

# **Cold In-Place Recycling Review 2004 and 2009 Update**

**Jason Harrington  
FHWA**

**2009 Mid-West Regional In-place Recycling  
Conference**

## **What were the Goals?**

Gather “Best Practices” – learn what is happening

Determine methods used to overcome barriers

Learn about advances in equipment, materials, & specifications

Learn about economics and performance benefits

## **Members of Review Team**

Jason Harrington - Pavement Technology

Mike Arasteh - East Resource Center

Butch Waidelich - NH Division

Tom Deddens - Asset Management

& Funding support from RMRC

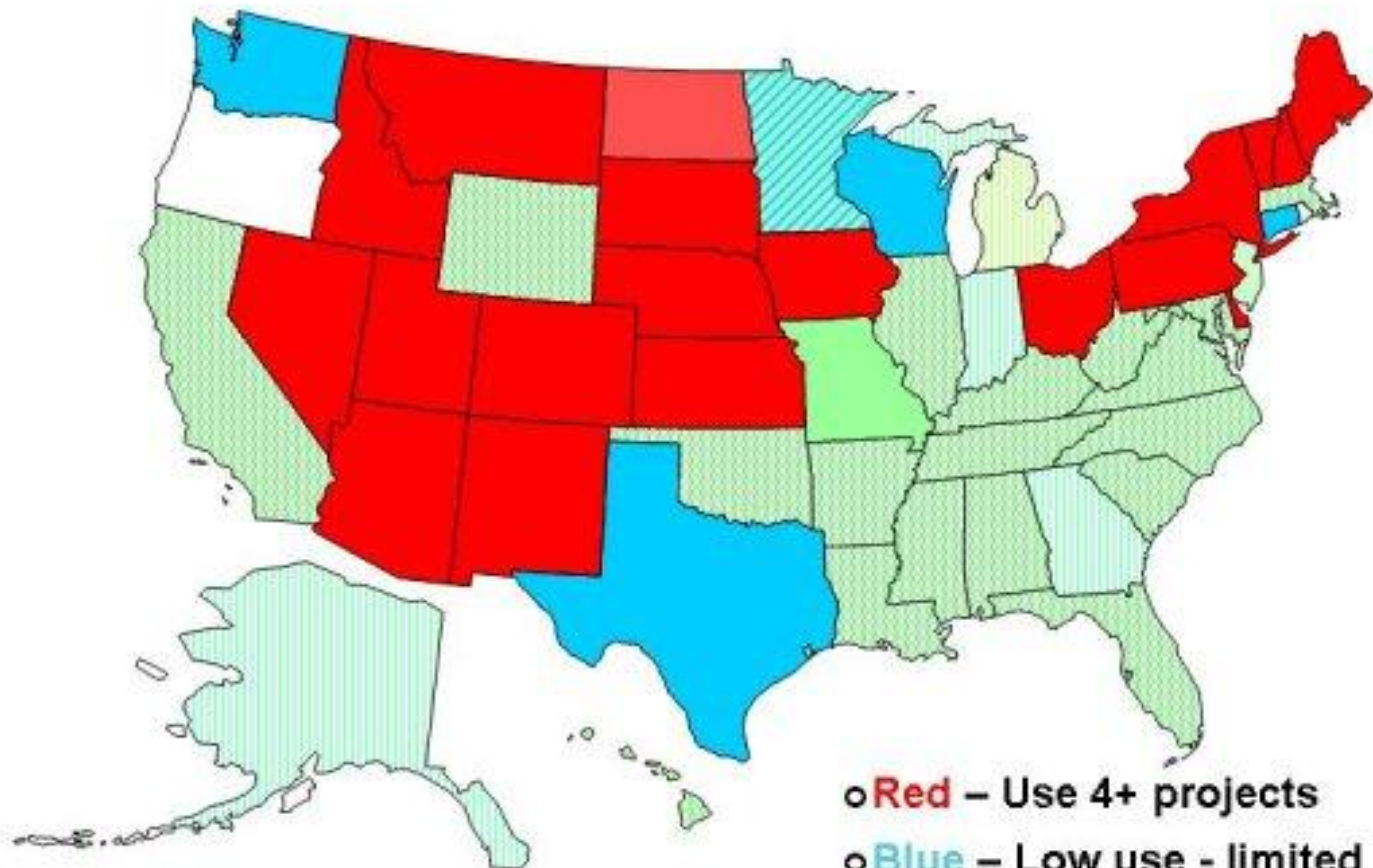
## Extent of Use in 2004?

41 out of 52 state DOT's replied to the initial questionnaire (79% response rate)

- 21 states use CIR on their roads
- 20 states reported no use of CIR



# 2004 States Use of CIR



## Of the 21 that said yes –

- 9 use it frequently or starting to increase their CIR projects
  - 6 states (KS, NV, NM, NY, NE, SD) have a well developed program
  - 3 states (IA, MT, and ME) note increasing use
- 4 have specs but use it on one or fewer projects a year
- 3 use it on only county/local roads
- 6 states really are not using it on STATE projects

## Three states selected for further investigation via an on-site review

- New York
- Nevada
- Kansas

## **Items we were interested in discussing**

**Project Selection**

**Program Implementation**

**Pavement Management System**

**Performance Monitoring**

**Materials**

**Quality Control / Quality Assurance**

**Research and Development**



# State Experience / Anticipated Savings

## New York DOT

Successfully used for 300 projects during the last 15 years.

Typically average 2 million metric tons per year

## Nevada DOT

Successfully used for 20 years.

Began w/ 6 projects between '85 and '92

Successfully treated 770 centerline miles (11 %) over the last 9 years

Figure savings of \$600 million during this period

Typically realize \$40 million annually

## Kansas DOT

KDOT has used CIR successfully since 1977, Since October of 1992 to date over 6000 lane miles have been cold in-place recycled thus exhibiting a high degree of confidence in performance of the process.

# Traffic Consideration

## New York DOT

Used on structurally sound roadways having  $\leq 8000$  AADT &  $\leq 10\%$  trucks

## Nevada DOT

Used on structurally sound roadways having  $\leq 800$  AADT

## Kansas DOT

# Pavement Design Coefficient

## New York DOT

Structural coefficient  
not used

## Nevada DOT

Structural coefficient used

- Values of 0.25 to 0.28
- Back calculated from FWD testing
- Representative of asphalt treated base
- Soft subgrade requires subgrade stabilization 8" to 12" using FDR including 2% cement

## Kansas DOT

A structural coefficient value of 0.25-0.28 is assigned to CIR layer. KDOT takes 20- 40 core samples per project, DCP subgrade test of the cores holes are also done at this time. Data given to SemMaterials, which in turn provides the project mix design, construction field adjustments, and provides technical guidance.



# Design parameters

## New York DOT

### Minimum existing thickness

4-inches total asphalt

- 3-inches processed
- 1-inch remains in-place

### Wearing course cover

- 1-1/2-inch overlay

Expect 10 –15 year life

## Kansas DOT

recycle 4" of existing and overlay it with 1 ½" to 2" of new wearing coarse PG 64-28 to PG 76-28 to address the thermal cracking effects of the pavement. Approximately 3% engineered emulsion (PG 58-28), 1.5% Lime, and 1½"-2" overlay. Service life of 5-10 yrs with little standard maintenance.

## Nevada DOT

### Minimum existing thickness

4-inches total asphalt

- 3-inches processed
- 1-1/2-inch remains in-place

### Wearing course cover

- Chip Seal  $\leq$  300 AADT
- 2" Structural Overlay  $\geq$  300 AADT

Expect 15 - 20 year life w/ lime slurry

Expect 10-15 year life w/o lime slurry



## Mix Design Criteria

### New York DOT

Perform mix design

Use 6" roadway cores

Determine

- % stone added
- % emulsion content
  - 3% emulsion typical

Adjustment to emulsion content made in the field

- Payment to 110% bid quantity permitted

### Nevada DOT

Mix design typically not performed.

- Assume 1.5% lime slurry
- Assume 1.5% CMS-2s emulsion
- Adjustment to emulsion content made in the field (1%-1.5%)



Add Stone

NY DOT



End Results



Add Stone on top



CIR Equipment



# NV DOT



Lime Slurry



CIR Train



Milling



Milling Teeth



Vibratory Roller



Processed Material

## Density Specifications

### New York DOT

#### Density spec' not used

Completed CIR mat subjected to full traffic for 7 days prior to overlay

Rutting limited to  $\leq \frac{1}{2}$ -inch

### Kansas DOT

KDOT relies on test strips to establish density targets.

### Nevada DOT

#### Use Density specification

- Establish optimum relative density from 1000' test strip
- Require target density of 98% optimum density w/ no test < 95% optimum density
- Density may be increased 2% to 3% by re-rolling 3 to 15 days later
- Surface placed after 10 to 45 days cure- full traffic



## Ride Specification

### New York DOT

No ride specification

### Kansas DOT

KDOT ride specification has resulted in better quality workmanship. Better ride may be achieved by use of wedge and/or leveling coarse, a finer mix i.e. two 1" lift of 9.5 mm vs. one 2" lift of 12.5 mm mix.

### Nevada DOT

Uses ride Specification

- California profilograph
- Roughness limited to 5" per mile when overlay is used for surface
- Roughness limited to 10" per mile when chip seal is used for surface

## Best Practices- Industry Partnerships

### New York DOT

Strong partnership with LADA (Liquid Asphalt Distributor's Association)

- Industry trained county
  - 30 year history
- Industry trained state
  - 20-year history

### Nevada DOT

Strong partnership with specialty contractors

- Successfully State history
- Non-use by county

### Kansas DOT

Strong relationship between emulsion supplier, and CIR construction industry has fostered a very cooperative partnership to advance the CIR initiative. Annual meetings with all involved to review specifications and prior to construction year has aided in improvements in the overall program. 20+ years of partnership



## Best Practices/ Pre-construction Meetings

### New York DOT

Pre-construction meeting 1-week prior to construction

Pre-pavement meeting first day of construction

### Nevada DOT

Mandatory Annual Lessons Learned meeting

Mandatory 2-hour workshop prior to construction

### Kansas DOT

Equipment specification requires be equipped with gradation screed, belt WIM scale, and secondary crusher to produce in-spec gradation materials and better control metering of lime and emulsion.

Pre-construction meeting are held to ensure that all involved parties understand their responsibilities. KDOT reviewed the experiences from New Mexico to utilize their best practices and adapt them to KDOTs geographical condition of shortage of good aggregate and poor subgrade.

## Best Practices- Contracting Mechanism

### New York DOT

Traditional contracting mechanism cumbersome:

- Too slow
- Makes specialty contractor sub to prime

Utilize Office of General Services (OGS) contracts

- Annually develop list of "Approved" contractors
- State requests Contractors annually submit line item quotes on materials and/or activities

"Quick Quote" requested once specific conditions of project are known

- "Quick Quote" prices can not exceed original quote



## Performance & Economics

### New York DOT –

CIR (4") with a 1 ½" overlay is expected to last 10-15 yrs with little maintenance as compare to a 5-8 year life with a 1 ½" traditional overlay.

NYSDOT requires that CIR withstand traffic for a minimum of seven (7) days before an overlay is placed as a performance-like acceptance mechanism.

Cost comparison to other Rehabilitation methods – CIR is more economical

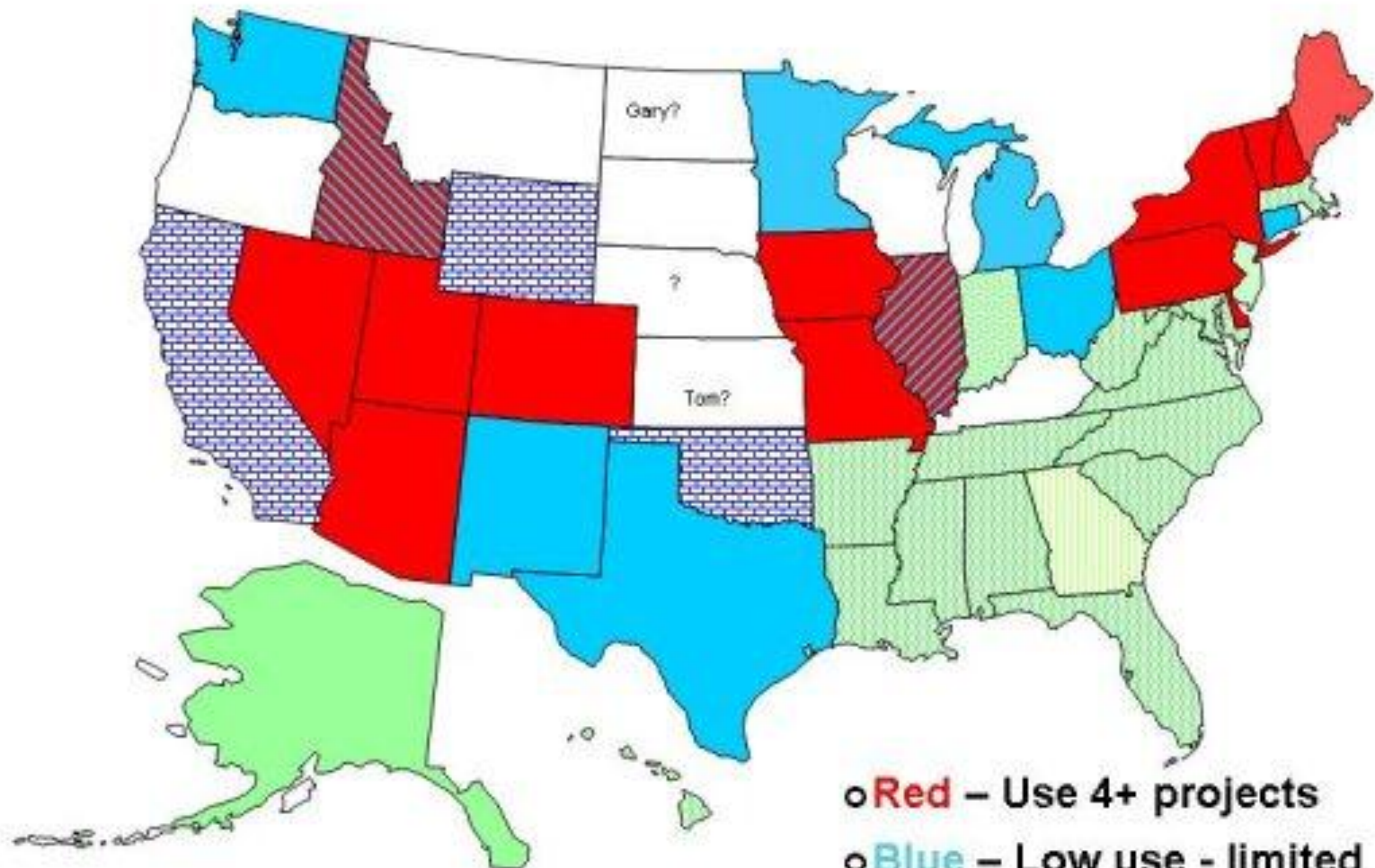
CIR is about 45% less cost then a 4" HMA overlay

## **2009 Survey Asked and Says!!**

40 FHWA Divisions reported back

- Does the State use CIR? (not county)
- Past year level of use
  - Low 1 – 3 projects
  - High 4 – 10 projects
  - Very high 10+
- This year level of use
- Future Extent level of use

# 2009 States Use of CIR



- o **Red** – Use 4+ projects
- o **Blue** – Low use - limited
- o **Green** – No Use
- o **White** – no response



## What I Learned:

22 yes 18 no as reported

Using what I know – 28 YES , 22 NO and 2 Unknown

Changes from 2004

- CA from NO to 3-4 projects and evaluation of performance
- IL from NO to very high use.. ( State or County?)
- MI from unknown to YES and low – future forecast –less
- MN from unknown to Yes and low – future forecast – increase
- MO from NO to Yes and high level and increasing!!!!!!!!!!
- OK from NO to “YES” and low – performance concerns, 1 maybe yr
- WY from NO to YES and low and staying same
- VT - Yes and increasing in future!!! Lots
- VA NO to still NO – but recently developed a special provision to perform CIR. VDOT is investigating several projects to use CIR on in the coming years.
- PA high use

Questions for SD, ND, OR, KY, KS. UT, MT, WY, CT



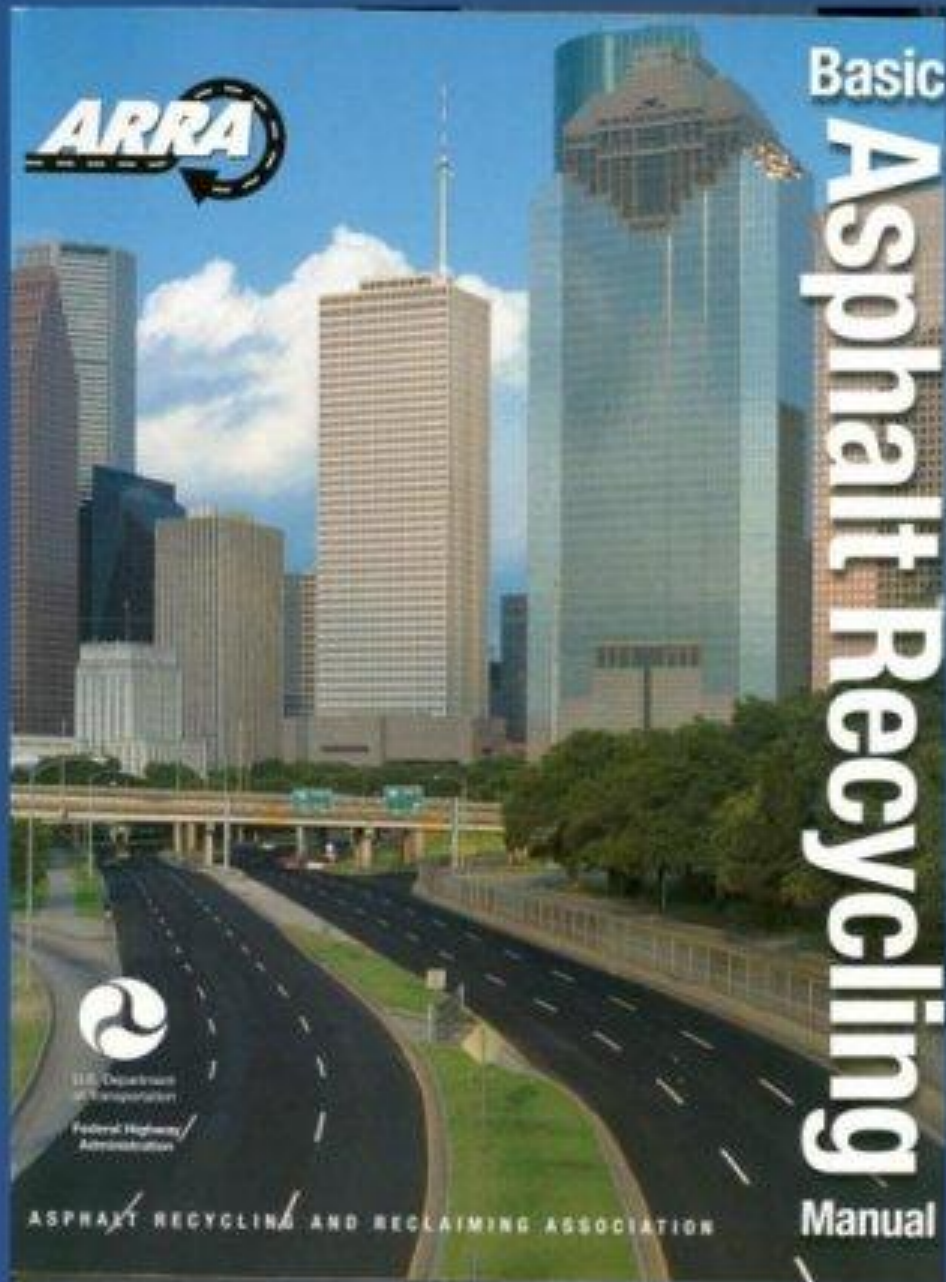




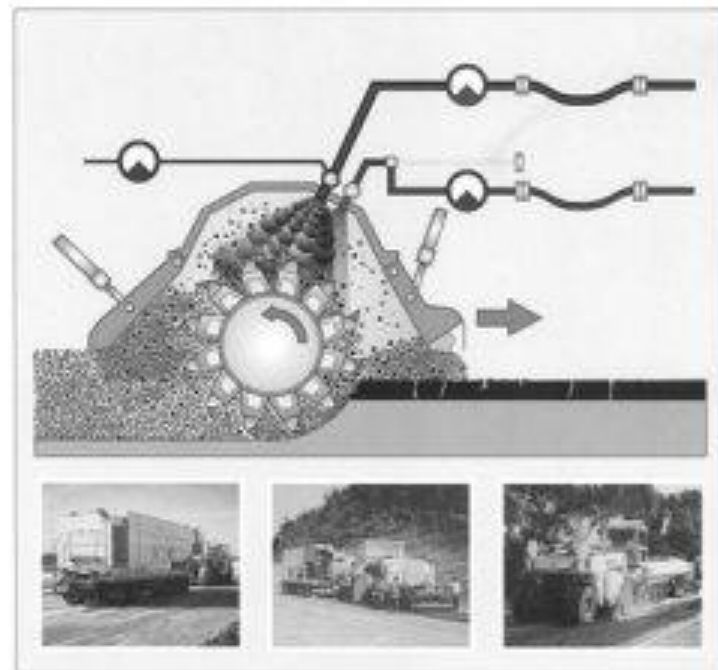




## Partners in CIR: Asphalt Recycling & Reclaiming Association



## Industry Is Active in Technology Transfer



***Wirtgen Cold Recycling  
Manual***





## Recycled Materials Resource Center – Another Partner

RMRC has completed research and reports focused on CIR and /FDR

- Determination of N-design for CIR Mixture Design Using the Super Gyratory Compactor (SGC)
- Laboratory Foamed Asphalt Producing Plant
- Determination of Structural Layer Coefficient for Roadway Recycling Using Foamed Asphalt
- CIR Design Guide for Emulsion using SGC
- Pete mentioned several others in the works
  - SD School of Mines
- [www.recycledmaterials.org/](http://www.recycledmaterials.org/)

# Thank You for the Lend of Your Ears!!

Jason Harrington

FHWA

202-366-1576

[Jason.Harrington@dot.gov](mailto:Jason.Harrington@dot.gov)

