Topics

- Emulsion Basics
- Mixing of Emulsions
- Tank Storage and Agitation
- Heating and Cooling
- Pumping
- Dilution
- Loading
What is an Emulsion?

- An emulsion is a mixture of two or more liquids that are normally immiscible (unmixable or unblendable).
Essential Components of an Asphalt Emulsion

- Asphalt
- Water
- Emulsifier

- TRB circular E-C102
Emulsifier Function

- An emulsifier allows mixing of incompatible materials
  - Oil and eggs in mayonnaise
  - Or asphalt and water in asphalt emulsions
The emulsifier used to make an emulsion, and its dosage, determine the speed and stability of an emulsion and is tailored to fit the emulsion’s use.
Emulsion Stability

- Emulsion stability indicated by Type
- Common Emulsion Types
  - **Slow Set** (very stable)
    - SS–1, CSS–1h
  - **Medium Set**
    - MS–1, HFMS–2, CMS–2
  - **Rapid Set** (less stable)
    - RS–1, CRS–1h, CRS–2P
- “Faster” emulsions will break more readily both on the road and in storage.
Basic Emulsion Classifications

- Anionic (includes nonionic)
- Cationic
- pH “imbalance” critical to performance
Mixing Anionic and Cationic Emulsions

- Anionic emulsifiers are effective at high pH (alkaline)
- Cationic emulsifiers are effective at low pH (acidic)
- Mixing anionic and cationic emulsifiers will shift the pH towards Neutral and cause demulsification
Avoid Mixing Anionic and Cationic Emulsions
Emulsions “break” when the asphalt particles stick together and the water is released.

- On the road in a tack coat, chip seal, prime coat
- ...or in tanks and machinery
Emulsions “break” when the asphalt particles stick together and the water is released.
Pumping

- Always avoid unnecessary pumping!
Pumping

- Tight tolerances create high shear zones
- Higher speeds increase shear
- Flush lines periodically
- Some pump types are harder on emulsions
- Gear pumps common
Pumping

- Higher Shear Pumps
  - Gear (internal and external)
  - Lobe
  - Vain
  - Piston
- Lower Shear Pumps
  - Centrifugal
  - Diaphragm
  - Progressive cavity (screw and Moyno)
  - Peristaltic
Pump Stability

Video
Tank Storage

- Vertical vs. Horizontal
  - Surface area
  - Skin formation
Tank Storage

- Agitation
  - Large diameter, slow-turning propellers best
  - Mix slowly and gently
  - Do not use forced air
Foaming

- Avoid processes or speeds that cause foaming
- Air bubbles attract the emulsifier molecules
- Competition between air bubbles and asphalt particles creates emulsion instability
Heating and Cooling

- Heat and cool emulsion slowly
- Agitate gently
- Do not heat above 85°C or 185°F
- Do not freeze
Avoid Extreme Contact Temperatures

- Emulsion will boil

Video
Diluting Emulsion

- Not all emulsions should be diluted
  - Tack coats, prime coats, fog seals – YES
  - Slurry, micro surfacing, chip seal – NO
- When diluting, always add water to emulsion
  - Adding emulsion to water can cause instability
- Contaminated water
  - Pond water
  - Irrigation water
  - Rusty surfaces or rusty water
  - Incompatible emulsions
Diluting Emulsion

- Diluted emulsion can settle quickly
- Do not store diluted emulsions for extended periods of time
- Gentle agitation may be used to control settlement
Loading Emulsion

- Consider previous load
  - Compatible emulsion?
  - Chemical residue
- Load trailers from bottom when possible
  - Avoid foaming
Loading Emulsion

- Do not load on hot material
  - Emulsion can boil over
  - Steam occupies 1,600x the volume of liquid water
  - 5 gallons X 1600 = 8000 gallons
Asphalt Emulsion Manufacturers Association (AEMA)  
“Recommended Performance Guidelines” excerpt

- Avoid foaming, over-agitation, over-pumping
- Avoid contamination with unclean water (if diluted), spoilage, cross-contamination (anionic with cationic)
- Avoid freezing, boiling, temperature shock