Federal Lands Highway

In-Place Recycling Experience

Southeastern States Regional In-Place Recycling Conference

Atlanta, GA

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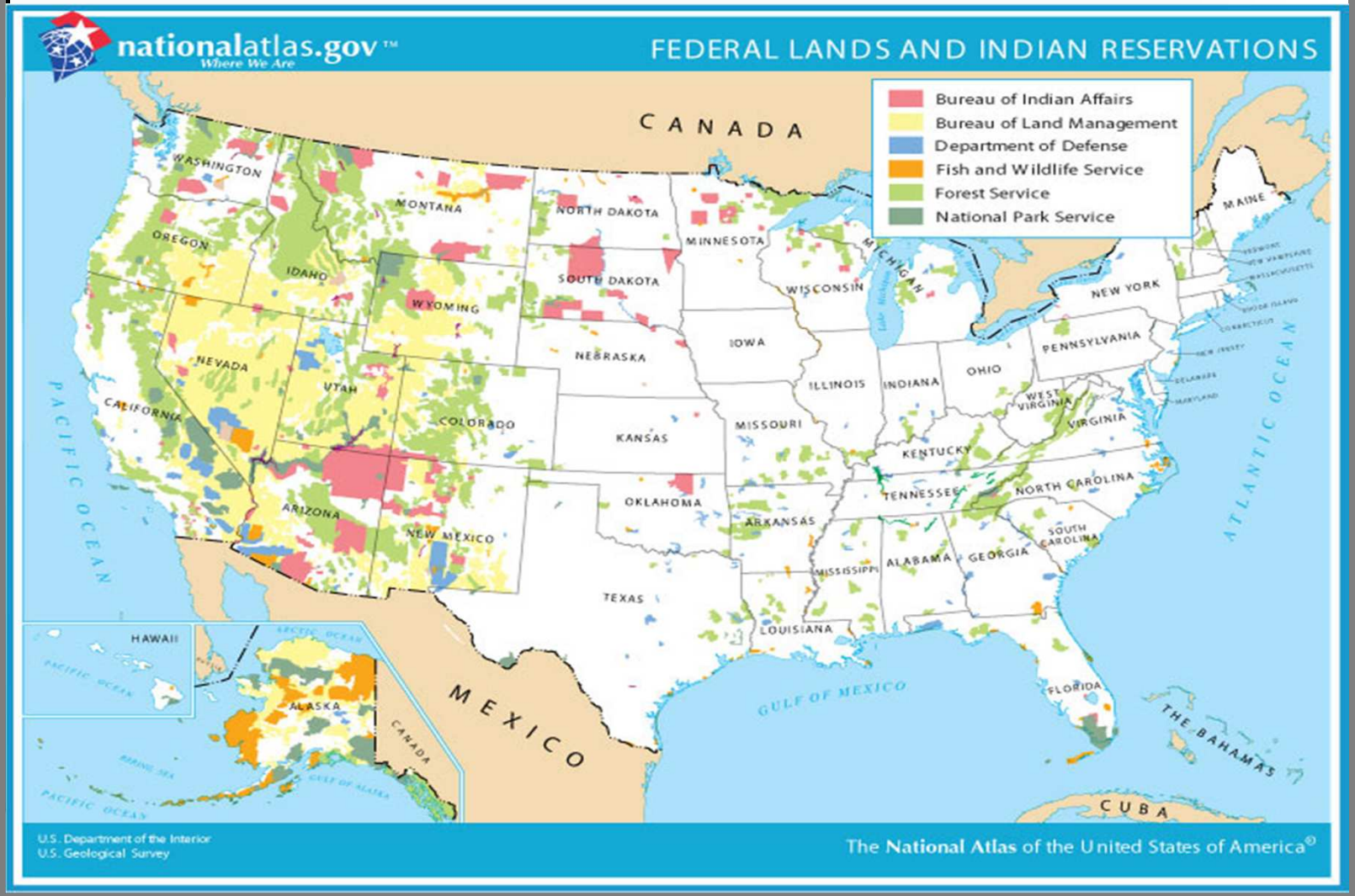
U.S. Department of Transportation
Federal Highway Administration
Office of Federal Lands Highway

Accessing America's Treasures

US Federal and Tribal Lands



U.S. Department of Transportation
Federal Highway Administration
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Accessing America's Treasures

Federal Partner Agencies

FOREST SERVICE
US
DEPARTMENT OF AGRICULTURE

U.S. DEPARTMENT OF THE INTERIOR
1824
BUREAU OF INDIAN AFFAIRS

U.S.
FISH & WILDLIFE
SERVICE
DEPARTMENT OF THE INTERIOR

NATIONAL
PARK
SERVICE
Department
of the Interior

SURFACE DEPLOYMENT AND DISTRIBUTION
MILITARY COMMAND

US Army Corps
of Engineers®

U.S. DEPARTMENT OF THE INTERIOR
BUREAU OF RECLAMATION

U.S. DEPARTMENT OF THE INTERIOR
BUREAU OF LAND MANAGEMENT

Additional Partners

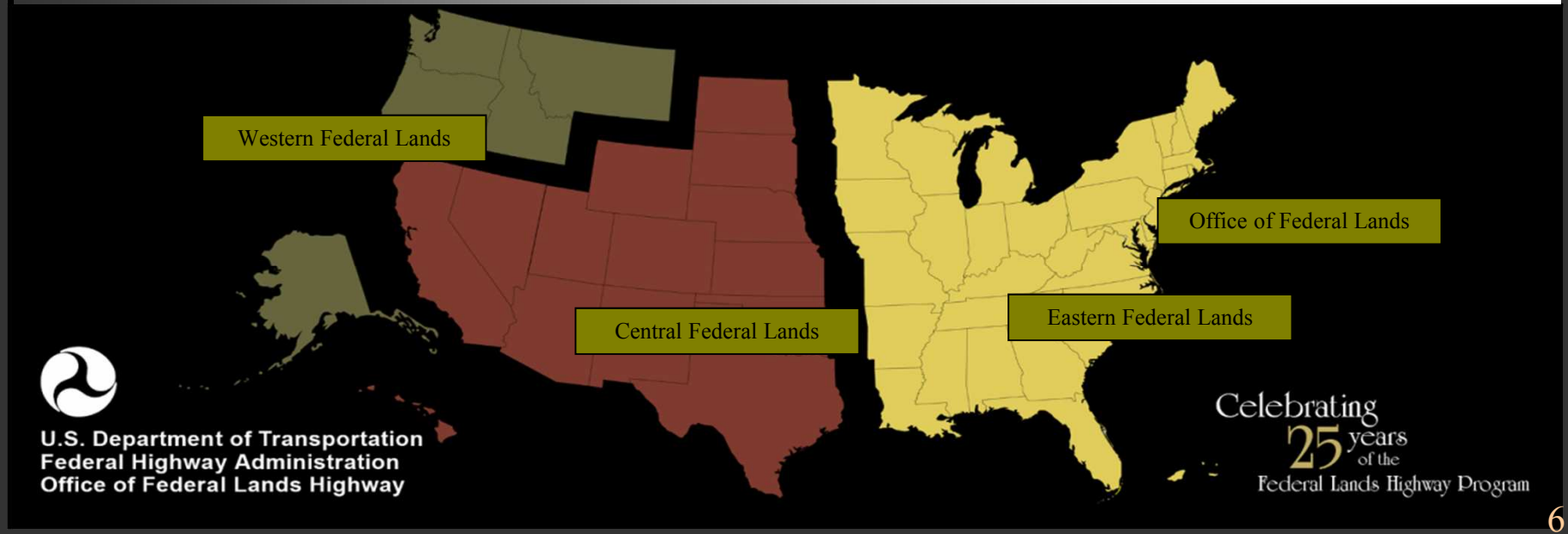
- Federally-recognized Indian tribal governments
- State DOTs
- Counties
- Virgin Islands
- District of Columbia
- Other Federal Agencies

Hoover Dam Bypass Complete

FLH Core Business

- Program Administration
  - About $1.3 Billion/year
- Project Delivery
  - Engineering Services
  - Technical Expertise
- Liaison with Federal Land Management Agencies
- Training and Development
- Deployment of New Technologies
- 660 FHWA Employees (approx. 23% of all FHWA employees)

FLH Field Division Service Areas



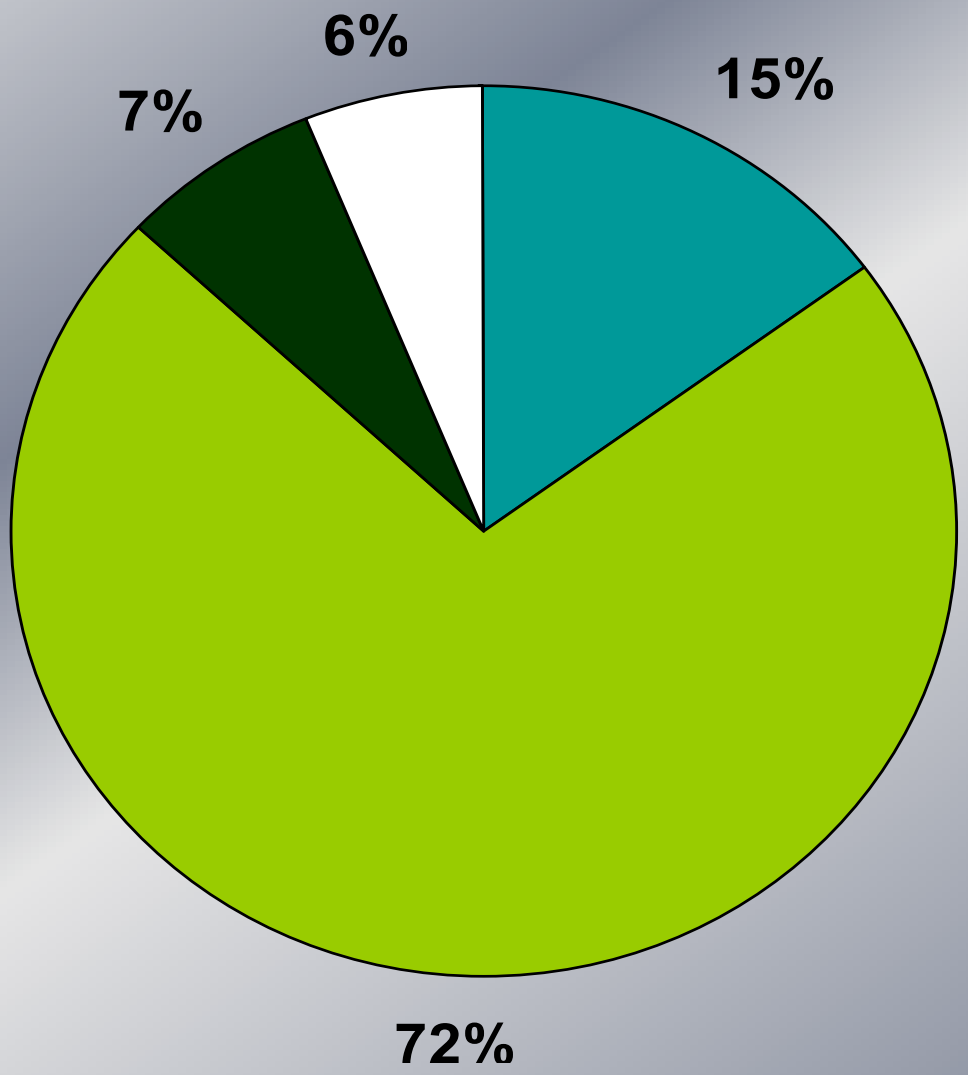
Outline

- **Project Selection / Investigation**
- Design
- Performance History
- Summary

Recycling & Reclamation Methods Used

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

In-Place Recycling in FLHD



6.8 Million SQYD last 5 years (2009 data)

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

Project Selection

- Federal Lands has had good success (long-term performance) with FDR/CIR
- 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 Investigations		
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 Investigations

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

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FDR Project Selection

- FDR is best suited for low to medium volume roads.
- The pavement distress should be to the point that a surface treatment or an overlay is not effective.
- Minor widening of the road can be easily accommodated.
- Very week/wet subgrade cannot be addressed by FDR along.

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
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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 ▪Requires dust abatement	$650 k
▪6” FDR – pulverize ▪4” HACP	20 – 30 years	▪Reuses/recycles materials ▪Favorable life-cycle costs ▪History of long-term performance	▪4-inch grade raise (may lead to significant issues with existing features such as walls and roadway width) ▪Requires dust abatement ▪Some risk for pumping prior to	$600 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

FLH 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

FLH Structural Guidelines

Treatment Type	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/

FDR Mix Design

- FDR Pulverize – N/A
- FDR Cement ✓
- FDR Bituminous – (foam & emulsion) ✓
- Need standardized method: ASTM/ AASHTO acceptance

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.

Key Specification Components

- Density, Density, Density
  - How to measure & enforce?
- Place riding surface within 14 days
  - Consider use of fog seal prior to overlay.
- Weather restrictions and seasonal cut-off dates
- Top size gradation requirements - FDR

Outline

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Performance

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

Baltimore - Washington Parkway (Springfield Rd.) - Maryland

FDR

1 year

Pulverize 8”, Base course 3”, HACP 2”

Great Smokey Mountain National Park (Cades Cove Loop Rd.) - Tennessee

FDR w/cement

2 years

Pulverize 6”, Two lift 2.5” HACP

10 miles

Cape Cod National Seashore - Massachusetts

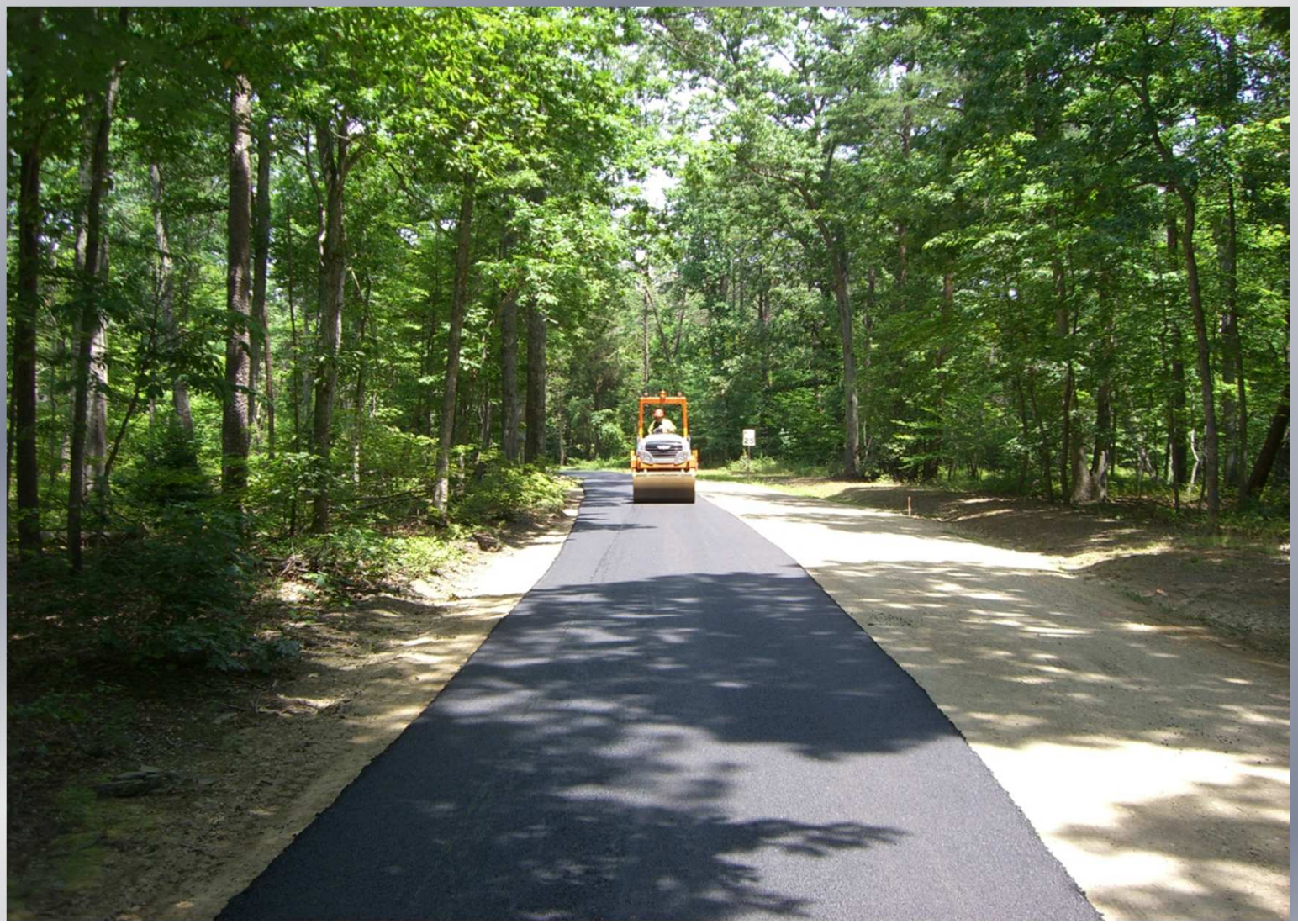
FDR w/cement

1 year

Pulverize 3”, Two lift 2.5” HACP

0.2 mile

Prince William Forest Park - Virginia



FDR w/cement

1 year

Pulverize 7”, Two lift 2.5” HACP

3.5 miles

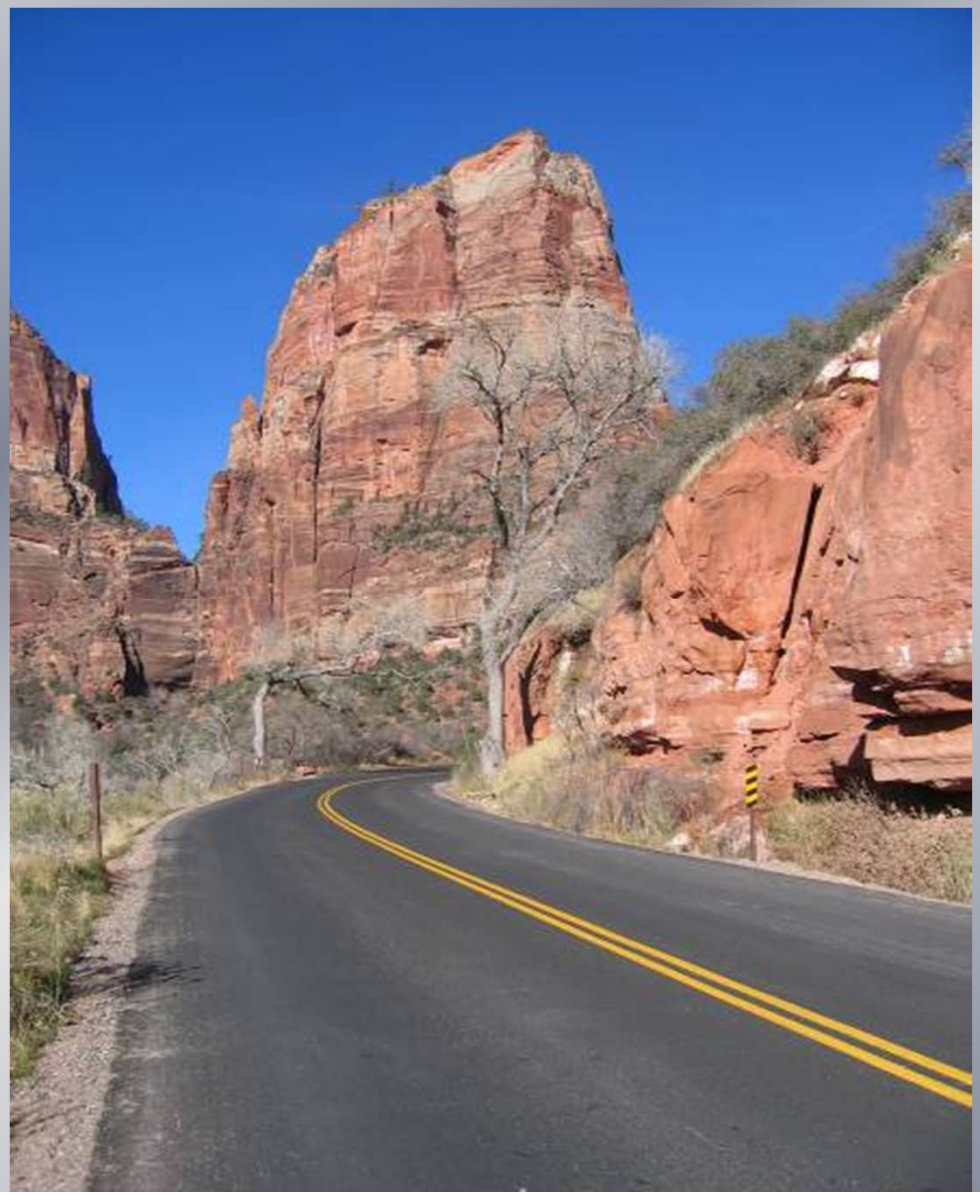
Big Bend National Park - Texas

FDR and double chip seal

Lake Mead N.R.A. - Nevada

FDR with 6’ of widening

Zion National Park - Utah



FDR with foamed asphalt

FLHD's first CIR Project

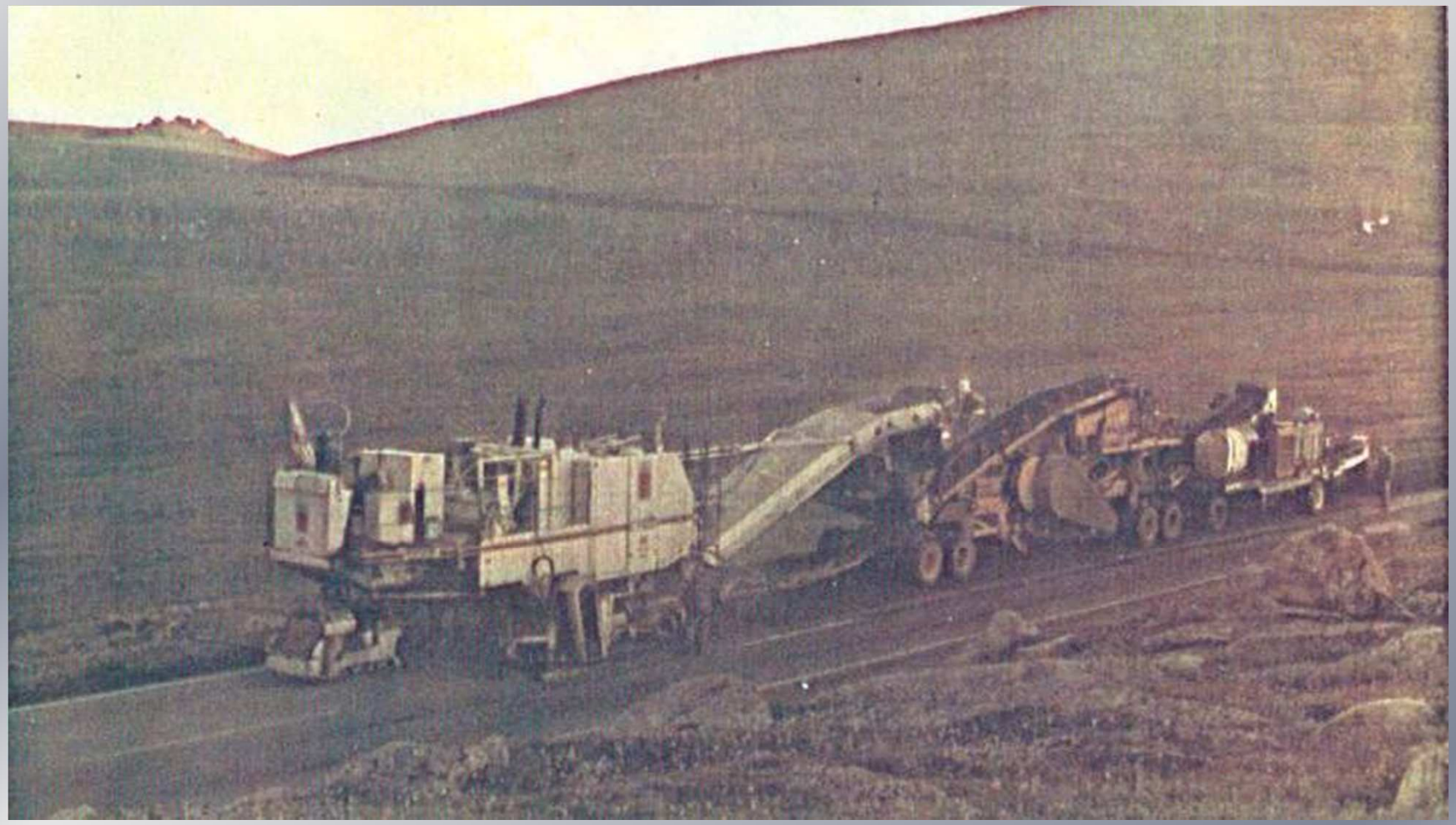
- Location: Rocky Mountain N.P.
- Year: 1982
- Typical Structural Section
  - 4 inches CIR
  - 2 inches HACP
- CIR Contractor: Valentine Surfacing

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

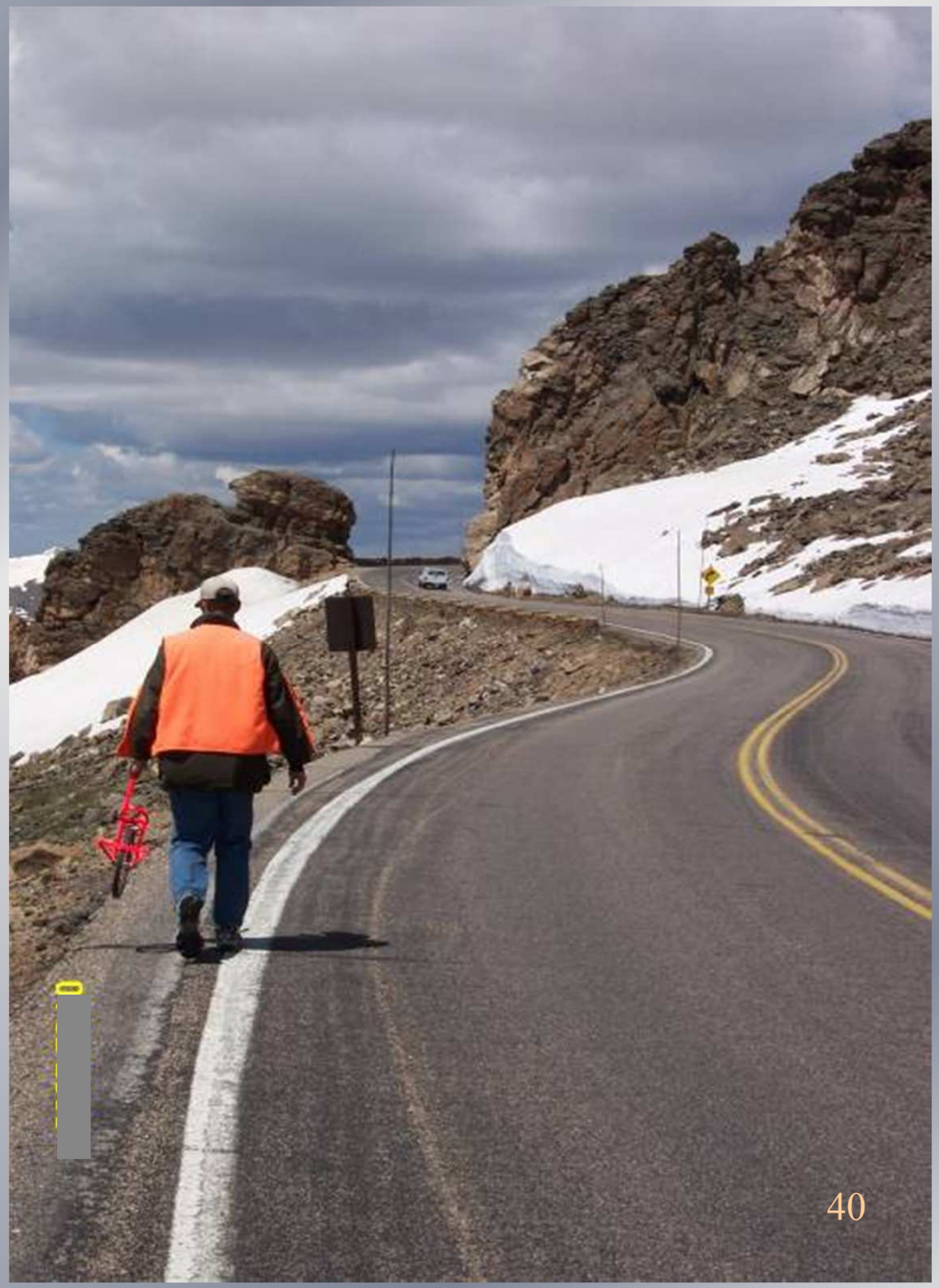
Rocky Mountain N.P. CIR - 1982



Rocky Mountain N.P. CIR - 1982

Rocky Mountain N.P. project ...

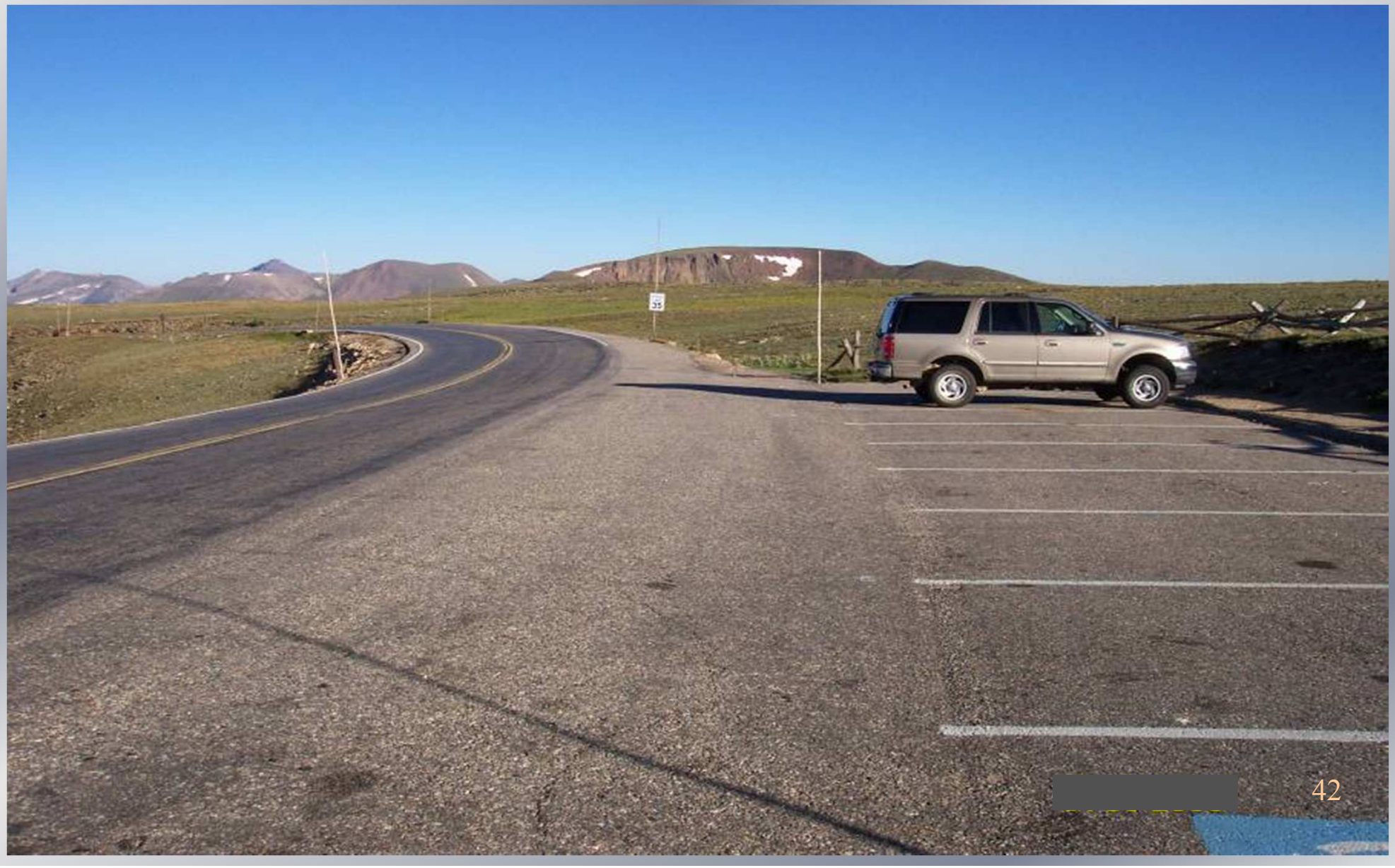
…after 26 years!



Rocky Mountain N.P. project...

…after 26 years!

Rocky Mountain N.P. Project - 2007



Eldorado National Forest - CA

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

Eldorado National Forest - CA

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

Eldorado National Forest - CA

Eldorado National Forest - CA

23 year &

counting!

Twin Lakes Rd - California

CIR

18 years and counting

HFMS-2s

Grand Canyon – Center Rd

CIR

18 years and counting

HFE-300s

Mendocino Pass - California

CIR

15 years and counting

HFMS-2s

Colorado State Hwy 145 (Dolores to Rico)

CIR

13 years and counting

HFMS-2sP

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FLHD Pavement Research

- CIR Construction QC/QA Study
  - FWD (before CIR, right after CIR, and post overlay)
  - Volumetrics (Gmm, Gmb, VTM, gradations)
  - Performance (retained stability, TSR, dynamic modulus)
- Light-Weight Deflectometer (LWD) for Construction QC/QA Validation

Questions?