Cold Recycling: Can We Use It Here?

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Stephen A (Steve) Cross, PhD, PE
S Cross & Associates, LLC
Technical Director
Asphalt Recycling & Reclaiming Association
Types of Cold Recycling

► Cold In-Place Recycling (CIR)
  ◼ Also called partial depth cold in-place recycling

► Cold Central Plant Recycling (CCPR)
CIR Process Description

► Restricted to asphalt pavement & minor amounts of base
► Pulverizing existing pavement 3-5” depth
► Sizing of the RAP
► Addition of recycling agent and additives
► Mixing all component materials
► Placement and compaction of mixture
► Placement of surface course
Multi-Unit CIR Train

- Controls top size of RAP with crushing & screening unit
- Adds recycling agent based on mass of material entering pugmill
- Type of recycling agent: Emulsified or Foamed Asphalt
Single Unit Train

- Controls top size of RAP with down cut and forward speed
- Adds recycling agent to cutting chamber based on assumed unit weight & volume of material
- Type of recycling agent: Emulsified & Foamed asphalt
Cold Central Plant Recycling

A viable alternative when stockpiles of high quality RAP are available or when it is not possible to in-place recycle the pavement. Use central mix plant or CIR train.
Clean Rap = New Pavement:

- Stockpiled and kept clean
- Crushed RAP to gradation
- Mixed with bituminous recycling agent in central plant
- Transported to lay down area
- Paved as a recycled mix
- Compacted to specified density
- Readied for surface treatment
3 Types of CCPR

1. Central Facility CCPR
   - RAP milled from various roadways is stockpiled for later use
     - NHCRP 9-51 Study said CCPR, CIR & bituminous stabilized FDR had dynamic modulus values similar to VDOT’s 1” nominal SuperPave mix
     - Central Facility CCPR mix can be used anywhere you would place a binder or base mix.
     - Requires a wearing surface
Adding Paved Shoulders
3 Types of CCPR

2. Onsite CCPR

- RAP Milled from Roadway to be Reconstructed
- Hauled To a Close Temporary CCPR Processing Site
- CCPR Processed and Returned to Same Road
  - Used with CIR to allow deeper treatments
  - Used with FDR to allow base and subgrade stabilization
US 191 Utah; 3” CCRP & 3” CIR, 8.5 miles, $3.2M

Step 1: Existing Pavement

Step 2: 3” Milling

Step 3: Stockpiled Millings
US 191 Utah; 3” CCRP & 3” CIR, 8.5 miles, $3.2M

Step 4: 3” CIR

Step 5: CCPR Mix

Step 6: Placing CCPR

Step 7: Finished Pavement
SR 101 IN; Reconstruction + Widening

Proposed cross section:
- 10” Cement FDR
- 6” CCPR
- 2” HMA Surface

26’ Width

ARRA Cold Planning
SR 101: Milled 6” HMA + 10” FDR

Step 1: Mill HMA

Step 2: Stockpile Millings

Step 3: 10” FDR
SR 101: 17.24 lane miles

- FDR/CCPR Cost: $4,970,715 (Awarded)
- Pavement Replacement: $11,939,980 (estimated)
- Percent Difference: 58%
3 Types of CCPR

► 3. Imported CCPR
  - RAP Imported from One Roadway
  - Hauled to a Close Temporary CCPR Processing Site
  - CCPR Processed and Returned to Different Application
    - Not that common
Project Selection

Basic Asphalt Recycling Manual

www.roadresource.org
### ARRA General Guidelines (Table 3-2)

<table>
<thead>
<tr>
<th>Pavement Distress Mode</th>
<th>Recycling Maintenance/Rehabilitation Techniques</th>
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<tbody>
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<td>CP</td>
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<td>Surface Defects</td>
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<td>Raveling</td>
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<td>Bleeding</td>
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<td>Skid Resistance</td>
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<td>Deformations</td>
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<td>Shoulder Drop Off</td>
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<td>Rutting - Wear</td>
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<td>Rutting - Mix Instability</td>
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<td>Rutting - Deep Structural</td>
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<td>Corrugations</td>
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<td>Shoving</td>
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<td>Load Associated Cracking</td>
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<td>Fatigue - Bottom Up</td>
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<td>Fatigue - Top Down</td>
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<td>Edge</td>
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<td>Sippage</td>
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<td>Non-load Associated Cracking</td>
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<td>Block</td>
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<td>Joint Reflection</td>
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<tr>
<td>Base/Subgrade Deficiencies</td>
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<tr>
<td>Rough Ride Quality</td>
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</tbody>
</table>

**Legend:**

- Green: Most Appropriate
- Light Green: Medium Appropriate
- White: Least Appropriate
<table>
<thead>
<tr>
<th>Condition</th>
<th>CR Applicability</th>
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<td>Bleeding</td>
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<td>Rutting - Mix Instability</td>
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<td>Corrugations</td>
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<td>All Levels of Traffic</td>
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<tr>
<td>Poor Drainage</td>
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Link to table: [www.roadresource.org/](http://www.roadresource.org/) Treatment Toolbox/ Treatment Resource Center/ CCPR/Pre-Construction/ Site Selection
Treatment Toolbox

► Which Treatment is Best for my Road?
  ■ Explore by Pavement Criteria
  ■ Explore by Pavement Photos

► Treatment Resource Center

► Find a Contractor/Supplier
Treatment Toolbox: Which treatment is right for my road?

Pavement Condition

- **Primary Distress**: Oxidation and Raveling - Low (≥ 25% to < 50% Agg L)
- **Road Type**: Urban: Major Collect
- **Surface Type**: Dense Grade HMA

Options include:
- Fog Seal
- Rejuvenating Fog Seal
- Slurry Seal
- Micro Surfacing
- Cape Seal
- Ultra Thin Lift HMA
- Chip Seal
- Crack Seal
- Scrub Seal
- Tack Coat
- Prime Coat
- Cold Planing & Micro Milling
- Hot In-Place Recycling
- Cold In-Place Recycling
- Cold Central Plant Recycling
- Full Depth Reclamation
- Base Stabilization
- Soil Stabilization & Soil Modification
Which Treatment is Right for My Road?

Photo Selector

PAVEMENT CONDITION D

(PCI 40-54)

PRIMARY DISTRESS:
FATIGUE CRACKING - HIGH

POSSIBLE SOLUTIONS:
Consider treatments that address this pavement's primary distress:
FULL DEPTH RECLAMATION
**Treatment Resource Center**

The PPRA Treatment Resource Center is an index of common treatments under various progressive pavement management disciplines. For specific questions contact a [contractor or supplier](#) in your region.

### SURFACE TREATMENTS
- Fog Seal
- Rejuvenating Fog Seal
- Slurry Seal
- Micro Surfacing
- Ultra Thin Lift HMA
- Cape Seal
- Chip Seal
- Crack Seal
- Scrub Seal

### PRE-TREATMENTS
- Tack Coat
- Prime Coat

### RECYCLING & RECLAMATION
- Cold Planing & Micro Milling
- Hot In-Place Recycling
- Cold In-Place Recycling
- Cold Central Plant Recycling
- Full Depth Reclamation

### BASE TREATMENTS
- Base Stabilization
- Soil Stabilization & Soil Modification
ARRA Best Practice Guidelines

► Series 100 Construction Best Practice Guidelines
  ■ Suggested Specification Language
► 200 Series Project Sampling & Mix Design Guidelines
► 300 Series QC Guidelines
  ■ Recommended Quality Control Checks and Remediation Actions
► Available for CIR, CCPR, FDR
  ■ All Provide User Notes for More Information
**VDOT Sections with CCPR at NCAT Test Track**

- **S12**
  - 4-inch AC
  - 5-inch CCPR
  - 8-inch FDR
  - Subgrade

- **N4**
  - 4-inch AC
  - 5-inch CCPR
  - 6-inch Agg
  - Subgrade

- **N3**
  - 6-inch AC
  - 5-inch CCPR
  - 6-inch Agg
  - Subgrade

- Basically same sections as on I-81
- 8 Years, 29 M ESALs, No Distress
NCAT Lee Road 159 Preservation Study
CCPR Base in Section L20

► 3/4 inch HMA Thin Lay over 5 inch CCPR
► Placed 2012, Over 1.3 M ESALs
► Performance
  ■ < 4% low severity cracking – Good
  ■ < 3 mm Rutting – Good
  ■ IRI 120 – Fair but no increase over time
NCAT US 280 Study
4-lane Divided Highway

- 18,300 AADT with 16% Trucks
- 1 inch HMA Thin Lay (20% RAP & RAS) over 4 inches CCPR or CIR base over 4 inches old pavement
- 5 years traffic, approximately 3.2 M ESALs

<table>
<thead>
<tr>
<th>Section/Mix</th>
<th>Binder</th>
<th>Cracking</th>
<th>Rutting</th>
<th>IRI</th>
</tr>
</thead>
<tbody>
<tr>
<td>40 CCPR</td>
<td>Foam 1% Cement</td>
<td>Good</td>
<td>Fair</td>
<td>Good</td>
</tr>
<tr>
<td>41 CCPR</td>
<td>Emulsion</td>
<td>Good</td>
<td>Good</td>
<td>Good</td>
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<tr>
<td>43 CIR</td>
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<td>Good</td>
<td>Fair</td>
<td>Good</td>
</tr>
<tr>
<td>44 CIR</td>
<td>Foam 1% Cement</td>
<td>Good</td>
<td>Good</td>
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</tbody>
</table>
Summary

- CIR & CCPR are economical and sustainable construction and maintenance procedures.
- CIR is best suited for cracked pavements with sound bases.
- CCPR can be considered anywhere one would place multi-lift HMA.
- CIR & CCPR require a wearing surface.
Thank You

Stephen A Cross, PhD, PE
Technical Director, ARRA
steve.cross@okstate.edu