2007 MAIREPAVE5

Emulsion for Pavement Maintenance and Rehabilitation

August, 8

What is an Emulsion?

- Mechanical and chemical processes are used to combine two or more materials that will not mix under normal conditions. Generally the mixture is a liquid.
- i.e. mayonnaise, latex paint, ice cream, and asphalt emulsions.

Composition

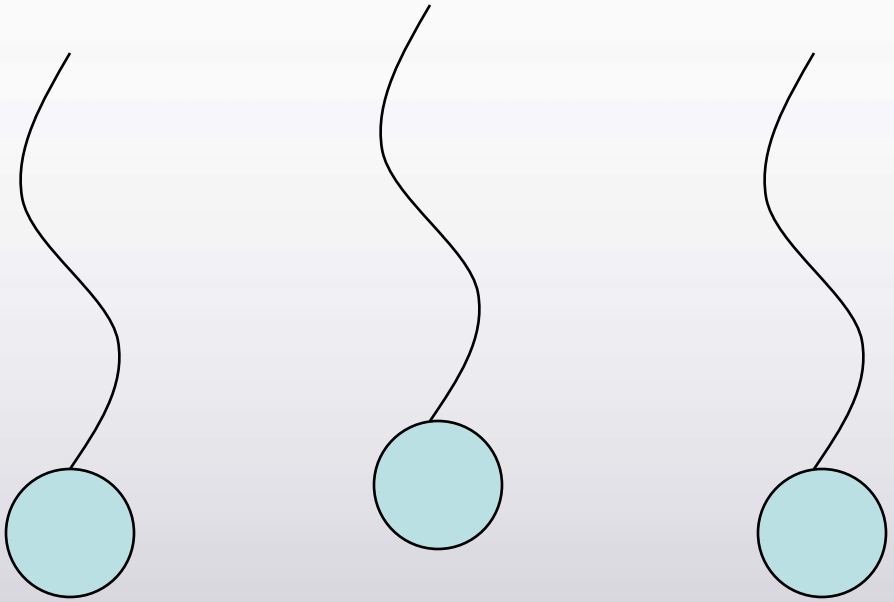
- 1. Asphalt
- 2. Water
- 3. Surfactant / Emulsifier
- 4. Acid or Caustic
- 5. Mechanical Energy

The emulsion is a chemically stabilized system; <u>all</u> components contribute to the stability of the system

Surfactant

- Water and Oil don’t mix?
- Surface Active Agent
  (Surfactant, chemical, emulsifier, emulgent, agent, emulsifying agent, soap)
- Surfactants = very large molecules
  - one end soluble in water (hydrophilic)
  - other end soluble in oil (lypophilic)

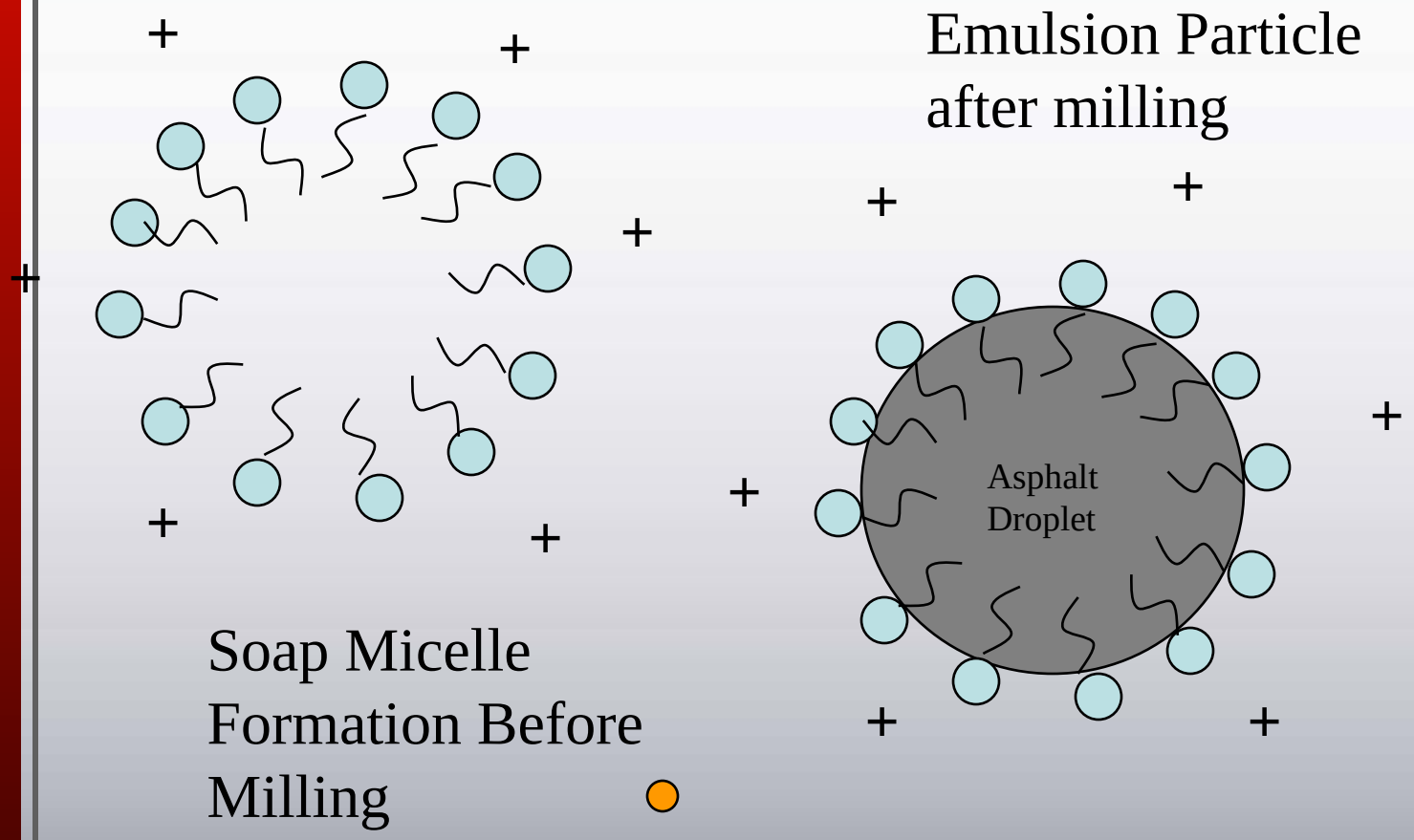
Surfactant Molecule



Lipophilic Tail
(Oil Loving)

Hydrophilic Head
(Water Loving)

Micelle Creation



Under the Microscope

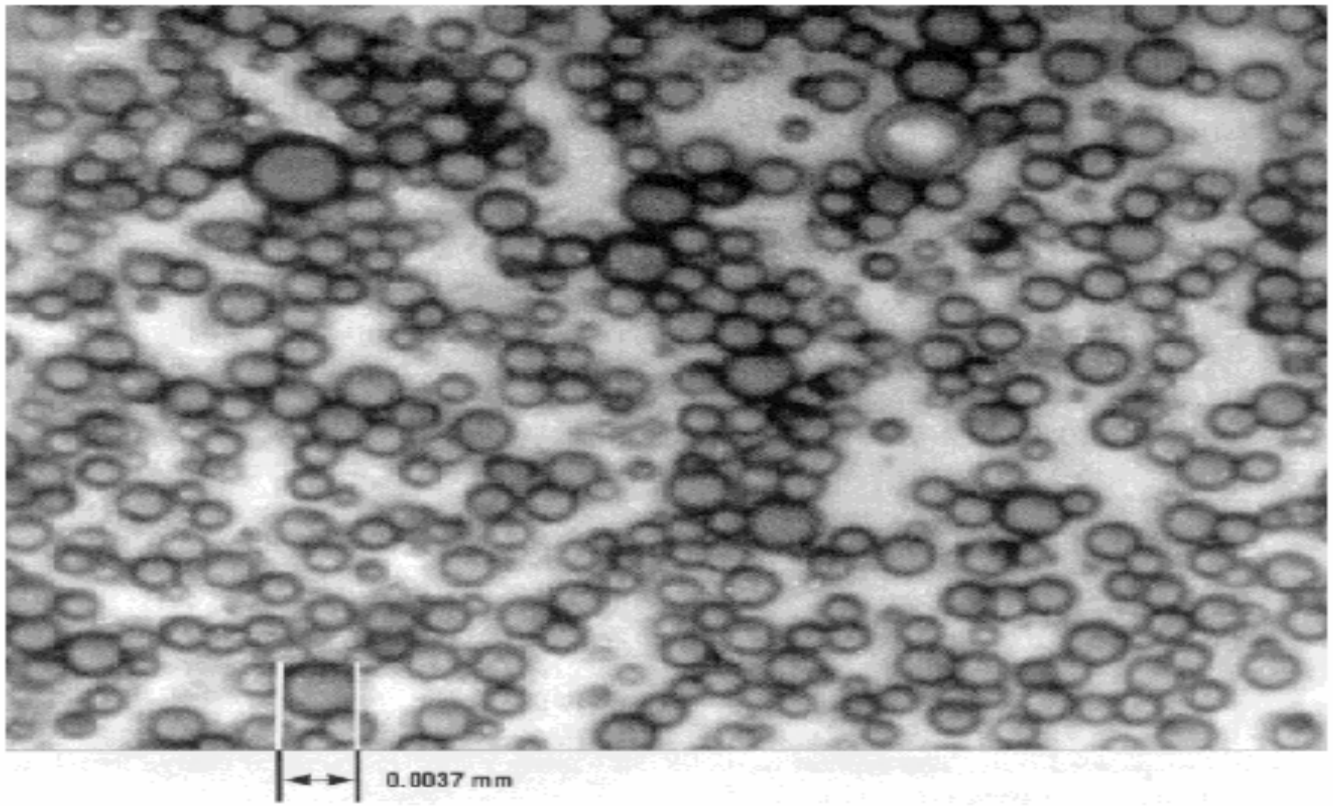
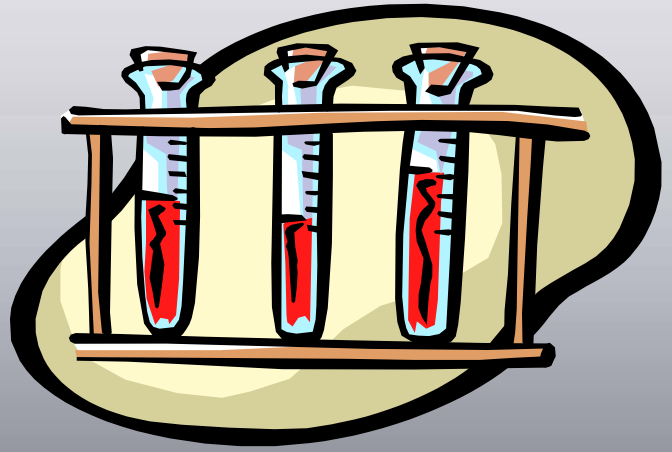


Figure 2.6-1 Relative Sizes and Distribution of Asphalt Particles in an Emulsion

Asphalt Emulsions
Classified by type of surfactant

- Cationic
  - Positively charged
  - **PMCRS-2H, CQS-1H, CSS-1H, CMS-2**
- Anionic
  - Negatively charged
  - SS-1H, HFRS-2P, QS-1H, HFE-xx
- Nonionic
  - Neutral



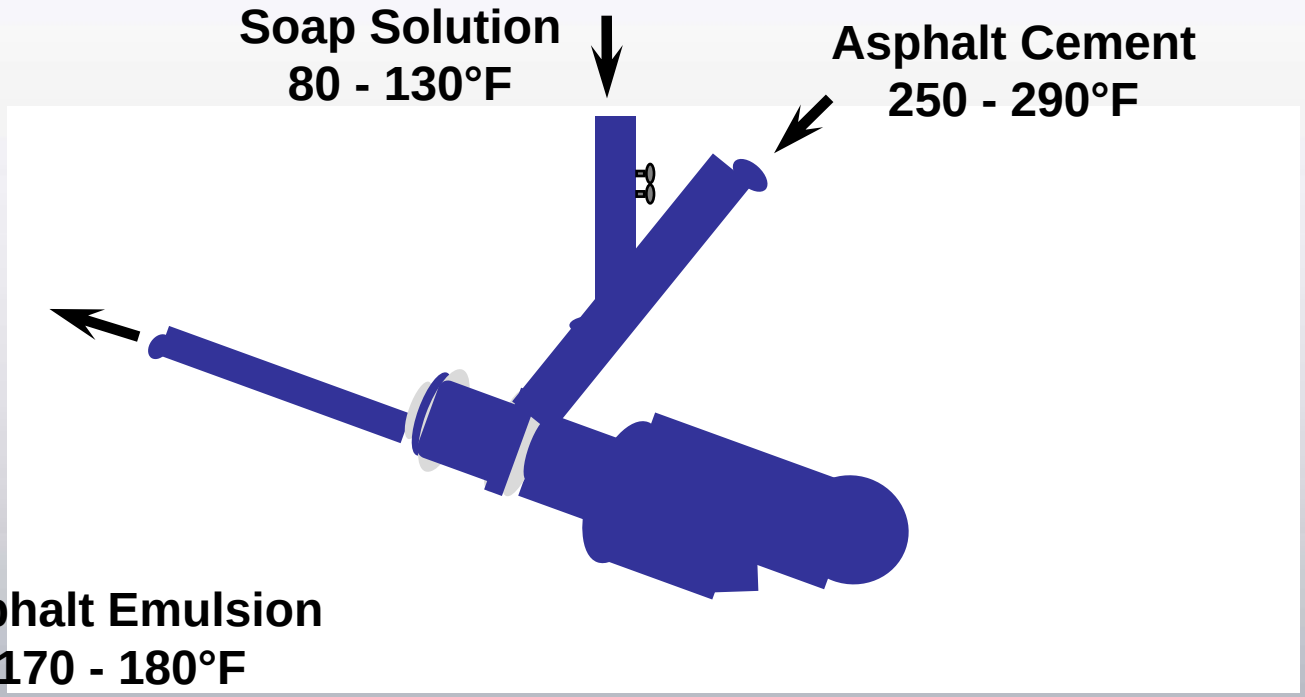
Nomenclature

- Emulsion Charge
  - C
  - HF
- Setting Characteristics
  - RS -
  - MS -
  - SS -
  - QS -
- Emulsion Viscosity
  - 1
  - 2
- Residual AC Characteristics
  - H
  - S
  - P
  - L
  - LM
  - R

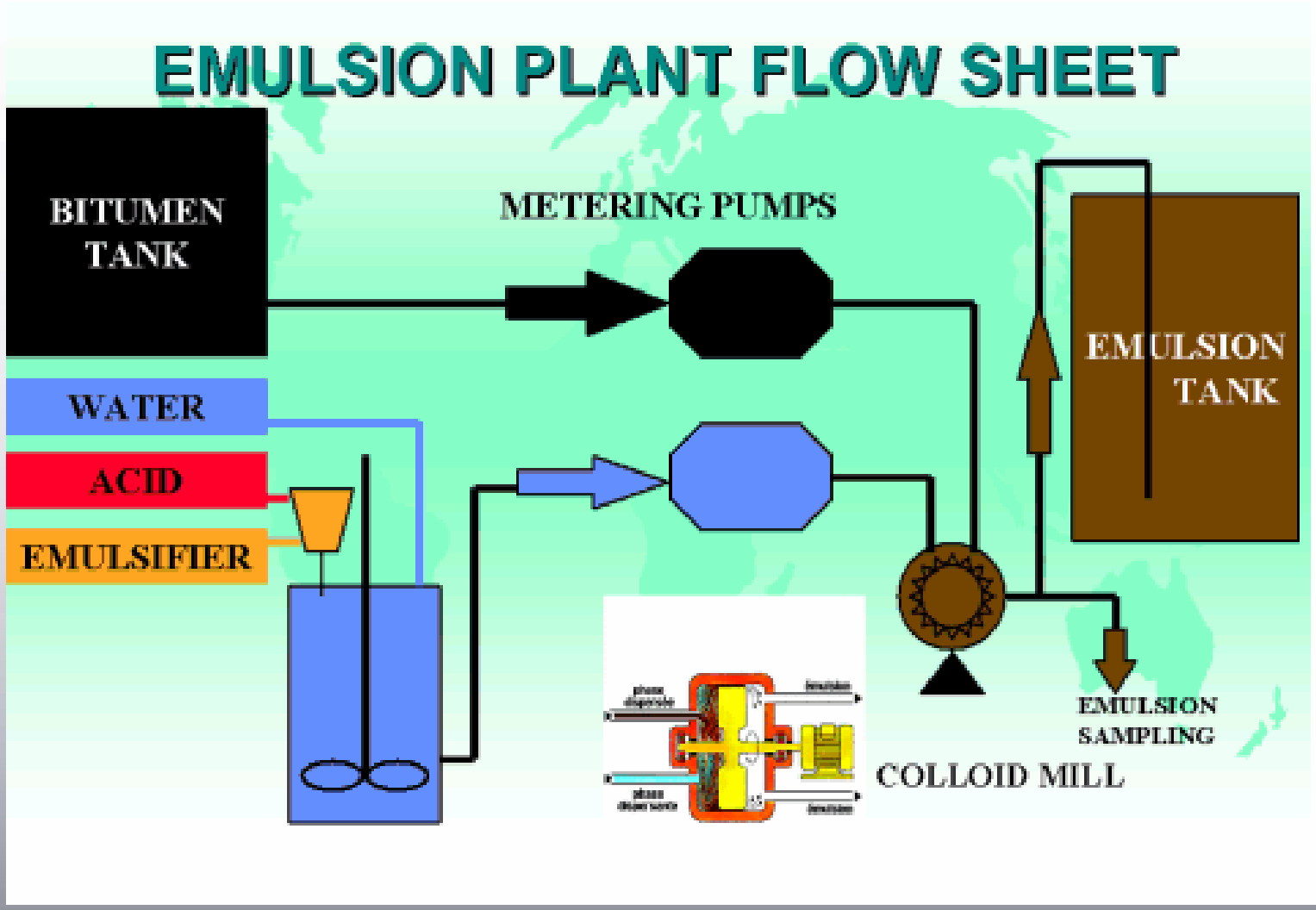
Add Water, Asphalt, Emulsifier

Do you get an emulsion?

Colloid mill shears asphalt into tiny particles



Mill Flow Diagram



Construction Benefits

- **Safer for Workers**
  - Lower temperatures reduce burn hazards
  - Minimal fume inhalation
  - Non-flammable
- **Ideal for remote locations where there are no hot mix plants**
  - In-situ processes reduce transportation needs

Community Benefits With:

- Costs less than traditional overlay maintenance or white topping
- Reduce user delay costs
  - Quick construction
  - Reduce reconstruction time
- Reduce overall life cycle costs of pavements

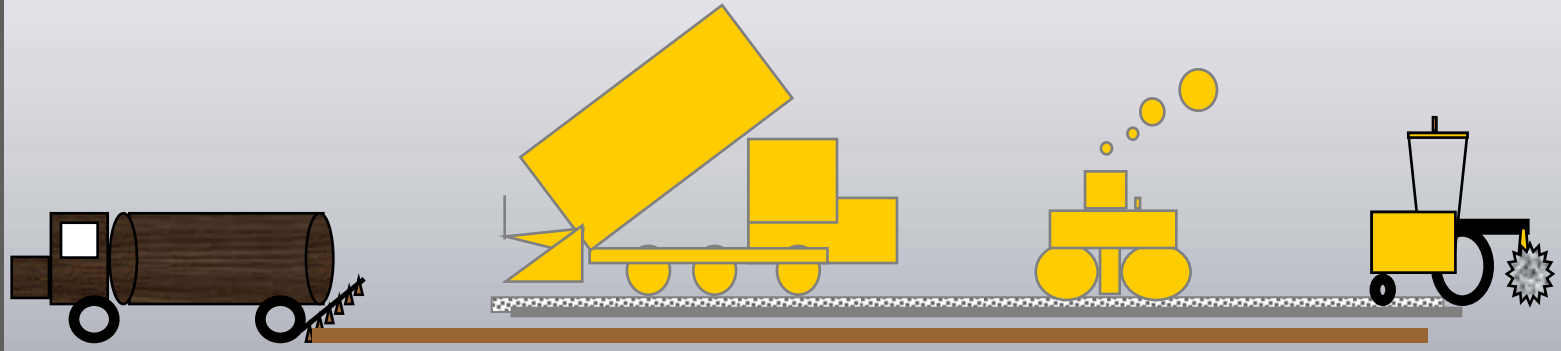
Where do we use emulsions?

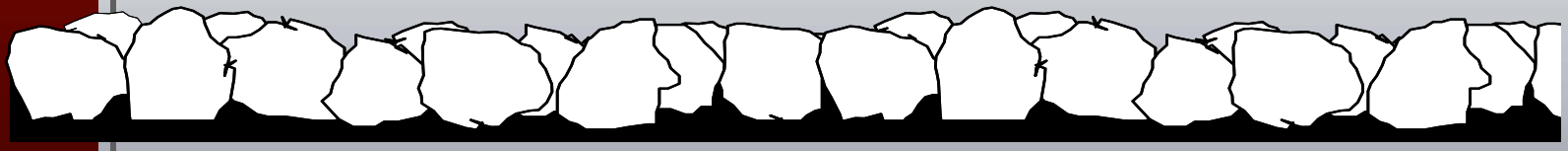
Applications

- **Base Stabilization**
- **Blade Mix**
- **Cape Seal**
- **Chip Seal**
- **Cold Mix**
- **Cold Recycling**
- **Crack Filling**
- **Dust Palliative**
- **Emulsion cold in-place recycling**
- **Fog Seal**
- **Hot Recycling**
- **Sand Mix**
- **Sand Seal**
- **Sandwich Seal**
- **Low Temp Seal Coat**
- **Low volume road surfacing**
- **Macro-surfacing**
- **Micro-surfacing**
- **Mix Paver**
- **Patch Mix**
- **Pavement Sealer**
- **Pipe Coating**
- **Prime**
- **Pugmill Mix**
- **Recycled Asphalt Pavement**
- **Slurry Seal**
- **Specialty**
- **Tack**

Chipseals

- RS, CRS, HFRS, HFMS
- Distributor sprays emulsion on road
- Chips spread on top of emulsion
- Mechanism of emulsion break
  - mostly chemical, partially evaporation
- Formulated for rapid set, low stability





Chipseals...

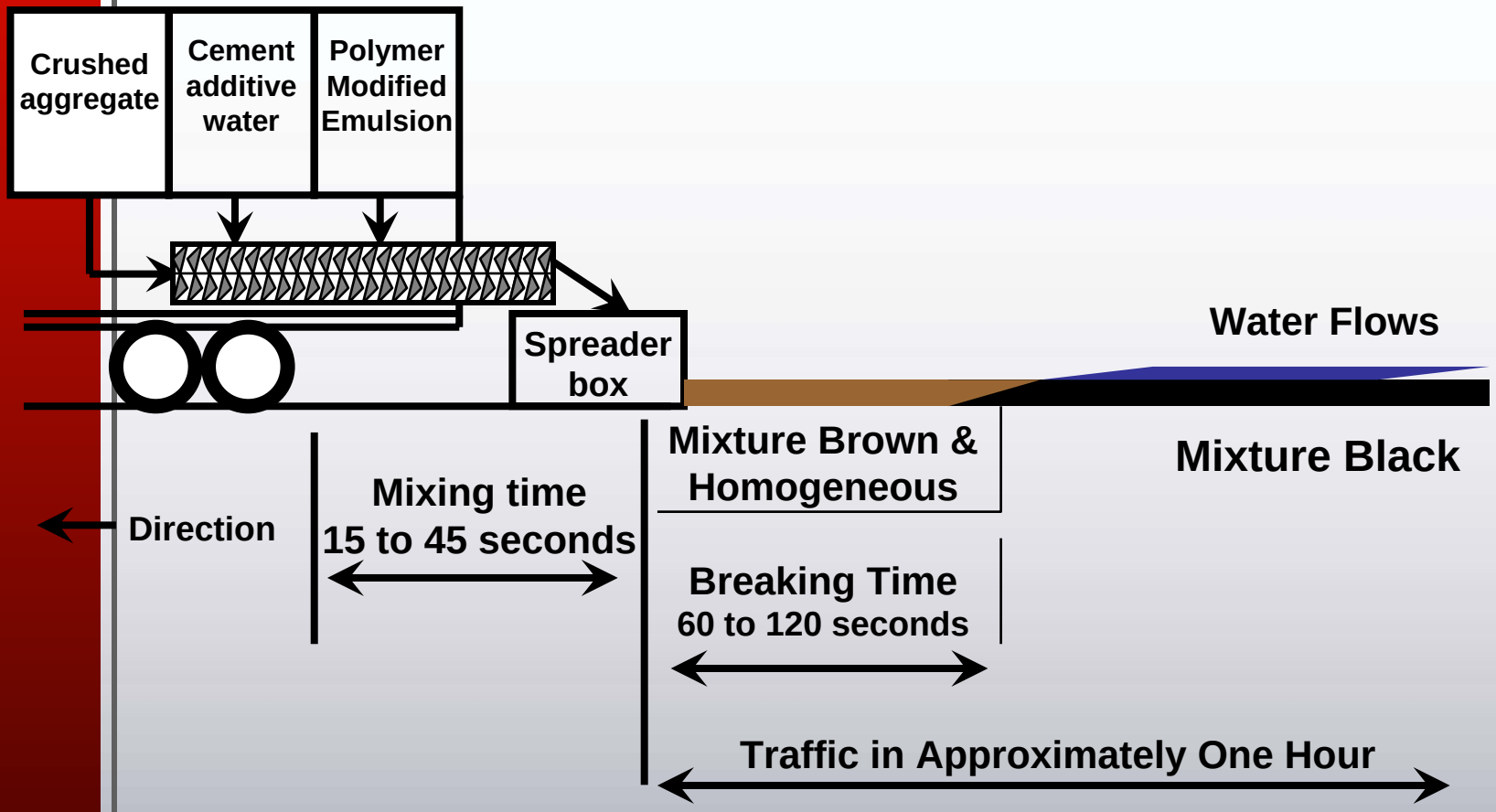
- Protect and waterproof the underlying pavement
- Extend pavement service life
- Improves surface friction (safety)
- Seals small cracks

Microsurfacing

Micro-Surfacing
The Right Treatment For:

- Restoring surface quality & skid resistance
- Rut filling
- Weatherproofing
  - Sealing
  - Reducing oxidation
- High traffic areas
- Extending the life of asphalt and concrete pavements

Micro-Surfacing Machine Schematic



Cold in Place Recycling

The Process

- Train of equipment
  - Mills old pavement
    - Reclaimed asphalt pavement (RAP)
  - Crushes RAP
  - Mixes with recycling emulsion
  - Paves recycled mix
  - Compacts
  - Ready for surface treatment

Engineered CIR Solventless Emulsion

- Contains No Solvent
- Binder selected for climate
- Innovative chemistry for CIR
  - Controlled break, cohesion, coating/adhesion
- Formulated for needs of each project
- Performance is built around mix

Benefits

- Flexible & strong bituminous stabilized base
  - Resists rutting
    - Strong enough for traffic before surfacing
  - Improved resistance to thermal cracking
  - Improved resistance to fatigue cracking
  - Improved resistance to moisture damage
- Better bituminous coating than alternatives
- Using the asphalt that is already there!

Emulsion Evaluation & Testing

- **Saybolt Viscosity**
- **Sieve Test**
- **Particle Charge**
- **Oil Distillate %**
- **Demulsibility**
- **Distillation Residue**
- **Penetration**
- **Ductility**

Purpose For Saybolt Viscosity

- Measurement of time a known volume of emulsion passes through a known orifice at given temperature.
- Pump ability
- Emulsion run off (i.e. chip seal application)

Sieve Test

Purpose for Sieve

- Measure of asphalt that fails to pass a #20 sieve / given quantity of emulsion
- Pumpability through spray nozzles
- The asphalt is sufficiently emulsified for consistent application.

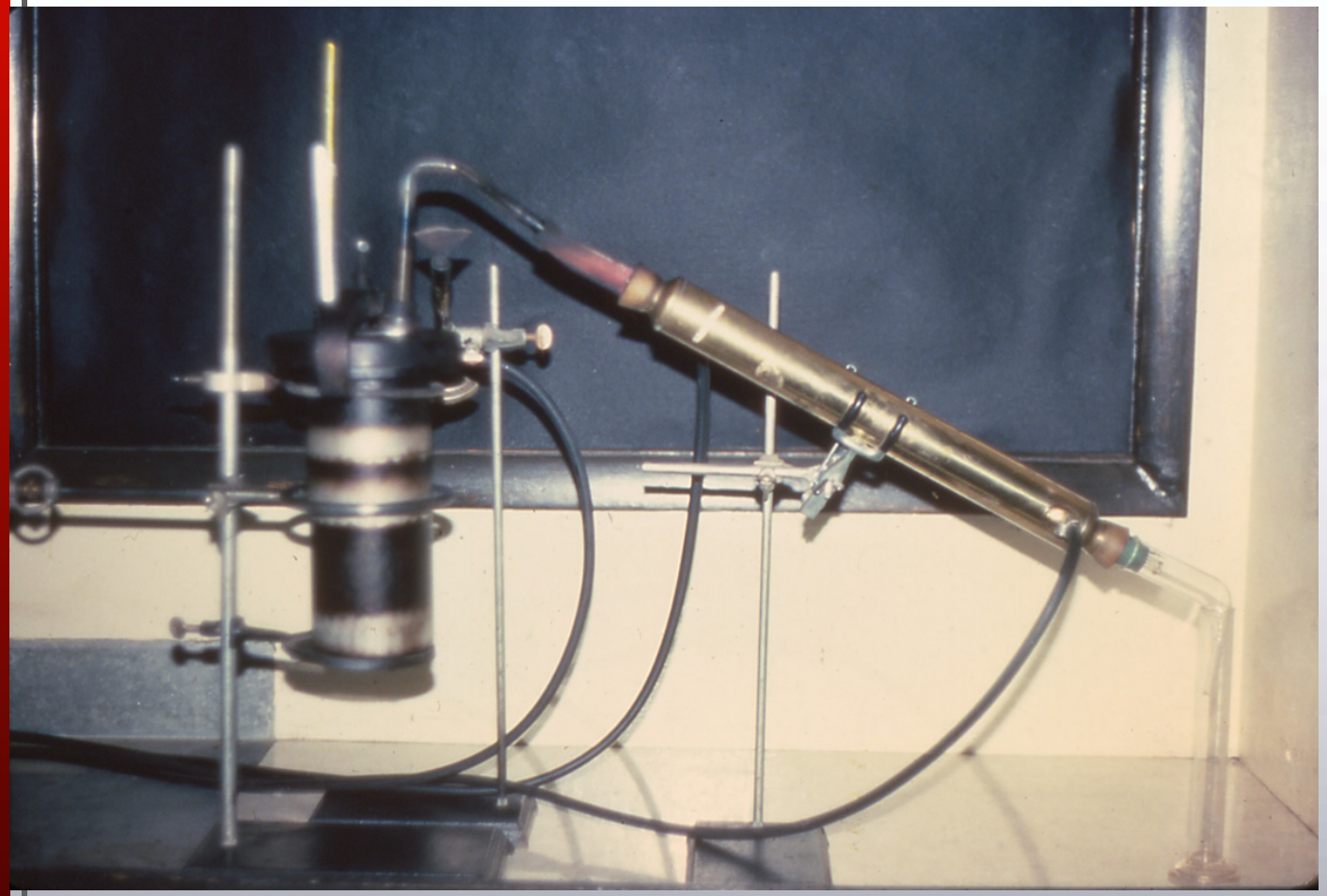
Purpose for Particle Charge

- To determine if the emulsion is Cationic or Anionic.
- Current is applied to the solution (emulsion) through probes and the particles will collect on the cathode (negatively charged) for cationic emulsions

Demulsibility

- Observation of a forced break of the emulsion by chemically deactivating the surfactant vs. the known residue of the emulsion.
- Used for rapid set (chip seal) emulsions (CRS, RS, PMCRS)
- Simulate set time as aggregate and oil are placed in contact.

Residue Distillation



Purpose for Oil Distillate

- Determine volatiles in the residual AC

Purpose for Residual Penetration

- Measure of the stiffness of asphalt left after the emulsion has cured.

Ductility

- Rheological properties of the residual Asphalt
- Indication of polymer presence
- Resistance to cracking

Thank You.

Questions?