Sustainable Development Utilizing Cold Asphalt Recycling

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Sustainable Development;

"Development that meets the needs of the present without compromising the ability of future generations to meet their own needs."

Reduce, Reuse and Recycle…

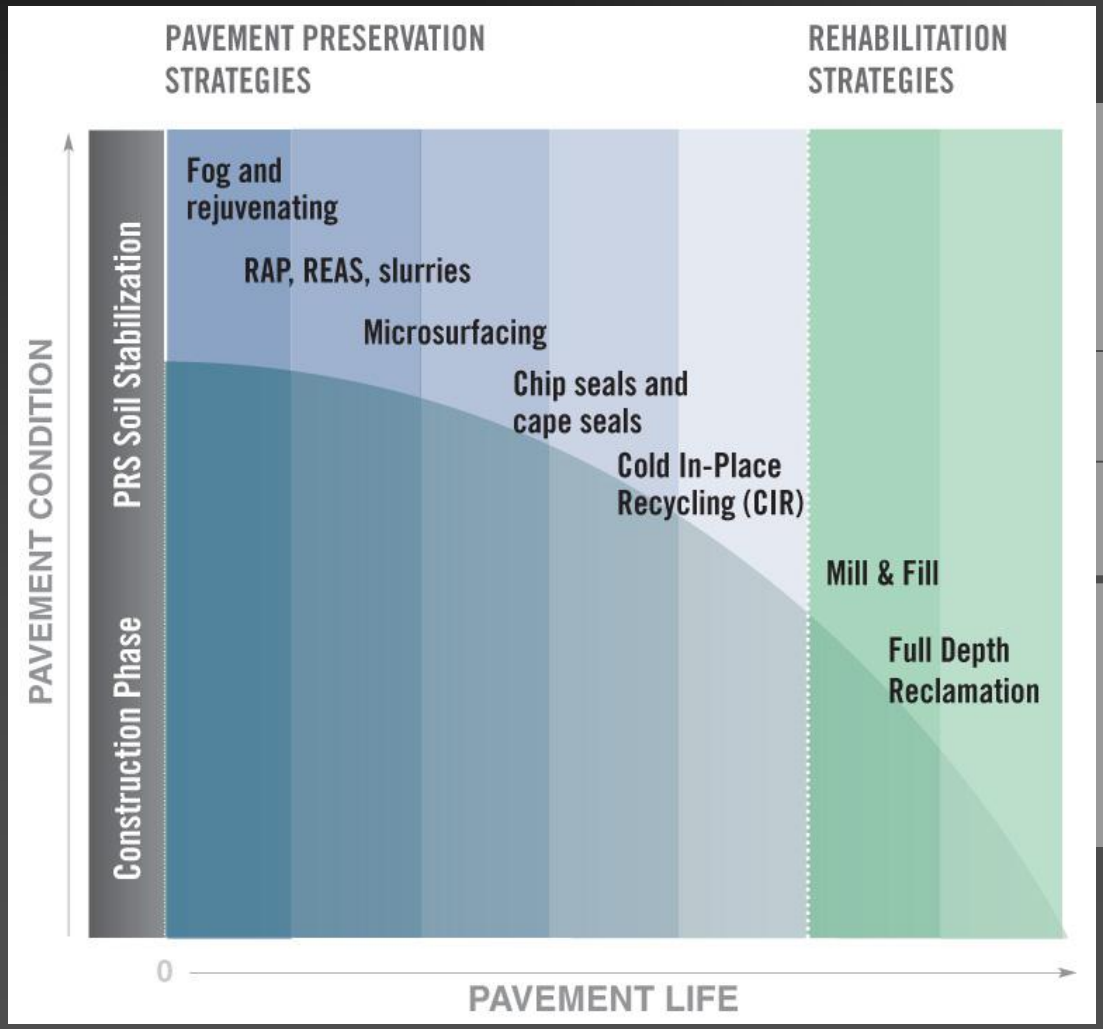
For Agencies: Sustainability of Infrastructure Investment

- Maximize “return-on-infrastructure” by re-using in-place materials
- Stretch budgets: two or three roads for the price of one
- Structural qualities reduce maintenance costs
- Solutions for every stage of lifecycle
- From public roadways to airport runways
- Your asphalt assets contain superior aggregates and materials

Today's "Tax Payer Friendly" Topics

- Project Selection
- Engineered Design
- Cold In-place Recycling (CIR)
- Cold Central Plant Recycling (CCPR)
- Benefits and Summery

Environmentally Sound Solutions for Every Phase of the Pavement Life Curve. Use Asphalt Recycling for Preservation

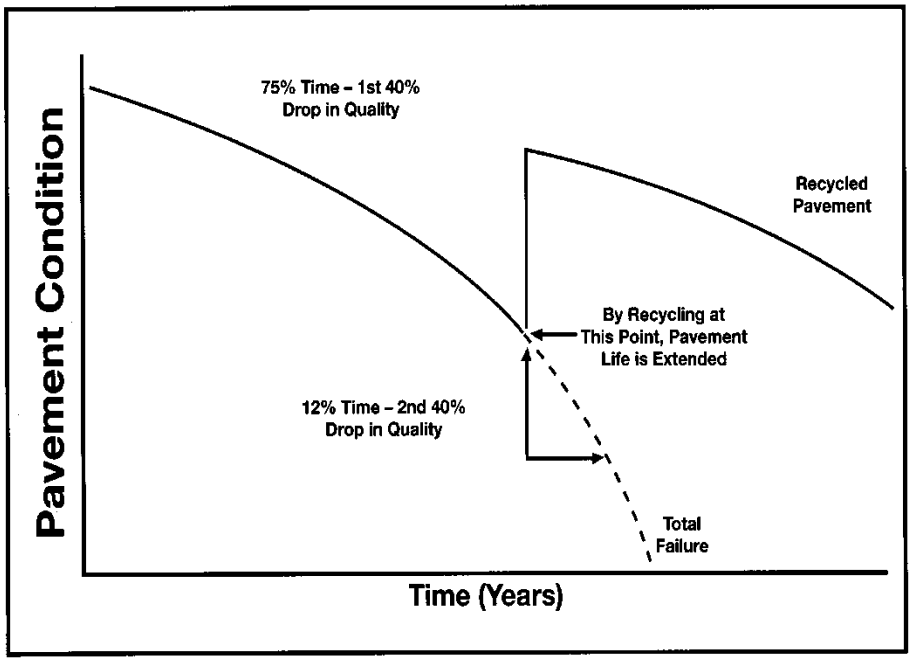


- Preservation
- Rehabilitation

More value, at lower cost to you and the environment

When to Utilize Asphalt Recycling

- Anywhere mill and fill is considered
- Adequate existing pavement thickness
  - 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 sub-grade or base related
- Where surface maintenance is no longer effective
- Where safety is a concern
- When life cycle costs dictate
- When you need to stretch your budget



Where to Utilize Asphalt Recycling?

City Streets

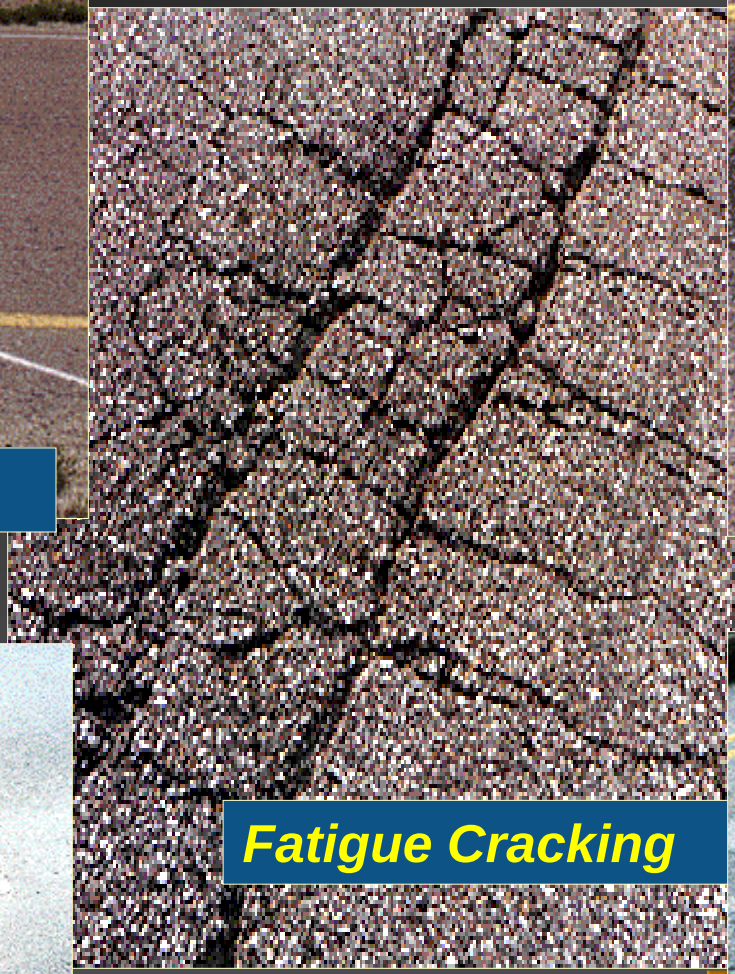
Highways

Virtually No Traffic Limitations

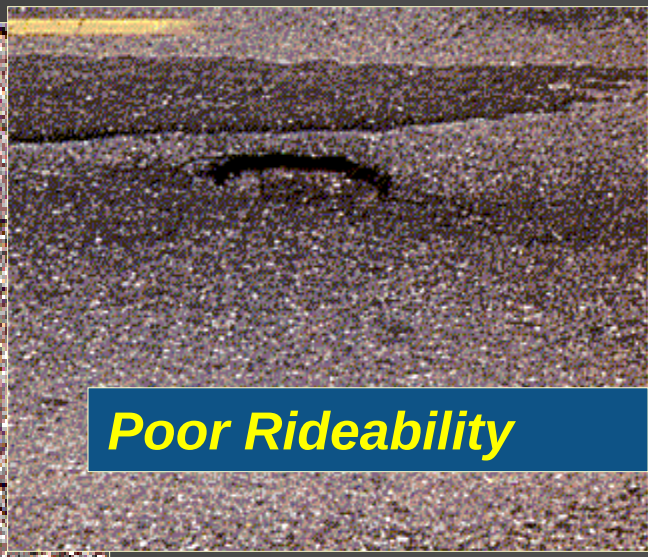
Airports

Type's of Asphalt to Recycle

Thermal Cracking



Fatigue Cracking



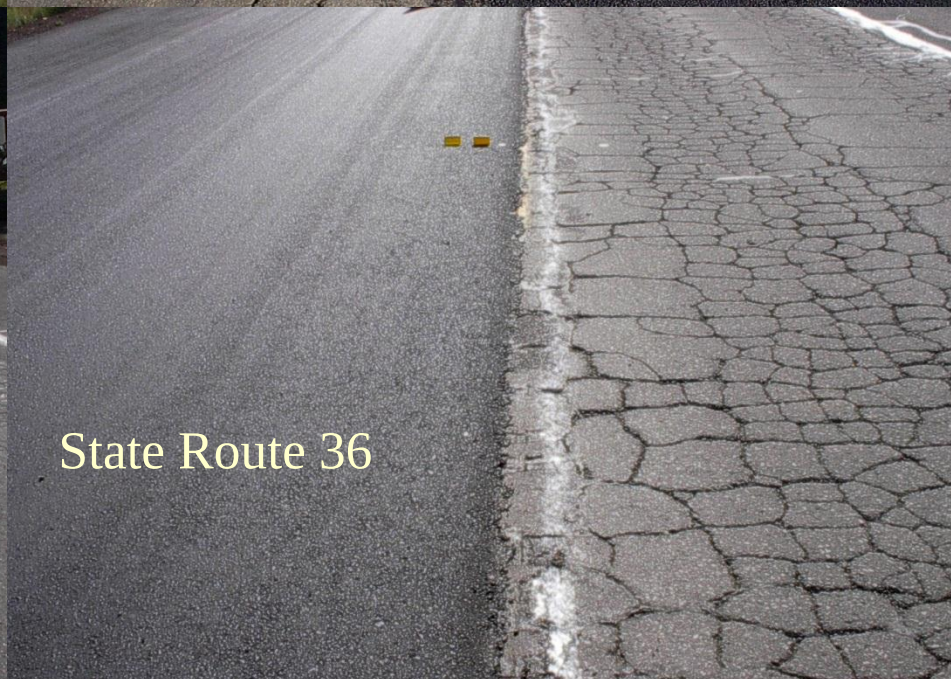
Poor Rideability

Patched

Dry, Raveled

Before and After Pictures Local CIR Projects

Ramona Expressway



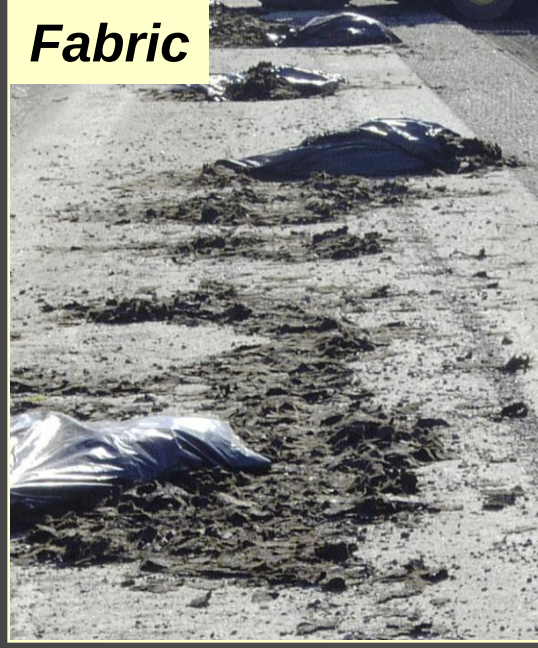
State Route 36

Other Selection Considerations

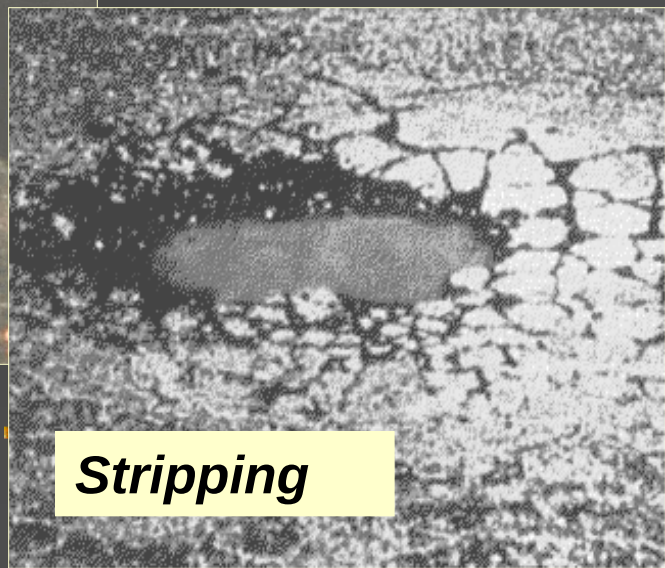
- Large Enough Project to Handle Minimum Daily Productions
- Width of Roadways, Cross Slope and Steep Grades
- Turns That can Accommodate the Train
- Height of Trees and Amount of Shaded Areas
- Utilities Need to be Double Adjusted
- Turn Around, Stage and Parking Areas
- Avoid Roads That are Road mixed, Cutbacks
- Temperatures and Time of Construction
- Use RAP to add Width or Increase Recycle Section

Pavements Not To Be ~~Recycled~~

Paving fabric makes it messy!



~~***Asphalt Rubber Type G or O***~~



Avoid unstable subgrade or base problems!

Removing Paving Fabric

Higher costs

Lower production

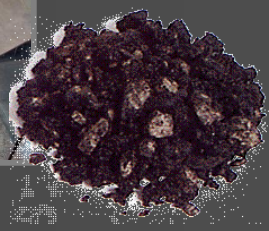
Engineered Mix Design On all Recycling Projects

- Prior to bidding the project.
  - Check existing pavement for adequate thickness.
  - Check for fabric and pavement type.
- Part of the contract is for contractor to core pavement to obtain samples for mix design using a systematic engineered system.
- Contactor 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
- Contactor determined the need for, percentage of and type of recycling additive at the mix design.

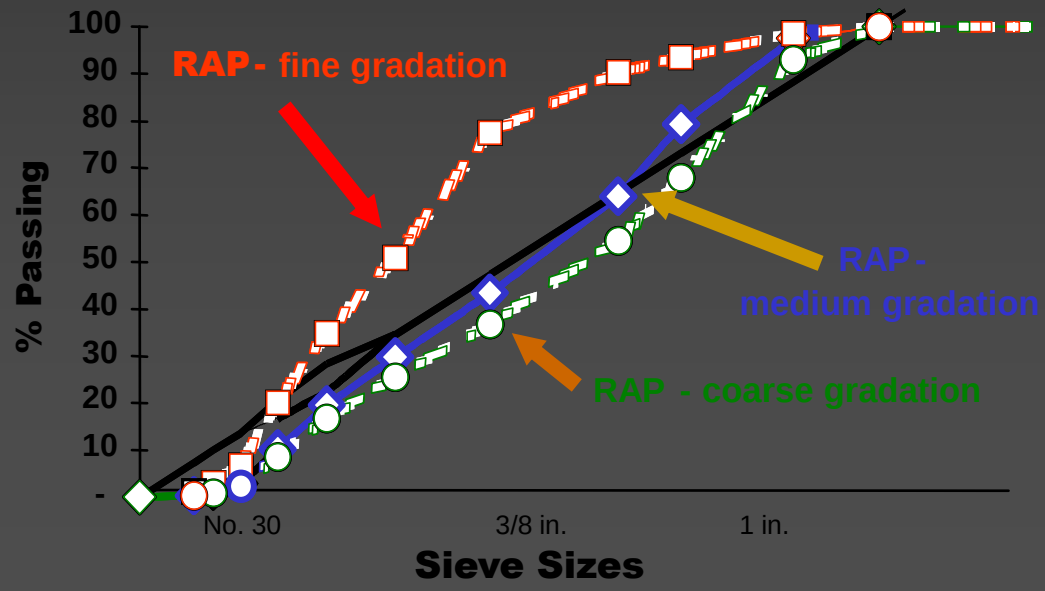
Mix Design

- 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 Gyratory Compactor or Marshal Compactor

Field

Lab

Raveling Test

Proper CIR

Inadequate CIR

Test Strip

- First day construct single lane 2,000 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.
  - Paver 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 Control

- 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

Cold In-place Recycling (CIR)

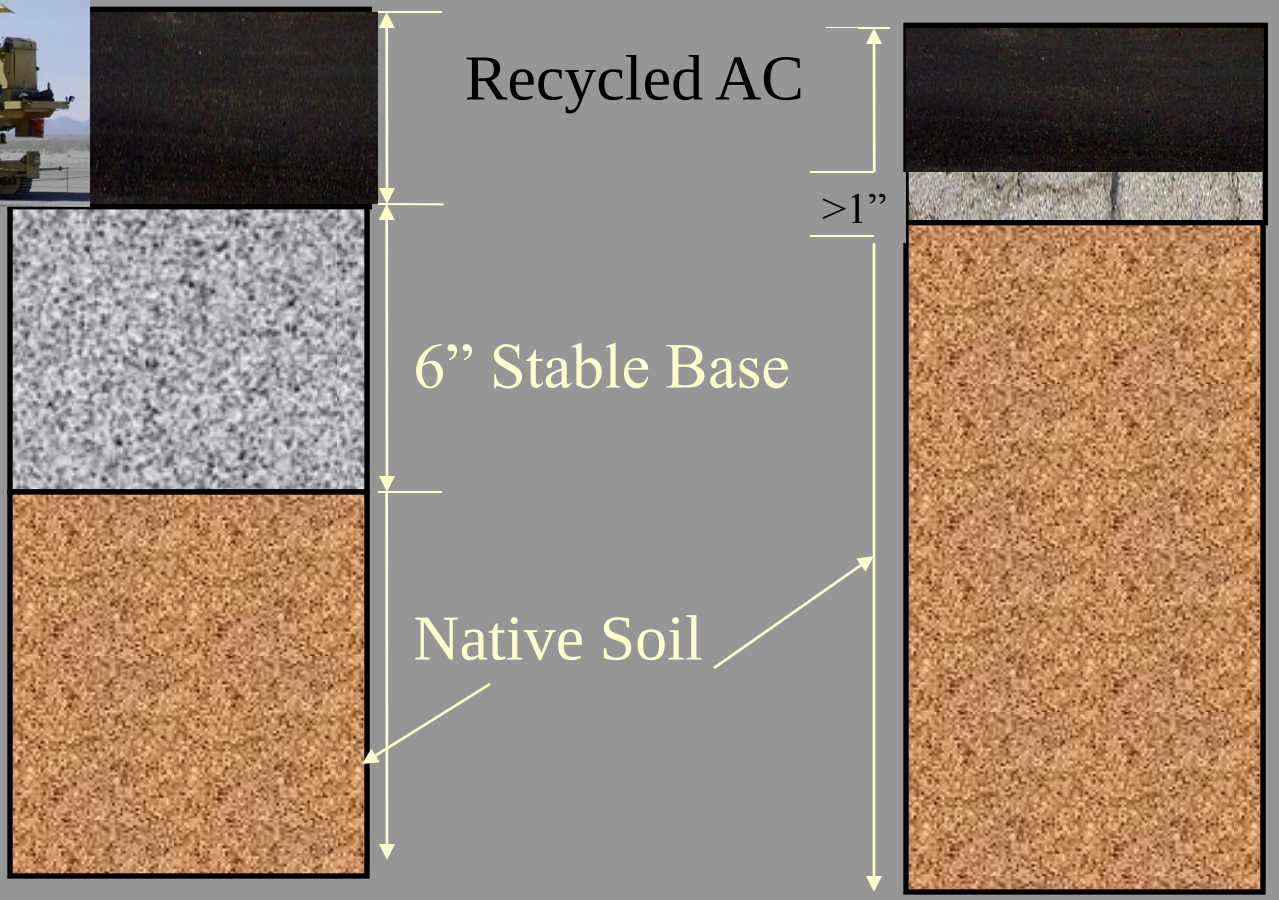
Distressed Pavement = New Pavement Using A Train of Equipment that:

- **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**
- **Small carbon footprint**

Cold In-place Recycling (CIR)
Preservation or Minor Rehabilitation

Recycle AC to:

- Stable Base
- Within 1” of less Supportive Material



Asphalt Recycling Train

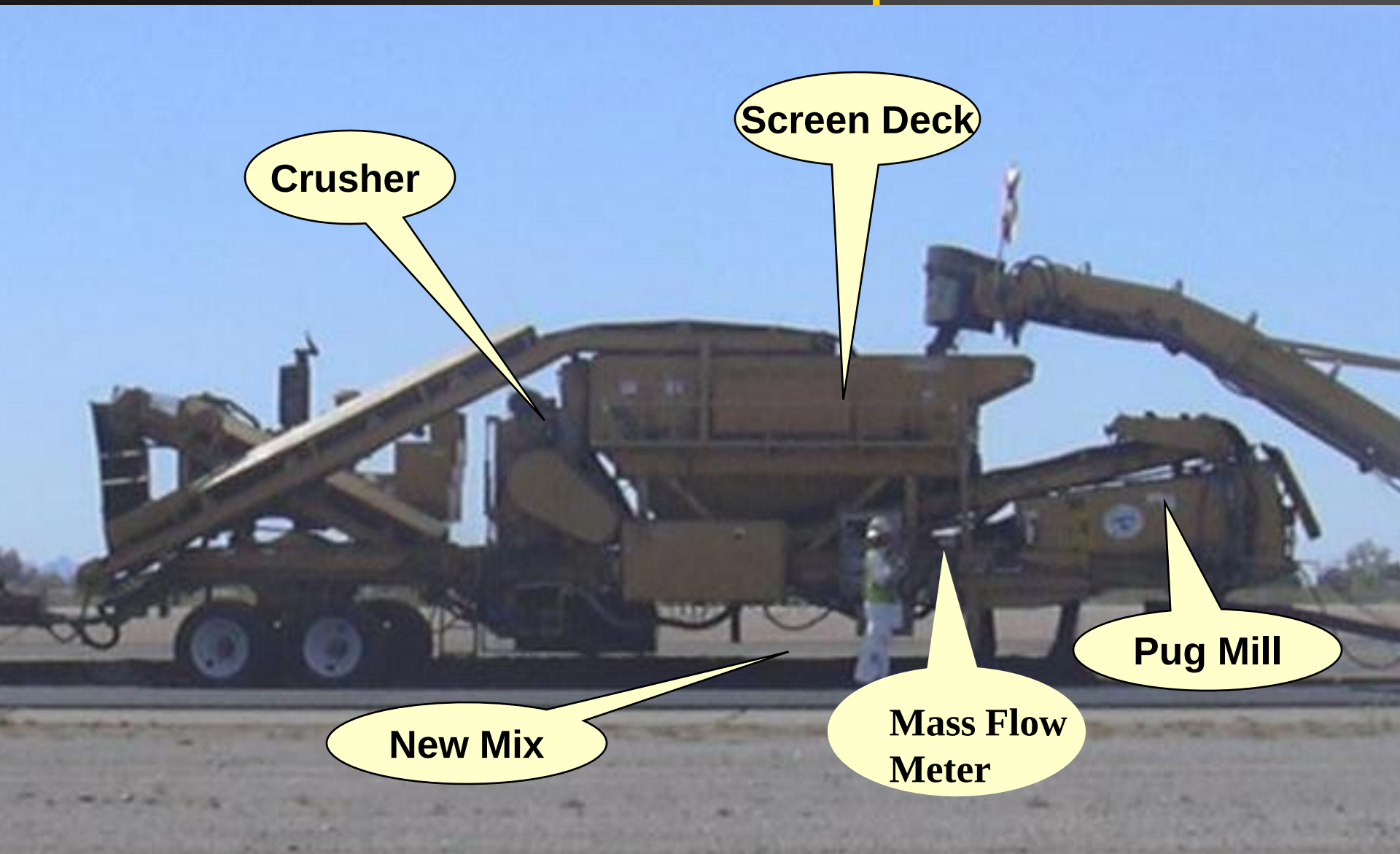
Pavement Milling Machine

- 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

Mixing and Proportioning Equipment

- Continuous pugmill
- Equipped with paddles to provide sufficient mixing.
- Belt scale and integrated microprocessor control.
- Automatic controls to obtain the proper amount of recycling agent and additives.
- Weighing and measuring devices must be tested in conformance with California Test 109.

Recycling Plant Meets Caltrans CT 109 Calibration Requirements



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 millings with engineered recycling agent.

New Recycled Asphalt Mix


NO RIGHT TURN


256022
RG4P55
CR562

Pick Up and Installation

Compaction and Testing

Quick Opening to Traffic

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

New Recycled Surface

Cracking Pattern Eliminated or Disrupted

Los Angeles County 2011

L.A. County CIR 3-inches

City of San Diego, Portofino Drive

Value Engineered

City of Beverly Hills August 2010

CIR Project of the year 2010 A.R.R.A

City of Agoura Hills July 2010

Value Engineered

City of Agoura Hills July 2010

Project Profile: CIR Eucalyptus Avenue

City of Moreno Valley, California

Value Engineered

Project Profile; City of Moreno Valley "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)

Clean Rap = New Pavement:

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

From RAP

to Pavement

“Urban Quarries”
Recycle Asphalt Assets on Site!

Crushing and Screening of the Reclaimed Asphalt Pavement (RAP) to the Specified Gradation for Cold Central Plant Recycling.


DEERE

Compaction

Recycled Asphalt Base Course Prior to Hot Mix Overlay

City of Santa Ana
Project “Restore” 2009-2011

Millings are Stockpiled, Processed to Specific Gradation Requirements.


DYNAPAC
DYNAPAC

Sweeping and Tacked Prior to Install

“The City of Santa Ana was able to improve 260 miles of the roads by the end of this program for $72 million. This is over two and a half times as many miles as originally envisioned for 72% of the cost and two years ahead of schedule”.

Souri Amirani, Deputy City Engineer for the city of Santa Ana’s Public Works Department.

California Asphalt Magazine June 2010

CIR/CCPR Surfaces Must Be Sealed

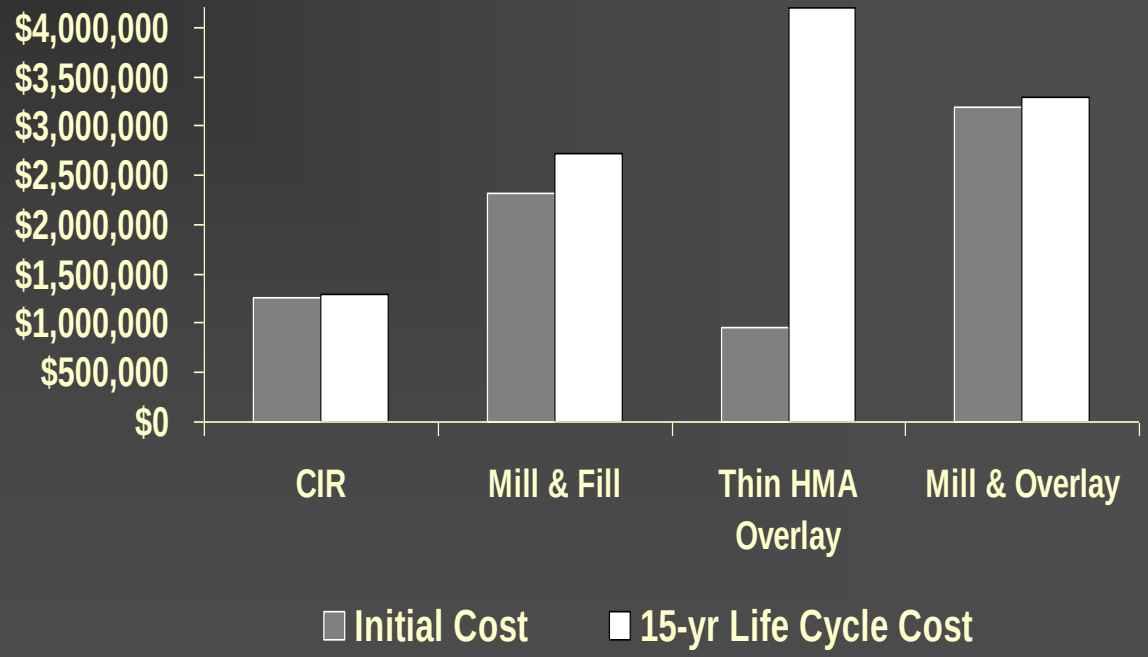
Fog Sealed or Slurry Sealed
Low volume – Shoulders and Lots

Chip Sealed – Low Volume Highways

HMA Overlaid – Higher Volume Highways

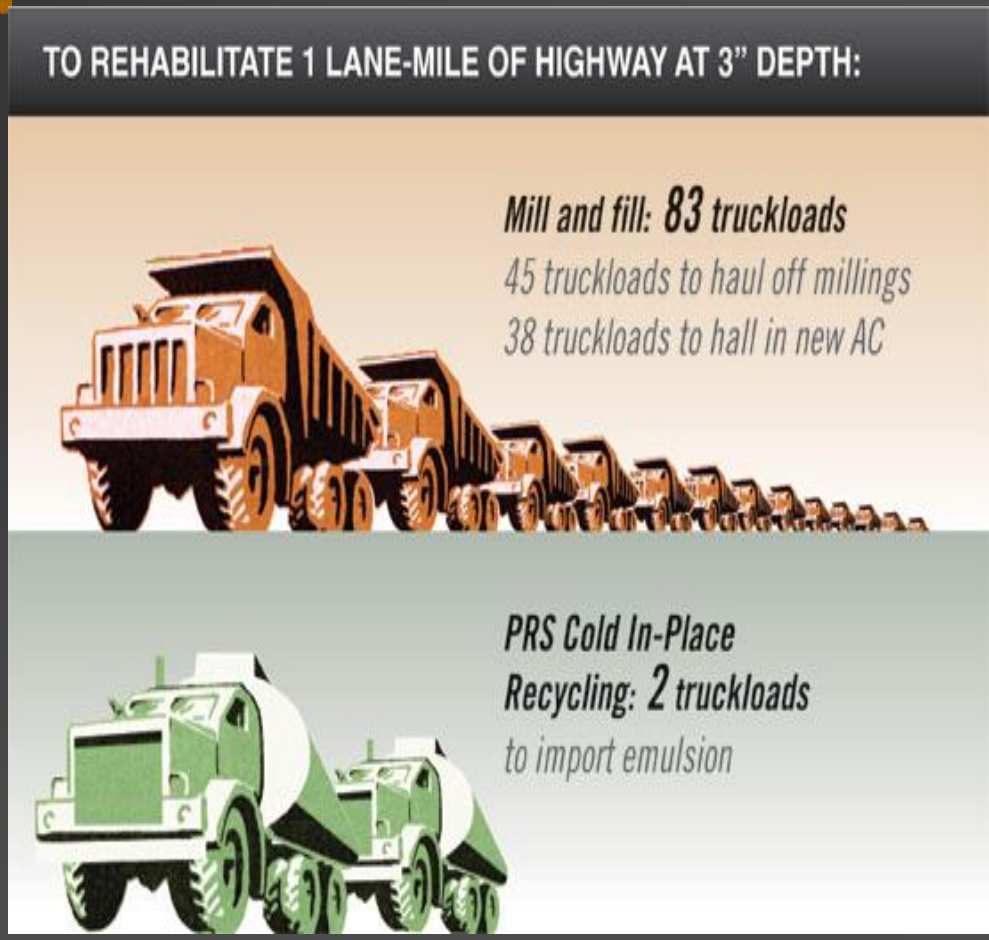
Recycling is Typically Utilized for the Initial and Life Cycle Cost Savings

- Costs up to 25% to 50% of traditional method of mill and fill
- Cost savings are a result of:
  - Value of existing aggregate and binder
  - Cost of milling asphalt
  - Trucking and haul off the millings
  - Dump fees of RAP
  - Cost of new AC



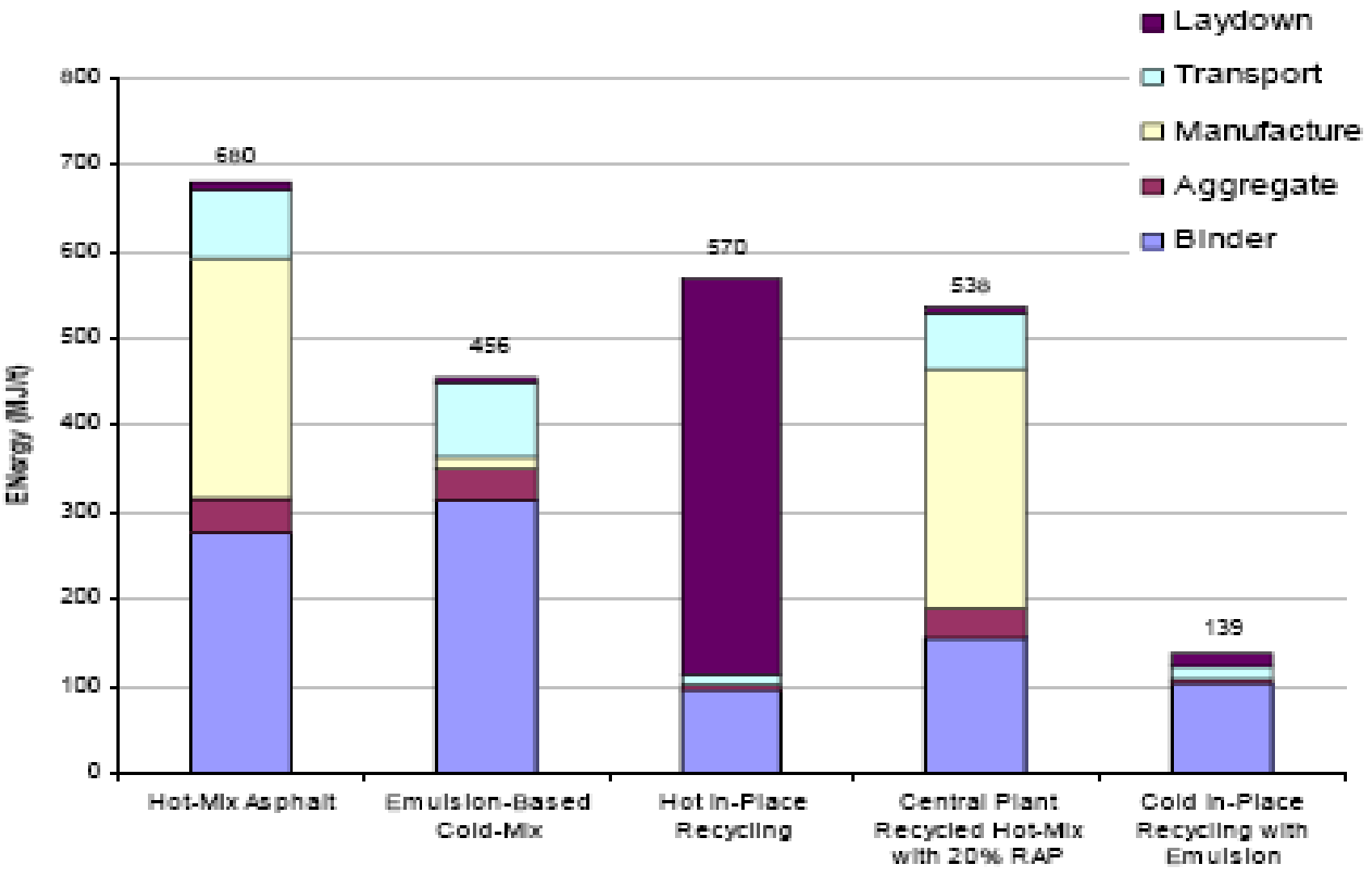
Recycling In-Place Saves Material Resources, Money and Energy

- Re-using existing asset's instead of replacing or discarding
- Reduces import-export from 83 truckloads
  (mill and fill) to two
- Fewer emissions, less traffic,small carbon footprint
- Structural value and long life: resists reflective and thermal cracking



Recycling is "Green"

Energy Use Per Tonne Of Material Laid Down



Source: *The Environmental Road of the Future, Life Cycle Analysis* by Chappat, M. and Julian Bilal. Colas Group, 2003, p.34

Performance Expectations

- Life Expectancy
  - 15-20 years minimum
  - Restores old pavement
  - Restarts design life
- Improves Ride Quality (Smoothness)
- Mitigate Reflective Cracking
- Preventative Maintenance Activities are Similar to that for Hot Mix Asphalt

Future Maintenance Activities Recommended

- Future PM applications may include:
  - Fog Seal
  - Crack Sealing
  - Chip Seals, Cape Seals
  - Micro Surfacing/Slurry
  - Thin AC Overlay
  - Bonded Ware Course
  - Cold In-place Recycling

Specified CIR and CCPR

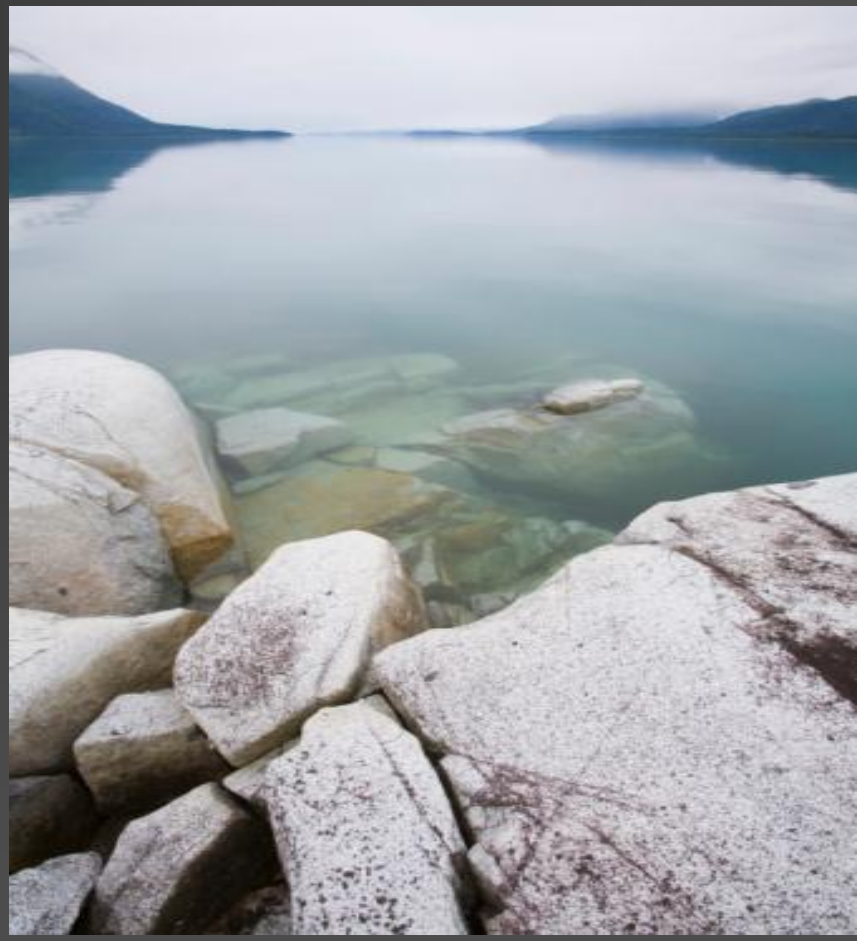
- Antelope Valley Fairgrounds
- Arizona Dept. of Transportation
- California Dept. Of Transportation
- City of Agoura Hills
- City of Anaheim
- City of Beverly Hills
- City of California City
- City of Chino
- City of Hanford
- City of Highland
- County of Elko
- Federal Highway Administration
- L.A. County Sanitation District
- City of Lancaster
- City of Lemon Grove
- City of Moreno Valley
- City of Modesto
- National Park Service
- Nevada Dept. of Transportation
- City of Palm Desert
- City of Porterville
- County of Los Angeles
- City of Napa
- City of Rancho Mirage
- County of Riverside
- City of Sacramento
- County of San Bernardino
- City of Santa Ana
- City of San Diego
- County of San Diego
- City of San Jacinto
- City of South San Francisco
- County of San Luis Obispo
- County of Sonoma
- City of Shafter
- City of Susanville
- County of Tulare
- City of Vernon

Summary - 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

Preservation of the Environment!

- Green and government approved: Caltrans, NDOT, FHWA, FAA, Green book, other national and local agencies
- Reduced environmental impact:
  - Smaller carbon footprint
  - Lower emissions, less disruption
  - Conserves scarce resources
  - Public Safety
  - Better Materials
- Be an eco hero



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