Cold Foam In-Place Recycling
(CIR)

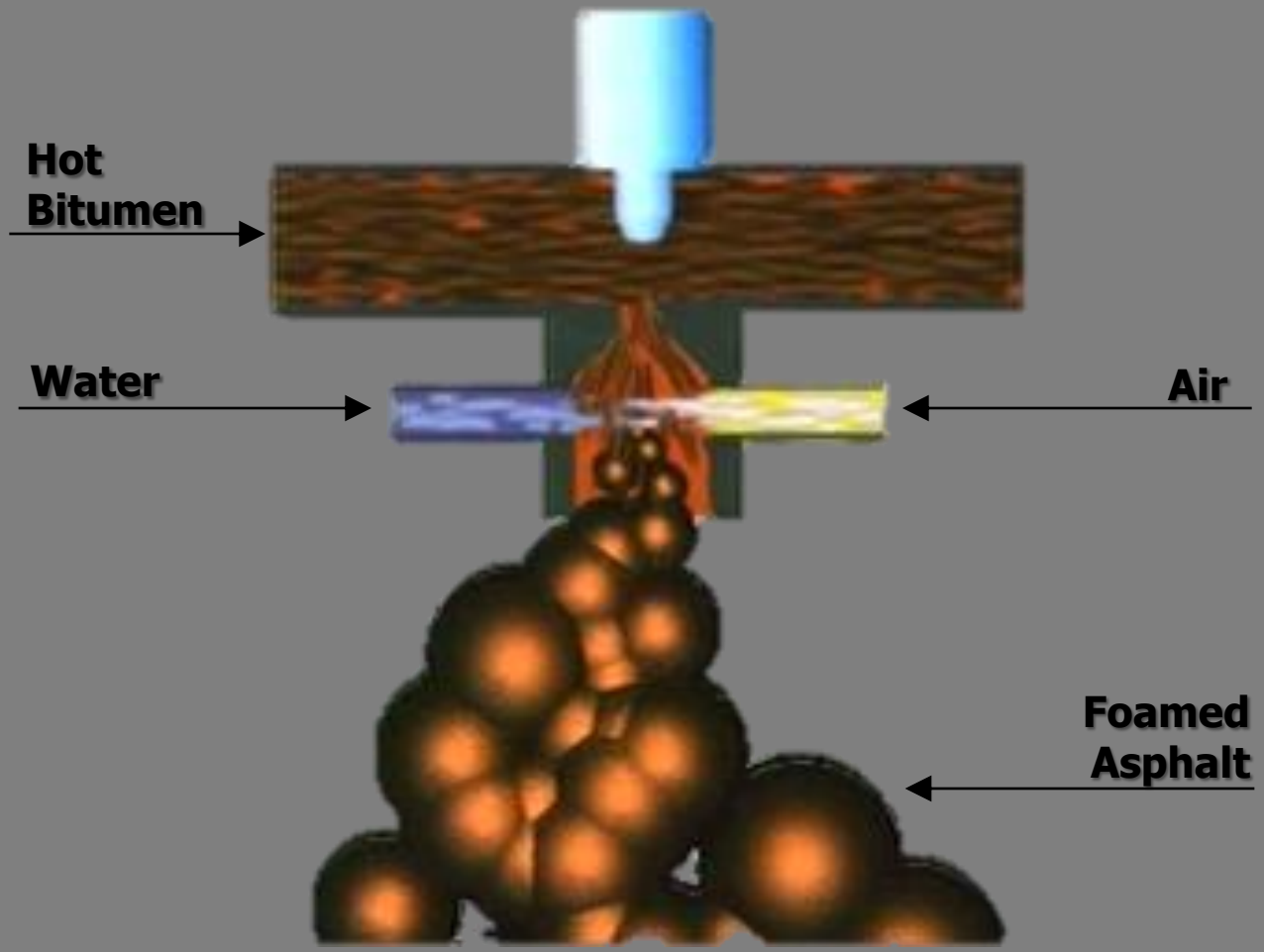
FONSECA/McELROY

GRINDING CO., INC.

Cold Foam CIR

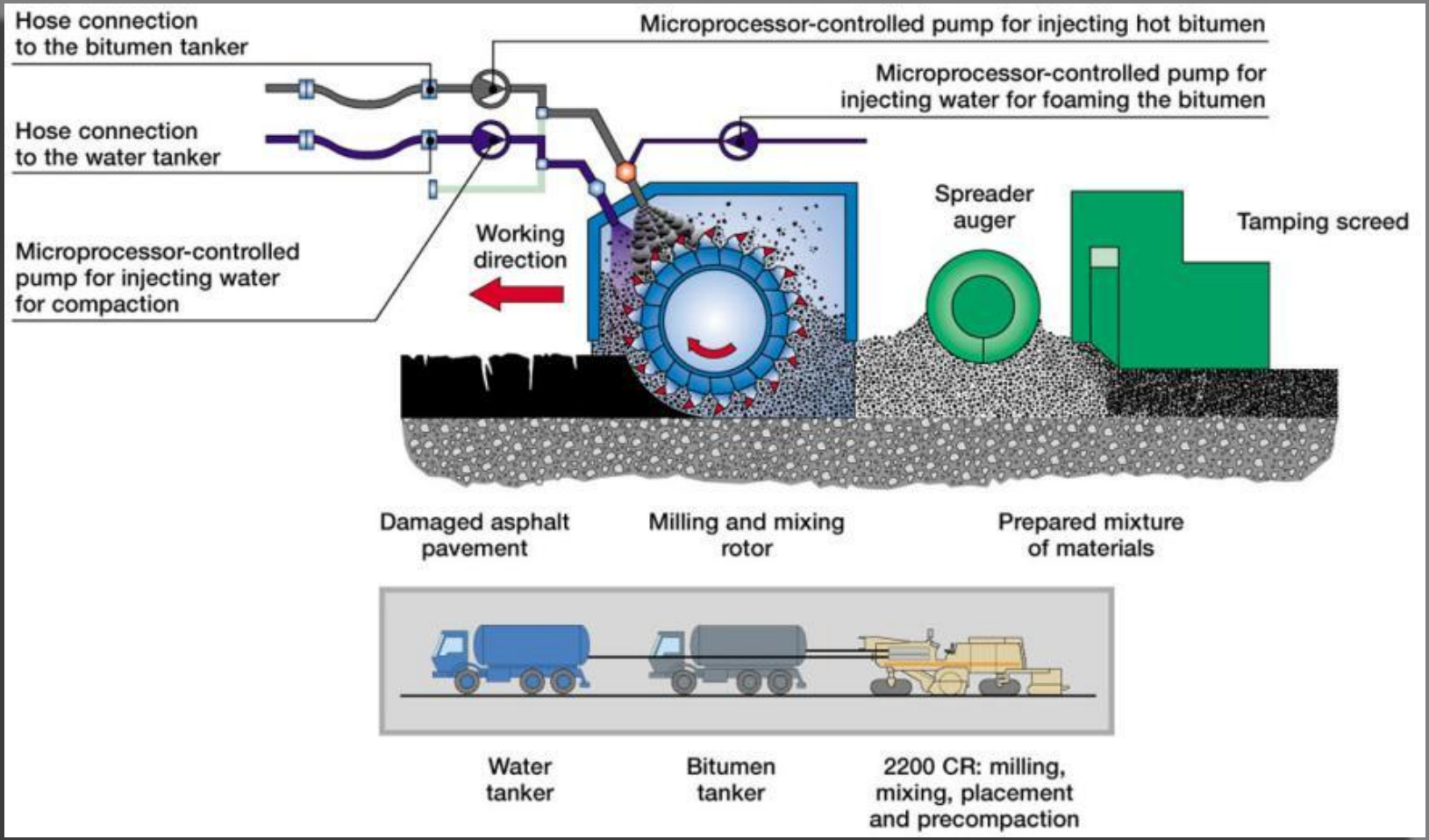
CIR Method/Foamed Asphalt

Cold In-Place Recycling Foamed Asphalt



The larger surface area allows the mixing of bitumen with cold and damp aggregate

Example of CIR Process



Feasibility Report/Mix Design

FOAM MIX DESIGN REPORT

Client: Fonseca/McElroy Grinding Co., Inc.
Project : Holsclaw Road CFA
Sample Source: Holsclaw Rd.
Sample Number : CFA- Mix #1

Material to be foamed

Location :	Holsclaw Road
Material Description:	100% AC CFA
Optimum moisture content :	
Maximum Wet density (pcf) :	

Asphalt cement used for foaming

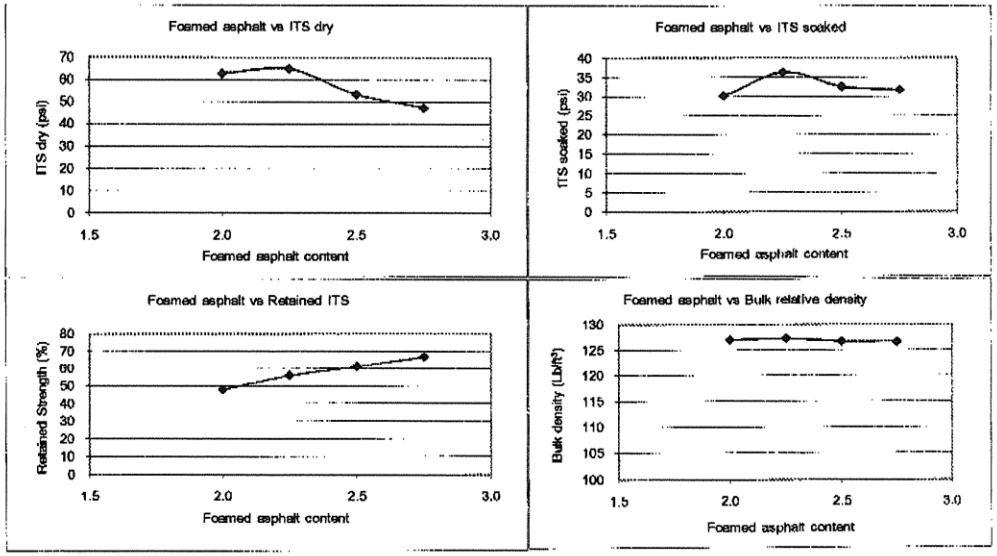
Supplier :	Shell
Type:	PG 64-10

Foam requirements

Percentage "foaming" water :	3
Temperature of asphalt cement :	180oC
Additive and percentage : Cement Type II	1.0% Cement

Foamed asphalt treated material characteristics

Foamed asphalt added (%) :	2.0	2.3	2.5	2.8
Diameter of specimen (in)	4.0	4.0	4.0	4.0
Height of specimen (in) :	2.6	2.7	2.7	2.6
Mass of specimen (lb) :	2.4	2.5	2.4	2.4
Bulk density (pcf):	127	127	127	127
ITS dry (psi):	63	65	53	47
ITS soaked (psi):	30	36	33	32
Retained ITS (%):	48	56	61	67



- Visual inspection
- Feasibility Report
- Random profiling samples collected at 1,000 linear feet or where you can see different mixes
- Mix Design

Pre-Mill/Wedge Cut

- Lower all existing utilities, iron, manholes, etc…
- Pre-mill wedge-cut existing pavement (if necessary) to accommodate the fluff of recycling and the required thickness, as well as make room for wear course

Cement Spreading

Spread cement on area to be recycled

*On average 1%

Cold Foam In-Place Recycling

- Add the designated percentage of liquid asphalt, proportional to working speed (On average 2.5%)
- Adding metered amount of compaction moisture to suit vary in-situ conditions, water taken from on-board tank (On average 2-4%)
- Place recycled and stabilized material with an attached screed
- Compact immediately behind the screed with double steel drum rollers, finishing the recycled surface by pneumatic roller

Fog Seal and Sand

- Spread sand over the fog sealed surface
- Open traffic immediately
- No rutting, no supplemental compaction necessary

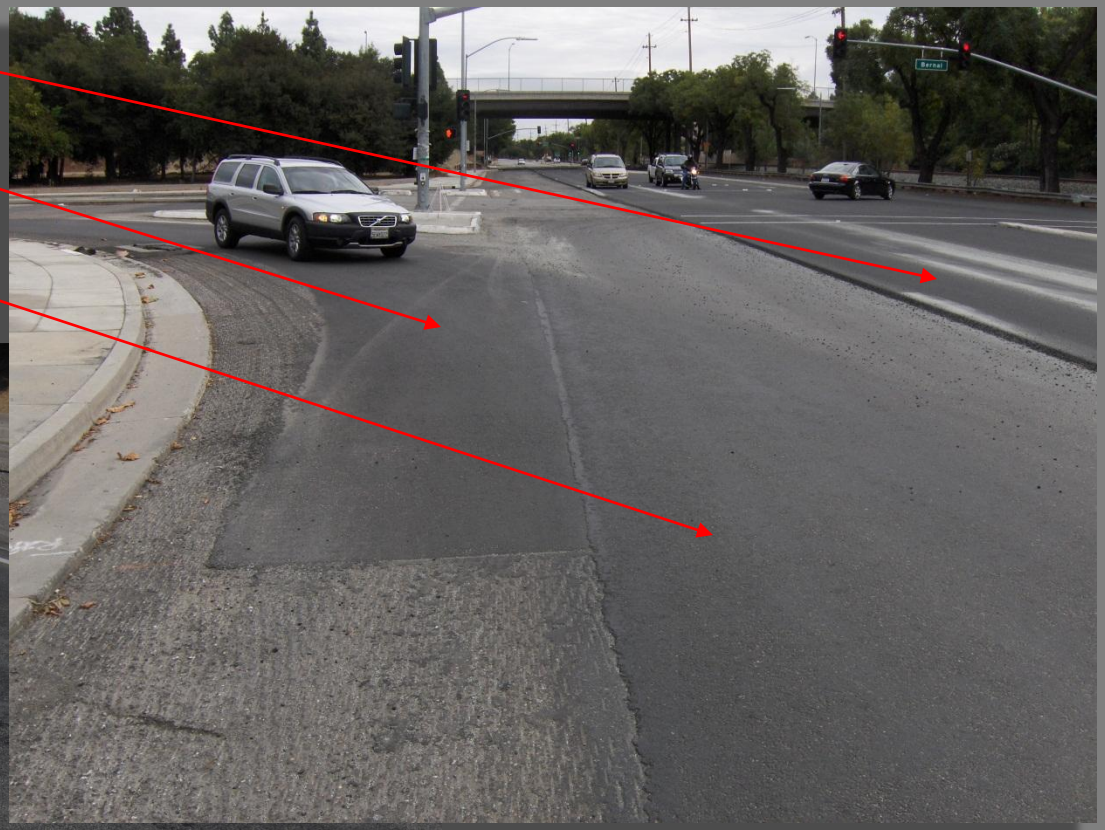
Finished CIR Surface

Rubberized AC Wearcourse

HMA

Foam CIR

Skidmarks



After two days (depending on moisture content), place wearing course over the recycled surface

Anthony Allopenna

Engineering, Testing, and Compaction

- Perform CFA Mix Design(s) on materials to be processed prior to construction
- The in place materials are sampled and tested every 3000 square yards recycled
- Test Perfomed include:
  - California Test Method 216 Compaction Curve (1 per lot)
  - Grain Size Analysis (1 per lot)
  - Compaction tests per California Test Method 231 at +98% of CTM 216 (Min. 10 per lot)
  - Marshall Compaction of Briquettes (6 per lot)
  - Indirect Tensile Strength of 4” Compacted Briquettes (6 per lot, 3 dry, 3 soaked)
  - Visual Inspection of the following:
    - ✓Cement Spread Rate
    - ✓Bitumen Temperature prior to foaming
    - ✓Percentage of foam introduced to processed material
    - ✓Foaming Characteristics (half-life vs. expansion)
    - ✓Rate of Recycle
    - ✓Temperature of Material Pre and Post Recycling
    - ✓Percentage of water added bitumen to create foam
    - ✓Percentage of water added post foam or Compaction

Monterey Road, San Jose

Project Specifications

- 638,040 Square Feet
- 4’ CIR with 2” AC Rubberized A/C

Existing Pavement Conditions

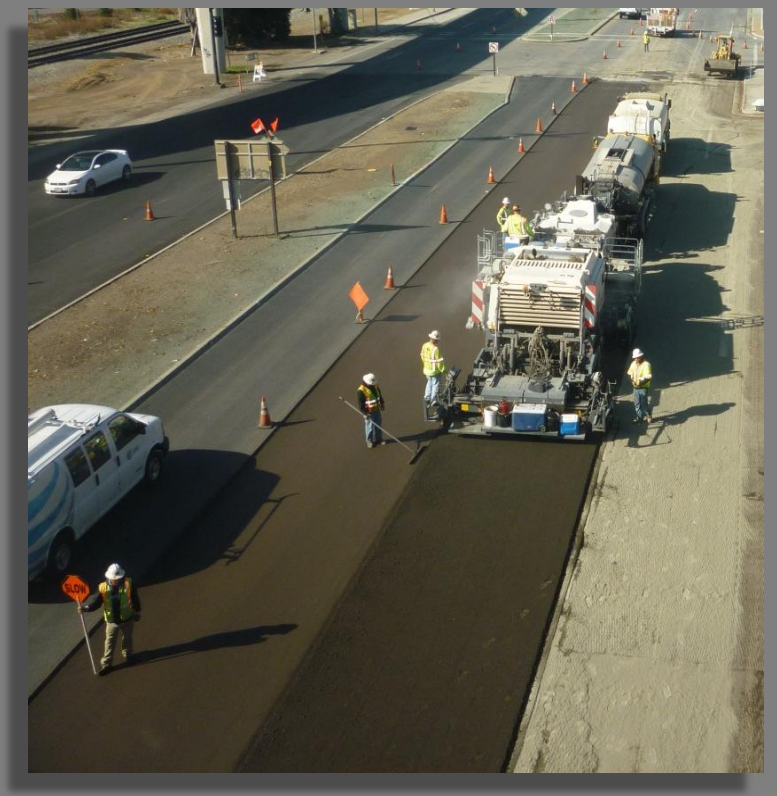
- Alligator cracked surface
- Years of patching
- Raveling/Potholes
- Aged oxidized pavement
- Type II Slurry Seal
- Areas of Petromat

Project Details

- Wedge cut existing pavement to allow for 2” rubberized wearcourse
- Adding the designated percentage of foamed asphalt, proportional to working speed
- Adding metered amount of compaction moisture to suit vary in-situ conditions, water can be taken from on-board tank, reducing the length of the train
- Paving the recycled and stabilized material with an attached screed

CIR Method/Monterey Road, San Jose

- Pre-spread cement at a rate of 1%
- Add approx. 2.5% liquid asphalt-PG 64-10
- Recycling pass
  - 12’6” wide
  - 4” depth
- Compact immediately behind the screed with one each, 14-ton double steel drum vibratory roller, followed with another 12-ton double steel drum vibratory roller and 11.5-ton double steel drum vibratory roller
- 98% compaction minimum per CTM 216 method
- Recycling layer surface finished with two each 10-ton pneumatic rollers
- Spread fog seal with sand
- 2” rubberized asphalt concrete overlay
- Resulting in a new continuous, homogenous, 6” structural section



CIR vs. Conventional R&R

Conventional R&R

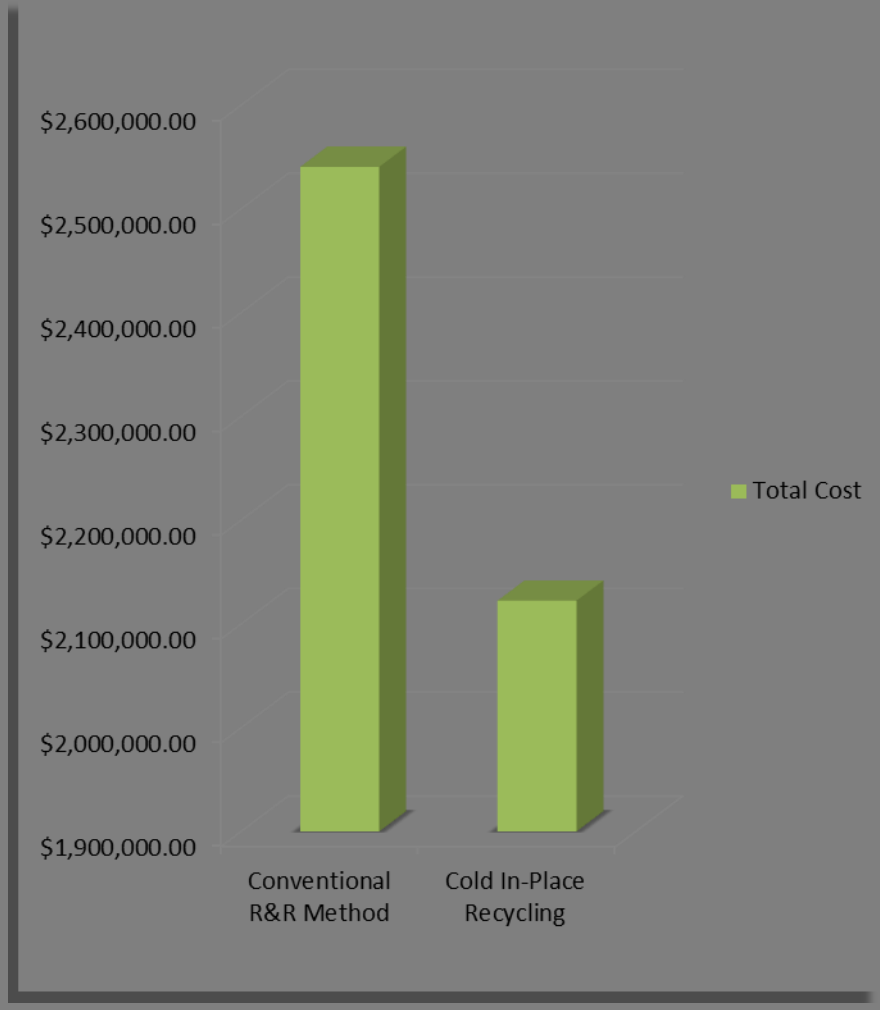
- 3” Mill
- 6” Digouts
- 1.5” HMA
- 1.5” RHMA

Total = $2,540,470

Cold In-Place Recycling

- 2” Wedge Cut
- Minimal 6” Digouts (areas inaccessible)
- 4” Foam CIR
- 2” RHMA

Total = $2,122,400



NET SAVINGS

16% or $418,070

Benefits (Aside From Cost Savings)

- Elimination of costs for 780 truckloads of importing and off haul costs of over 15,600 tons of aggregates to and from landfill and/or asphalt plant or quarry
- Conventional R&R method would have taken approximately 18 days, whereas the CIR method took only 9 days

Recycled/Temporary Striped and Open Roadway

Holsclaw Road, Santa Clara Co.

Project Specifications

- 130,099 Square Feet
- 3” CIR with Double Chip Seal

Existing Pavement Conditions

- 3” A/C on dirt
- Alligator cracked surface
- Areas of patching
- Wheel track rutting

CIR Method/Holsclaw Road, Santa Clara Co.

- Spread cement at a rate of 1% by mass
- 2.3% to 2.5% foamed asphalt – PG 64-10
- Recycling pass (overlap)
  - 12’6” wide
  - 3” depth
- Compact immediately behind the screed with 11-ton double steel drum vibratory roller, followed with another 8-ton double steel drum vibratory roller as intermediate roller
- 98% minimum compaction per CTM 216 method
- Recycling layer surface finished with ten ton pneumatic roller with another 7-ton pneumatic roller
- Double Chip Seal
- Resulting in a new 3” structural section

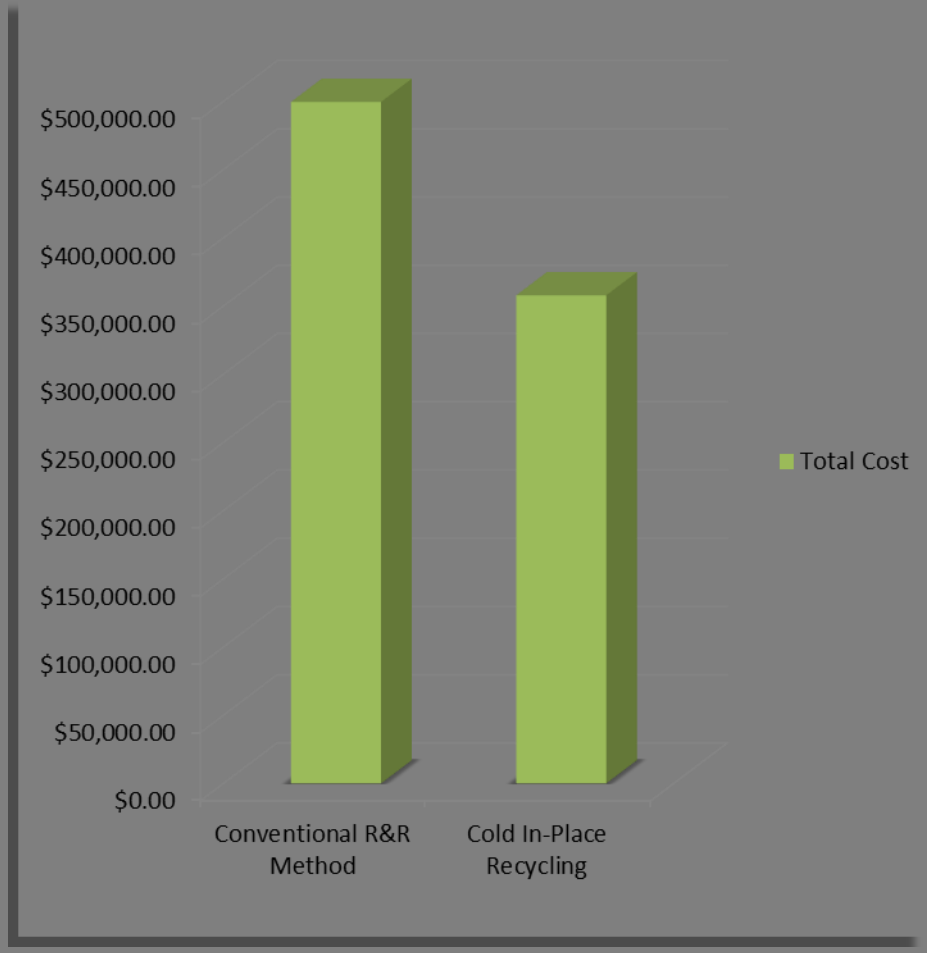
CIR vs. Conventional R&R

Conventional R&R

- 3” remove and replace asphalt surfacing @ $3.84 per SF = $499,580.16

Cold In-Place Recycling

- 3” CIR with foamed asphalt @ $1.75 per square foot = $227,673.25
- Double Chip Seal provided by Santa Clara County = $130,099.00
- Total = $357,772.25



NET SAVINGS

21% or $141,807.91

Benefits (Aside From Cost Savings)

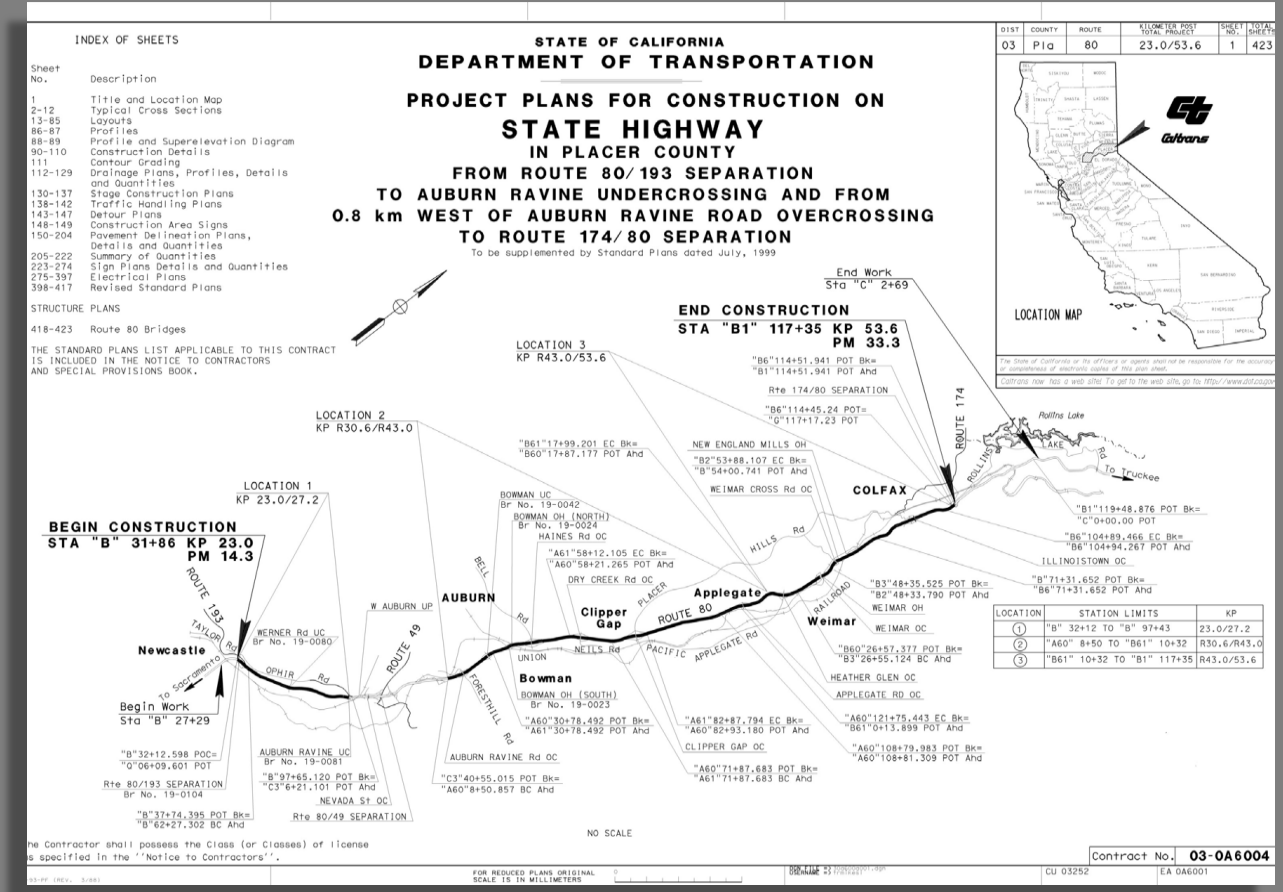
- Elimination of costs for 100 truckloads of importing and off haul costs of over 2,012 tons of aggregates to and from landfill and/or asphalt plant or quarry

- Conventional R&R method would have taken 4 days, whereas the CIR method took only 2 days

Foamed A/C Longevity

INTERIM REPORT
CONSTRUCTION COMPLETION
FOR
COLD-IN-PLACE RECYCLING
Placer 80 PM 14.3 /33.3

North Region Materials
Marysville, CA
August 2006



INDEX OF SHEETS

Sheet No.	Description
1	Title and Location Map
2-12	Typical Cross Sections
13-85	Layouts
86-87	Profiles
88-89	Profile and Superelevation Diagram
90-110	Construction Details
111	Contour Grading
112-129	Drainage Plans, Profiles, Details and Quantities
130-137	Stage Construction Plans
138-142	Traffic Handling Plans
143-147	Detour Plans
148-149	Construction Area Signs
150-204	Pavement Delineation Plans, Details and Quantities
205-222	Summary of Quantities
223-274	Sign Plans Details and Quantities
275-397	Electrical Plans
398-417	Revised Standard Plans

STRUCTURE PLANS

418-423 Route 80 Bridges

THE STANDARD PLANS LIST APPLICABLE TO THIS CONTRACT IS INCLUDED IN THE NOTICE TO CONTRACTORS AND SPECIAL PROVISIONS BOOK.

STATE OF CALIFORNIA
DEPARTMENT OF TRANSPORTATION

PROJECT PLANS FOR CONSTRUCTION ON
STATE HIGHWAY
IN PLACER COUNTY
FROM ROUTE 80/193 SEPARATION
TO AUBURN RAVINE UNDERCROSSING AND FROM
0.8 km WEST OF AUBURN RAVINE ROAD OVERCROSSING
TO ROUTE 174/80 SEPARATION

To be supplemented by Standard Plans dated July, 1999

DIST	COUNTY	ROUTE	KILOMETER POST TOTAL PROJECT	SHEET NO.	TOTAL SHEETS
03	Pla	80	23.0/53.6	1	423

LOCATION MAP

BEGIN CONSTRUCTION
STA "B" 31+86 KP 23.0
PM 14.3

Begin Work
Sta "B" 27+29

END CONSTRUCTION
STA "B1" 117+35 KP 53.6
PM 33.3

End Work
Sta "C" 2+69

LOCATION 1 KP 23.0/27.2
LOCATION 2 KP R30.6/R43.0
LOCATION 3 KP R43.0/53.6

LOCATION	STATION LIMITS	KP
1	"B" 32+12 TO "B" 97+43	23.0/27.2
2	"A60" 8+50 TO "B61" 10+32	R30.6/R43.0
3	"B61" 10+32 TO "B1" 117+35	R43.0/53.6

NO SCALE

Contract No. 03-0A6004

CU 03252 EA 0A6001

Highway 80

Foamed A/C Longevity

Traffic Volume since Cold In Place Recycling

100,000 vpd, 8.5% trucks **Caltrans 2005 Figures**

Construction 2005

Photo January 2011

5.5 Years Traffic estimated **137,000,000 vehicles**

11,500,000 trucks

No Calls for Maintenance

2011 CIR Savings Summary

Alviso Trucking Yard	$50,000
Gilroy	$30,000
Redwood City	$38,144
Foster City	$100,078
Holsclaw Road	$141,808
Blackford High School	$54,594
Monterey Road	$418,070
TOTAL	$832,694

Benefits of Foam Recycling

- Environmental Factors: Full use is made of the material in the existing pavement. Spoil sites do not have to be found and the volume of new material that has to be imported from quarries is minimized. Haulage is drastically reduced. The overall energy consumption is thus significantly reduced, as is the damaging effect of haulage vehicles on the road network. Reduced emissions from trucks on roads, less wear and tear on surrounding roads, and reduced traffic congestion.

- Quality of Recycled Layer: Consistent, high quality mixing of the in-situ materials with water and stabilizing agents is achieved. The addition of fluids is accurate due to micro-processor controlled pumping systems. The recycled material and additives are rigorously mixed together in the mixing chamber.

- Structural Integrity: The cold recycling process produces a layer that is homogenous and does not contain weak vertical interfaces between existing pavement when using the base repair method.

- Safety: One of the most important benefits of this process is the high level of traffic safety that can be achieved. The full recycling train can be accommodated within the width of one traffic lane.

Benefits of Foamed Recycling

- Shorter Construction Time: The foamed AC process is capable of high production rates that significantly reduce construction times compared to alternative rehabilitation methods. Shorter construction times reduce project costs, as well as providing a largely intangible benefit for the road user in the reduced time that traffic is disrupted.

- Cost Effectiveness: The above benefits combined generate 20-40% cost savings, which makes cold recycling a most attractive process for pavement rehabilitation.

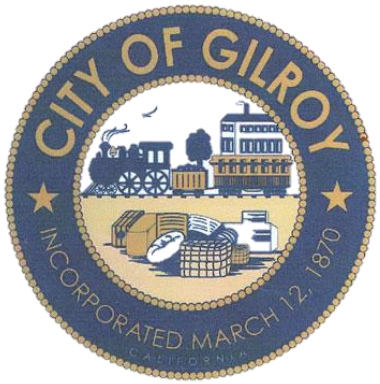
- Material Savings: 95% of the materials needed to reconstruct the roadway have already been purchased by the agency, owner, or the tax payer - No new aggregates purchased.

Why Recycle

Primary Reasons for Choosing Foam Recycling:

- History of success on previous foam full depth reclamation projects (over 13 years)
- Single Pass all-in-one Recycle Train, from milling to paving
- **Open to traffic in as little as 3 to 4 hours**
- Reduction in construction window traffic congestion
- Less construction equipment on roadway
- Fewer truck ingress/egress
- Preservation of natural resources
- Significant potential cost savings
- **It's the right thing to do**

Acknowledgements



THANK YOU

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