Cold Central Plant Recycling

March 11, 2019

Mark Stahl
We see traffic like this.
and like this..
Pavement Condition
Why Recycle?

• Past conventional overlay stage
• Produces flexible pavement retards cracking
• Utilize already paid for materials
• Make maximum use of tight budgets—typically 40% less cost
• Fast process—shortened construction time
• Responsible construction practice—IT’S GREEN
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<table>
<thead>
<tr>
<th>Code</th>
<th>Description</th>
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<tbody>
<tr>
<td>LR400-4</td>
<td>FDR with emulsified asphalt</td>
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<tr>
<td>LR400-5</td>
<td>CIR with emulsified asphalt</td>
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<td>LR400-6</td>
<td>CIR with foamed asphalt</td>
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<td>LR400-7</td>
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<td>LR1000-1</td>
<td>Mix design procedures for CIR &amp; FDR with emulsified asphalt</td>
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<td>LR1000-2</td>
<td>Mix design procedures for CIR &amp; FDR with foamed asphalt</td>
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Cold Central Plant Recycling

Another Tool in the Tool Box

Allows road owner to:

- Stretch funding or # of miles
- Address the cause of failure not symptom
- Re-utilize the good material
- Utilize jobsite material OR Stockpile RAP
Cold Central Plant Recycling

Similar to FDR and CIR
- Road Evaluation and Sampling
- Mix design principles
- Emulsion or Foam with cement

Differences
- Engineering controls during production
  - Time to see gradation, material quality
  - Evaluate finished product before laid
  - Allows for stepped up testing if desired
- Increased trucking
- Need for material yard
Cold Central Plant Recycling--CCPR

Typical Candidate
Cold Central Plant Recycling--CCPR

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Cold Central Plant Recycling--CCPR

Typical Candidate
Typical CCPR layer is 6”-8” of compacted base
Can be on a stabilized subbase
Cold Central Plant Recycling--CCPR

3 Processes:

1. Use stockpiled RAP
   Utilize as original base in roadways, private lots

2. Remove and stockpile RAP
   Recycle RAP through CCP
   Pave recycled RAP in removal area
   Install wearing course

2. Remove and stockpile RAP
   Stabilize subbase in removal area
   Recycle RAP through CCP
   Pave recycled RAP in removal area
   Install wearing course
Cold Central Plant Recycling--CCPR

Where it is being utilized

Virginia—Interstates and state routes
West Virginia—State routes
Indiana—State routes
Michigan—county highways
California, New Jersey, New York—private lots
Material Source – Milling Direct from Job Site
Material Source – Millings from multiple sites

Use of impact crusher to regulate sizing
Use screening plant to fractionate RAP or aggregate
Cold Recycling Mixing Plant

Wirtgen KMA 220i

- Twin-shaft mixer: 220 t / h
- Aggregate Hopper: 2 x 7 cu yd
- Transport: 44ft x 8ft x 13ft
- Power Output: 174 HP Deutz
No Permits Needed

It is a Cold Process
No Burner—Aggregate stays at ambient
No Baghouse
Cold mixing plant - Components

175 hp Engine

Cement auger

Material hoppers

1200 gallon water tank

Injection system for water, emulsion and foamed bitumen

Twin shaft pugmill

Loading belt

Control house
Mineral aggregate (2 Hoppers)

Weighing by means of a belt scale

Transfer conveyor

Aggregate dosage openings

Cementitious and/or bituminous binding agent dosage

Loading belt

Cold mixed material conveyed onto a stockpile or transferred into tip trucks

Mixing in a twin shaft pugmill mixer

Weighing by means of a belt scale

Material flow
Typical Site Setup

Convenient for small material yards or Interstate interchanges
Material Loading

Aggregate loaded into left hopper

Sand loaded into right hopper
Aggregate / Sand Blend

Proportional Gate Openings at Bottom of Hoppers

Allows for different Blends

Example:

65% Aggregate

35% Sand
Common Materials Produced by the KMA:

100% RAP

RAP + New Aggregate

Cement Treated Base material (CTB)

Roller Compacted Concrete (RCC)
Bitumen

Bitumen emulsion

Foamed bitumen
KMA Plant load out

Loaded into trucks
Transported to jobsite
Laid in milled out area
CCPR Projects

• Interstate 81 in VA—2011
• Interstate 64 in VA—ongoing

• NCAT US280 CCPR Section—2015
• US460 in West Virginia—2016
Utilized FDR, CIR, CCPR
4 miles
Process:

Passing Lane
Removal of 2” and stockpile RAP
CIR 4” with 1% cement and foam

Driving Lane
Removal 10” and stockpile RAP
Stabilize subbase 12” with 5% lime
Install 6” CCPR material at 2.2% foam

Both Lanes
2” IM 19.0 lift
2” SMA surface course
Performance Examples of Similar Sections

I-81, Augusta County, 2011

- Right lane
  - FDR, CCPR, asphalt surface layers
- Summer 2016
  - 10 million ESALs
  - 0.10 inches rutting
  - IRI 44 inches per mile

Source: Brian Diefenderfer
I-64 Project Scope

- Newport News, James City, and York Counties
- Approx. 1 mile west of Exit 242 to 0.5 miles east of Exit 247
  - 7.08 miles, both directions (~56 lane miles)
    - 3,000+ trucks per day (in each direction)
  - Add a travel lane and a 12ft shoulder to the left
  - Reconstruct existing lanes
  - $189.7 Million
Project Scope

• Construct new travel lane and 12ft shoulder
  – CTA foundation
  – CCPR base
  – Asphalt surface layers

• Reconstruct existing lanes
  – Remove existing concrete
  – FDR foundation
  – CCPR base
  – Asphalt surface layers
Project Scope

PAVEMENT DESIGN (RECONSTRUCTED)

1. 2" Asphalt Concrete SMA-12.5 PG76-22
2. 2" Asphalt Concrete SMA-19.0 PG76-22
3. 6" Cold Central Plant Recycling Material (CCPRM)
4. 2" Open Graded Drainage Layer - Asphalt or Cement Stabilized
5. 12" Full Depth Reclamations (FDR) Existing Aggregate and Stabilized Subgrade
6. 2" Asphalt Concrete SM-12.5D
7. 2" Asphalt Concrete Type IM-19.0A

Shoulder only
Why Use Pavement Recycling

• 30 to 50 percent cost savings
• 50 percent less greenhouse gases emitted
• Fix deterioration causes rather than symptoms
• Can be quicker than full reconstruction

• I-64 Segment II
  – RAP use could exceed 200,000 tons
  – Cost savings of about $10 Million
NCAT US280 CCPR Section

CCPR Section Pre-milled to depth of 5"
Millings taken off site to stockpile
Source Material Pre-Screened RAP, $\frac{3}{4}$” minus
Job Mix Formula

1.5% cement
2.0% water
2.5% foam
Well graded fine mix loaded directly to trucks
20 tons batches
Load recycled millings directly to paver hopper
Pave Processed RAP at 5 ½” to finish compacted finish depth of 4”
NCAT US280 CCPR Section
Apply fog seal at rate of 0.05 gal/sy
Cure – open to traffic
1” Fine graded surface course
US 460 West Virginia

Scope:
Remove 8” asphalt
Install 6” CCPR with foam
Install 2” surface course

16,000 tons of foamed base
US 460 West Virginia

Laid nominal 8” lift with RAP with foam
Compacted to 6” finished lift
US 460 West Virginia

Compacted with a 14-ton double drum vibratory and a 12 ton pneumatic
US 460 West Virginia

Finished:
6” foamed CCPR
2” surface course
Benefits:

- Produces a flexible pavement that retards cracking
- Allows engineering controls with material quality and consistency
- Utilizes jobsite material or stockpiled RAP
- Contactor can use normal paving equipment
- CCP do not need permits
Cold Central Plant Recycling (CCPR)

Summary:

• Another tool in your recycling tool box
• Can easily be coupled with other recycling disciplines
• Adaptable process—DOT or private
• Proven process that other states are utilizing