Cold Recycling Process Description

- Pulverizing Existing Pavement
- Sizing of the Reclaimed Asphalt (RAP)
- Addition of new Binder/Additives
- Mixing all Component Materials
- Placement and Compaction of Mixture
- Placement of Wearing Surface
CIR – QA/QC Plan

1. Just-in-Time Training
2. Calibration of Meters
3. Site Preparation
4. Weather
5. Depth of Milling
6. RAP Gradation
7. Recycling Additive Contents
8. Compacted Density
9. CIR Smoothness
10. Moisture Content Before Overlay
1. Just-in-Time Training

- Familiarize Everyone with Process
- 1 Week Before Construction Begins
- Contractor & Owner Agency Personnel Required to Attend
- Exempt by Verified Experience

Course Should Cover:
- Construction Methods
- Materials
- Test Methods Associated with CIR Construction
2. Calibration of Equipment

- Calibrate Belt Scales & Pumps
- Accurate to within 0.5% of Required Rate
- Pumps should be Tied to RAP Weighing System
- Interlocks Shut Off Pumps When no RAP is Present or Train Stops
3. Site Preparation

- Sweep or Blade Roadway to Remove Dirt, Standing Water, Oils, Raised Roadway Markings and other Objectionable Materials.

- Identify Presence of Excessive Crack Filler and/or Geotextiles and Develop Plan to Remove
3. Site Preparation

- Adjust Affected Utilities Down and Fill with Cold Mix Asphalt or
- Pre-Mill Around Affected Utilities Prior to Recycling.
- Correct Any Known Areas of Soft or Yielding Subgrade.
- Correct with RAP, HMA, Aggregate
- Correct Drainage Issues
4. Weather Limitations

- Air Temperature of > 45°F & Rising.
- Pavement Temp. > 50°F
- Minimum Overnight Temp. > 32°F
- Heavy Rain Must not be Occurring, Imminent or Predicted.
5. Check Depth of Milling

► Mill Required Depth & Cross-Slope

► Typical Tolerance
  ¼-inch (6 mm)

► Positive Means
  Controlling Depth & Cross-Slope

► Frequency of Measurement
  each 1/8 mile
6. RAP Gradation

► Check for Max. RAP Size – 4 times/day

► Some Agencies Perform Washed Gradation to Check % Retained No. 4 Sieve

  ■ Assist with Adj. to Additive Contents

  ■ Once per day
6. Crushing & Screening

- Some Agencies Require Closed Loop System of Crusher & Scalping Screen to Control Maximum RAP Size
- Max RAP Size 1.25 in. (31.5 mm)

Large RAP particles can cause placement & compaction difficulties (segregation, mat tearing, etc.)
7. Recycling Additives

- Traveling Pugmills are Required to Mix & Coat RAP with Recycling Agent
- Separate, Combined, & All-In-One Available
7. Additive Application

**Slurry Application.**
Portland Cement and Hydrated Lime may be applied in slurry form, at cutting head or directly into pugmill.

**Dry Application.**
May be spread dry in front of the recycling train. (Environmental Restrictions)
7. Additive Contents

► Emulsion Content From Microprocessor

► Lime or Cement From Meters Accurate to Within 5% Desired Rate
  - Lime: Max. 1.5%
  - Cement: min 3:1 ratio residual binder to cement

► Water from Microprocessor or Flow Meter
7. Adjustments to Mix

- Cold Recycling is a Variable Process and Existing Mix may not be Uniform Throughout the Project
- Rigid Adherence to JMF can Result in Less Than Optimal Performance
- Many Agencies Allow Changes in Recycling Agent Content of ± 0.5% Without New Mix Design
- Changes Should be Made Judiciously by Experienced Personnel Only
Placement

Homogenous Mixture is Deposited in Windrow and Placed in Paver (min 170 hp) With Windrow Elevator or
Placement/Laydown

Mix Can Be Deposited Directly Into Paver Hopper or Mix Pavers Can be Used
8. Compaction

- Uses same equipment as Hot Mix
  Except CR Harder to Compact (More Viscous due Cold Temperature)

- Pay Attention to Longitudinal Joint

- Roll Joint First
  Then Roll From Low to High Side
8. Compaction

► Specify Heavy Pneumatic Roller(s) 25 ton min., min. 65 inch width
► Roll Until Roller “Walks Out”
► Initial Pass or Passes with Vibratory Roller May be Required
8. Compaction

► Specify Heavy Double Drum Vibratory Steel Wheel Roller(s)
  ■ 10 ton min., min. 65 inch width

► Finish Rolling in Static Mode
8. Compacted Density

- Establish a Control Strip During First Day of Production
  - Demonstrate Equipment, Materials & Process Produce Mix Meets Specs
  - Verify Optimal Rates for Recycling Additives
  - Determine Rolling Pattern Necessary to Obtain Maximum Density (Target Density)
8. Compaction

- Use 1000 Foot Control Strip
- Monitor Wet Density vs. Roller Passes with Various Combinations to Establish Roller Pattern
- Peak of Curve is Target Density
8. Compacted Density

- %Compaction = \[
\frac{\text{Wet Density}}{\text{Target Density}} \times 100
\]

- Compact to 95-105% Compaction
- Majority (95-98%) tests should meet requirement
- Establish new Target Density:
  - Can’t Achieved Density Requirement
  - Significant Roller Checking /Cracking
8. Compacted Density

- Use Density Gauge
- ASTM D2950 or Equivalent
- Record Wet Density
- Frequency of Testing
  - 1 per 1000 yd\(^2\) or m\(^2\)
  - 10 Tests / Day
Apply Fog Seal

- Stop 30 Minutes Before Sundown
- Use Emulsion From Job or CSS-1h /SS-1h
- Dilute CSS-1H or SS-1h 50% with Water
- Dilute Engineered Emulsion 60% with water
- Apply at 0.05 – 0.15 gal/yd²
- Apply Blotter Sand at 2-3 lbs/yd² to prevent pick-up
9. Smoothness

► A Floating Beam or Ski is Often used to Improve Smoothness of CIR Layer
9. Smoothness

Most Agencies Check Compacted Smoothness of CIR Mat Using Straight Edge (3/8 inch in 10 ft)

- Correct humps
  - Reworking
  - Rerolling
  - Trimming
  - Milling
  - Abrasive Grinding

- Depressions > 3/8”
  Tack & Fill with HMA
10. Moisture Content Before Overlay

Place Wearing Surface:
- Minimum 3 Day Cure
- < 3.0% Moisture
- If > 3.0% Moisture After 10 days and Free From Rain Min. 2 Days

Foam cures quickly

Some Agencies Require Re-Rolling before Placement of Wearing Surface
- Emulsion only, Pavement Temp. > 80°F
Wearing Course

- Chip Seal
- Slurry Seal
- Micro-Surfacing
- Hot Mix Overlay
CR Guidelines for:
- CR 101 Construction
- CR 201 Mix Design
- CR 301 QA Sampling & Testing
- CR 401 Project Selection

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