

Using Hot In-place Recycling to Ensure Success



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Cutler Repaving Inc.



ASPHALT RECYCLING & RECLAIMING ASSOCIATION

ARRA 1976

MEMBERSHIP of ARRA

- CONTRACTORS
- SUPPLIERS
- AFFILIATE MEMBERS

Hot In-Place Recycling

A Rehabilitation Alternative



The 3 Types of HIR

Surface Recycling:

Heating, reworking and rejuvenating the top one-two inch of an existing asphalt pavement in preparation of either a seal coat, micro-surfacing or overlay.

Repaving:

Heating, reworking and rejuvenating the top one inch of an existing asphalt pavement and simultaneously applying an overlay while the temperature of the recycled layer is 200°F.

Remixing:

Heating, reworking and rejuvenating the top 1 to 2 inches of an existing asphalt pavement adding virgin aggregate and/or admix and mixing the newly recycled material in a pug mill mixing plant prior to laying, either as a binder or surface course.

The Bottom Line Question

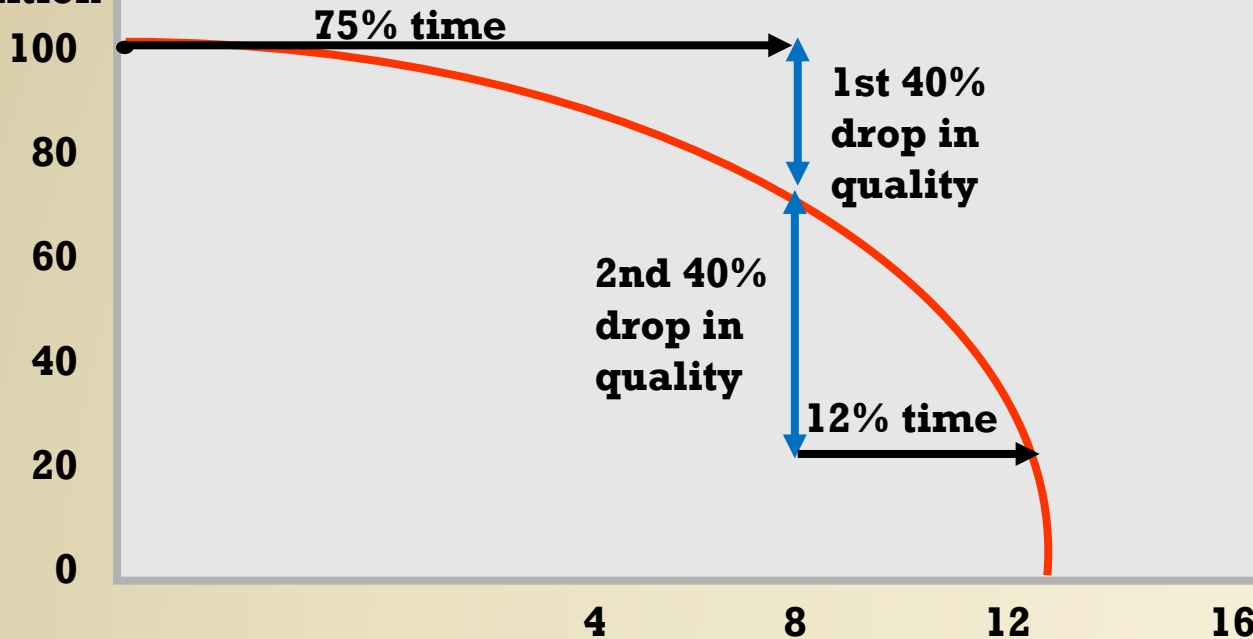
- How can I maximize the return on my investment in asphalt pavement rehabilitation funding?

Answer

- By repairing your asphalt pavement during the first 40% drop in quality

The Savings of Timely Maintenance

**Pavement
Condition**



Years (Time Varies for each Road Section)

Each \$1 spent during the first 40% drop in quality will cost \$5-\$7 if delayed until pavement loses 80% of its original quality.

Project Considerations

- Uniformity
- Depth of existing HMA
- Presence of Chip Seals
- Asphalt content (bleeding)
- Asphalt properties
- Traffic
- Types of pavement distress
- Environment

Urban Applications

- Curb line milling may be necessary
- Traffic easily controlled in work zone
- Environmental considerations

Selecting the Appropriate Hot In-place Recycling Process

Pavement Distress Mode	Candidate HIR Process		
	Surface Recycling	Remixing	Repaving
Raveling			
Potholes			
Bleeding			
Skid Resistance			
Rutting			
Corrugations			
Shoving			
Fatigue Cracking			
Edge Cracking			
Slippage Cracking			
Block Cracking			
Long. /Trans. /Reflect. Cracking			
Swells, Bumps, Sags, Depressions			
Marginal Existing Pavement Strength			

Non-Distress-Related Considerations		More Appropriate	Less Appropriate
Initial Cost ¹	\$1.00 - \$2.00 SY	\$3.75 - \$4.75 SY	\$1.25 - \$2.00 SY
User Costs	See PDM, C.4.3.1	See PDM, C.4.3.1	See PDM, C.4.3.1
Min. turning radius greater than 500'			
Min. turning radius less than 500'			

More Appropriate
Appropriate → Less

¹The initial cost does not include the cost of any succeeding pavement layer that will be required to complete the work. The cost of any additional pavement overlay to be installed after each hot in-place recycling process should be considered in the cost evaluation step.

















Remixing 2"



A long line of heavy machinery, including road recycling machines and trucks, is positioned along a multi-lane highway. The machines are equipped with various components like conveyor belts, crushers, and storage bins. Workers in high-visibility vests are visible near the equipment. The scene is set against a backdrop of tall evergreen trees and a clear blue sky. The road surface is dark asphalt, and the shoulder on the left is covered in grass and gravel.

Green Roads Recycling, Ltd
Fernie, British Columbia



Surface Recycling 1 inch

Dustrol, Inc.



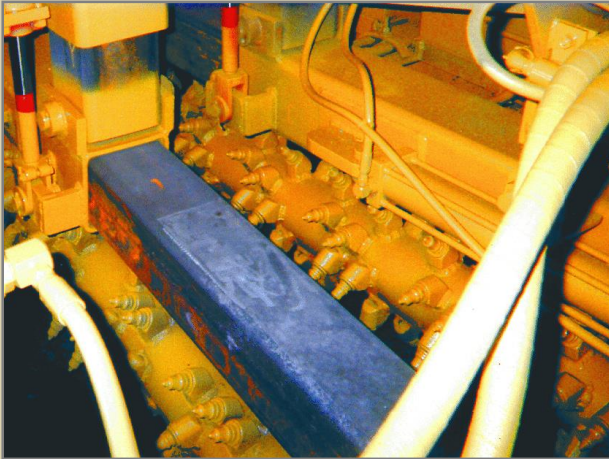
The 1" HIR Process

- Surface heated to approximately 275°F



The HIR Process

- Softened pavement scarified to depth of 1"









**Gallagher Asphalt Corporation
Thornton, Illinois**





Dustrol, Inc.

**Mobile Asphalt Recycling System
Deep Heating**

The Process

Deep HIR System

❑ Continuous Process with Self-Contained Train

- Asphalt Surface Heated
- Heated Pavement Milled in $\frac{1}{2}$ " to $\frac{3}{4}$ " increments
- Engineered Emulsion Added at Design Content
- Materials Mixed and Windrowed
- Recycled Mix Placed by Paver with Vibratory Screed
- Mat Compacted
- Surface Applied
 - Such as UBAWS, Micro, Polymer Chip Seal, Thin HMA overlays



The Process

Deep HIR System

Continuous with Self-Contained Train



Mobile Asphalt Recycling Train

- ▣ Asphalt pre-heaters and milling heaters working in front of the asphalt recycling unit. Several pre-heaters and heater millers can be used to achieve the specified heating depth.



Pre-heaters and Milling Heater



Tunnel Heater

- ▣ Windrow of material from milling heater going under a tunnel heater. Heat is transferred into underlying pavement and into windrow.



Milling, Mixing Heater

- ▣ Milling drum on main unit mills additional depth and adds emulsion. The milling drums extend to process width up to 15 feet.



The Process



➤ Combination
– Heater Unit
and Milling
Section

➤ Engineered
Emulsion
Metered at
Design
Content

ARA-1P

This safe, water-based emulsion replaces the chemical constituents of the asphalt that have oxidized. ARA-1P emulsion also contains polymer modified asphalt, which further improves elasticity and coating. Moisture, rutting, and crack resistance are also improved.

Recycled Asphalt Laydown

- Windrowed 100% recycled material is picked up and paved in a conventional paver to the specified width.



The Process

Deep HIR System



Recycled Asphalt
Mix Placed with
Paver and
Vibratory Screed.
Minimum temp at
screed 190° F.

Recycled Material Compaction

- The blended recycled material is compacted using conventional rollers.



Surface Repaving

Heating, reworking and rejuvenating the top 1 to 2 inches of an existing asphalt pavement and simultaneously applying an overlay while the temperature of the recycled layer is 200°F



Surface Repaving

Heating, reworking and rejuvenating the top 1 to 2 inches of an existing asphalt pavement and simultaneously applying an overlay while the temperature of the recycled layer is 200°F

Hot-In-Place-Recycling

A Valuable Tool For Denver Pavement Preservation

Pat Kennedy, PE
Denver Street Maintenance

2014 AEMA-ARRA-ISSA-PPRA
Fall Meeting
Baltimore, MD



- **Population 634,000 – Metro area 2.5M**
- **Street network 6,100 lane miles**
- **Capital Maintenance Budget \$23M annually**
- **2014 paving program;**
 - Self performed Mill and Overlay; 210 In-mi 53%
 - Contracted Mill and Overlay; 28 In-mi 7%
 - Hot-In-Place-Recycle; 109 In-mi 27%
 - Chip Seal; 50 In-mi 13%

HIPR/M&O Compared

Trigger Point

HIPR

- Fair to slightly Poor
- Few structural defects
- PCI 50 to 70

M&O

- Poor to Very Poor
- Structural defects
- PCI > 60

HIPR/M&O Compared

HIPR

- Edge mill only
- Minor patching



for City Services
Denver gets it done!

Milling/Prep

M&O

- Full width milling
- Possible extensive patch



HIPR/M&O Compared

Paving Train

HIPR

- **Pre heater**
- **Recycler/Laydown**
- **Three rollers**
 - **Breakdown**
 - **Rubber Tire**
 - **Finish**

M&O

- **Tack**
- **Laydown**
- **Three rollers**
 - **Breakdown**
 - **Rubber Tire**
 - **Finish**

HIPR Preheater



HIPR Paver



HIPR Paving Train



Unique Considerations

- **Traffic Control- No special needs**
- **Street selection- No cul-de-sacs or tight curves, uniform width, x-slope**

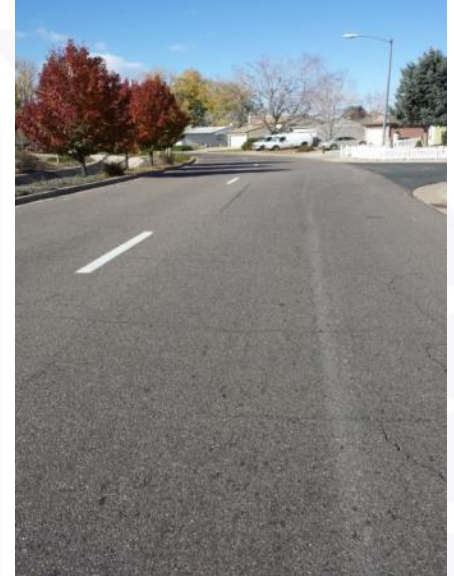


Unique Considerations

- **Traffic Control- No special needs**
- **Street selection- No cul-de-sacs or tight curves, uniform width, x-slope**
- **Vegetation- Minor protection of street side plants**
- **Specialized mixes**
 - SMA
 - AR
 - RAS

Specialized Mixes

2010 RAS- Minor Arterial- 5,000 AADT one way



Current PCI ~85

Denver Asphalt Plant

- **City owned Astec asphalt plant**
- **Standard HMA and specialty mixes**
- **Less expensive**
 - Production costs
 - Wait times
 - Hauling costs



Life Cycle

Arterials- Track record of 10 years on



2005 Process
10,000 AADT
PCI ~75



2003 Process
10,000 AADT
PCI ~70

Life Cycle

Collectors- Track record of 10 years on collectors



2003 Process
3,000 AADT
PCI ~70

Life Cycle

Locals- ??? Haven't seen full life, some sites covered with chip seal at 7 years



Local streets, 2003 HIPR, average PCI 75

Sustainability

- **Less disruption**
- **Smooth surface**
 - 40% IRI improvement, 265 in/mi to 165 in/mi
- **Less use of raw materials**
 - One half existing pavement reuse
 - One half added pavement at 25% RAP

Final product 60%+ recycled material

Economics

- **Reduced Mill/Prep**
- **Reduced raw materials**
- **Reduced hauling**
- **Unit cost \$1 to \$2 per sy less than m&o**

**Life cycle cost savings of
6%-10%**

Compared to mill and overlay

Cutler Hot Air heating system



Cutler Hot Air heating system



Cutler Hot Air heating system



Cutler Hot Air heating system



Recycling & Paving screed



Cutler Hot Air heating system



Cutler Hot Air heating system



Cutler Hot Air heating system



Cutler Scarification System



Cutler Hot liquid application



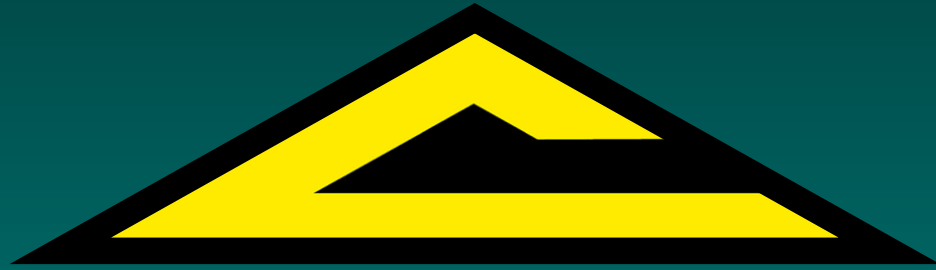
HMAC Placement



Final Compaction



Thank You!



Questions?