In-Place Recycling in the Federal Lands Highway Program

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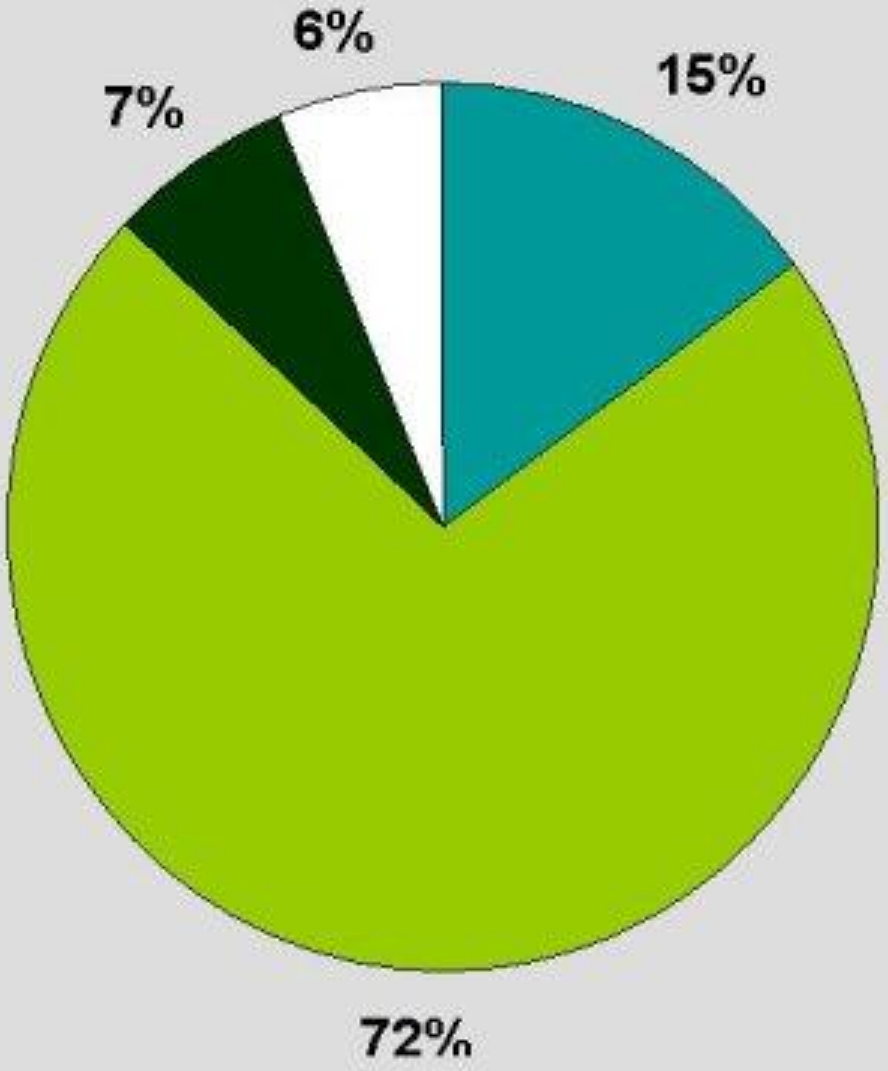
Recycling & Reclamation Methods Used

- Cold In-Place Recycling
- FDR pulverize
- FDR with cement
- FDR with foam
- FDR with emulsion

In-Place Recycling in FLHD



6.8 Million SQYD last 5 years

- CIR
- FDR-Pulv
- FDR-Bitumen
- FDR-Cement

Project Selection

- Federal Lands has had good success (long-term performance) with CIR/FDR
- They have proven to be a cost effective, good performing, rehabilitation methods
- Structural design completed and compared with other rehabilitation alternatives.

Project Selection

- Let field investigation guide decision
- FLHD management and decision-makers present few challenges to in-place recycling use.
- No cut-offs or pre-set requirements for use – it's an engineering decision

Candidate for In-Place Recycling

Field Investigation for CIR

Reconnaissance	Sampling Frequency	Purpose
Pavement Distress Survey	Project wide	-Document suitability; isolate problem spots
Pavement Layer Depths, Uniformity, Quality	Every ¼-mile	Determine: -Feasibility -Recycling Depth
Subgrade soil	Minimum 1 per mile	-Structural design -Support for equipment

Field Investigation for CIR

Reconnaissance	Sampling Frequency	Purpose
FWD Survey (not completed on all projects)	300 feet (maximum)	-Determine subgrade modulus -Delineate soft spots
Bulk Pavement Sampling*	As needed to represent differing project conditions	-Determine mix quality -Estimate application rates

*Completed on projects with marginal conditions and there is a concern about being able to obtain a quality product

CIR Project Selection

- Subgrade and base must have the ability to support the recycling train.
- Adequate Geometrics: minimal steep grades and sharp curves, minimal widening.
- Consider economy of scale -project size > 5 mi.


EIW
EAGLE IRON WORKS

Project Selection- Example

PAVEMENT REHBILITATION ALTERNATIVES (long-term, structural improvements)				
Treatment Type / Method	**Life Expectancy**	**Pros**	**Cons**	**Cost/Mile ($1000s)**
•8" Full-depth reclamation (FDR) – stabilized •2" HACP	20 – 30 years	•Stabilization reduces risk for pumping (and potential for subexcavation overrun) •Reuses/recycles materials •Efficient/smaller "carbon footprint" •Favorable life-cycle costs •Minimal dust	•Contractor availability / mobilization •Slight grade raise •More intensive inspection during construction	$600 k
•4" Cold in-place recycling (CIPR) •3" HACP	20 – 30 years	•History of long-term performance •Reuses/recycles materials •Efficient/smaller "carbon footprint" •Favorable life-cycle costs •No dust	•Contractor availability / mobilization •Treating some base materials •Not suitable for pullouts & parking areas •Grade raise •Subgrade/base may not have sufficient strength to support CIPR train	$600 k
•Mill 4" of existing material •Recondition base •4" HACP	15 – 20 years*	•Zero grade raise •Conventional construction / ample contractor availability	•No in-place recycling •Requires 3 separate operations (mill, recondition, pave) •Lower structural value	$650 k

Why complete a design?

- Fairly compare rehabilitation alternatives & additives
- Programmatic approach is not practical when you work in all 50 states (much variability)
- Justify chosen method to client-agency

FLHD Structural Guidelines

FDR Method	Minimum Thickness of Riding Surface	Typical Structural Coefficient
Mechanical (pulverize)	2" HMA	0.10 – 0.12
Bituminous	Surface Treatment or Structural HMA	0.20 – 0.28
Cement	Surface Treatment or Structural HMA	0.15 – 0.20

FLHD Structural Guidelines

	Minimum Thickness of Riding Surface	Typical Structural Coefficient
CIR	Surface Treatment or Structural HMA	0.28

See Chapter 11 in the FLH Project Development and Design Manual for further details. Web link: www.wfl.fhwa.dot.gov/design/manual/

CIR Mix Design

- CFLHD performs a mix design and provides initial application rates -Hveem method (AASHTO Task Force 38)
- WFLHD determines application rate during test strip
- Future: Use Superpave Gyratory Compactor? Project underway designed with SGC.

Performance

- Performance has exceeded expectations
- Nearly all of FLHD's CIR projects are still in-service
- A couple case studies follow…

FLHD's first CIR Project

- Location: Rocky Mountain N.P.
- Year: 1982
- Typical Structural Section
  - 4 inches CIPR
  - 2 inches HMA
- CIR Contractor: Valentine Surfacing

FLHD's first CIR Project

- Recycling agent: Rejuvenator (Reclamite)
- Application Rate: 0.9 to 1.2 percent
- Cost Effectiveness
  - About 40% savings from the alternative to place a 1.5-inch leveling course
- Elevation: 9,500 to 12,000 feet

Rocky Mountain N.P. CIR - 1982

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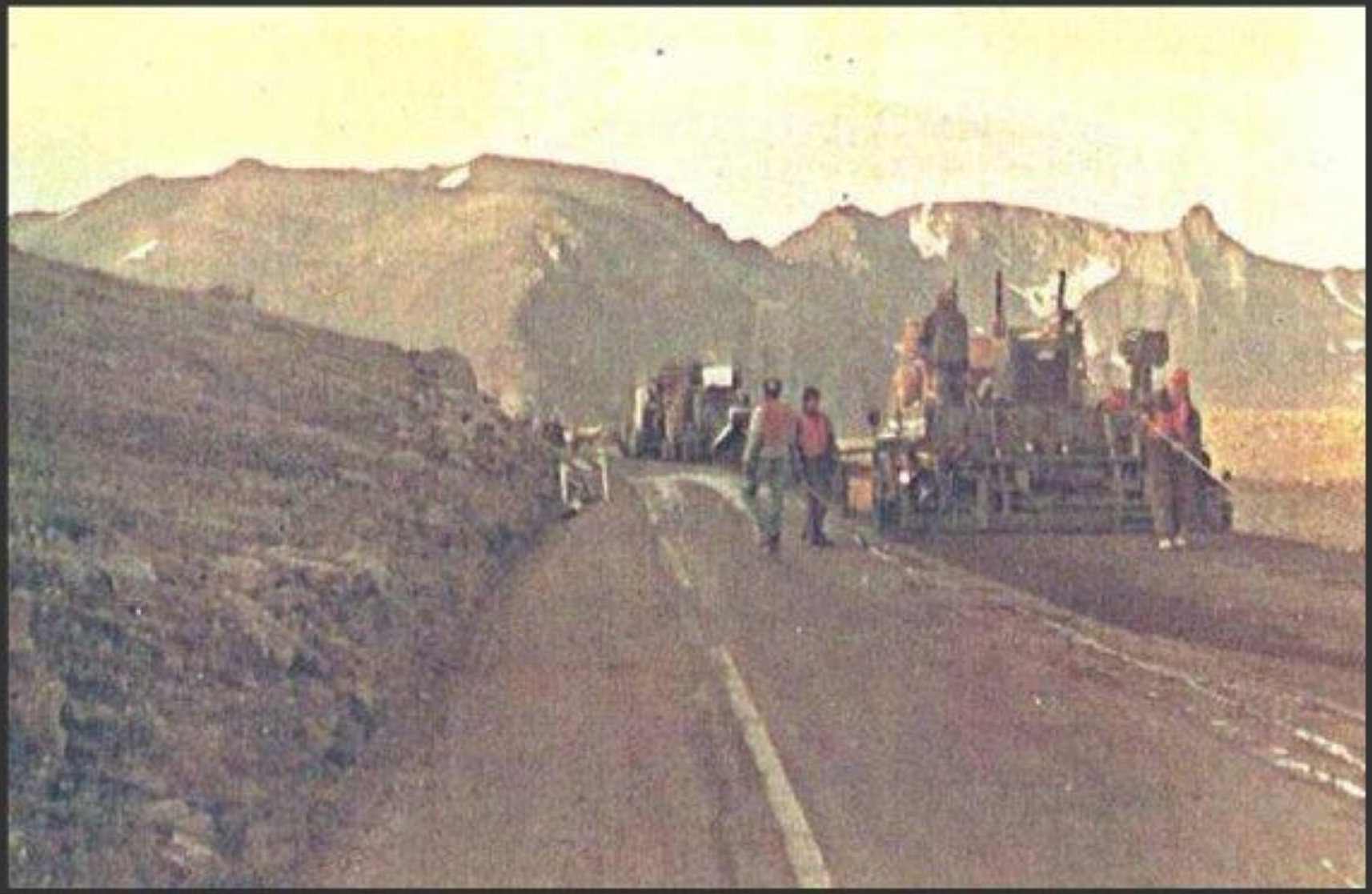
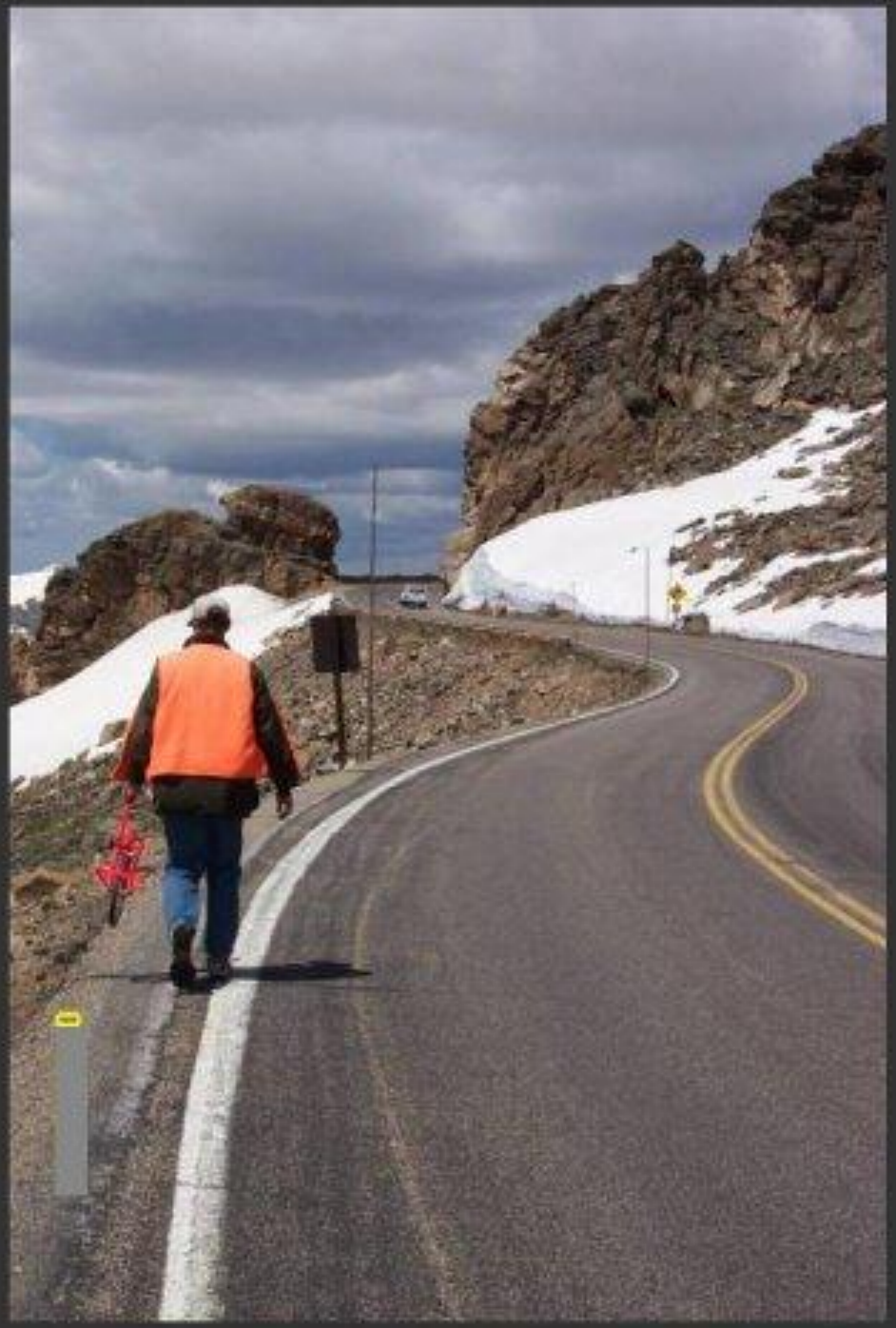


Rocky Mountain N.P. project …

…after 26 years!



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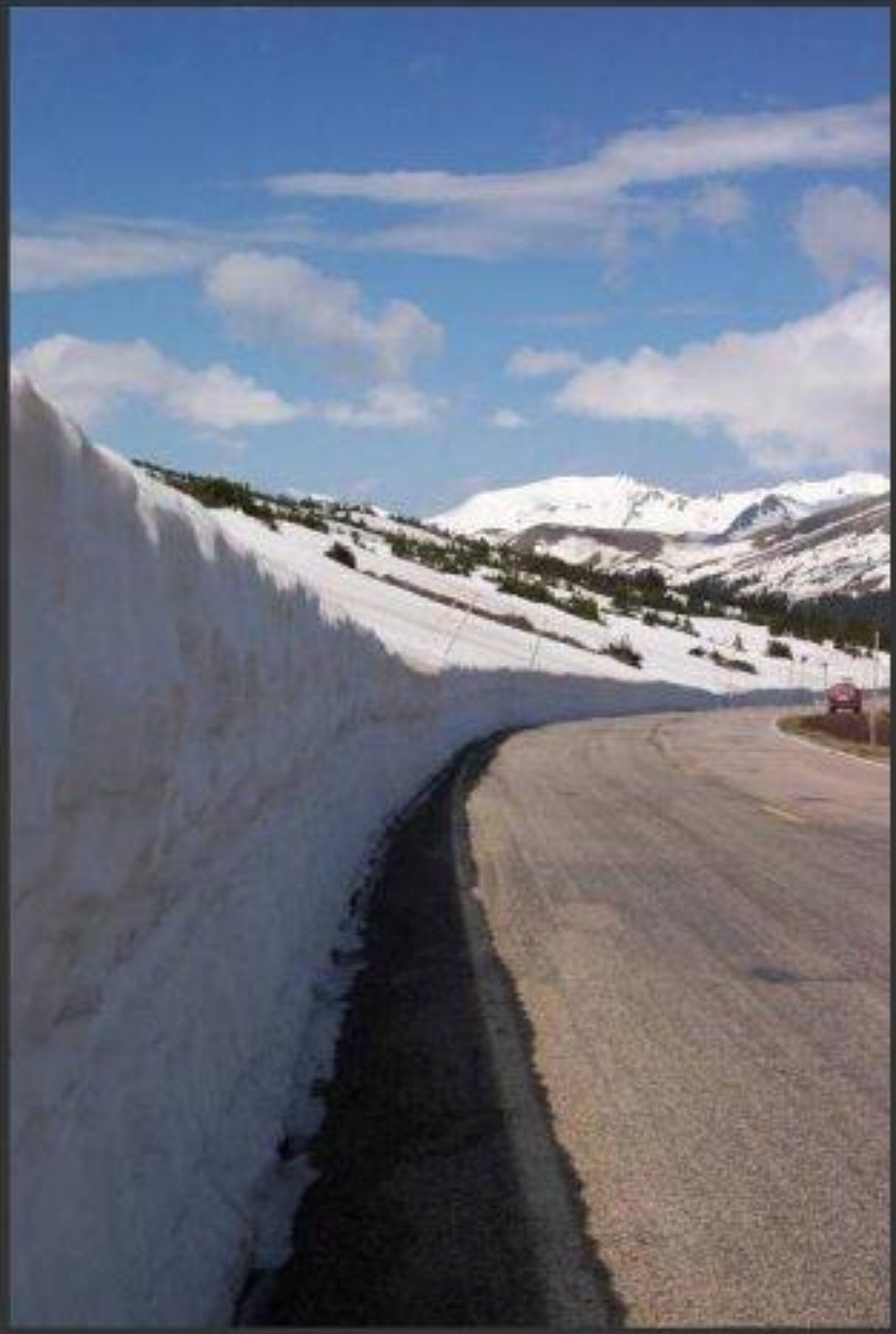


Rocky Mountain N.P. Project - 2007

First CIR project in California

- Location: Ice House Road (Eldorado National Forest)
- Year: 1988
- Typical Structural Section
  - 4-5 inches CIPR
  - 2 inches HMA
- CIPR Contractor: Valentine Surfacing

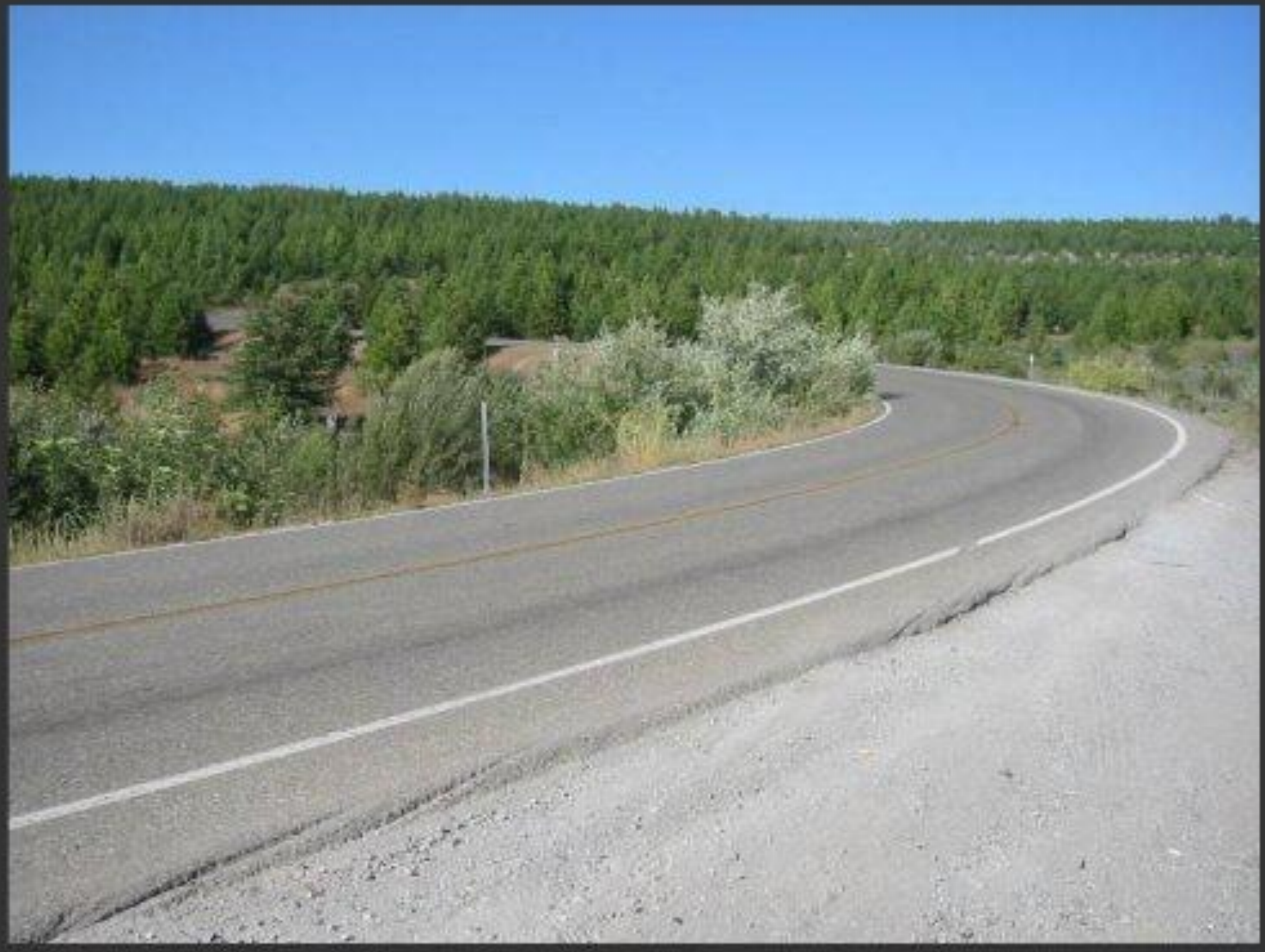
First CIR project in California

- Recycling agent: HFMS-2
- Project length: 13 miles
- Traffic: 1000 vpd (1988) with heavy logging trucks

First CIR project in California

20 year &

counting!



First CIPR project in California

First CIR project in California

After 20 years of performance…

Twin Lakes Rd - California

CIR

15 years and counting

HFMS-2s

Grand Canyon – Center Rd

CIR

15 years and counting

HFE-300s

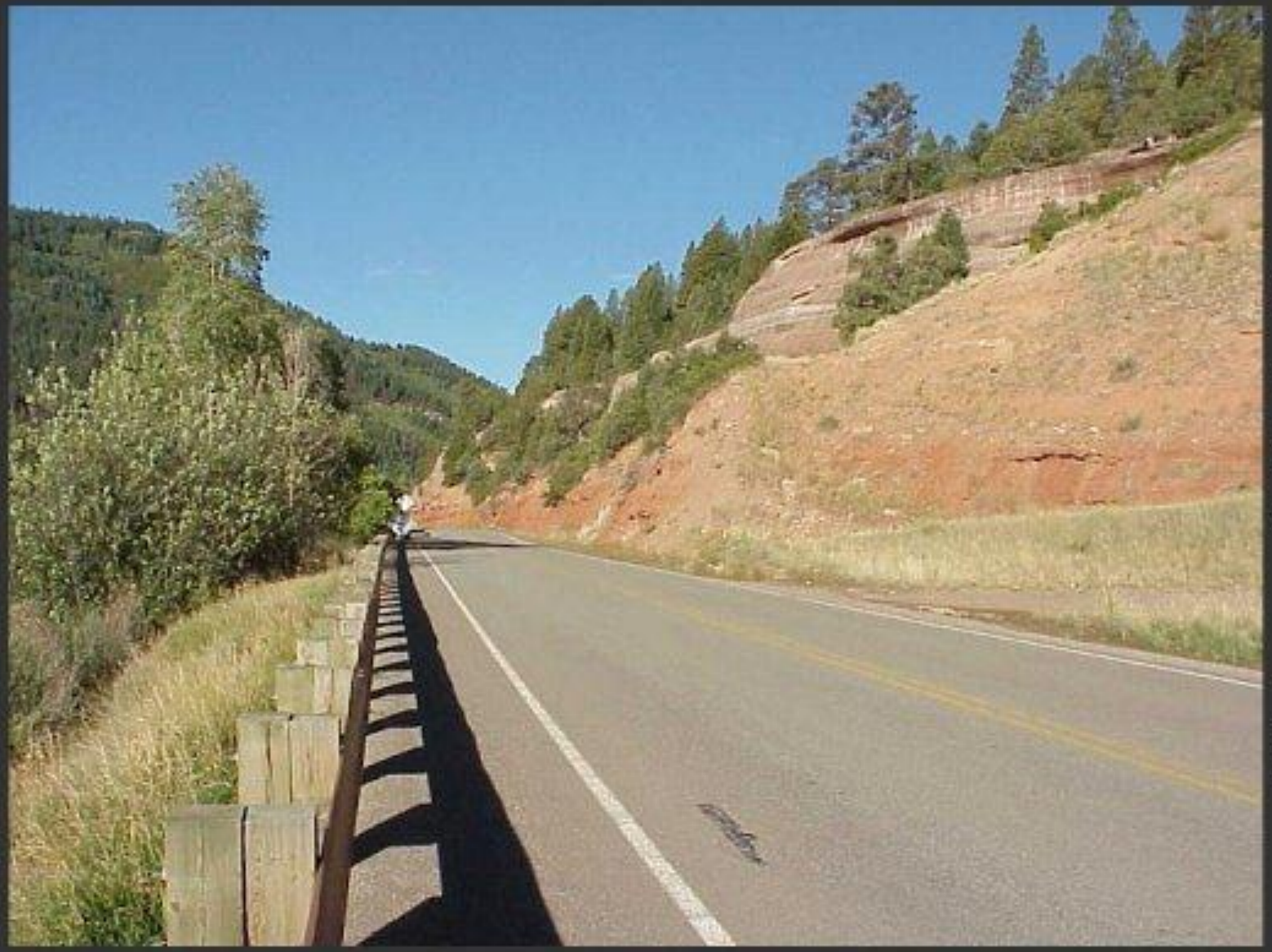
Mendocino Pass - California

CIR

12 years and counting

HFMS-2s

Colorado State Hwy 145 (Dolores to Rico)



CIR

10 years and counting

HFMS-2sP

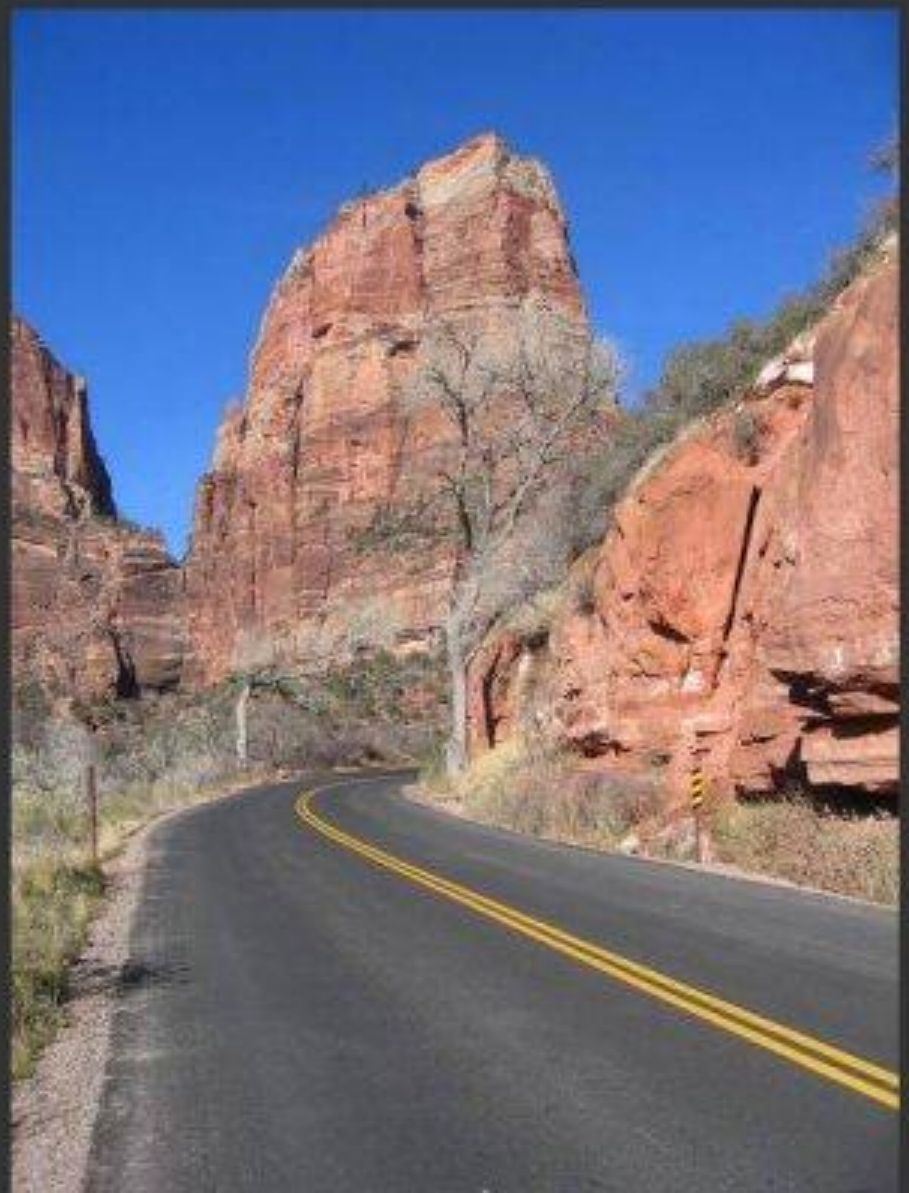
Big Bend National Park - Texas

FDR and double chip seal

Lake Mead N.R.A. - Nevada

FDR with 6’ of widening

Zion National Park - Utah



FDR with foamed asphalt

Questions?