### Cost-effectiveness and Performance of Recycling

### Webinar In-Place Recycling Workshop Earth Day April 22, 2010

### Sohila Bemanian, PE Parsons Transportation Group



# Outline

### >Why recycle?

- ➢Sustainable
- Cost-effective
- >Long-lasting performance

### >How do you select a project?

>How do you construct a successful project?

Conclusions and Recommendations



# The Myth!

# Sustainable means increased costs or low quality



# **In-Place Recycling Facts**

> Up to 40 % reduction in the rehabilitation cost
> Lasts longer than conventional strategies
> Uses 100% in-place materials requiring minimal energy



### Why Recycle? Meet the 3E Challenge





# Sustainable



*Time*, Oct. 1, 2007



Newsweek, April 16, 2007





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

🕅 Ontario

Ministry of Transportation Ministère des Transports

### **Cost-effective**

### **Full-Depth Reclamation (FDR)**

### **Energy Savings**

#### Energy Use and Materials

#### Full-Depth Reclamation vs. New Base



### **Cost-Effectiveness**

|      | 3" CIR & 1.5" HMA  | 3" Mill & 3" HMA   |
|------|--|--|
| SN   | 3(0.3-0.21) + (1.5" x0.42) =0.90   | 3 x (0.42-0.21) =0.63  |
| Cost | CIR:<br>50,688 S.Y.@ \$2.30 = \$116,582<br>Recycling Binder:<br>196 tons @ \$535 = \$104,860 | Rotomill:<br>50,688 S.Y. @ \$1.50 = \$76,032<br>HMA:<br>8,781 tons @ \$95.00 = \$834,195 |
|      | 1.25 inch HMA Overlay<br>3,659 tons @ \$95.00 = \$347,605                                    |  |
|      | TOTAL: <b>\$570K</b>   | TOTAL: <b>\$910K</b>   |
|      | CIR & HMA provides 37% less<br>Save \$341,180 43% increase in S                              | COST Unit Prices form<br>Caltrans  |

#### Life-cycle Cost Analysis-Present Worth for Pavement Rehabilitation State-of-the-Practice on CIR and FDR Projects NDOT, Nov. 21, 2005



# **Long-lasting Performance**

### Cold In-Place Recycling (CIR) and 2" Overlay Section, 6 years, Reno, NV



### Long-lasting Performance 20 years, US-95 NV



### First California CIR Project 20 Years +



# **First California CIR Project**



### Grand Canyon Center Rd Project California , 15 Years +



### Mendocino Pass California, 12 Years +



# Outline

- >Why recycle?
- >How do you select a project?
- >How do you construct a successful project?
- Conclusions and Recommendations



# **Project Selection**

> Investigate existing pavement condition > Environmental condition Future projected loading Contractors availability



### **Pavement Performance** No Preservation or Rehabilitation



Traffic Time

### **Pavement Preservation**

#### PAVEMENT PRESERVATION STRATEGIES

#### REHABILITATION STRATEGIES



#### PAVEMENT LIFE

# **Timing of Rehabilitation Techniques**



#### **Time / Traffic Loading**

### Hot In-Place Recycling (HIR) Candidate and Process



www.betterroads.com

#### KDOT recycles up to 3 million sq. yd. annually

# Medium and Wide Transfers Cracking Good CIR Candidate



### **CIR Process**





### **Candidate and Process**



### **FDR with Cement**



### Before



California Nevada Cement Association

# Outline

- > Why recycle?
- >How do you select a project?
- >How do you construct a successful project?
- Conclusions and Recommendations



# How to Construct a Successful Project

- > Input from contractors & material suppliers
- Contact ARRA and AEMA for list of local suppliers and contractors
- > Use performance-based specifications
- > Develop checklist for inspectors
- > Pre- and post-construction meetings are a must!
- > Require contractor to perform mix design
- > Successful projects are based on win-win strategy

# Construction of a Successful Project



### **CIR Train** SR447, Nevada



### CIR Project I-80 Pequop, NV



2008 Award: Roads & Bridges MagazineYear:2007-2008Cost:\$33.7 MillionLength:20 miles

Agency:NDOT District 3Contractor:Road & Highway BuildersSubcontractor:Valentine Surfacing

### HIR Project Final Product I-Drive Orlando, FL



# **Mix Design Process**











# Outline

- >Why recycle?
- >How do you select a project?
- >How do you construct a successful project?
- Conclusions and Recommendations



### **Conclusions** Recycling Meet the 3E Challenge

### Sustainability

#### Energy Use Per Tonne Of Material Laid Down Laydown Transport 800 Manufacture 680 700 Aggregate Binder 600 570 538 500 456 ENergy (MJN) 400 300 200 139 100 Hot-Mix Asphalt Emulsion-Based Hot in-Place Central Plant Cold In-Place Cold-Mix Recycling Recycled Hot-Mix Recycling with

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



Ministry of Transportation Ministère des Transports

Emulsion

with 20% RAP

### **20-Yr Performance**



### \$600M Cost-Saving



### Recommendations

 > Agencies should add all types of in-place recycling to their tool box
 > Start slowly, get contractors involved early
 > Continue improving the process



# **Websites with More Information**

- <u>www.fhwa.dot.gov</u>
- ≽ www.fp2.org
- <u>www.arra.org</u>
- <u>www.pavementpreservation.org</u>
- ➢ <u>www.dot.ca.gov</u>
- <u>www.transportation.org</u>
- <u>www.pavementrecycling.com</u>
- <u>www.greenroads.us</u>

### Let's Create a Sustainable Future!

Sohila Bemanian, PE Parsons Transportation Group Carson City, Nevada Sohila.bemanian@parsons.com (775) 297-6515