

# ***CIR Construction Practices and Specifications***



**Virginia Pavement Recycling Conference**

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# ***Cold Recycling Process Description***

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- ▶ **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***

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- ▶ **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***

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- ▶ **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***

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- ▶ **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**

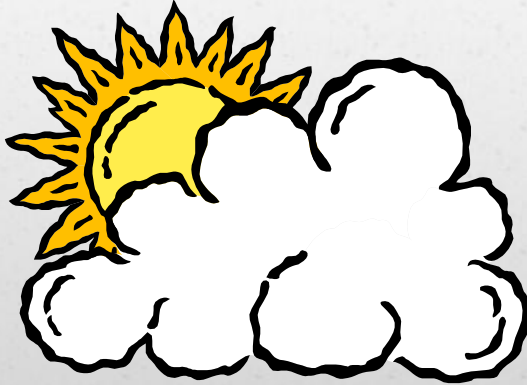
# ***3. Site Preparation***

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

# 4. *Weather Limitations*

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- ▶ **Air Temperature of  $> 45^{\circ}\text{F}$  & Rising.**
- ▶ **Pavement Temp.  $> 50^{\circ}\text{F}$**
- ▶ **Minimum Overnight Temp.  $> 32^{\circ}\text{F}$**
- ▶ **Heavy Rain Must not be Occurring, Imminent or Predicted.**



# 5. Check Depth of Milling

- ▶ **Mill Required Depth & Cross-Slope**
- ▶ **Typical Tolerance**  
**1/4-inch (6 mm)**
- ▶ **Positive Means**  
**Controlling Depth**  
**& Cross-Slope**
- ▶ **Frequency of**  
**Measurement**  
**each 1/8 mile**



# 6. RAP Gradation

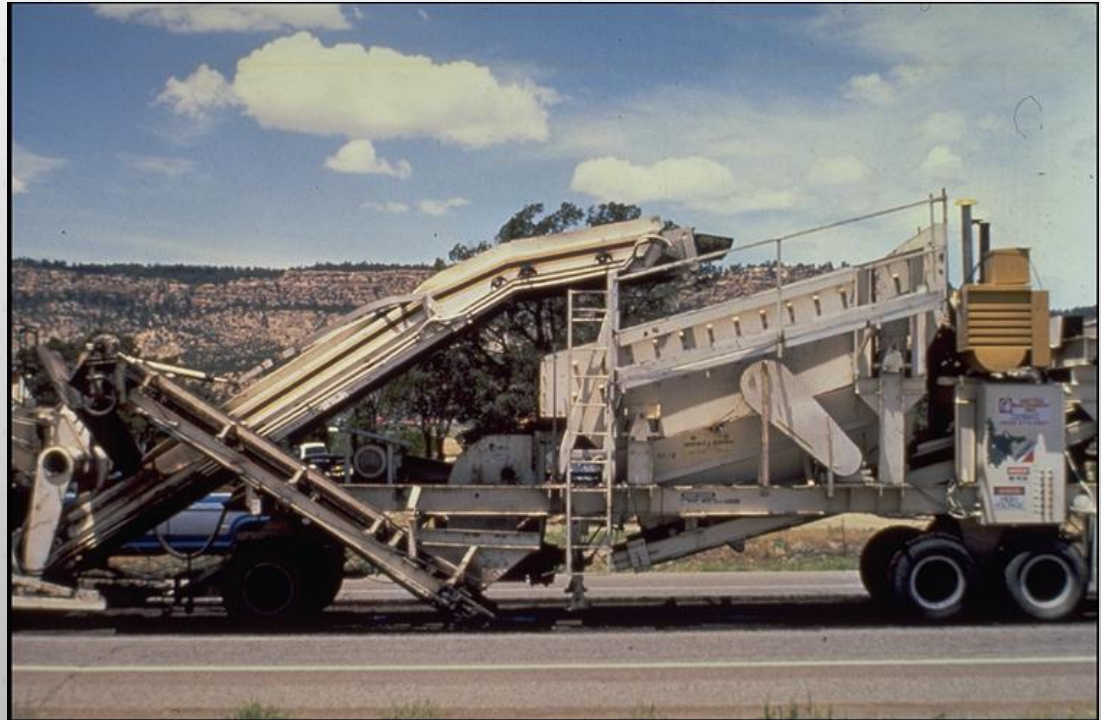
- ▶ **Check for Max. RAP Size – 4 times/day**
- ▶ **Some Agencies Perform Washed Gradation to Check % Retained No. 4 Sieve**
  - **Assist with Adj. to Additive Contents**
  - **Once per day**



# 6. *Crushing & Screening*

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- ▶ **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

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- ▶ **Traveling Pugmills are Required to Mix & Coat RAP with Recycling Agent**
- ▶ **Separate, Combined, & All-In-One Available**



# 7. Additive Application

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## 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

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- ▶ **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***

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- ▶ **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  $\pm 0.5\%$  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*

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- ▶ **Mix Can Be Deposited Directly Into Paver Hopper or Mix Pavers Can be Used**



# 8. *Compaction*

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- ▶ **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*

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- ▶ **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*

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- ▶ **Specify Heavy Double Drum Vibratory Steel Wheel Roller(s)**
  - 10 ton min., min. 65 inch width
- ▶ **Finish Rolling in Static Mode**



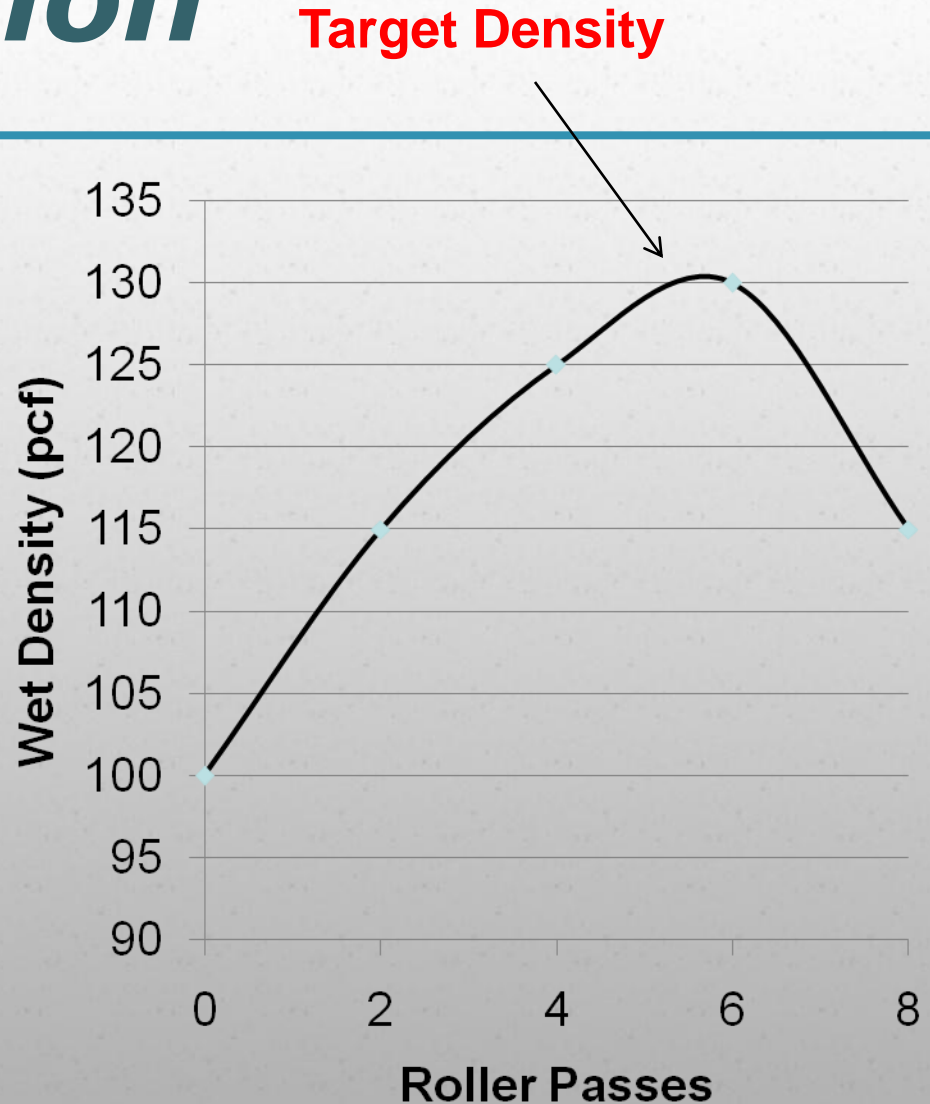
# ***8. Compacted Density***

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- ▶ **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*

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■ **%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*

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- ▶ Use Density Gauge
- ▶ ASTM D2950 or Equivalent
- ▶ Record Wet Density
- ▶ Frequency of Testing
  - 1 per 1000 yd<sup>2</sup> or m<sup>2</sup>
  - 10 Tests / Day





# *Apply Fog Seal*

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- ▶ **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/yd<sup>2</sup>**
- ▶ **Apply Blotter Sand at 2-3 lbs/yd<sup>2</sup> to prevent pick-up**



# 9. Smoothness

- ▶ A Floating Beam or Ski is Often used to Improve Smoothness of CIR Layer



# 9. Smoothness

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**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***

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- ▶ **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

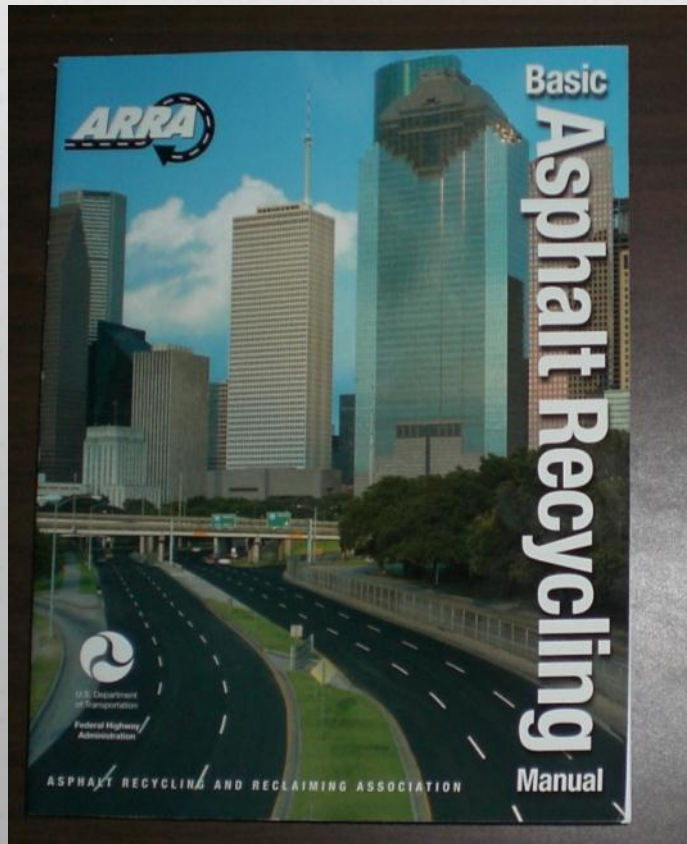


- **Chip Seal**
- **Slurry Seal**
- **Micro-Surfacing**
- **Hot Mix Overlay**





2<sup>nd</sup> Edition



Pavement  
Recycling



Reclaiming  
Center

[www.ARRA.org](http://www.ARRA.org)

- ▶ **CR Guidelines for:**
  - **CR 101 Construction**
  - **CR 201 Mix Design**
  - **CR 301 QA Sampling & Testing**
  - **CR 401 Project Selection**
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