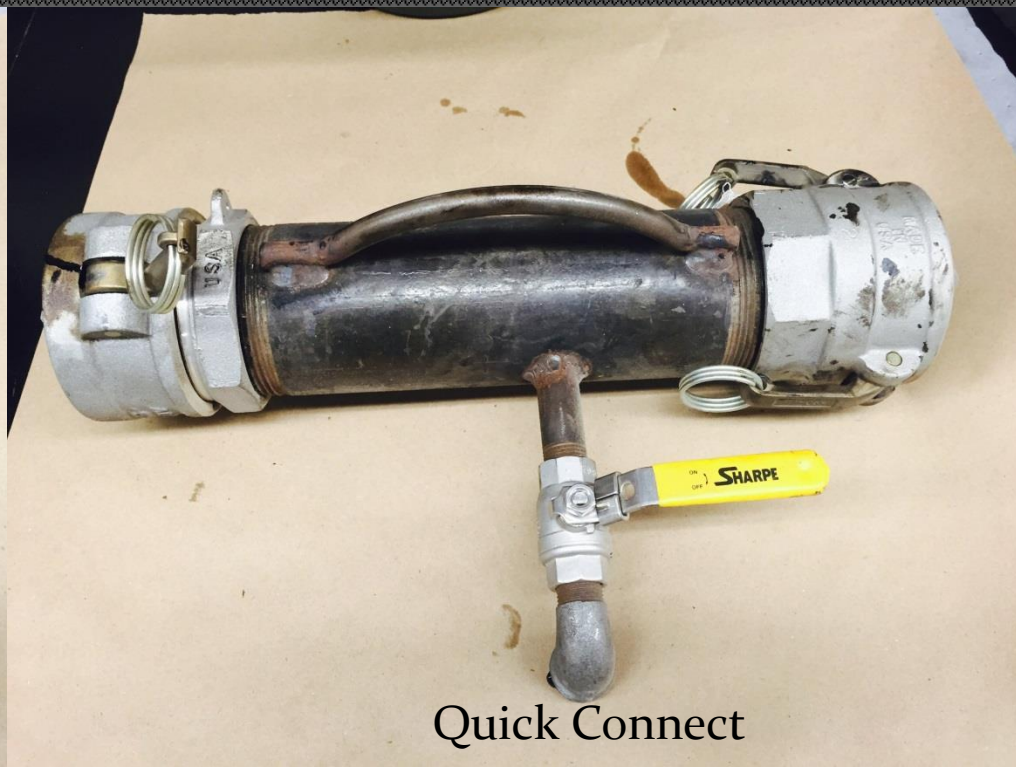
Neither valve should be opened all the way. Perhaps one turn. We have adapters for use that will aid in collecting a samples from a tanker.

2 Valve Tanker Sampling

Tanker Sampling

The following adapters can aid in sampling from a tanker they can reduce the flow down to a manageable size.

Screw On



Quick Connect

1 Valve Tanker Sampling

Field Sampling

You will need to following containers to collect the sample. A 5 gallon plastic bucket to allow 1+ gallons of emulsion to flow before collecting the sample in the ½ wide-mouth plastic container. You may also want to carry some disposable towels as well as a sharpie to label the containers.

5 gallon bucket and rubber mallet

Wide-mouth ½ gallon plastic container

Field Sampling

Once obtained, caution must be taken in handling the sample. The collected sample should not be shaken, agitated or handled roughly and should be transported to the testing facility as soon as possible.

The container should have the following information written on it.

- Material type/grade
- Date Sampled
- Location sampled from (tanker trailer, distributor or storage tank)
- Batch Number and quantity shipped (if available)

A copy of the shipping ticket/bill of lading should accompany the sample, if available.

Sample Information

- Sample Cards

If at all possible should contain as much information as possible about the material. Information that should include the following

Material type

Batch number

Quantity (i.e. 5000 gallons)

Sample from (tanker, distributor, storage tank)

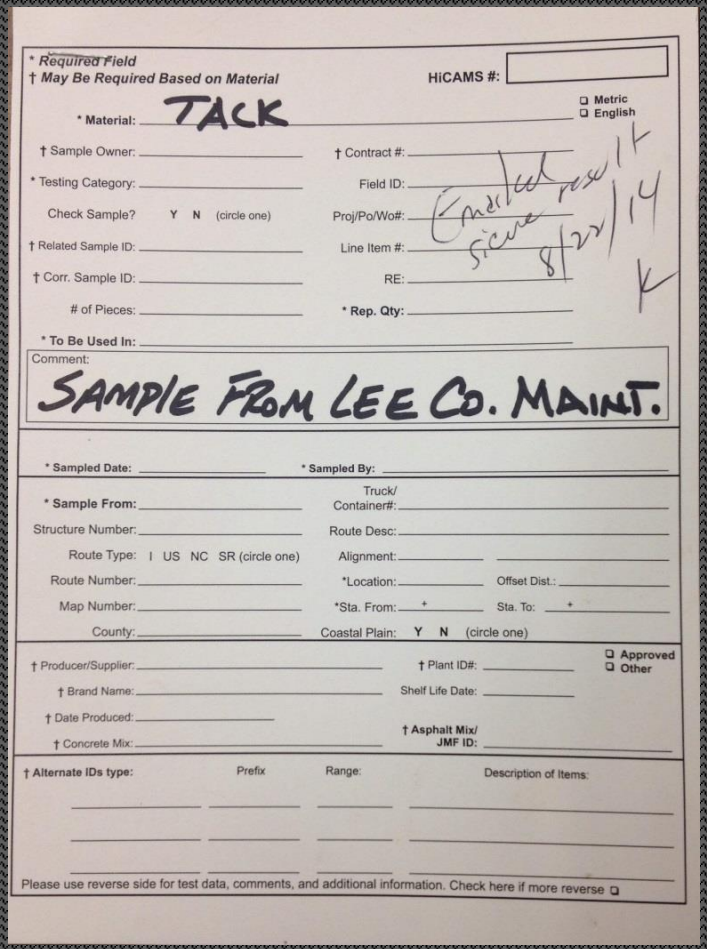
Date sampled

Name of person collecting sample

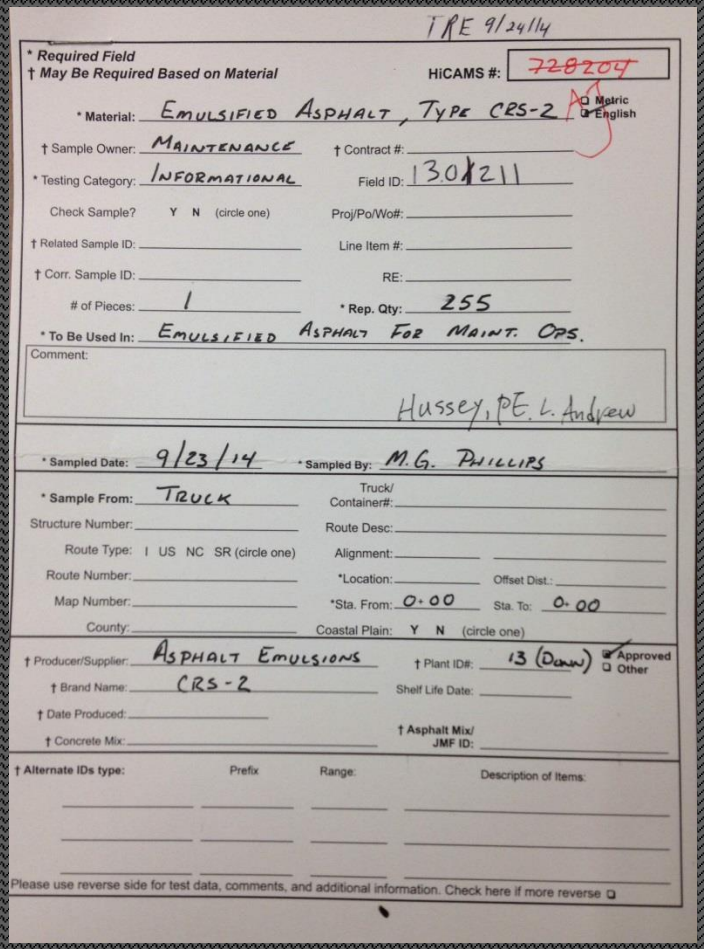
Contact information

If possible obtain a copy or the shipping ticket or bill of lading and submit it with the sample and the sample card.

Sample Cards



* Required Field
† May Be Required Based on Material
HiCAMS #:
* Material: TACK
☐ Metric ☐ English
† Sample Owner:
† Contract #:
* Testing Category:
Field ID:
Check Sample? Y N (circle one)
Proj/Po/Wo#:
† Related Sample ID:
Line Item #:
† Corr. Sample ID:
RE:
# of Pieces:
* Rep. Qty:
* To Be Used In:
Comment: SAMPLE FROM LEE CO. MAINT.
Emailed sieve result 8/22/14 K
* Sampled Date:
* Sampled By:
* Sample From:
Truck/ Container#:
Structure Number:
Route Desc:
Route Type: I US NC SR (circle one)
Alignment:
Route Number:
*Location:
Offset Dist.:
Map Number:
*Sta. From: +
Sta. To: +
County:
Coastal Plain: Y N (circle one)
† Producer/Supplier:
† Plant ID#:
☐ Approved ☐ Other
† Brand Name:
Shelf Life Date:
† Date Produced:
† Concrete Mix:
† Asphalt Mix/ JMF ID:
† Alternate IDs type: Prefix Range: Description of Items:
Please use reverse side for test data, comments, and additional information. Check here if more reverse ☐



TRE 9/24/14
* Required Field
† May Be Required Based on Material
HiCAMS #: ~~728204~~
* Material: EMULSIFIED ASPHALT, TYPE CRS-2
☐ Metric ☑ English
† Sample Owner: MAINTENANCE
† Contract #:
* Testing Category: INFORMATIONAL
Field ID: 130211
Check Sample? Y N (circle one)
Proj/Po/Wo#:
† Related Sample ID:
Line Item #:
† Corr. Sample ID:
RE:
# of Pieces: 1
* Rep. Qty: 255
* To Be Used In: EMULSIFIED ASPHALT FOR MAINT. OPS.
Comment: Hussey, PE. L. Andrew
* Sampled Date: 9/23/14
* Sampled By: M.G. PHILLIPS
* Sample From: TRUCK
Truck/ Container#:
Structure Number:
Route Desc:
Route Type: I US NC SR (circle one)
Alignment:
Route Number:
*Location:
Offset Dist.:
Map Number:
*Sta. From: 0+00
Sta. To: 0+00
County:
Coastal Plain: Y N (circle one)
† Producer/Supplier: ASPHALT EMULSIONS
† Plant ID#: 13 (DOWN)
☑ Approved ☐ Other
† Brand Name: CRS-2
Shelf Life Date:
† Date Produced:
† Concrete Mix:
† Asphalt Mix/ JMF ID:
† Alternate IDs type: Prefix Range: Description of Items:
Please use reverse side for test data, comments, and additional information. Check here if more reverse ☐

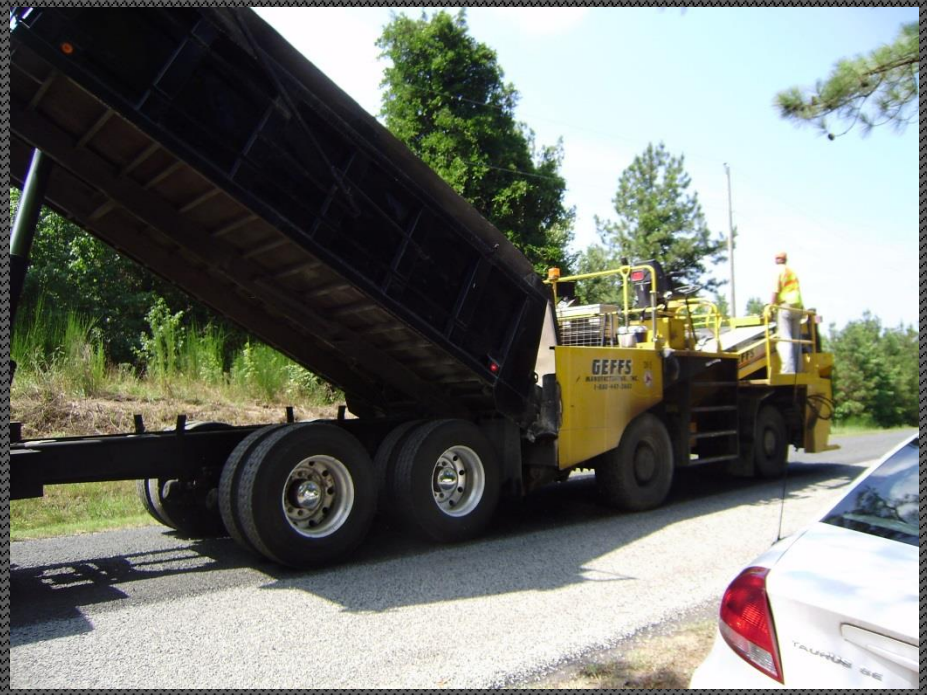
Incorrect

Correct

Chip Seal Operations

Chip Seal Operations

Chip Seal Operations



Questions?

Application

Field Sampling

CRS-2L

CRS-2P

Chip Seal Emulsions

Storage and Handling

Asphalt Emulsion

Troubleshooting

Contact Us

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Tony Collins 919-329-4208 tdcollins@ncdot.gov

Sources

- www.bpbitumen.com.au
- www.slurry.com
- "Chip Seals Best Practices" – National Center for Pavement Preservation
- "Asphalt Emulsion Technology" – Transportation Research Board *Of the National Academies*
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- "How Relative Humidity Affects Evaporation" – Atula Gupta
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- www.pavementinteractive.org/article/emulsified-asphalt
- http://www.asphalt-emulsion.com/gallery.html