Maine's Experience Utilizing Full Depth Reclamation with Foamed Asphalt

NESMEA 2004

Portsmouth, NH

History of FDR in Maine

- Late ’80s: 2 projects stabilized with emulsion
- 1990s: Numerous projects, most not stabilized
- 2000: Experimental project comparing four methods – Emulsion, Emulsion + Lime, Cement and untreated control section

Results of Study

- Emulsion w/Lime showed greatest strength gain, lowest life-cycle cost
- Follow-up lab study showed similar benefit from Emulsion w/Cement
- Decision made to stabilize majority of FDR projects

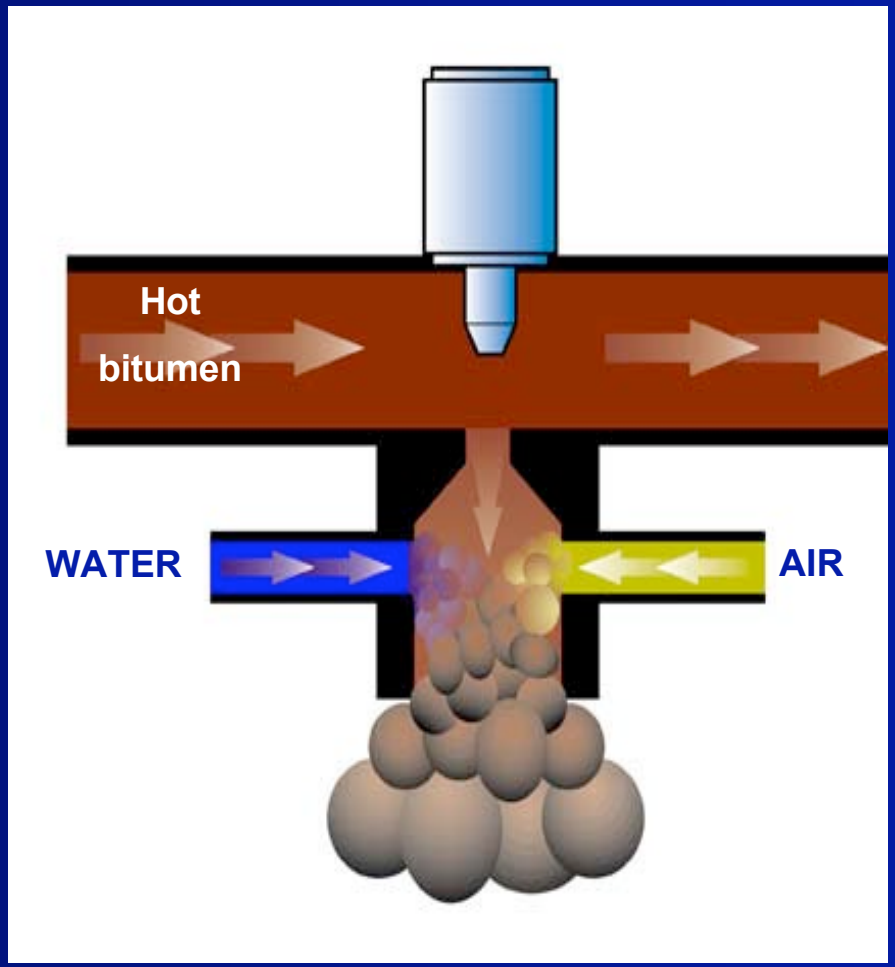
Foamed Asphalt

- MDOT was interested in trying foam stabilization
- In spring of 2001, Wirtgen assisted us in advertising a pilot project
- Loudon Associates and WPI performed onsite evaluation and mix design
- Project advertised later that spring

Why the interest in Foam Stabilization?

- Uses PG binder, less expensive than emulsified asphalt
- Emulsion contains 30 percent water, requires curing period (7-10 days)
- Process had been used successfully elsewhere

How does Foamed Asphalt work?



Typical candidate

Typical candidate

Typical candidate

Test Pit Evaluation

Collecting Pavement and granular material samples

Crushing Specimens

Samples now obtained with milling attachment

Sieve Analysis

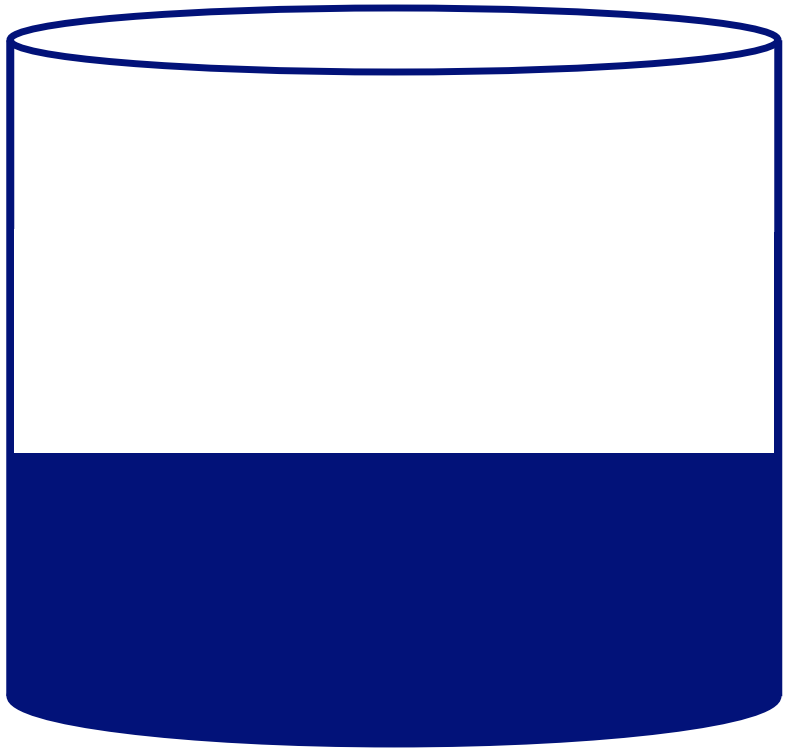
Need > 5%
Minus #200

Moisture-Density Relationship

Lab Foam Plant

Testing the Binder

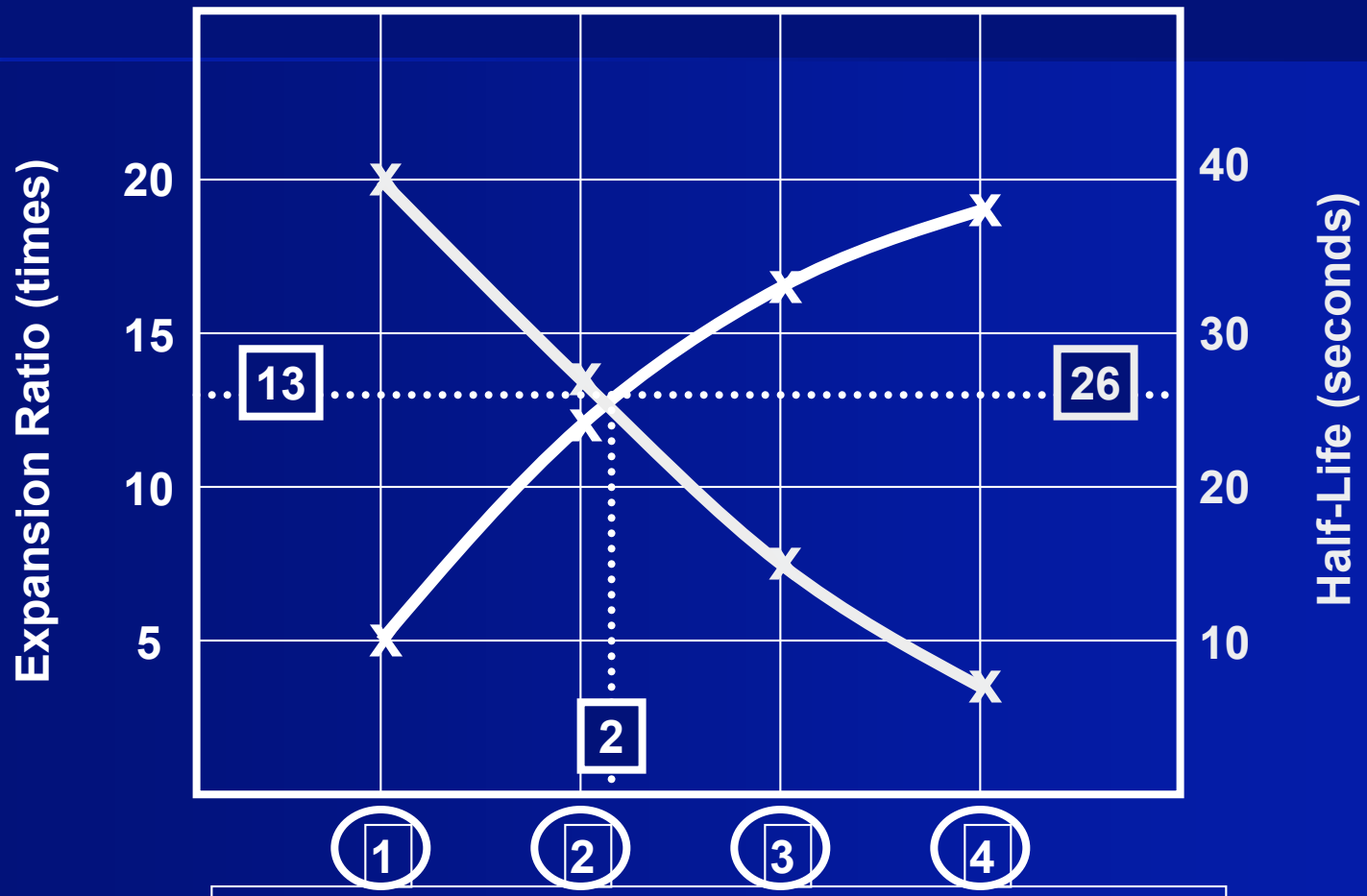
Foaming Characteristics



Expansion

Half-life

Determining Foam Water



Bitumen Temperature 175°C

What if you don't get good foaming?

- Increase binder temperature
- Change binder source
- Change binder grade

Mix Design specimens

- Blend crushed pavement and granular material at specified ratio
- Add other materials required (cement or lime, crusher dust)
- Add moisture
- Mix specimens at several binder contents

Additives

- Most designs contain portland cement
- Recommendation is 1 to 1-1/2 % max
- Used to prevent moisture damage and aid in dispersion of the foamed asphalt

Compacting specimens

- Wirtgen design method uses Marshall compaction
- New procedure uses gyratory compactor
- 100 mm specimens recommended to reduce material needed

Curing

- 40 degrees C
- 72 hours

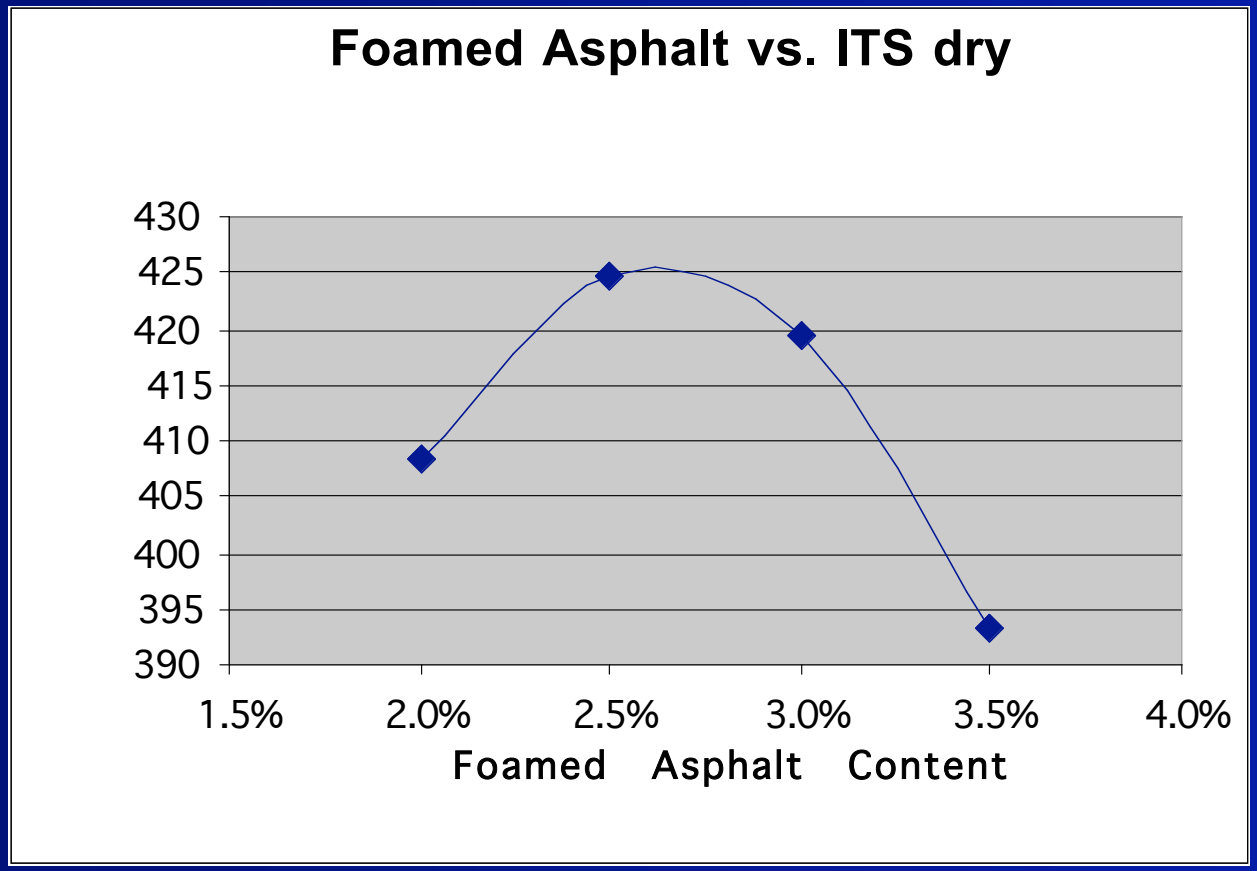
Testing of specimens

- Indirect tensile strength (dry)
- Indirect tensile strength (soaked)

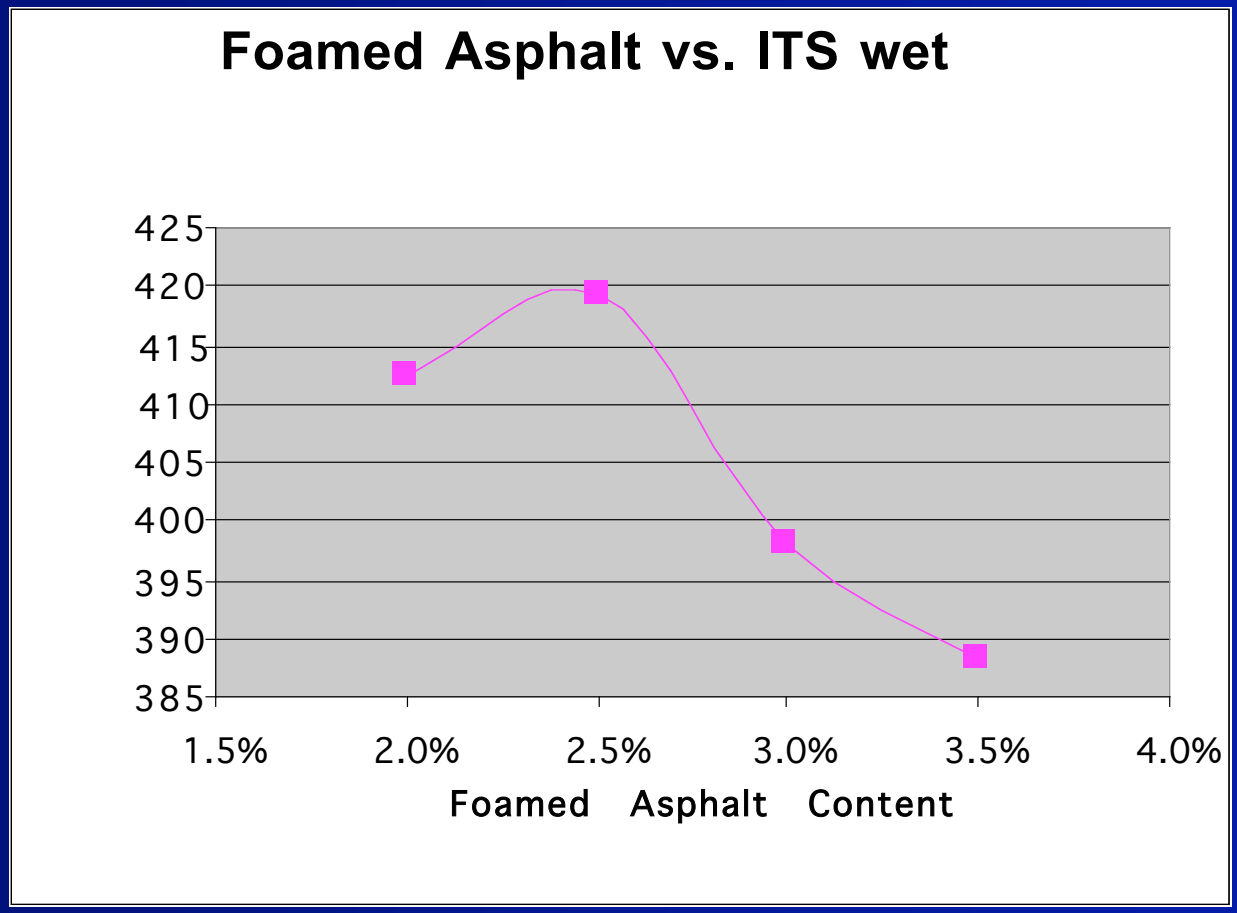
Criteria for selecting binder content

- Maximum soaked tensile strength
- Dry tensile strength > 200 kPa
- Wet tensile strength > 100 kPa
- Retained tensile strength > 50%

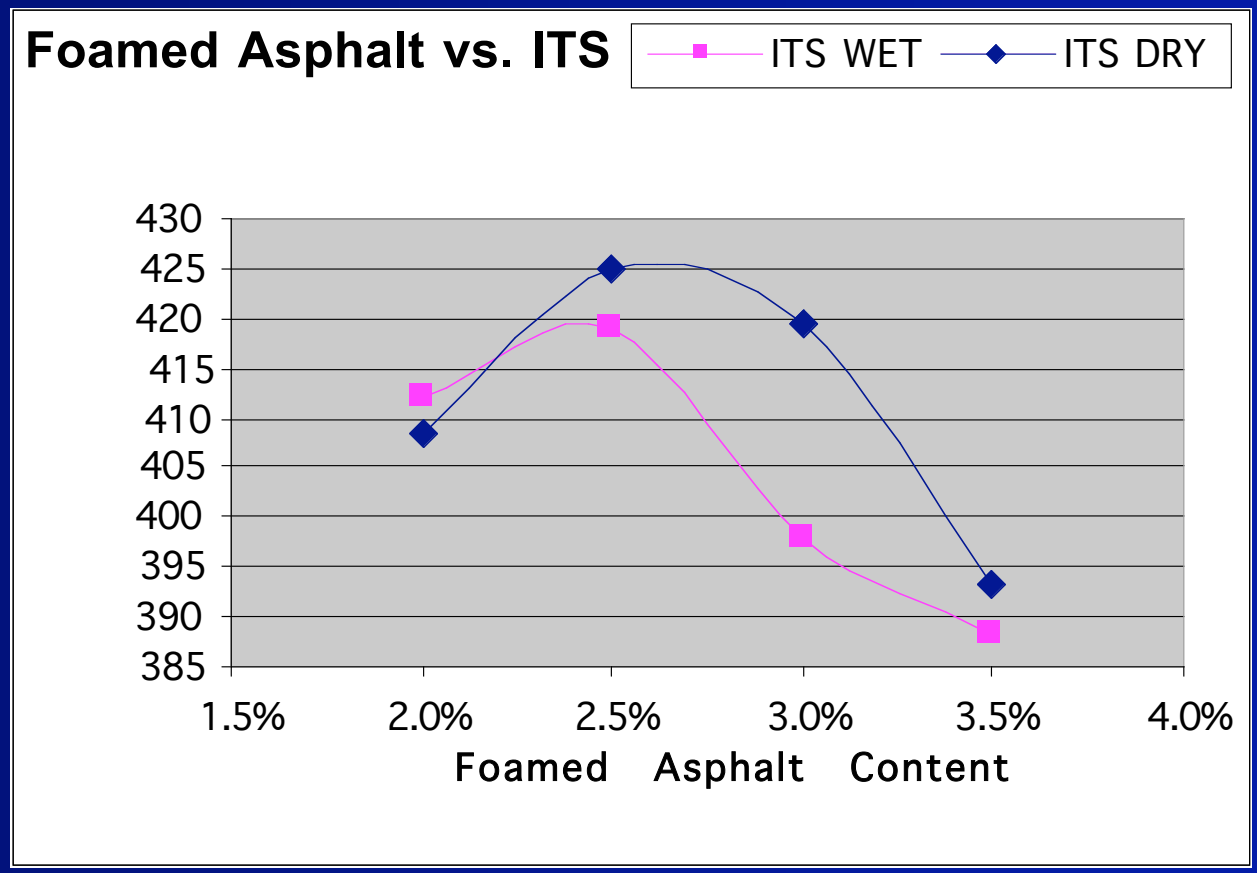
Typical Mix Design



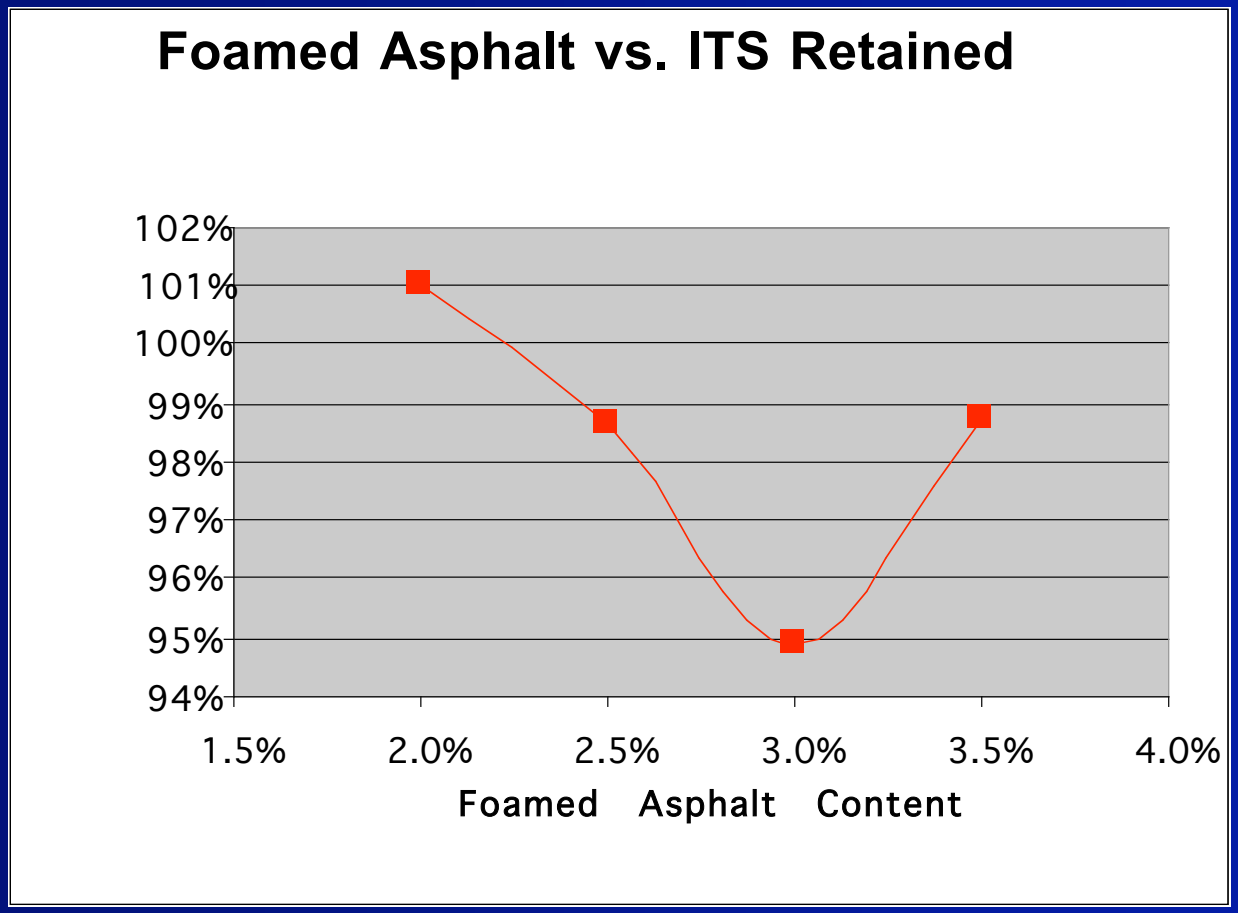
Typical Mix Design



Typical Mix Design



Typical Mix Design



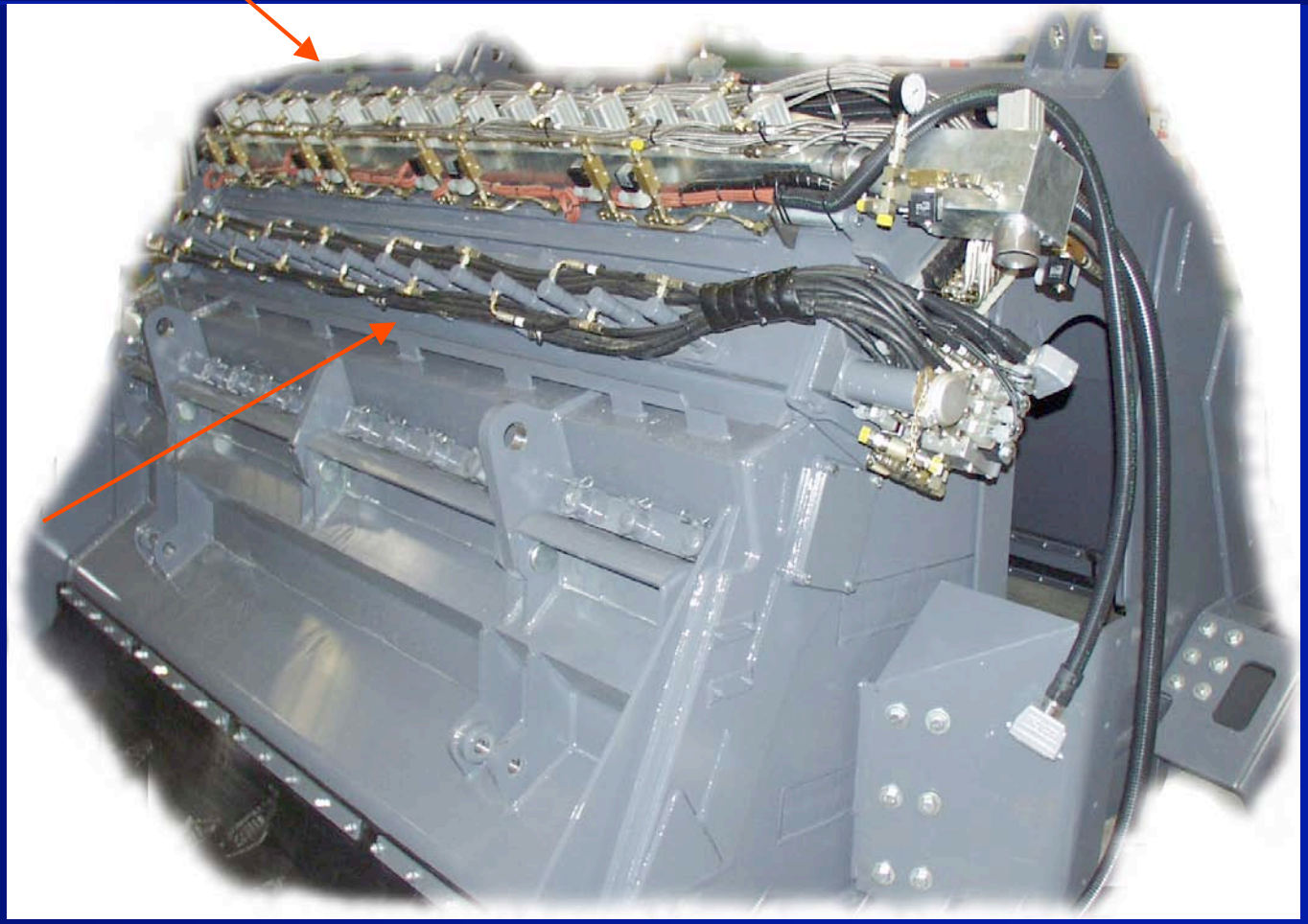
Construction Issues

- Need proper equipment
- Need trained operator and ground person
- Proper compaction is critical

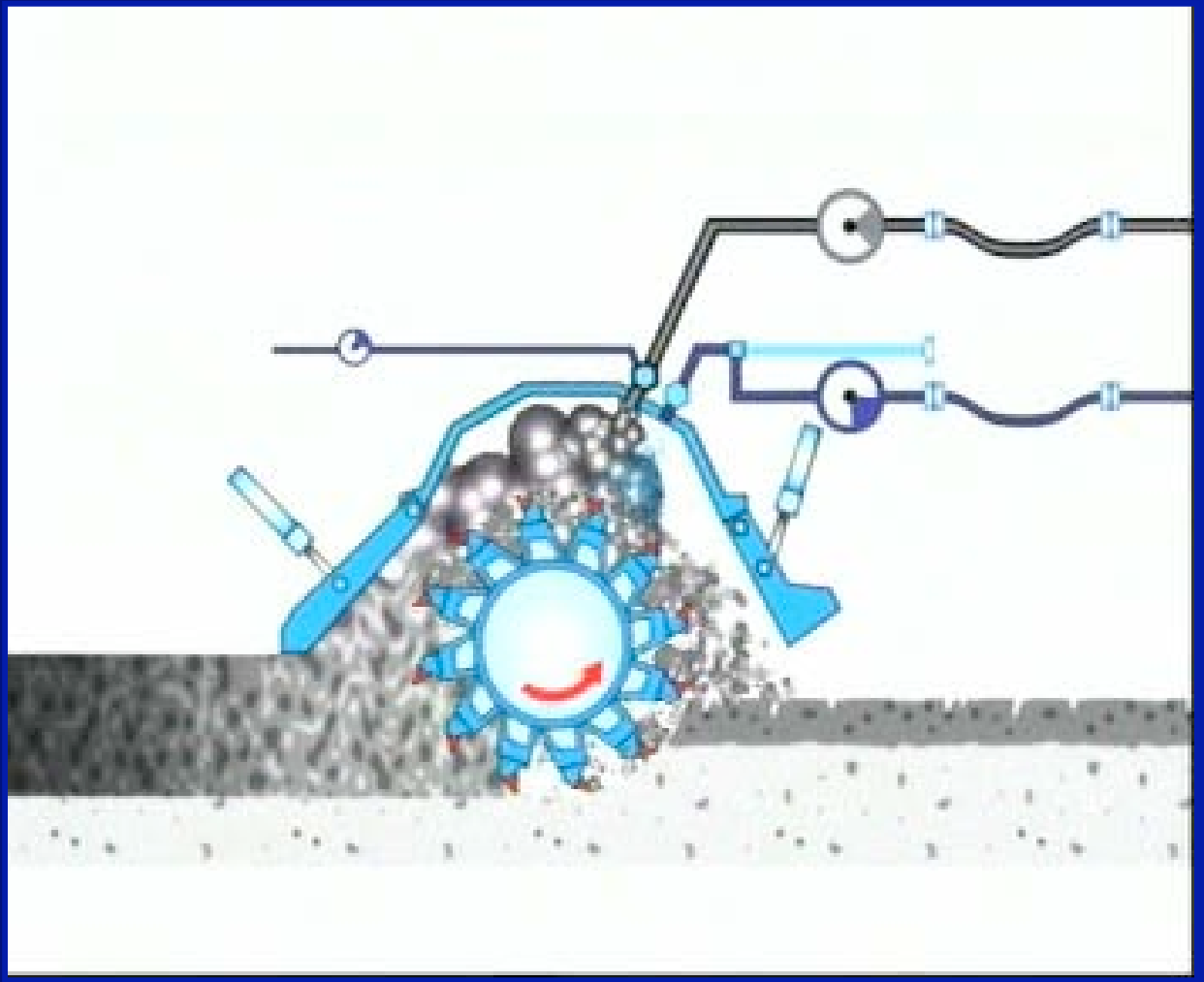
Foam Recycler

Foam spraybar

Water spraybar

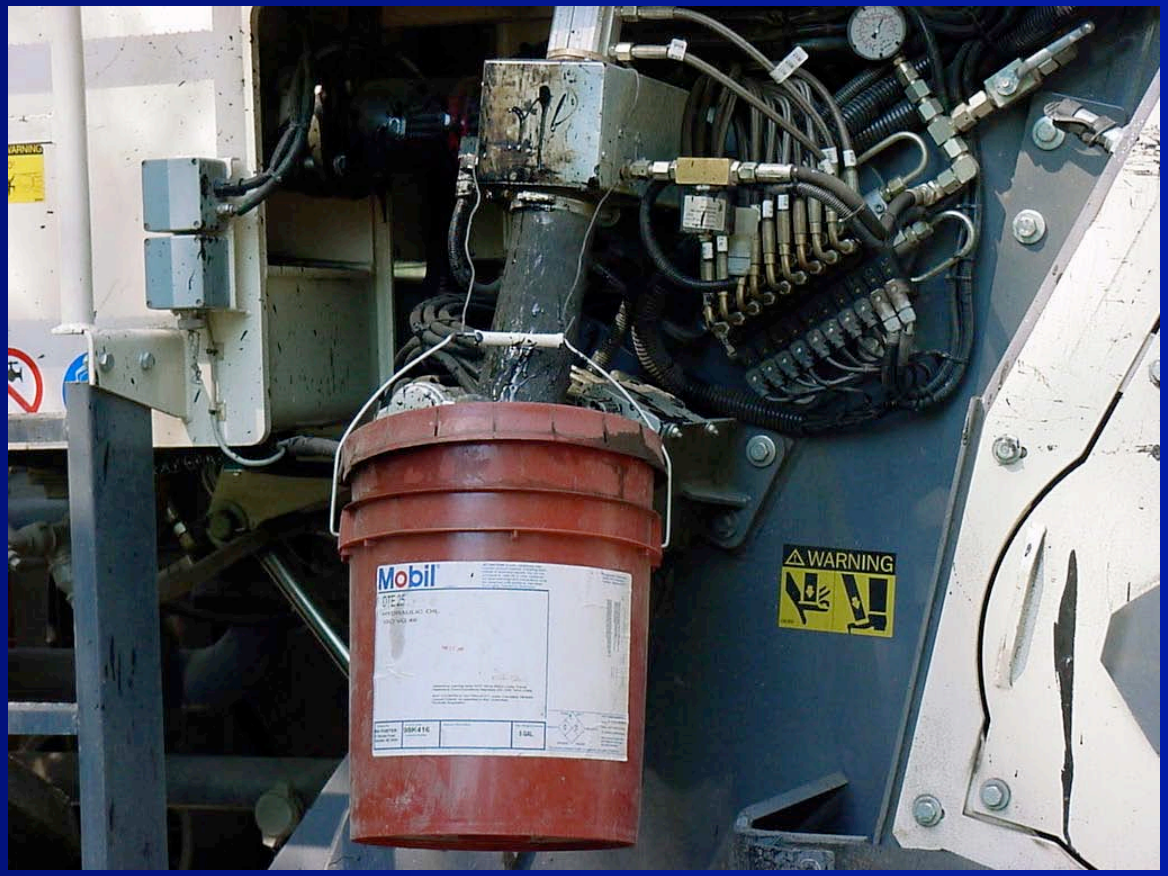


Injection of foamed asphalt and water



Control panel

Foam test nozzle



Manually applying cement

Spreading cement

One type of spreader

Most commonly used now


WATER
NOT FOR DRINKING

Note

- Roadway has been pulverized prior to foam stabilization
- Typical treatment depth is 6”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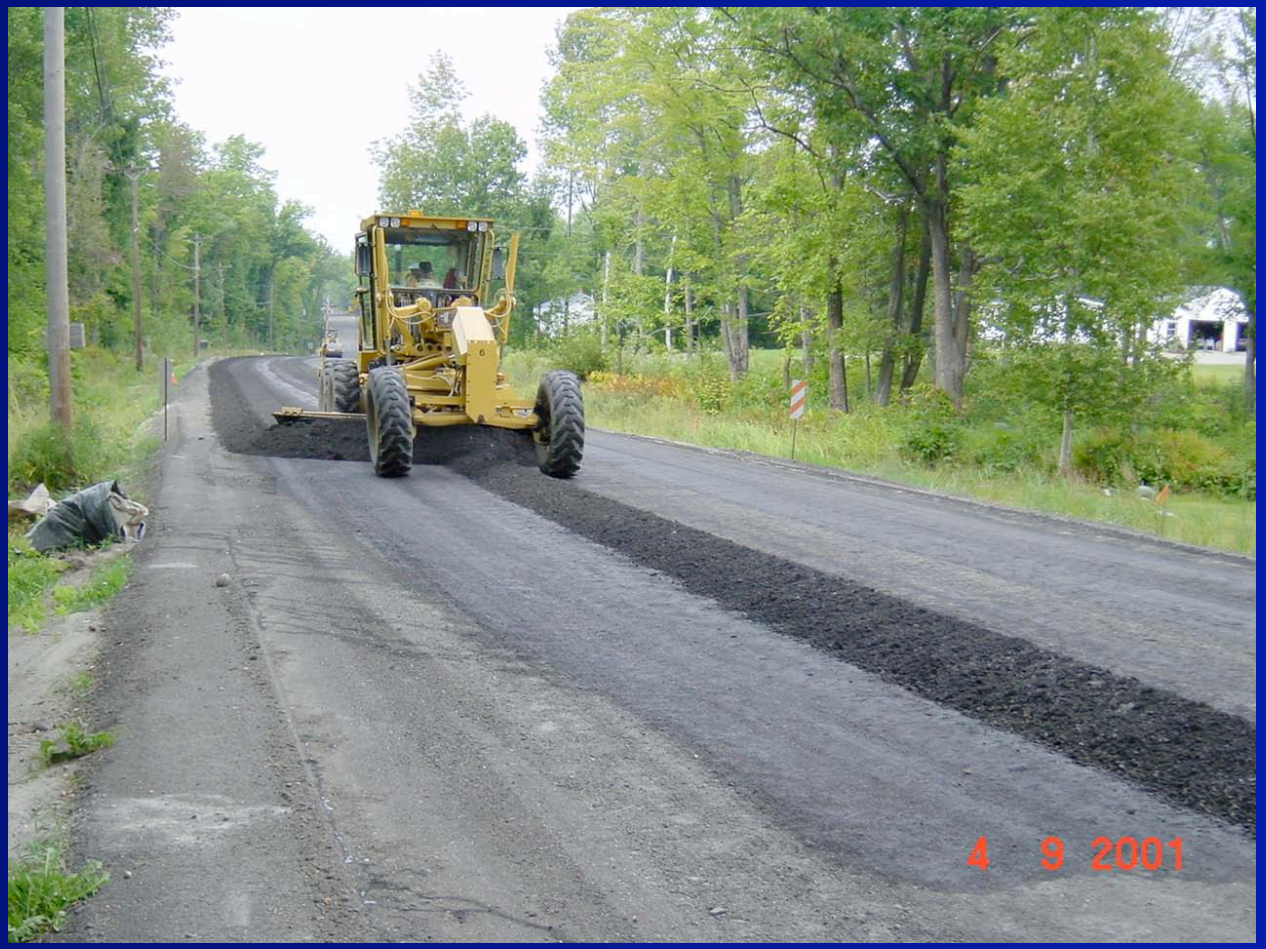
Behind the train

Checking consistency

Compaction

Padfoot roller

Cutting to grade



Smooth drum roller

Sealing the surface

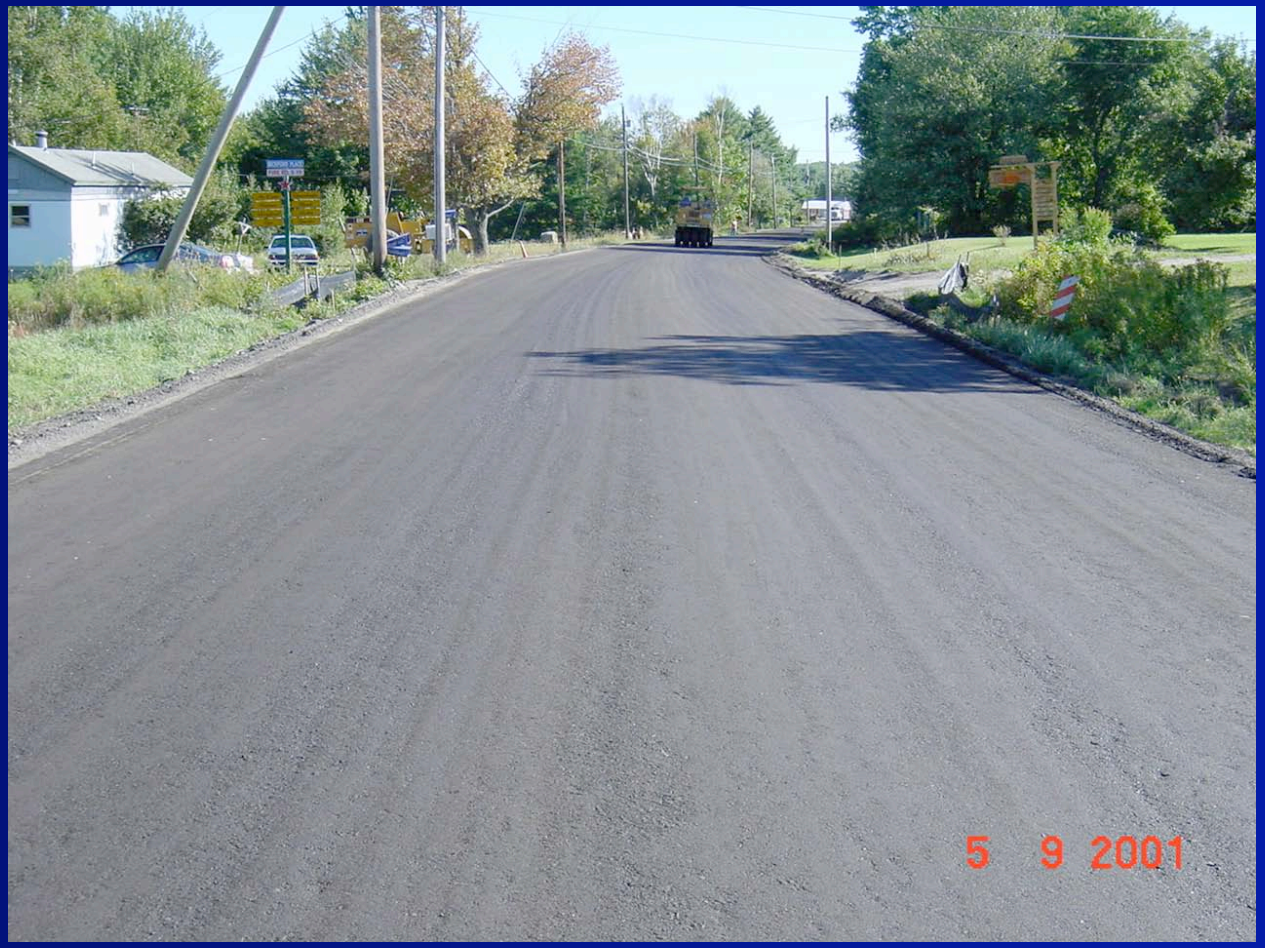
Tight, “well-knit” surface

Compaction testing

Compaction specification

- Based on test strip density
- Roll with padfoot until roller “walks” out of mat
- After grading, make passes with soil compactor until no increase for 4 passes
- Take 5 random compaction tests
- Throw out high, low, average other 3
- Must meet 98 % of this for Acceptance

Finished product



With HMA layers applied

Cores

Problems

Potholing

Padfoot marks??

Things to monitor during construction

- Proper recycling depth
- Quantities of asphalt and cement
- Asphalt temperature
- Nozzles working?
- Asphalt foaming at test nozzle?
- Recycler speed
- Compaction

Results

- Lab specimens and FWD data show an estimated layer coefficient of 0.22 – 0.24
- Most projects have been very successful
- Specifications revised to include QC tests and seasonal limitations
- Price: $6.25 - $8.75 /square meter
- MDOT will use foamed asphalt as primary means of FDR stabilization