Southeastern States Regional In-Place Recycling Conference

Asphalt Recycling & Reclaiming Association: ARRA

US. Department of Transportation

Federal Highway Administration

What will be covered

- What is Cold In-Place Asphalt Recycling
- Why Cold In-Place Asphalt Recycle?
- What does a candidate look like
- Equipment
- QC QA: Inspection
- Utilities and curb reveal in urban areas
- Preparation before CIR
- Additives: Emulsions, Portland cement, Fly-ash
- Differing types of Projects

What is Cold In-Place Recycling?

- The recycling of a deteriorated asphalt pavement material that has reached the end of its useful life. This includes asphalt wearing and asphalt base course material and in some cases a small amount of the underlying aggregate. Typical depths are 3 to 5 inches.
- The milling machine or processing unit cuts and sizes the old asphalt. The material is then mixed in-place with a new asphalt binder, paver-laid and compacted to the desired depth and scope of the project specifications.

CIR – Okeechobee Runway 14/32, 2002

What does a CIR candidate look like?

- Transverse and Longitudinal cracking
- Alligator cracking
- Oxidized, raveled pavement
- Some structural deficiencies
- Patched area on top of patched area
- Multiple overlays

Why CIR?

Asphalt pavements eventually will develop distress such as:

- Cracking
- Raveling
- Pot holes
- Poor ride quality

Traffic, weather and hardening of the asphalt binder all contribute to these problems.

- We can rejuvenate these pavements

Benefits of Cold In-Place Recycling

- Roadway remains open during construction
- Conserves energy and natural resources
- Reduced impact to adjacent roadways
- Reduced cost over reconstruction
- Re-use existing material
- Reprofile roadway
- Restores curb reveal
- Construction time halved

Road Preparation for CIR

- Any damaged cross pipes should be replaced.
- Drainage and water problems should be addressed
- Any vegetation growing on the pavement should be removed.
- Shoulder or pavement widening should take place before CIR
- Any under ground utilities should be addressed

The CIR Process

- Core the roadway and perform a mix design
- Any widening should take place prior to CIR
- The CIR train pulverizes, mixes and paver lays the new asphaltic base course to the desired cross-slope
- Compact with a 10-12 ton steel wheel roller and a 25 ton pneumatic tire roller
- Place the HMA surface course

Things to Consider in a CIR - QC/QA Plan

Document Review

- Bid specifications
- Mix design
- Special provisions
- Agency requirements
- Traffic control plan

Things to consider in a CIR - QC/QA Plan

- Mandatory pre-construction meeting
- Equipment inspection
- Inspection training
- Check the mill is correct Single Unit down cut
- Multi-unit has screen and crushing capabilities
- Additive Systems both water & asphalt and any other additive system is calibrated

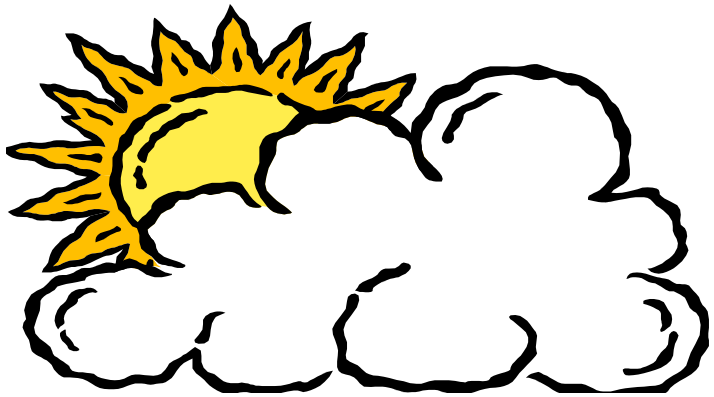
Things to consider in a CIR – QC/QA Plan

- All meters and computers should be calibrated
- Recycling additive – check on specifications and compliance.
- Recycled mat smoothness
- Moisture added to RAP
- Compacted density
- RAP gradation
- Moisture content before overlay
- Recycling additive content
- Depth of pulverization/milling 3” – 5”

Things to consider in a CIR – QC/QA Plan

- Pavers are in good working condition and of the right size and width
- Rollers meet the requirements both steel drum and pneumatic.
- Check depth of recycled mix
- Take representative mixed material sample for future comparison & testing
- Weather requirements

Weather Limitations



- Air Temperature of 50 Degrees F
- Rain must not be occurring

Core samples are essential in any Cold In-Place Recycling project

Curb-line milling performed by a specialized road widener

- The Bartmill PR205 is a specialized piece of equipment that is used for widening.
- This type of equipment is capable of widening from one to four feet per pass.

Pavement is recycled and curb reveal restored


14 9:31 AM

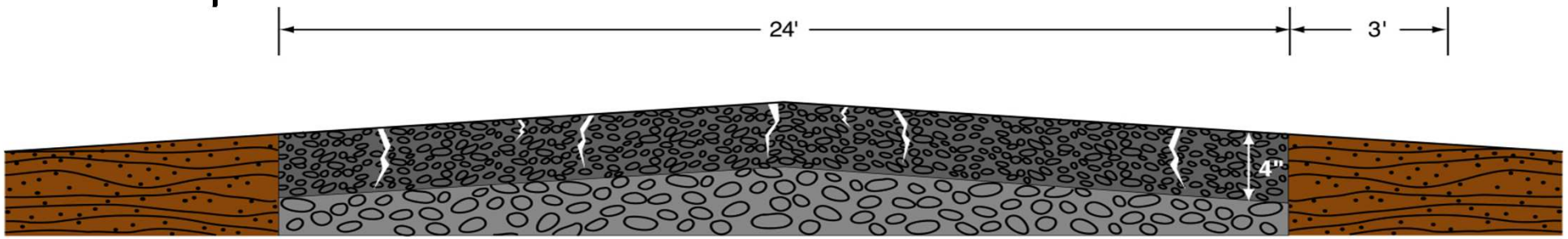
Manhole and utility valve milling

Excavated manhole before recycling

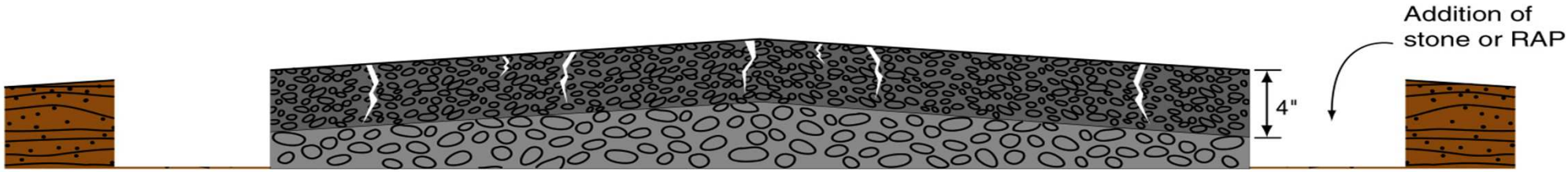
Compaction of recycled asphalt around manhole


9'96

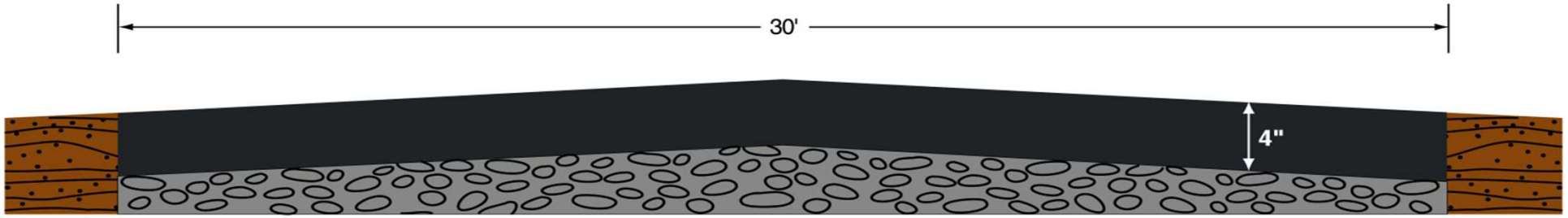
CIR – Pavement Widening



Existing section before CIR



Proposed widening section (addition of stone or RAP)



Completed widening section after CIR

Specialized mill excavates shoulder to desired depth

Excavated shoulder backfilled

CIR – Aggregate Application

- existing asphalt pavement properties may be enhanced with the addition of aggregate or RAP. Not only can the mix properties be improved, but additional structure may also be added to the asphalt pavement.

Classes of Cold In-Place Recycling

- Multi-Unit Train Pulverize, Screen, Crush, Add Recycling Agent Based on RAP Weight & Mix in Pugmill
- Two-Unit Train Pulverize, Add Recycling Agent Based on RAP Weight & Mix in Pugmill
- Single Unit Train Pulverize, Add Recycling Agent – All in Cutting Chamber of Milling Machine

Single Unit Train

- Proportioning of Recycling Agent based on volumetric (depth and width of cut and forward speed of train)
- Down cutting milling head, sizes material, forward speed of train
- Material is mixed in milling head chamber

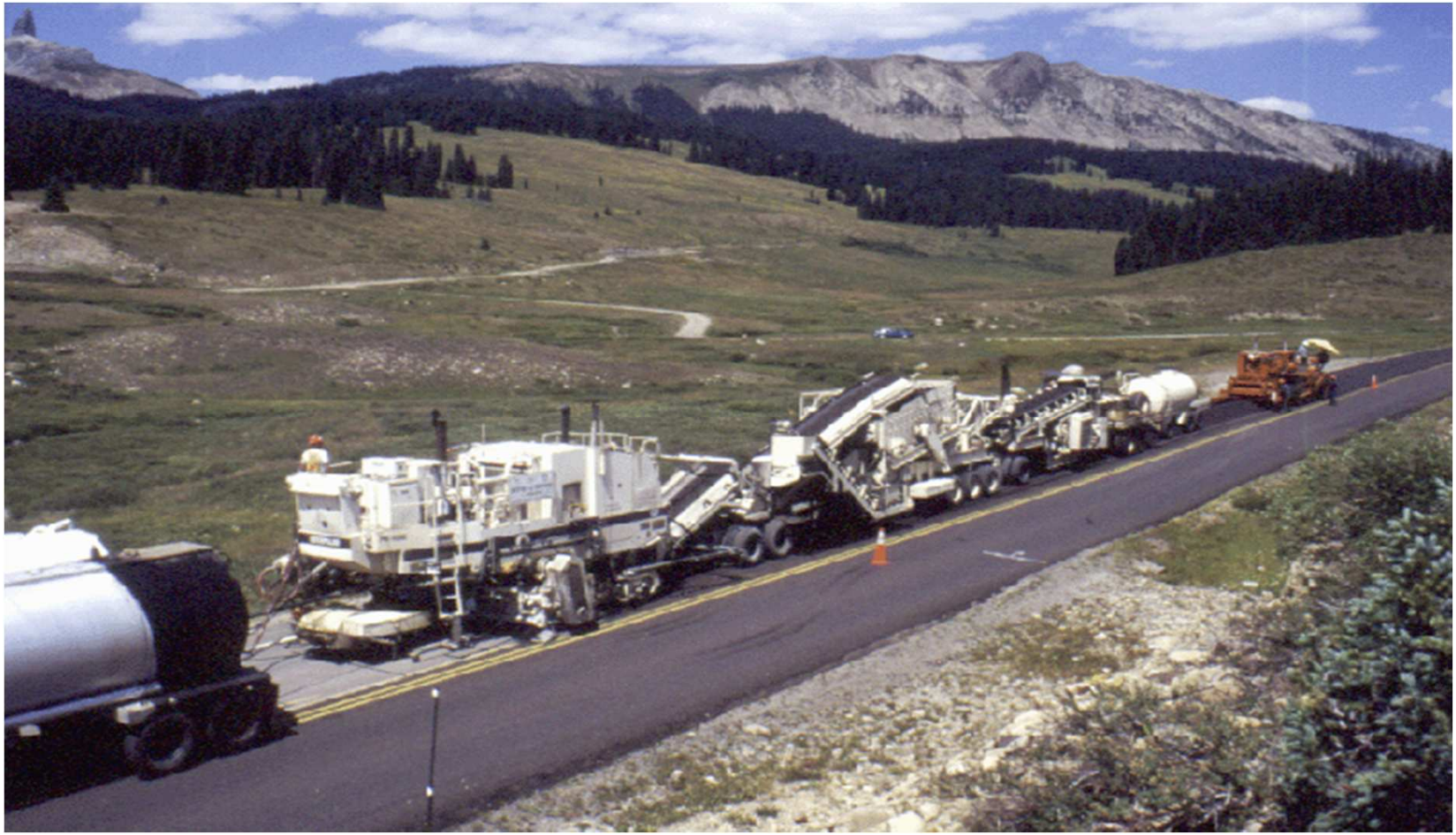
Single Unit Train

Directly into a bituminous paver

Two-Unit Train

- Variable width cutting head
- Down Cutting milling machine sizes RAP
- Belt Scale weighs RAP and microprocessor controls additive
- Recycling Agent added and blended with RAP in twin-shaft pug mill

Multi-Unit Train

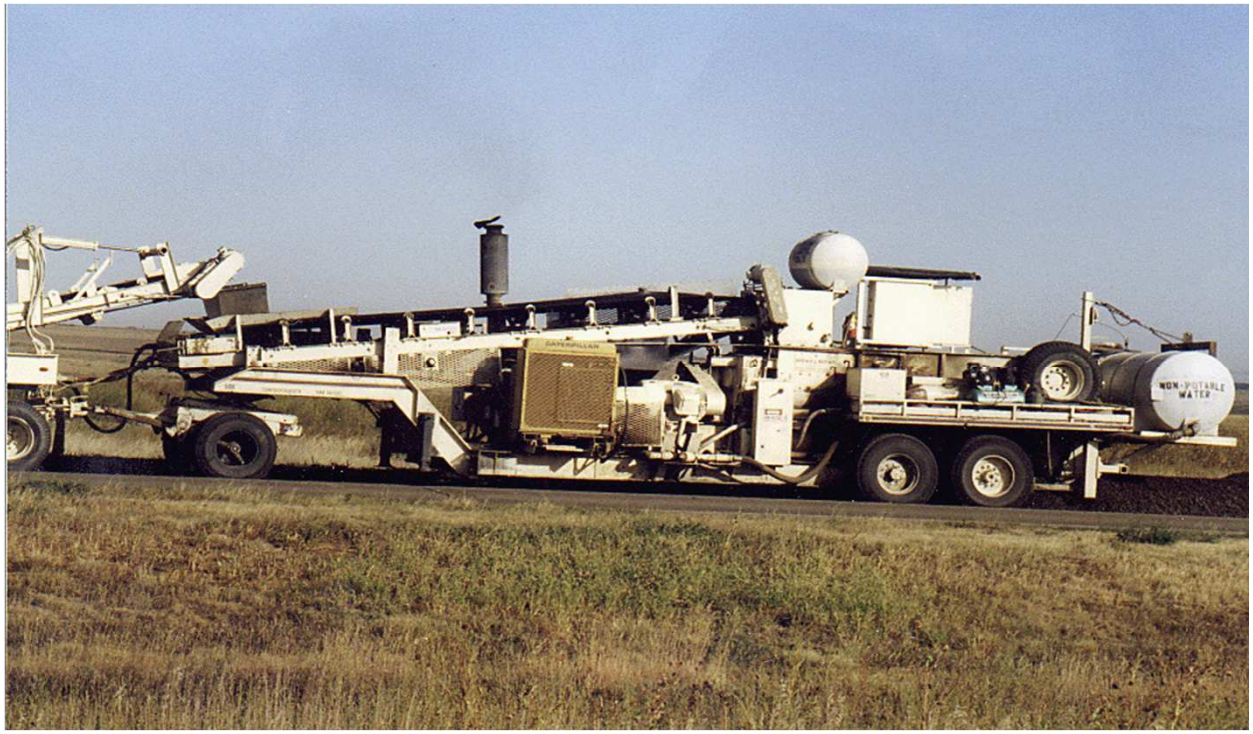


Multi-Unit Train –Screening/Crushing

- All reclaimed asphalt pavement (RAP) is screened to a maximum size requirement (typically 1.25”).
- The oversized material is crushed and returned to the screen deck for total sizing control.

Multi-Unit Train - Pug mill

- Belt scale weighs RAP, microprocessor controls additives
- Multiple additives may be added simultaneously
- Pugmill thoroughly blends RAP and additives



CIR - Laydown

Traditional Asphalt Pavers

Wirtgen 3800CR

Wirtgen 3800CR

Both pneumatic and steel drum rollers are used for compaction

Quincy Gadsen Airport - Design/Build, Quincy, FL 1997

CIR – Mix Design

- Obtain Sample of RAP from Field
- Determine RAP Gradation, Binder Content, Extracted Gradation and Aged Binder Properties
- Select Amount and Gradation of Additional Aggregate, if required
- Select Type and Grade of Recycling Additive
- Determine Pre-Mix Moisture Content
- Test Trial Mixtures: Initial Cure Properties, Final Cure Properties, and Water Sensitivity
- Establish Job Mix Formula

CIR – Selection of Additive(s)

Bituminous Additives:

- **Asphalt Emulsion (with & without polymer)**

Anionic Emulsions	HFMS-2 HFMS-2s
Cationic Emulsions	CSS & CMS

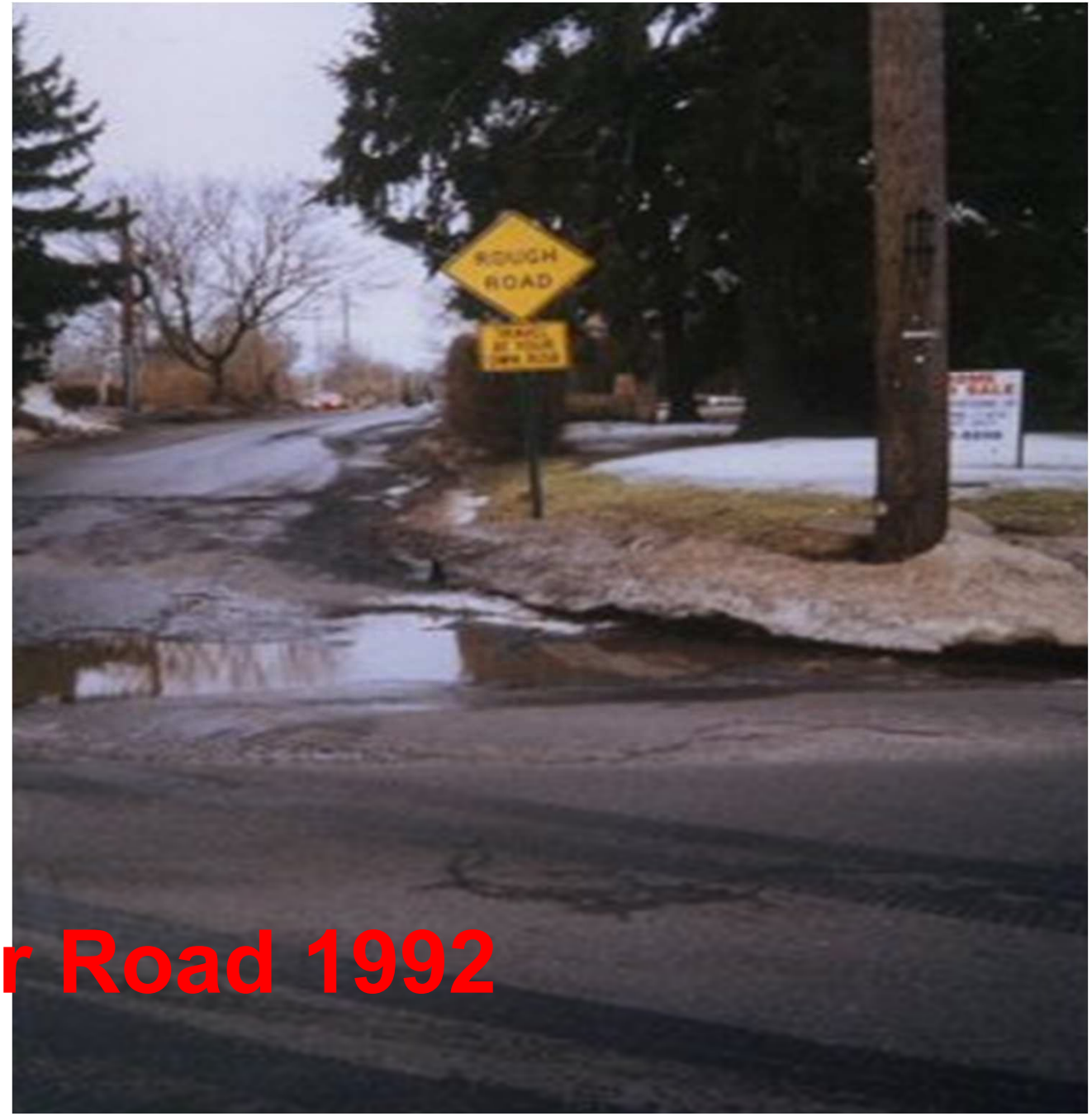
- **Cutback Asphalts**
- **Rejuvenating Agents**
- **Foamed Asphalt**

CIR – Selection of Additives

Chemical Additives:

- **Portland Cement – Dry or Slurry (1-2%)**
- **Hydrated Lime – Dry or Slurry (1-2%)**
- **Portland Cement & Hydrated Lime have been used in conjunction with asphalt emulsion to improve early strength, increase rut resistance and improve moisture resistance**
- **Fly Ash – Class C Fly Ash (8-12%)**

  Used to cement RAP particles together



Moyer Road 1992

Problems associated with Moyer Road

No drainage (natural or storm water inlets)

No crown or cross slope

No curbs

Trees and utility poles at edge of pavement

To many width changes in roadway

Moyer Road 1992

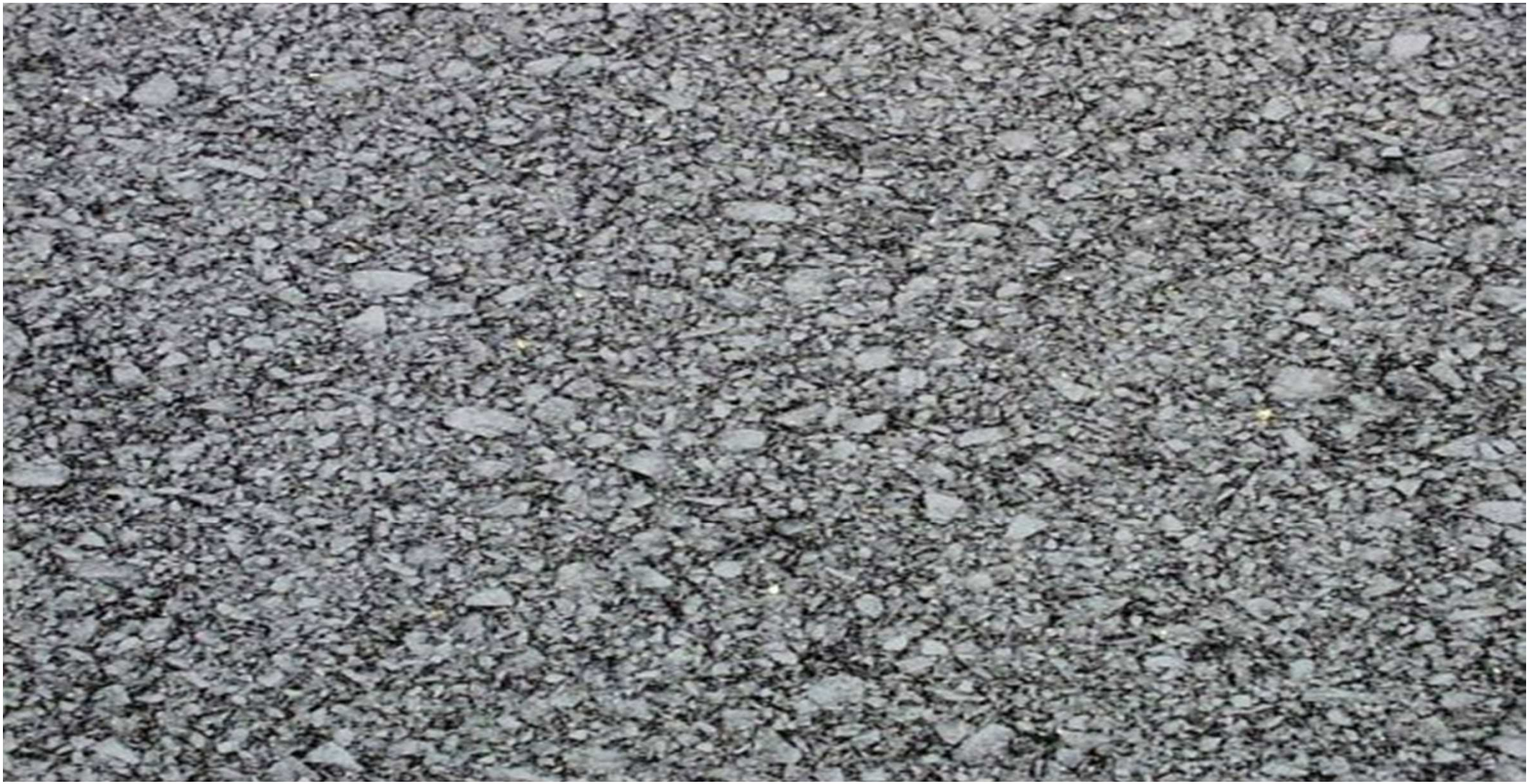
Moyer Road, existing problems

New curb and storm water catch basin

Gas, water, sanitary sewer services replaced before CIR

CIR first pass along new curb

Gradation of Cold In-Place Asphalt Recycling (CIR)



Cold In-Place Asphalt Recycling before hot mix overlay

Moyer Road 2007

Delaware Department of Transportation

Bad cross section, bleeding chip seal, standing water

8% percent cross slope create water problems

Corrugated cracks

RAP is then added to adjust cross slope to 2% or 3%

Old Pavement & RAP material under go CIR treatment

Cold In-Place Recycled Asphalt Lorewood Grove Road

Cold In-Place Recycling

Gradation of Cold In-Place Recycled material

New hot mix wearing course and aggregate shoulders

Thank You! Questions