NORTH DAKOTA ASPHALT CONFERENCE
April 5–6, 2016 • Ramada Bismarck Hotel

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Incorporated in September 1976, ARRA’s primary function has been to promote the recycling of existing roadway materials through various construction methodologies, to preserve limited natural resources and reduce costs. This ongoing effort continues through education, strategic alliances and partnering at both the industry and agency level. (Mission Statement)

- Not for Profit Organization made up of DOT agencies, equipment suppliers, Material suppliers, contractors & etc.

- Closer Partnerships with the FHWA and others to build awareness of the overall industry
Industry Overview
Choose the right process, @ the right time, on the right road, for the right price

- Visual site investigation
- Subsurface investigation (includes subgrade)
- Classify & Quantify each layer to determine existing condition/performance
- Mix Design and/or recommendations from experienced person for all present varying conditions, choose the “right team”
- Cost comparison of available options
- Fix subgrade drainage issues if needed
- Utilizing a competent “team” of civil engineer, geotechnical engineer and contractor
- Realize and inform customer that there can be field changes due to unforeseen circumstances at times
- Infield QC/QA when possible
Industry overview
pavement preservation processes

Crack Treatments
Chip Seal
Slurry Pavement

Micro Surfacing
Combination of (ex. Cape Seal)
Industries Overview

recycling processes

Milling

HIR - Hot In-Place Recycling

CIR - Cold In-Place Recycling

FDR - Full Depth Reclamation

Soil Stabilization/ Modification

Mix Design/ Testing
Pavement Condition Index

- Excellent
- Good
- Fair
- Poor
- Very Poor
- Failed

AGE OF PAVEMENT

1 5 10 15 20 25

PP = Pavement Preservation
RM = Reactive Maintenance

$2.00 for PP Here
$4.00 for RM Here
Will Cost $12.00 to $16.00 for Rehabilitation Here

40% drop in quality
75% of life
12% of life

ARRA
NDSU

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Crack treatments consist of placing specialized materials into prepared cracks to prevent water and incompressible intrusion into the cracks and underlying pavement layers, and to reinforce the adjacent pavement. Restriction of water entry into underlying pavement base and sub-grade layers serves to maintain pavement strength and prolong pavement life. Pavements in different climate zones, with different construction types, and with different traffic loadings experience different types of cracking. The various crack types experience different movement ranges depending mostly on crack spacing and temperature variations. Different types of crack treatment materials and installation geometries are required for the different conditions. (ISSA)
Chip Seal is an application of a bituminous binder covered with an application of clean graded aggregate to an existing asphalt surface. It is also known as armor coat, bituminous sealing or seal coat, to name a few. The binders may be emulsions, paving grade asphalt cements, and modified versions of each being modified with various polymers such as latex, tire and natural rubbers.

The aggregates commonly vary in size from a maximum of 5/8 of an inch to a minimum of ⅛ inch with less than 5% passing the No. 4 screen. Aggregate must be durable with the use of crushed stone, gravels or manufactured aggregates. Aggregates may be precoated with a small % of asphalt cement when used with hot asphalt binders. Chip Seal has been used in various forms since at least the early 1900’s. The quality has improved over the years with better binder technology, cleaner aggregates, and improved equipment and a better understanding of how the materials perform together. (ISSA)
Slurry Pavement is the principal materials used to create slurry seal such as aggregate, asphalt emulsion, and filler, which are mixed together according to a laboratory’s design-mix formula. Water is also added for workability. Asphalt emulsions serve as a binder, holding the crushed aggregate together and adhering the new slurry surfacing to the old surface over which it is being applied. Various emulsions and aggregates are used to meet the conditions, specifications, and requirements of individual projects. The aggregate must be clean, crushed, durable, properly graded, and uniform. The asphalt emulsion is a three-part system consisting of asphalt, water, and emulsifier. Fillers such as Portland cement, hydrated lime, or aluminum sulfate liquid are often used in small quantities as stabilizers or chemical modifiers. (ISSA)
**Micro-Surfacing**

*Micro Surfacing*, one of the most versatile tools in the road maintenance arsenal, is a polymer-modified cold-mix paving system that can remedy a broad range of problems on today’s streets, highways, and airfields. Like its parent product, slurry seal, *Micro Surfacing* begins as a mixture of dense-graded aggregate, asphalt emulsion, water, and mineral fillers. While conventional slurry seal is used around the world as an economical treatment for sealing and extending the service life of both urban and rural roads, *Micro Surfacing* has added capabilities, thanks to the use of high-quality, carefully monitored materials, including advanced polymers and other modern additives. (ISSA)
Any combination of the previous treatments (Cape Seal)

*Cape Seal* is a layer of bituminous surface treatment or chip seal, followed by an application of the micro surfacing. This process combines the benefits of chip sealing and micro surfacing and offers a finish that is similar to an asphalt overlay, but at a lower cost. (ISSA)
Milling is the removal of an existing asphalt concrete prior to placing a surface treatment or full depth removal. There are many different reasons for milling and types of milling like Micro or profiling or full depth removal of asphalt.
**HIR**

**Hot In-Place Recycling**

**Definition**

Hot In-place Recycling is an on-site, in-place, pavement rehabilitation method that consists of heating, scarifying, softening, mixing, placing and re-compacting the existing bituminous pavement.
HIR
Hot In-Place Recycling Methods

• Two Types of HIR Methods
  • Surface Method
    • Hot-In-Place Recycling Surface Method is an on-site, in place, pavement rehabilitation method that consists of heating, scarifying, mixing, replacing and re-compacting the existing bituminous pavement.
  • Re-HEAT Method
    • Re-HEAT is an on-site, in place, pavement rehabilitation method that consists of heating the existing pavement, removing the top surface course, adding an asphalt rejuvenating emulsion, mixing the material uniformly in an on-board mixing drum, re-laying the recycled material, followed by compacting.
HIR
Hot In-Place Recycling
the process (surface method)

1st Preheat
(180 – 200 Degrees)
HIR
Hot In-Place Recycling
the process (surface method)

2nd Preheat
(280-300 Degrees)
HIR
Hot In-Place Recycling
the process (surface method)

Rejuvenating Agent
HIR
Hot In-Place Recycling
the process (surface method)

Loosen Pavement
HIR
Hot In-Place Recycling
the process (surface method)
HIR
Hot In-Place Recycling
the process (surface method)

Re-profile

Preheat
2\textsuperscript{nd} Preheat
Rejuvenating Agent
Loosen pavement
Remix
HIR
Hot In-Place Recycling
the process (surface method)

Finish Roll

Preheat

2nd Preheat

Rejuvenating Agent

Loosen pavement

Remix

Re-profile

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HIR
Hot In-Place Recycling
the process (surface method)

Final Surface Course

Preheat
2nd Preheat
Rejuvenating Agent
Loosen pavement

Remix
Re-profile
Finish Roll
Cold In-place Recycling is a method of reconstructing the top layer of pavement where the need arises from structural failures. These failures include: transverse cracking, wheel rutting, potholes, surface irregularities, or a combination of the above. (ARRA)
CIR
cold In-Place Recycling
cross section

Existing

W/ CIR

Overlay

CIR

HMA

Base/Sub-base

Subgrade

HMA

Base/Sub-base

Subgrade
CIR
cold In-Place Recycling
candidates

- Deteriorating Asphalt (Maintenance)
  - Secondary Roads
  - City Streets
  - Interstate Highways
  - Airport Runways
  - Large parking lots
CIR
cold In-Place Recycling
how to utilize CIR

- Thermal Cracking
- Poor Rideability
- Fatigue Cracking
- Patched/ Dry and Raveling Roads
CIR
cold In-Place Recycling
additives

- Emulsions
- Foamed Asphalt
- Other additives can be incorporated into either Emulsions or Foamed Asphalt
CIR
cold In-Place Recycling
single unit

• Small size for urban projects
• Short turning radius
• Less operating/ mobilization costs
CIR
cold In-Place Recycling
the process (single train)
CIR
cold In-Place Recycling
multi unit

- Rural/ long stretches of roads
- Sizing control
- Mix in pugmill not a drum
cold In-Place Recycling
the process (multi-train)
Full Depth Reclamation is a technique in which the full flexible pavement section and a predetermined portion of the underlying materials are uniformly crushed, pulverized, or blended, resulting in a stabilized base course; further stabilization may be obtained through the use of available additives. By addressing the entire pavement section, full depth reclamation is able to correct delinquent cross sections, increase the load-bearing strength of the base, and utilize 100% of the existing materials. (ARRA)
FDR
Full depth reclamation
cross section

Existing

Full Depth Reclamation

Surface Course

6-10” FDR

Subgrade

Base/Sub-base

HMA

Subgrade
FDR
Full depth reclamation
Full depth reclamation
Cold Recycling Mill vs. reclaimer

- Collects millings into central windrow
- Utilize to remove surface asphalt if your project is sensitive to grade/ elevation

- Keeps pulverized material in same path
- Creates homogenous blend
- Adds volume/ raises grade
- > 6” → compact before grading
• Deteriorated Asphalt and/or Aggregate Base (Reconstruction)
  • Parking Lots
  • Industrial Storage Lots
  • All Roads
    • City Streets
    • Interstate Highways
    • Secondary Roads
  • Airport Runways
Full depth reclamation when to utilize fdr

- Spec’d or Value Engineered on Asphalt Pavements in Need of Replacement
  - Frequent Deep Cracking
  - Reflective Cracking
  - Heavy Pothole Patching
  - Severe Rutting/ Shoveling
  - Frost Heaves (may require drainage corrections)
  - Insufficient Base Strength
FDR
Full depth reclamation
mechanical stabilization

• Recompacon of pulverized asphalt and/or aggregate surface
• May incorporate the addition of supplemental aggregate
• No stabilizer or binder are incorporated into the blend
Full depth reclamation
chemical stabilization

• Includes the addition of chemical stabilizers such as:
  • Portland Cement
    • Dry or Slurry
  • Quicklime or Hydrated Lime
    • Dry or Slurry
  • Lime Kiln Dust (LKD)
  • Cement Kiln Dust (CKD)
  • Class “C” Fly ash
    • Or blends of the above
FDR
Full depth reclamation
bituminous stabilization

• Includes the addition of bituminous binders
  • Emulsified Asphalt
  • Expanded Foam
FDR
Full depth reclamation
The Process

Pre-pulverization
FDR
Full depth reclamation
The Process

Shape & Compact

Pre-pulverization
FDR
Full depth reclamation
The Process

Transportation

Pre-pulverization
Shape & Compact
FDR
Full depth reclamation
The Process

Spreading

Pre-pulverization
Shape & Compact
Transportation
FDR
Full depth reclamation
The Process

Mixing Powder

- Pre-pulverization
- Shape & Compact
- Transportation
- Spreading
FDR
Full depth reclamation
The Process

Mixing
Emulsion/Foam

Pre-pulverization
Shape & Compact
Transportation

Spreading
Mixing
FDR
Full depth reclamation
The Process

Compacting

Pre-pulverization
Shape & Compact
Transportation

Spreading
Mixing

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FDR
Full depth reclamation
The Process

Grading

Pre-pulverization
Shape & Compact
Compacting
Transportation

Spreading
Mixing

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FDR
Full depth reclamation
The Process

Finish Static Roll

Pre-pulverization
Shape & Compact
Transportation
Spreading
Mixing
Compacting
Grading
Soil Stabilization is the long-term physical and chemical alteration of soils to enhance their physical and engineering properties. Stabilization of in-place soils by incorporating available additives can increase the shear strength of a soil and/or control the shrink-swell properties of a soil, thus improving the load bearing capacity of a subgrade to support pavements and foundations. (ARRA)

Soil Modification, sometimes referred to as “mud drying”. Soil Modification is primarily intended to reduce moisture content and the plasticity in order to expedite construction, whereas stabilization can substantially increase the shear strength of a material such that it can be incorporated into the projects structural design. (ARRA)
Soil stabilization/ modification cross section

Unstable Wet Subgrade

Stabilized Subgrade

Below Subgrade

Subgrade
Soil stabilization/ modification candidates

- **Soil Modification**
  - Up to 20’+
  - Dry wet/ unstable soil that cannot be properly compacted due to high moisture
    * High groundwater
    * Previous rain events
    * Unstable soil
  - Reduce moisture/ strengthen subgrade

- **Soil Stabilization**
  - Spec’d to add strength to the top 8” – 14” of subgrade
  - Spec’d to reduce moisture and stabilize soil characteristics of swelling and/or shrinkage
Soil stabilization/ modification when to utilize soil stab/mod

• Reactive
  • To avoid project delays
  • To reduce costs of undercuts
  • To utilize onsite materials
  • To improve subgrade prior to aggregate placement (pass a proof roll)

• Spec’d
  • To improve structural integrity of the entire pavement section
  • To reduce thickness of aggregate base or asphalt to achieve overall structural strength determined by the engineer
    • 1” stabilized subgrade = 1” compacted aggregate base (.10 - .14 structural coefficient)
Soil stabilization/ modification
typical stabilizers/ binders

- **Lime (%)**
  - Lime Kiln Dust (LKD) (3-6%)
  - Quicklime (1-3%)
- **Flyash (%)**
  - Class C (8-12%)
  - Class F, not on its own
- **Portland Cement (3-6%)**
  - Type I/II
- **Slurry**
  - Mostly urban areas
  - More expensive than powders
  - Less dusty
- **Others**
  - Enzymes, polymers, other stabilizers

### Typical Stabilizers/ Binders

<table>
<thead>
<tr>
<th>Type of Stabilizer</th>
<th>Fine-Grained: More than 35% Passing No. 200</th>
<th>Coarse-Grained: Less than 35% Passing No. 200</th>
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<tbody>
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<td>Plasticity Index (PI)</td>
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<td>Portland Cement</td>
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<tr>
<td>Kiln Dust</td>
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<tr>
<td>Class C Fly Ash</td>
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<tr>
<td>Bituminous*</td>
<td>Not Applicable</td>
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</tbody>
</table>

* Special Applications
Soil stabilization/ modification
the process

Transportation
Soil stabilization/ modification
the process

Spreading
Soil stabilization/ modification
the process

Mixing & Water
Soil stabilization/ modification
the process

Compaction

Transportation

Spreading

Mixing & Water
Soil stabilization/ modification
the process

Grading

Transportation

Spreading

Mixing & Water

Compaction
Soil stabilization/ modification
the process

Finish Static Roll

Transportation

Spreading

Mixing & Water

Compaction

Grading
Mix Design/ Testing
SAVE THE DATE

ARRA IN-PLACE RECYCLING & RECLAIMING SEMINAR WITH LIVE DEMONSTRATION

WHO SHOULD ATTEND:
The Seminar addresses the needs of professionals at all levels from Interstate Highways to Commercial and Residential Developments—Design Engineers, Highway Engineers, Consulting Engineers, other Public Works Officials, Contractors, and Material Suppliers, who want to incorporate responsible recycling into their pavement program.

Seminar Topics

- Slurry/Micro Applications Live Demo
- Cold Planing Live Demo
- Hot In-Place Recycling Live Demo (WI Only)
- Cold In-Place Recycling Live Demo
- Full Depth Reclamation Live Demo
- Soil Stabilization Live Demo
- Alternative Road Designs
- Mix Designs

August 9th (Classroom) & 10th (Live Demonstrations), Ramada Plaza Fargo, ND 7:30 am - 5:00 pm
August 16th (Classroom) & 17th (Live Demonstrations), Lake Geneva, WI 7:30 am - 5:00 pm

FOR MORE INFORMATION VISIT WWW.ARRA.ORG

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