Cold In-place Recycling (CIR) and Full Depth Reclamation (FDR)

What it is and What it Does

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CIR on the Pavement Life Curve. Use Asphalt Recycling for Preservation



CIR

Preservation or Minor Rehabilitation



Cold In-place Recycling (CIR)

Distressed Pavement = New Pavement Using A Train of Equipment that:

- Mills deteriorated pavement
 - Reclaimed asphalt pavement (RAP)
- Crushes RAP to gradation
- Mixes with recycling agent
- Re-Paves recycled mix
- Compacts to specified density
- Readies for surface treatment



Cold In-place Recycling (CIR) Repairs Deteriorated Pavement 2" to 4"





BEFORE: DISTRESSED PAVEMENT AFTER: COLD IN-PLACE RECYCLING Distressed AC pavement: fatigue, cracking Base/sub-base Subgrade Subgrade Subgrade



CIR Crushing and Sizing Train (Some Variations But Same Concept)



Recycling Plant Meets Caltrans Calibration Requirements



Pavement Milled

Main Mill

- Self-propelled
- Minimum 12.5 ft cutter
- Automatic depth controls to maintain the depth
- Control cross slope



Supplemental Mill

- Put millings in front of main mill to pickup and process
- Shoulders and misc. areas



Cracking Pattern Disrupted

70% Rule for Mitigation of Reflective Cracking

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.



New Recycled Mix Windrowed





Pick Up and Paved

Paver with minimum power of 170 Hp

Laydown and Rolling





Compacting Equipment

Minimum 1 pneumatic-tired roller at least 25 tons

At least 2 double drum vibratory steel-wheeled rollers at least 10 tons

Minimum width at least 66inches.

All rollers must have working water spray systems.

Quick Opening to Traffic

Rolling is completed
Some cure time
Fog-seal and sand blotter are applied



Cured 2 to 3 Days Down to 2.0% Residual Moisture and then Rerolled Prior to Surfacing



Because of Higher Void Ratio's Surfaces Must Be Sealed

Fog Sealed or Slurry Sealed Low volume – Shoulders and Lots





Chip Sealed – Low Volume Highways

HMA Overlaid – Higher Volume Highways and Most Residential



Caltrans State Route 36



100% Recycled Asphalt

City of Moreno Valley, July 2009



Eucalyptus Avenue Moreno Valley, July 2009

Project Profile; Moreno Valley, July 2009 "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.

Cold Central Plant Recycling (CCPR)

From RAP

Clean Rap = New Pavement:

- Stockpiled and kept clean
- Crushed RAP to gradation
- Mixed with recycling emulsion
 - In central plant
- Transported to lay down area
- Paved as a recycled mix
- Compacted to specified density
- Readied for surface treatment



to Pavement

City of Santa Ana Project "Restore" 2009/2010



Milling Existing Asphalt/Sweeping



RAP Loaded, Crushed, Processed

New Recycled Asphalt

Swept and Tacked Prior to Install

What to Asphalt Recycle

Thermal Cracking

Fatigue Cracking

Poor Rideability

Dry, Raveled

Patched

Where to Use In-Place Recycling

Anywhere mill and fill is considered

- Adequate existing pavement thickness
 - CIR typically 2 to 4 inches in thickness.
 - Thick enough to take to stable base or leave 1" of existing pavement over native soils.
- Will handle all cracking distress provided not base related
- Surface maintenance is no longer effective
- To repair raveling & potholes
- Where safety is a concern
- When life cycle costs dictate
- No limitation to traffic/ADT
- Able to accommodate train

Pavements Not To Be Recycled

Poor Drainage

Paving fabric makes it messy!

Poor Base

Asphalt Rubber Type G or O

Avoid unstable subgrade or base problems!

Stripping

Removing Paving Fabric

Full Depth Reclamation (FDR)

Mechanical Stabilization (Pulverization)
Bituminous Stabilization
Chemical Stabilization

FDR on the Pavement Life Curve. Use Full Depth Reclamation for Rehabilitation.

Full Depth Reclamation

Improves existing materials in-place to provide greater structural support and reduction of imported material.

Full Depth Reclamation Construction Sequence

Existing roadPulverizationRemoval ofAddition ofFinal surfactorto design depthexcess materialreagents, mixingtreatment(if necessary)& compactingand shaping

Mechanical Stabilization (Pulverization)

AC and underlying materials are pulverized and mixed to provide a homogenous base material.

Add Additives = Stabilized Base

Chemical StabilizationPortland CementLime

Bituminous StabilizationAsphalt EmulsionFoamed Asphalt

Bituminous Stabilization

Asphalt Emulsion or Foamed Asphalt

Generally for stabilization of blended material with 8 to 20 percent fines.

Increases long term strength and pavement support characteristics, while remaining flexible and wear resistant. (Caltrans Gravel Factor = 1.5 to 1.7)

Does not crack within itself (shrinkage cracking). Immediate traffic.

Can add RAP, Aggregate Base, Cement or Lime to enhance gradations or change underlying soil plasticity characteristics.

Bitumen or Emulsion Introduced at Mixer

Project Profile; Cecil Avenue Delano, CA FDR with Asphalt Emulsion Traffic Index - 9

Pulverization

Reclaimer adding 4% Engineered Emulsion

Compaction and Final Grading

Delano Project Before

City of Delano Benefits with FDR

- Construction time reduced from 33 shifts to 11 shifts.
 Cost savings of 35% to City of Delano.
- Higher structural value for base section that will accommodate an increase in T.I. in future.
- 1,675 truck loads of export/import eliminated along with the associated emissions, wear and tear on city streets and traffic congestion.
- Reduced Disruption to local business and schools.

Chemical Stabilization Portland Cement or Quicklime (CaO)

Cement is the most economical way to gain substantial increases in strength and wear resistance, but more rigid behavior. (Caltrans Gravel Factor = 1.4 to 1.8)

Lime is used to increase the performance when soils have plastic and expansive properties. (Caltrans Gravel Factor = 1.2 to 1.3)

Curing period typically 3 to 4 days, traffic is allowed if surface is compacted and un-yielding.

May require a stress relief course to prevent new reflective cracking or utilize micro-cracking.

Project Profile; City of Oxnard FDR Strategy Using Type II Portland Cement

Pavement Pulverized

Spreading Portland Type II Cement

Initial Mixing

Secondary Mixing (adding water)

Grading & Compaction

CATERPILLAR

Open to Local Traffic During Construction

Cement Stabilized Base

Questions?

The Road to Smart Solutions

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