



Construction of Cold In-place Recycling (CIR)

MTC Cold In-place Recycling Technical Workshop

Oakland California

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Topics

- Engineered Approach, Mix Design
 - Cold In-place Recycling Equipment
 - Construction method, Testing, Quality Control
 - Benefits and Closing
 - Questions
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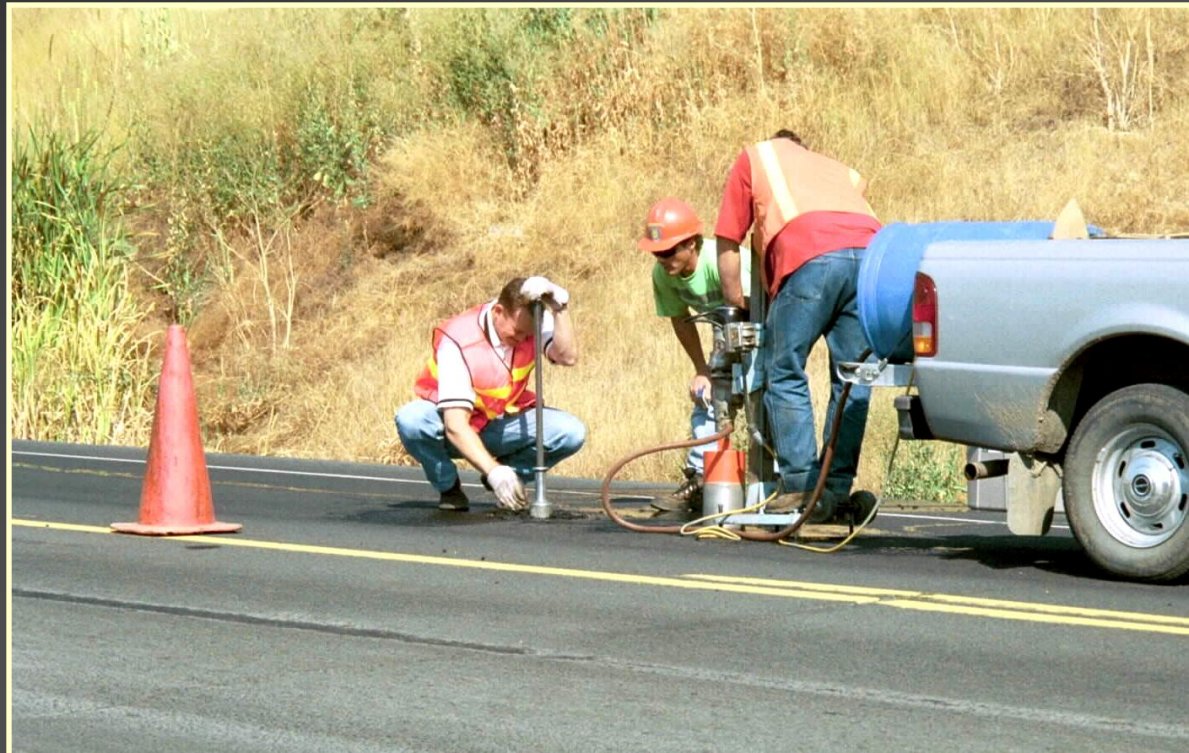
Engineered Approach with Mix Design

On all Recycling Projects

- Prior to bidding the project.
 - Check existing pavement for adequate thickness.
 - Check for fabric and pavement type.
- Part of the contract is to core pavement to obtain samples for mix design using a systematic engineered system.
- Optimizes the percentage and type of recycling agent unless state specifies asphalt foam. For asphalt foam the optimum percent asphalt is determined in a mix design by the Contractor
- Determined the need for, percentage of and type of recycling additive at the mix design.

Mix Design Process

- Defined sampling procedure, cores taken from various locations. Core samples sent to independent AASHTO approved lab.



Lab RAP Analysis

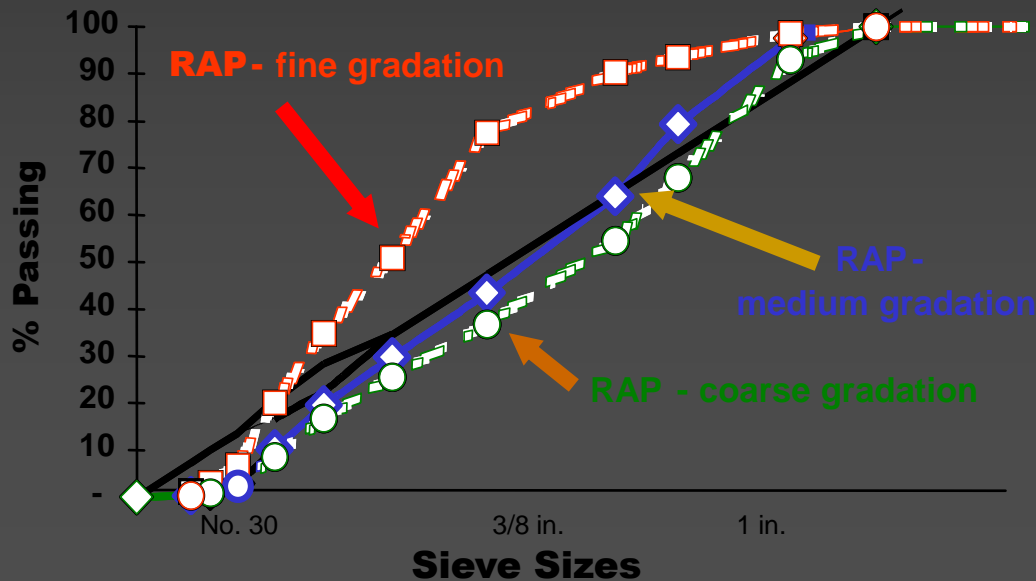


■ Lab

- Field cores crushed to specific gradation bands
- A design made for 2 of the gradations

■ Field

- Field gradation depends upon multitude of factors: milling, weather, etc.
- Gradation compared to lab tested band
- Recycling agent percentage based on applicable gradation



Density Compaction Effort

Superpave Gyrotory Compactor or Marshal Compactor

Lab



Field



Asphalt Recycling Train Components



Recycling Unit

Full Lane Mill

Recycling Additive

Pavement Milling Machine

- Main Asphalt Mill
 - Self-propelled
 - Minimum 12.5 ft cutter (full lane)
 - Automatic depth controls to maintain the depth
 - Cross slope controls
- Supplemental Mill
 - Put millings in front of main asphalt mill to pickup and process
 - Shoulders and misc. areas can be processed

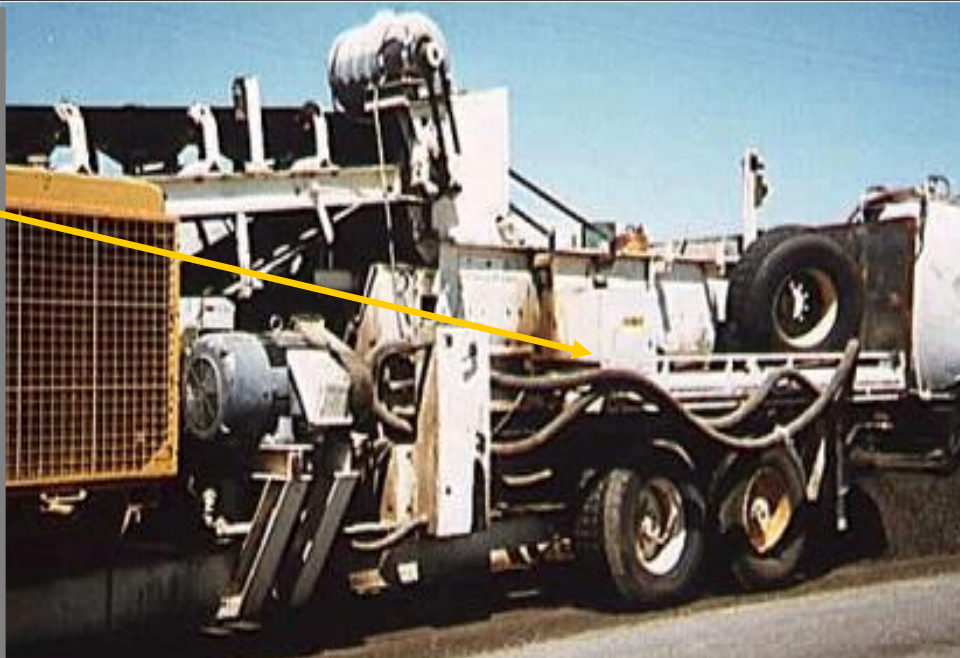


Brooms for Clean Vertical Edges

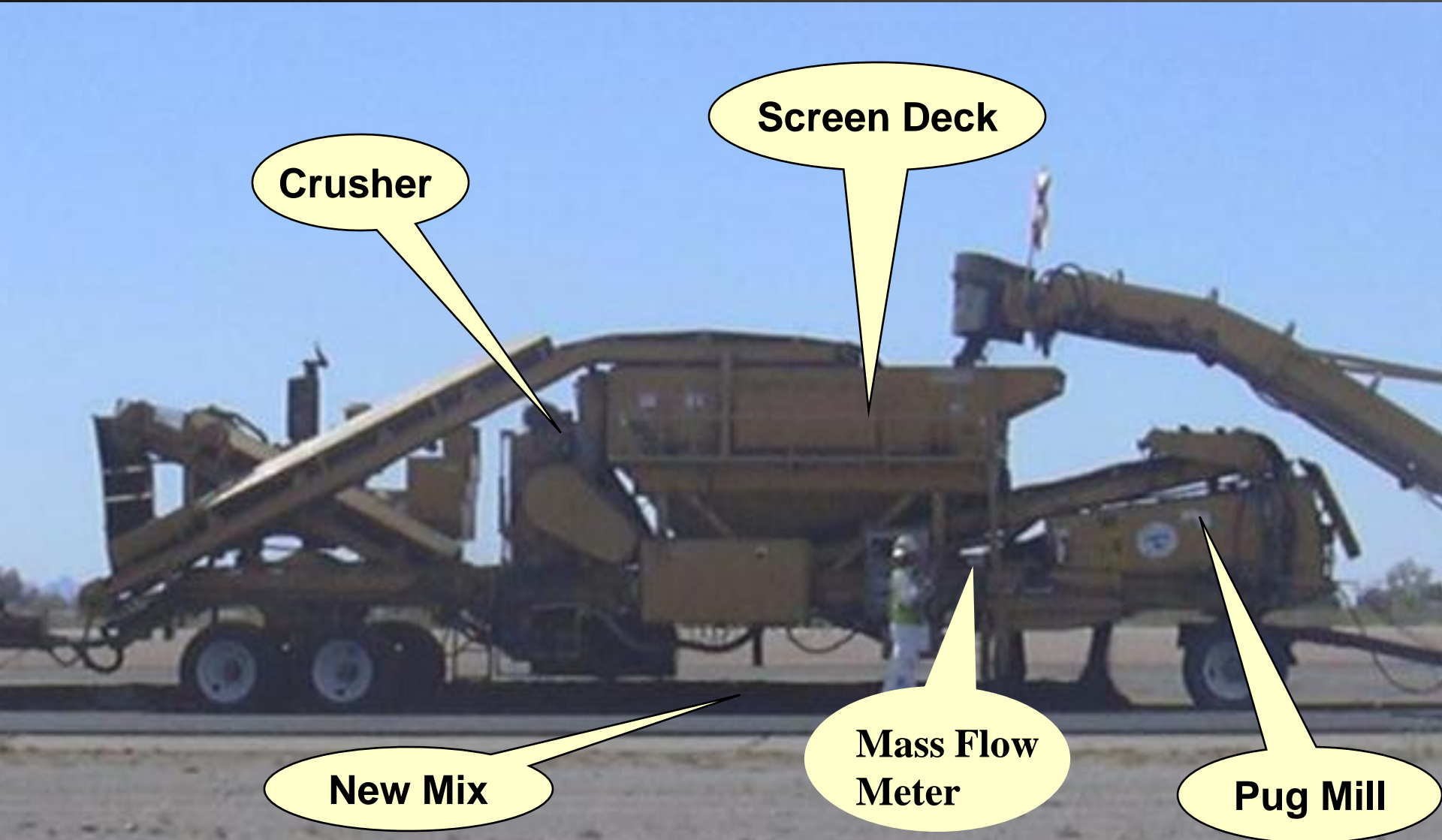


Mixing/Proportioning Equipment

- Continuous pug mill operation.
- Equipped with variable paddles to provide sufficient mixing.
- Belt scale and integrated microprocessor with interlocks.
- Automatic controls to obtain the proper amount of engineered recycling agent/foamed asphalt and or additives.
- Weighing and measuring devices must be tested in conformance with California Test 109.



Asphalt Recycling Plant Meets Caltrans CT 109 Calibration Requirements per Specifications



Mass Flow Meter

Emulsion/Foamed Asphalt Injection System



Return Belt to Screen Decks

Return Belt to Screen Decks



Crushing and Sizing Equipment, 100% Closed Circuit System.

Crushing and sizing equipment capable of reducing RAP to the 100% passing 1-inch sieve prior to mixing and weighing millings with engineered recycling agent.



Asphalt Assets Recycled in Place



Insulated and Heated Trailers for Emulsions or Liquid Asphalt



Pick Up and Installation

Caltrans State Route 33



Recycled Asphalt Surface

Beverly Hills



Track Paver

California City



Beverly Hills



Sonoma County



L.A. County





100% Recycled Asphalt

10-12 Ton Double Steel Drum

Minimum one, must have working water spray system



25-Ton Pneumatic Roller

Minimum one, must have working water spray system



Test Strip

- First day construct single lane 1,000 ft (minimum) in length within the limits to be cold in-place recycled.
- Demonstrate:
 - Planer clean cuts and proper width.
 - Pugmill good mixing and coating of recycling agent and water.
 - Pickup machine picking up windrow.
 - Track paver with proper horsepower and leaving a smooth mat.
 - Rollers proper weight with working water.
 - Crushing and screening meets maximum gradation.
- Determine rolling pattern and maximum density (Breakover Point) by testing in same location.
- Determine moisture content before and after recycling.
- Cold in-place recycling operations may continue through the first day after successful test strip.

Quality Testing and Documentation



City of Palm Desert

Quality Assurance

- Adjustments may be made based upon the opinion of the Contractor. Need to be documented.
- QA/QC results submitted to Engineer on a daily basis
- Each Lot 3,000 square yards record:
 - Depth of cut on both ends of drum every 300 ft
 - Length, width and depth of cut
 - Mass of water, dry RAP and emulsion
 - Percent Emulsion
 - Ambient and compacted recycled surface temperatures
 - Maximum particle size of recycled material – Field Sieve over 1-inch
 - In-place density from nuclear gauge readings in 10 random locations
 - Relative Compaction of lot compared to rolling vs. density chart
 - Every third lot field gradation through the No. 4 sieve. Compare to mix design

Fog-Seal



Quick Opening to Traffic

- Rolling is completed
- Some cure time, fast return to traffic
- Fog-seal and sand blotter are applied



Before and After Pictures, CIR Projects

Ramona Expressway



State Route 36

New Recycled Surface



L.A. County CIR 3-inches

2.75% PASS R
Engineered Emulsion

City of Agoura Hills

Project Profile; 500,000 S.F. “Energy and Cost Savings”

- 8,744 tons of asphalt removed and repaved.
- 840 fewer trucks used utilizing CIR, compared to a mill and fill operation.
- 1,649 fewer barrels of oil used.
- 79.6% fewer carbon emissions utilizing CIR compared to mill and fill operation.
- Cost savings to the City \$262,320.00.
- Cut 30% off the project schedule.

Benefits of Recycling and Reclamation

- Shorter Construction Periods with Reduction in User Delays
- Improved Pavement and Structural Section Properties
- 20 Plus Years Performance Expectations
- Cost Savings Over Traditional Rehabilitation Methods
 - Preserves the Investment Already Made in Pavements
- Sustainable Development “.... Development that meets the needs of the present without compromising the ability of future generations to meet their own needs.”
 - Optimize the use of natural resources
 - Reduce energy consumption
 - Reduces Truck Traffic
 - Reduce greenhouse gas emissions, limiting pollution

Questions?



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