



New Jersey Asphalt Pavement Association

Pavement Preservation

**The right process on the right roadway
at the right time.**

Green Technologies



Cold In-Place Asphalt Recycling

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What will be covered

- What is Cold In-Place Asphalt Recycling
- Why Cold In-Place Asphalt Recycle?
- QC QA
- What does a candidate look like
- Utilities and curb reveal in urban areas
- Small Train, Two Unit Train, Multi-Unit Train
- Preparation before CIR
- Project revues
- Additives: Emulsions – Portland cement

A Traditional Asphalt Production and Application Company. Established 1942





Cold In-Place Recycling



CIR on Independence Parkway, Florida

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. Typical depths are 3 to 5 inches.
- The milling machine 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.



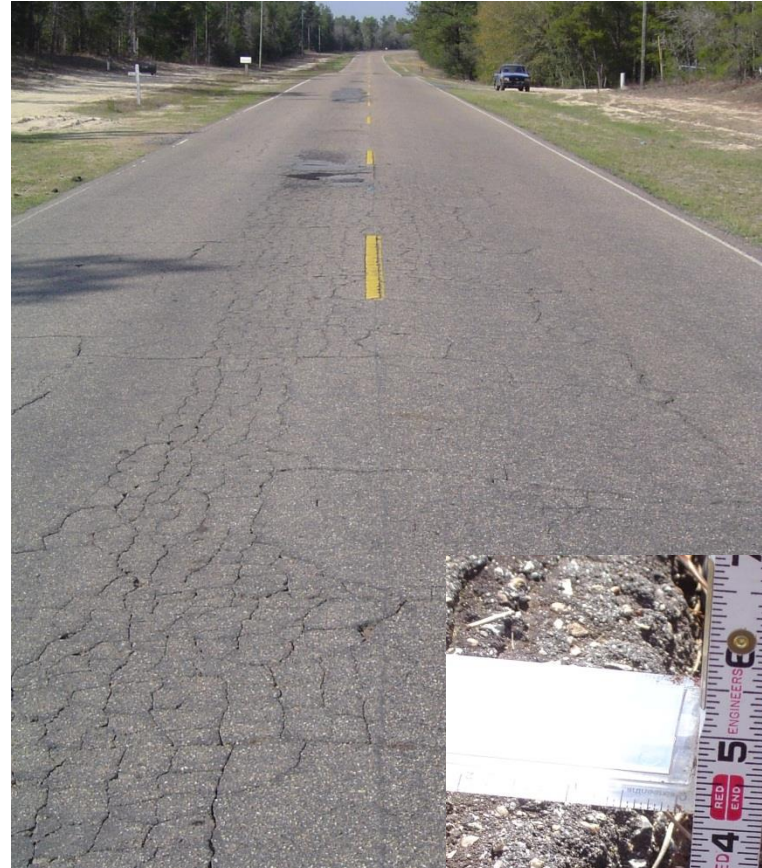
CIR – Okeechobee Runway 14/32, 2002

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.



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

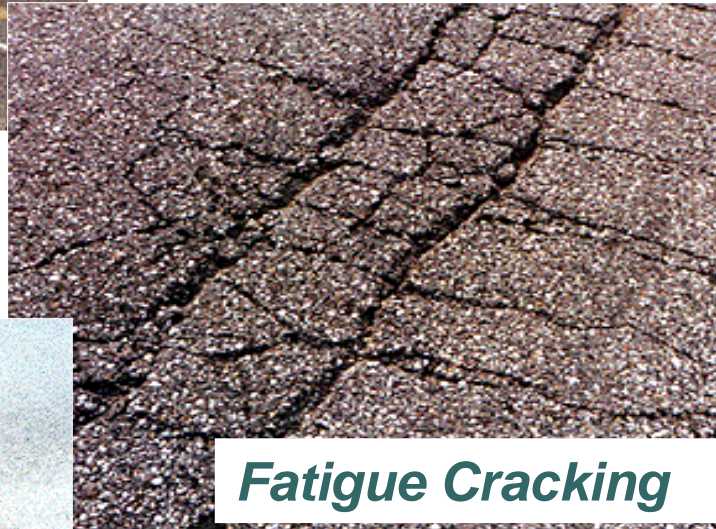




CIR - Candidates



Thermal Cracking



Fatigue Cracking



Poor Rideability



Patched



Dry, Raveled



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
- Re-profile roadway
- Restores curb reveal
- Environmentally friendly
- 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
- Any under ground utilities should be addressed
- Take an experienced contractor with you to review roadway before you specify and bid project.

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 27 ton rubber tire roller
- Place the HMA surface course



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”



- ● ●

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



● ● ● | **Often times, the cracking network penetrates the full depth of the mix**



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.



RAP or aggregate added to increase pavement thickness



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Recycling train picks up aggregate and old asphalt pavement



Curb-line milling performed by a specialized road widener

- Specialized pieces of equipment are used for widening.
- This type of equipment is capable of widening from one to four feet per pass.









Manhole and utility valve milling



Excavated manhole before recycling



Compaction of recycled asphalt around manhole





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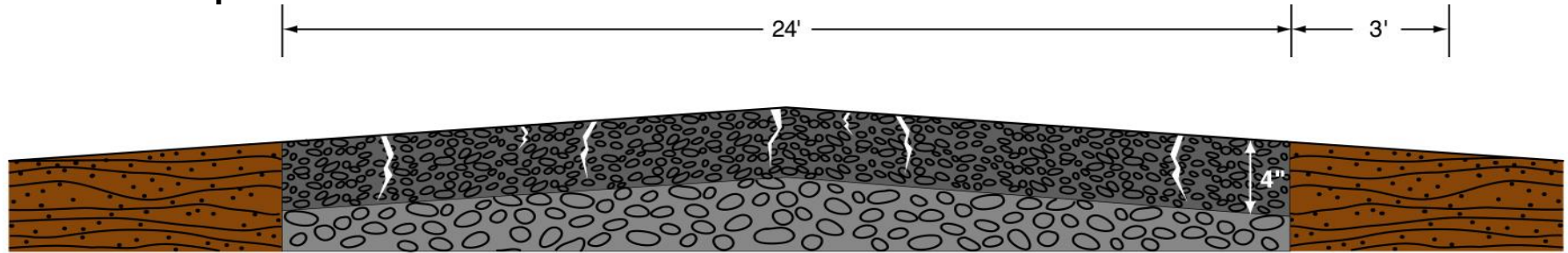
Area along curb is excavated



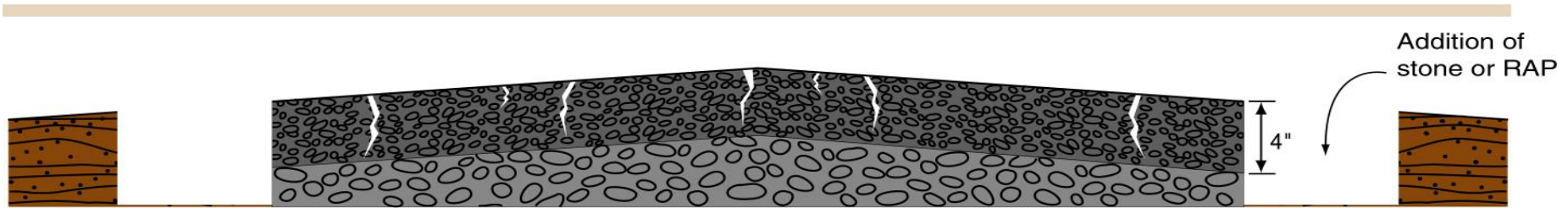
Pavement is recycled and curb reveal restored



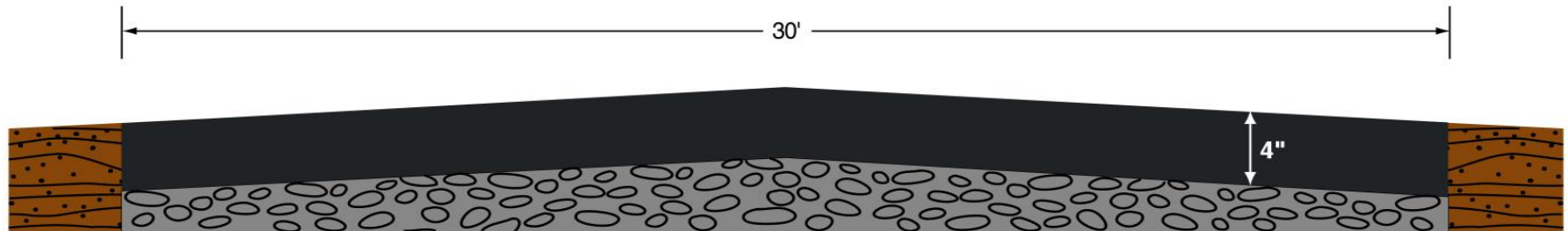
CIR – Pavement Widening



Existing section before CIR

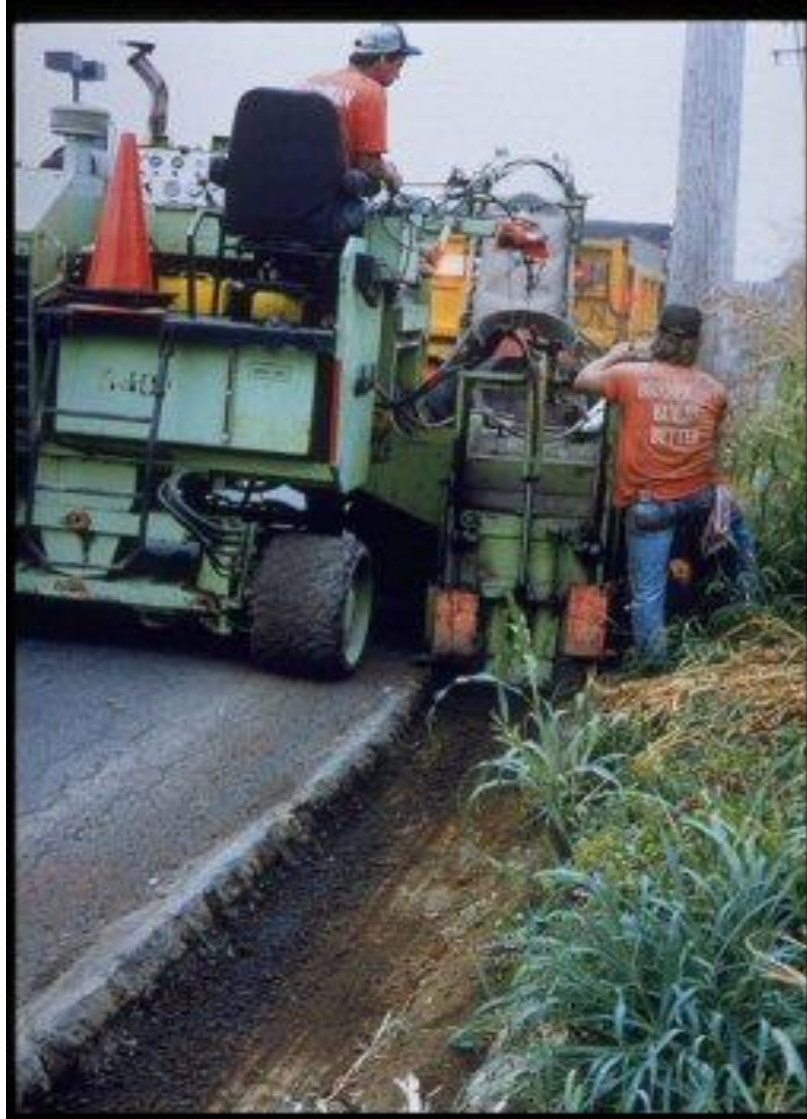


Proposed widening section (addition of stone or RAP)



Completed widening section after CIR

Specialized mill excavates shoulder to desired depth



Excavated shoulder backfilled





Equipment for CIR Train

- Emulsion tanker for CIR train.
- Down cutting milling machine 10/11 foot cutting width.
- Processing plant
- Conventional paver 16 foot minimum screed width
- Steel drum vibratory roller (12 ton)
- Pneumatic tired roller (25/30 ton).
- Small milling machine for utilities
- Water truck



Classes of Cold In-Place Recycling

- **Multi-Unit Train Pulverize, Screen, Crush, Add Recycling Agent Based on RAP Weight & Mix in Pug-mill**
- **Two-Unit Train Pulverize, Add Recycling Agent Based on RAP Weight & Mix in Pug-mill**
- **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 controls sizing of RAP**
- **Material is mixed in milling head chamber**



Single Unit Train



Recycled pavement being placed into the paver





Two-Unit Train

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



Multi-Unit Train



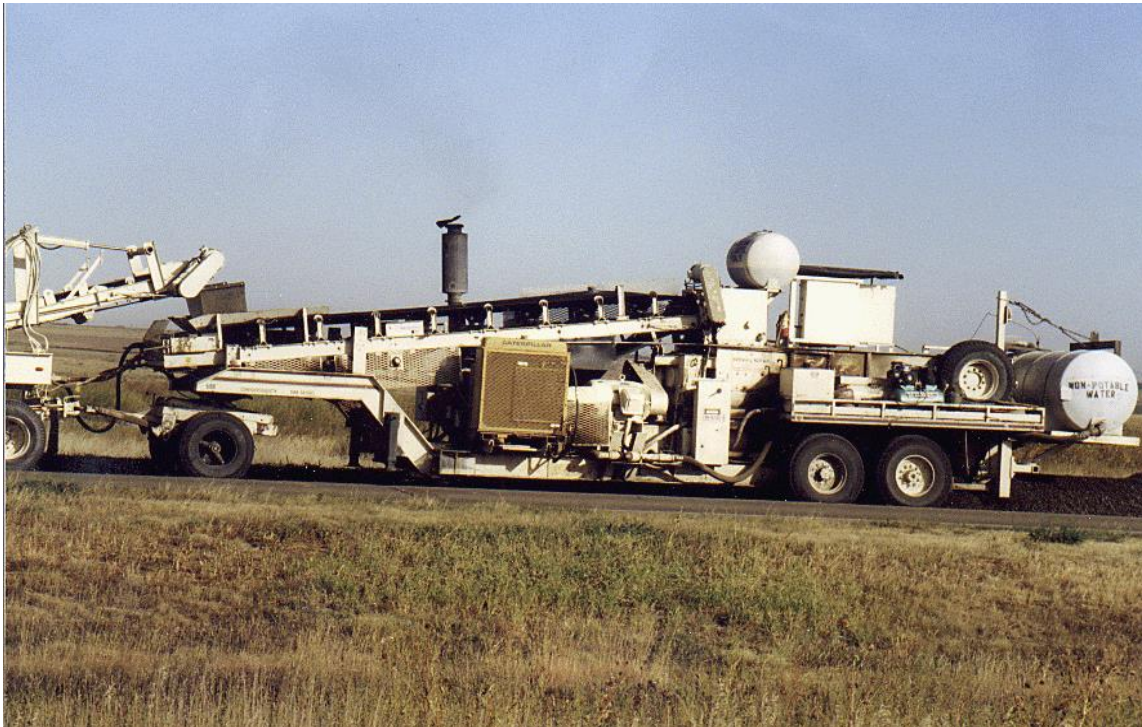
Multi-Unit Train – Screening/Crushing

- 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 Used or ...



CIR - Laydown

Mix Pavers may be used to mix additives with RAP



Directly into a bituminous paver



CIR - Laydown



COLD RECYCLING AFTER OVERLAY





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**

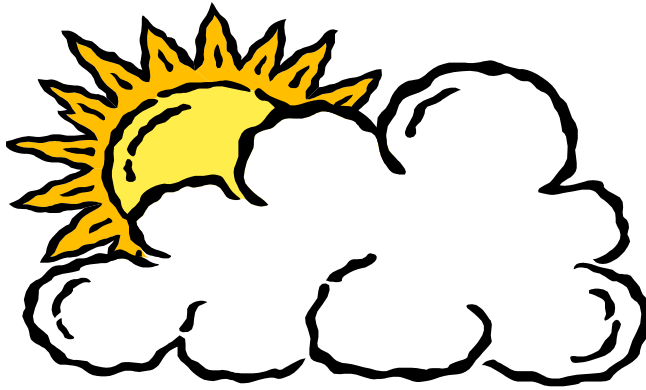


CIR – Selection of Additives

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

Weather Limitations



- Air Temperature of 50 Degrees F. is preferred.
- Rain or Misting must not be occurring.

Both pneumatic and steel drum rollers are used for compaction

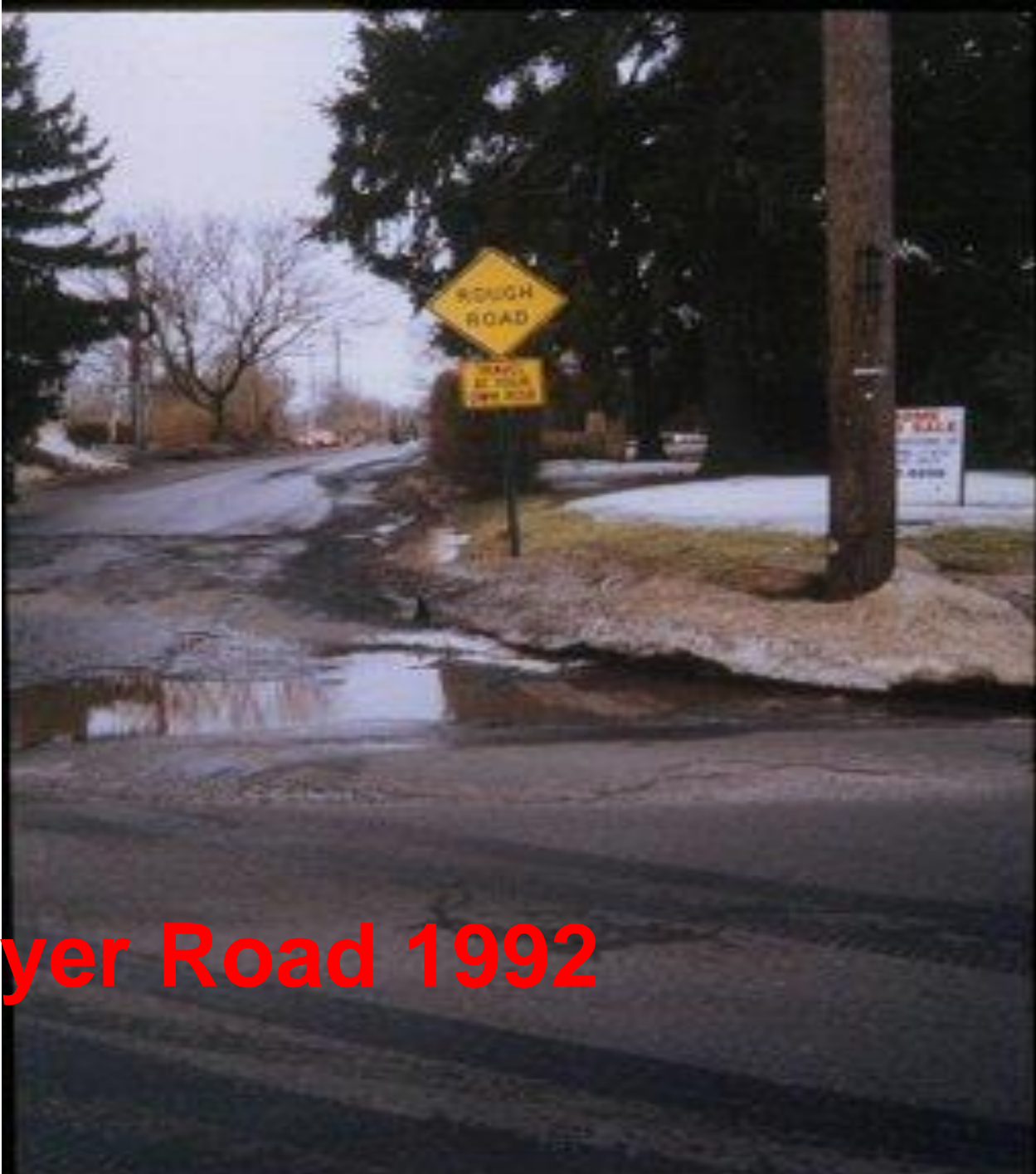


Quincy Gadsen Airport - Design/Build, Quincy, FL
1996









Moyer Road 1992



Problems associated with Moyer Road

- No curbs
- No storm drains
- Trees and utility poles at edge of pavement or in pavement
- Too many width changes in roadway
- No crown or cross-slope
- Two municipalities, centerline ownership

Moyer Road 1992



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Moyer Road, existing problems



New curb and storm water catch basin



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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 2002





Harford County Maryland

Jarrettsville Road 2004



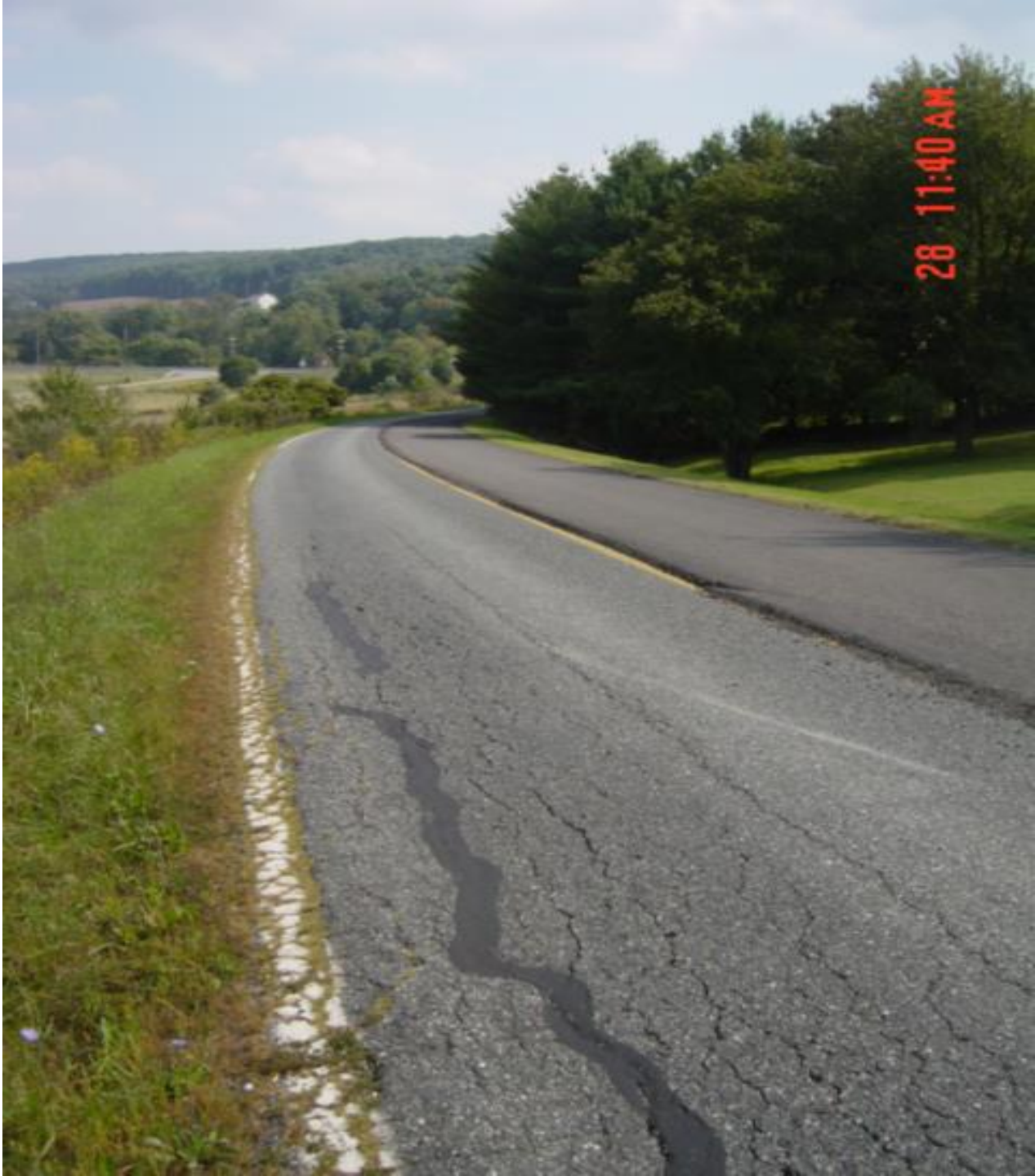








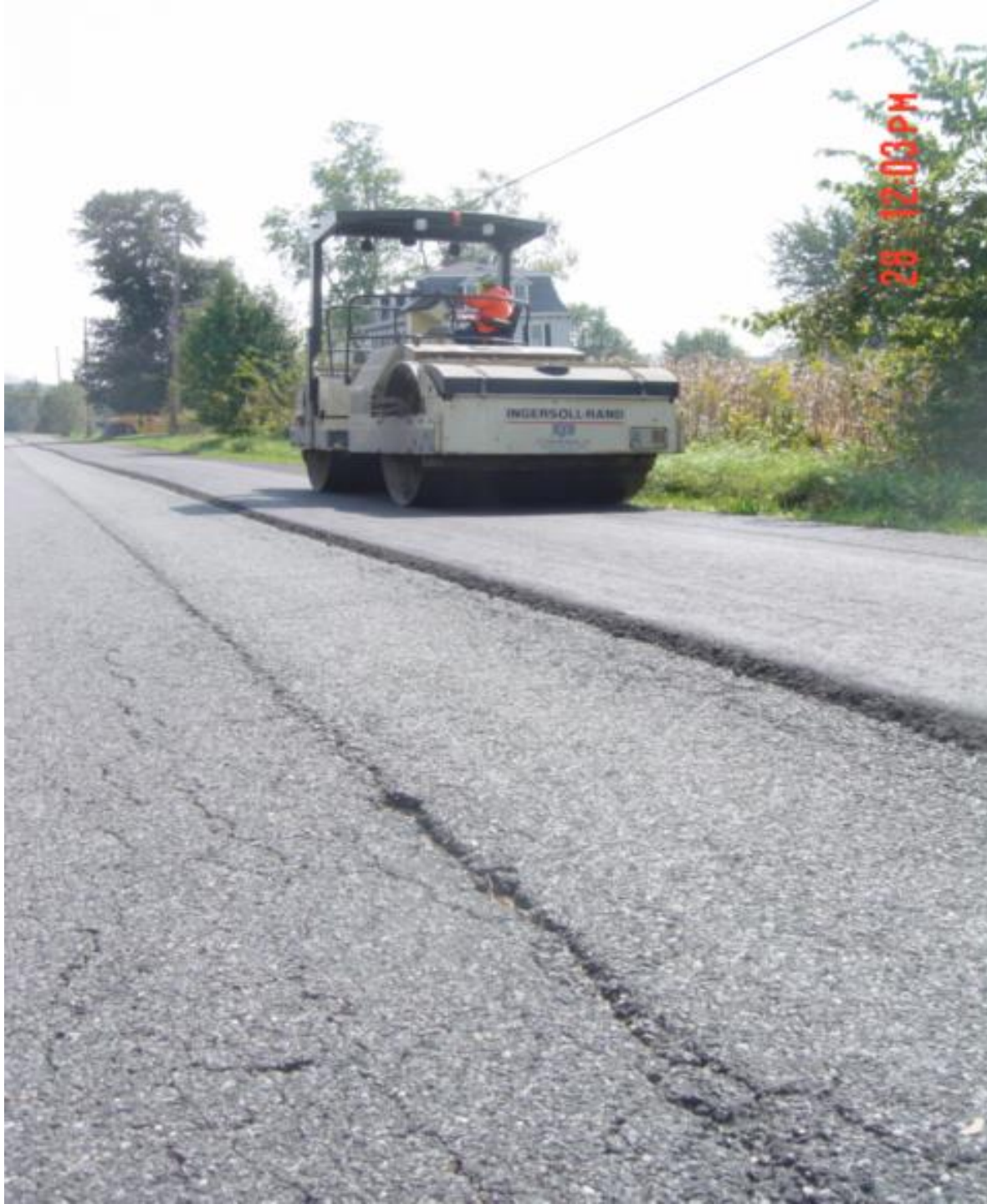




Gradation of cold in-place recycled material









Upper Providence Township

Montgomery County, Pennsylvania
2007













● ● ● | **Full width paving.
19mm overlay**



CIR – Rural Highway



CIR – Town and City



CIR - Business Districts



CIR – Runway, Taxiway, Parking Areas

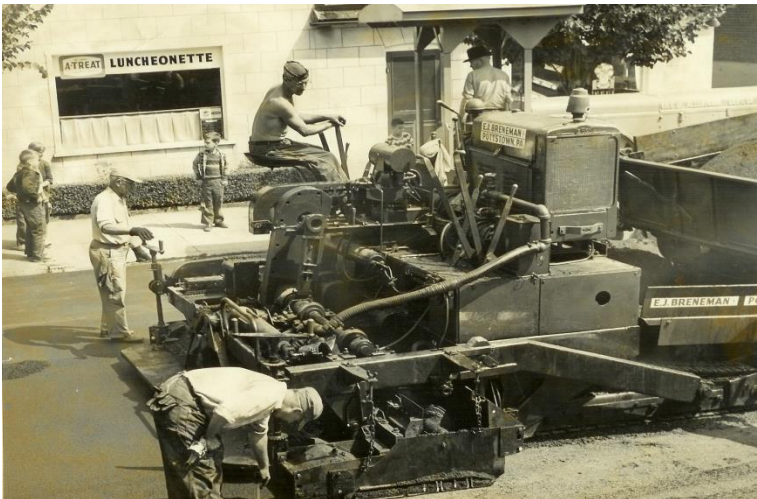


CIR - Night Work



Our Nations most valuable asset

“It was not our wealth that made our highways possible; rather it was our highways that made our wealth possible”



*Thomas MacDonald,
former U.S. Commissioner
of Public Roads*

Breneman Paving 1955

Questions Thank You!





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