



**NORTH DAKOTA  
ASPHALT CONFERENCE**

**April 5-6, 2016 • Ramada Bismarck Hotel**

**Jonathan Pease, President**  
**5104 Mann Drive, Ringwood, IL 60072**  
**(815)653-2585**  
**[www.RockSolidStabilization.com](http://www.RockSolidStabilization.com)**

**ROCK SOLID™**  
**STABILIZATION & RECLAMATION, INC.**



**ARRA**

**NDSU**

UPPER GREAT PLAINS  
TRANSPORTATION INSTITUTE  
NORTH DAKOTA LOCAL TECHNICAL ASSISTANCE PROGRAM

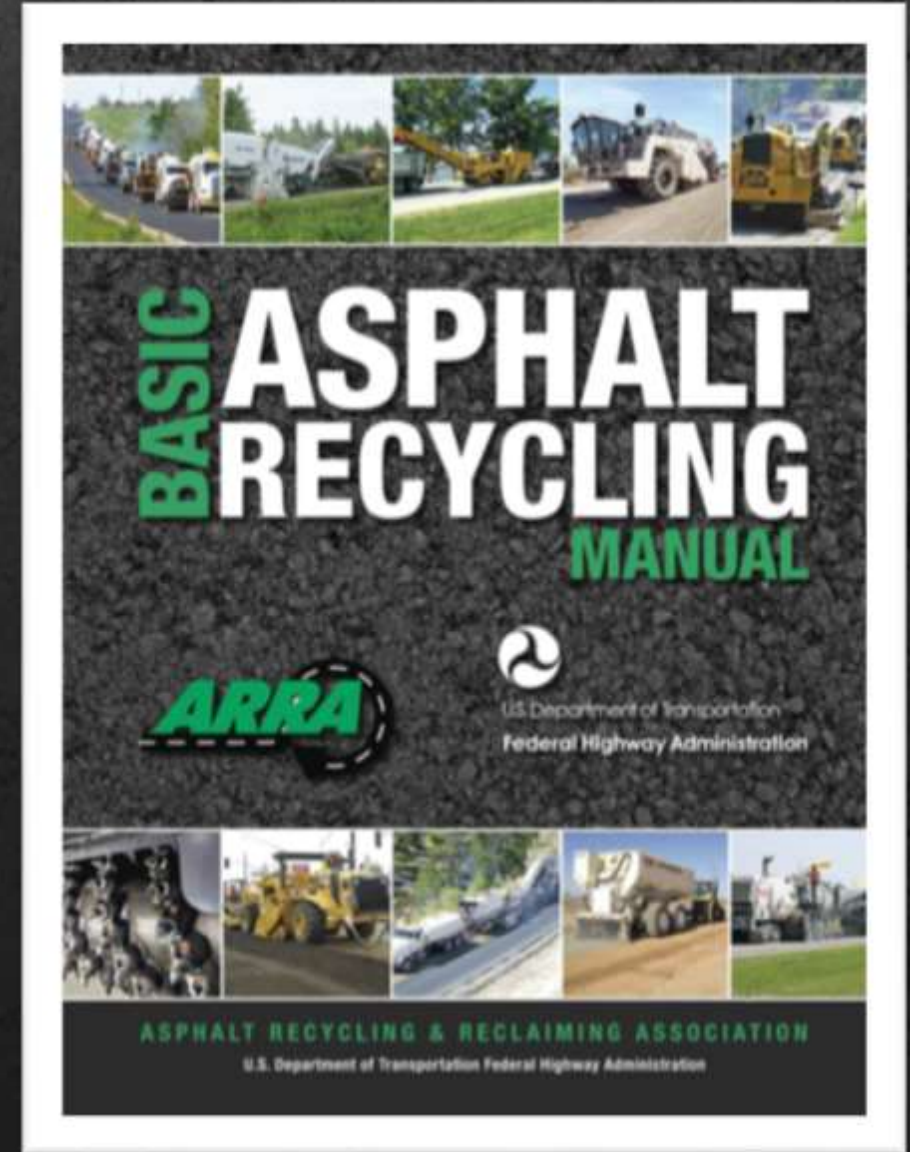


## Who is ARRA?

NDSU

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

NDSU

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)





# Industry Overview recycling processes



Milling



HIR - Hot In-Place Recycling



CIR - Cold In-Place Recycling



FDR - Full Depth Reclamation



Soil Stabilization/ Modification

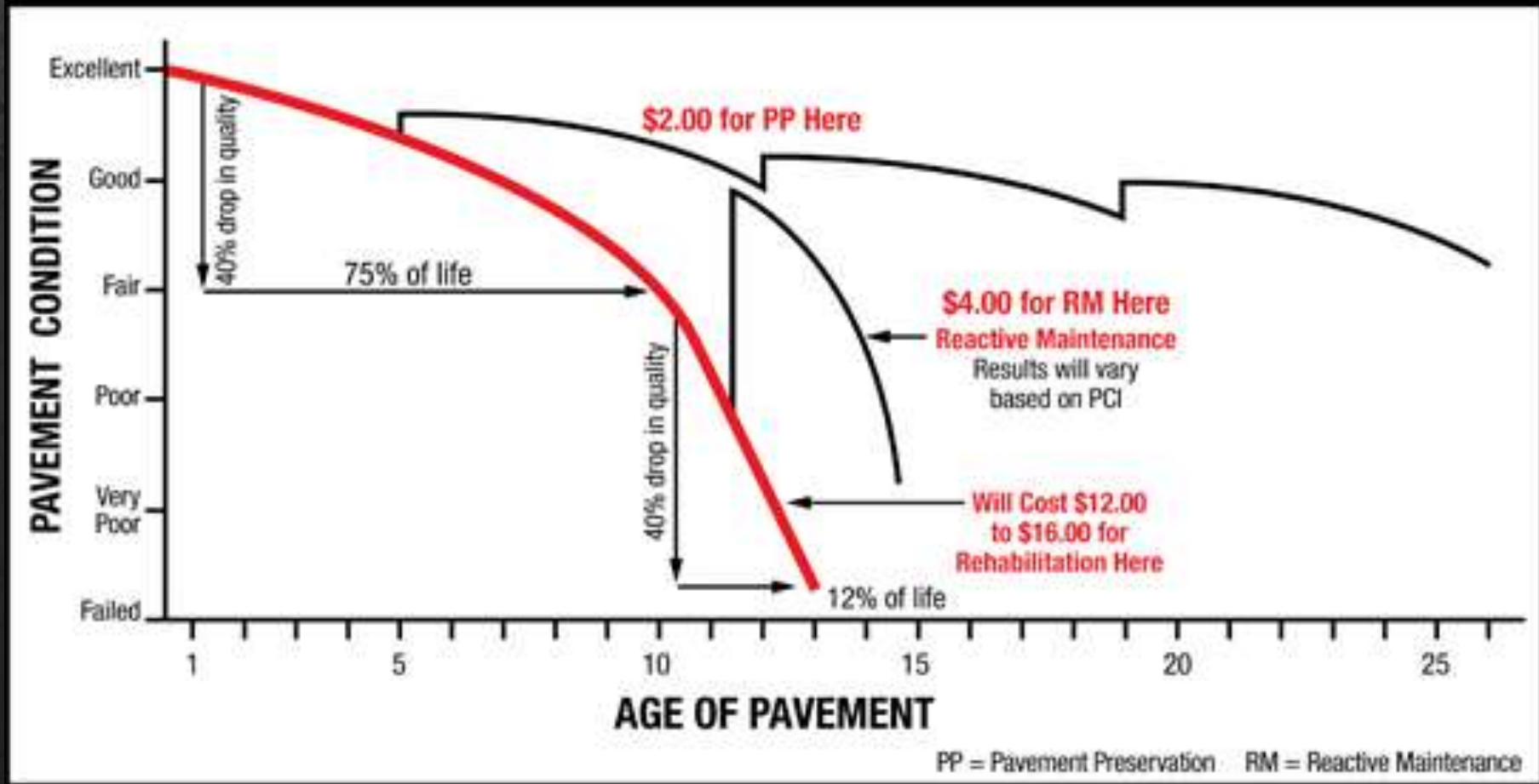


Mix Design/ Testing





# Pavement Condition Index





# Crack Treatments

NDSU

**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

NDSU

**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 1/4 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

NDSU

**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

NDSU

**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 Definition



**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)

# 1<sup>st</sup> Preheat (180 – 200 Degrees)





Preheat



HIR

Hot In-Place Recycling  
the process (surface method)



# 2<sup>nd</sup> Preheat (280-300 Degrees)







HIR

Hot In-Place Recycling  
the process (surface method)

Preheat



2<sup>nd</sup> Preheat



# Rejuvenating Agent





HIR

Hot In-Place Recycling  
the process (surface method)

Preheat



2<sup>nd</sup> Preheat



Rejuvenating  
Agent



# Loosen Pavement





HIR

Hot In-Place Recycling  
the process (surface method)

Preheat



2<sup>nd</sup> Preheat



Rejuvenating Agent



Loosen pavement



# Remix





HIR

Hot In-Place Recycling  
the process (surface method)

Preheat



2<sup>nd</sup> Preheat



Rejuvenating Agent



Loosen pavement



# Re-profile

Remix





HIR

Hot In-Place Recycling  
the process (surface method)

Preheat



2<sup>nd</sup> Preheat



Rejuvenating Agent



Loosen pavement



# Finish Roll



Remix



Re-profile





HIR

Hot In-Place Recycling  
the process (surface method)

Preheat



2nd Preheat



Rejuvenating Agent



Loosen pavement



# Final Surface Course



Remix



Re-profile



Finish Roll





CIR

## cold In-Place Recycling definition

NDSU

**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)



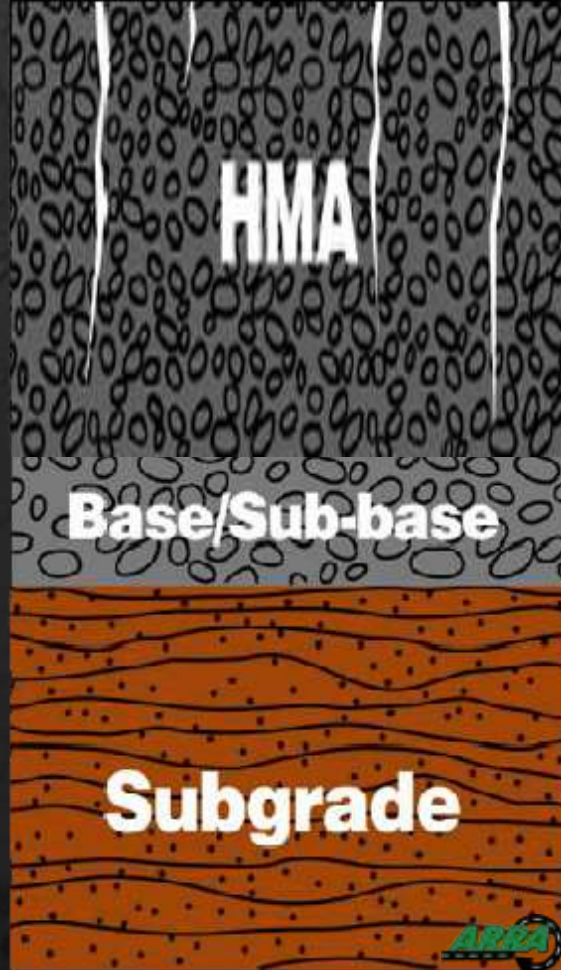


CIR

cold In-Place Recycling  
cross section



Existing



W/ CIR







CIR

cold In-Place Recycling  
candidates

NDSU

- Deteriorating Asphalt (Maintenance)
  - Secondary Roads
  - City Streets
  - Interstate Highways
  - Airport Runways
  - Large parking lots





CIR

cold In-Place Recycling  
how to utilize CIR

NDSU

- 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

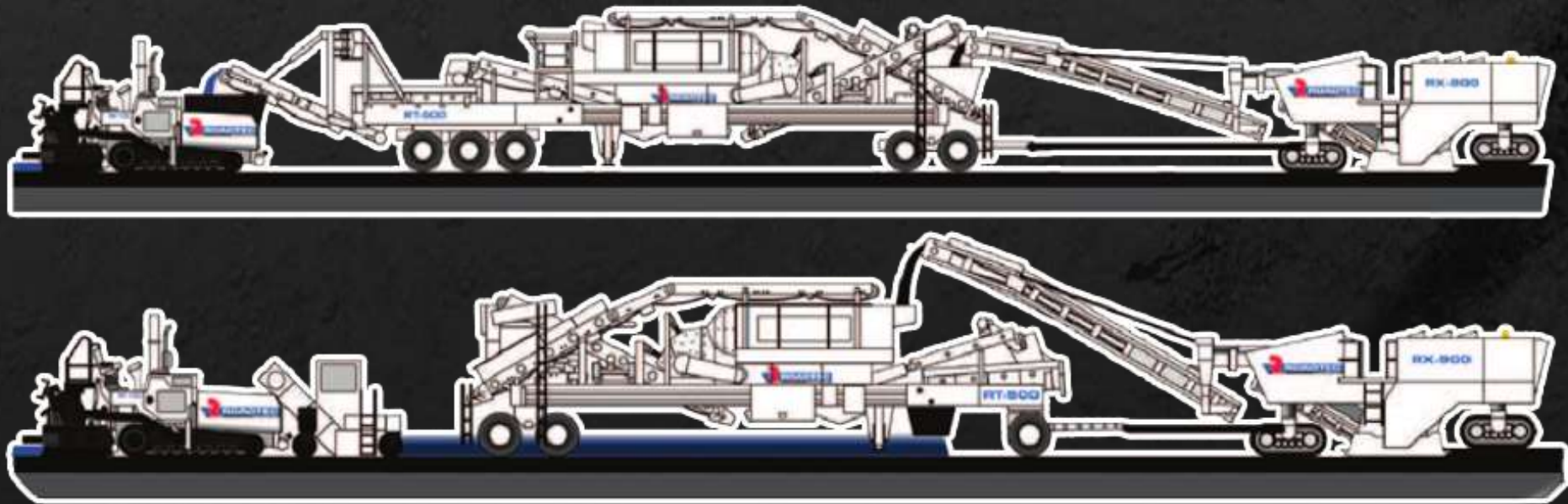
NDSU

- Rural/ long stretches of roads
- Sizing control
- Mix in pugmill not a drum





# cold In-Place Recycling the process (multi-train)





## FDR

# Full depth reclamation definition



**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)



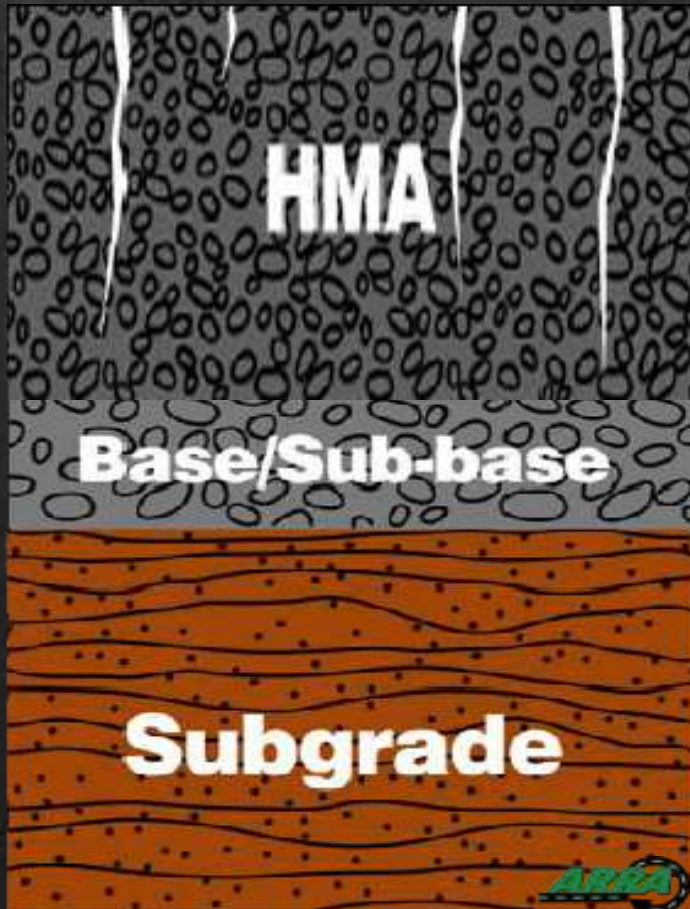


FDR

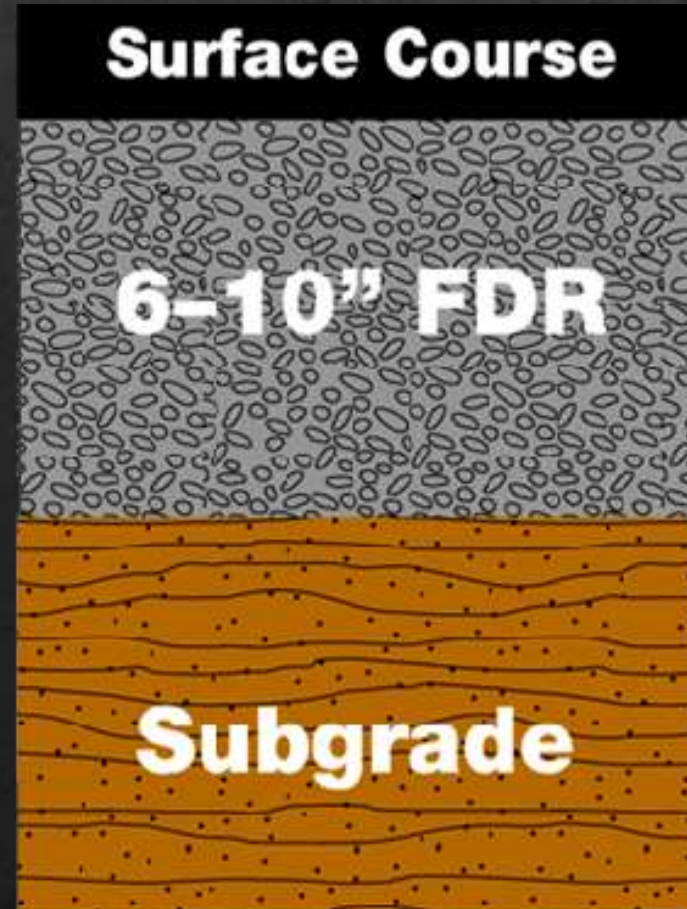
Full depth reclamation  
cross section



Existing



Full Depth Reclamation





# 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





FDR

## Full depth reclamation Candidates

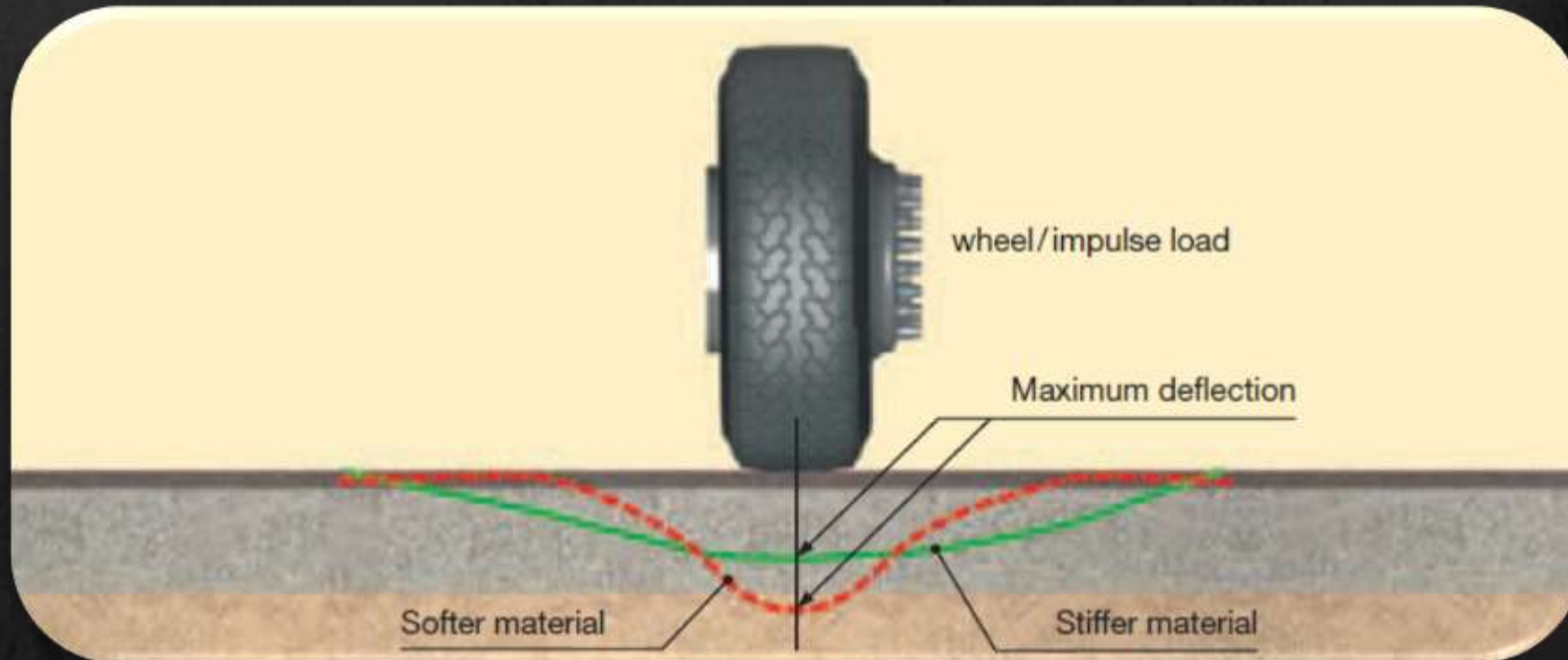


- Deteriorated Asphalt and/or Aggregate Base (Reconstruction)
  - Parking Lots
  - Industrial Storage Lots
  - All Roads
    - City Streets
    - Interstate Highways
    - Secondary Roads
  - Airport Runways



# 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

NDSU

- Recompaction 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

NDSU

- 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

NDSU

- Includes the addition of bituminous binders
  - Emulsified Asphalt
  - Expanded Foam







FDR  
Full depth reclamation  
The Process

NDSU

# Pre-pulverization





FDR

Full depth reclamation  
The Process



Pre-pulverization



# Shape & Compact





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



Spreading



# Mixing Powder

Pre-pulverization



Shape & Compact



Transportation





FDR  
Full depth reclamation  
The Process

Mixing  
Emulsion/Foam

Spreading



Mixing



Pre-pulverization



Shape & Compact



Transportation





# FDR Full depth reclamation The Process



## Compacting

Pre-pulverization



Shape & Compact



Transportation



Spreading



Mixing





# FDR Full depth reclamation The Process



## Grading

Pre-pulverization



Shape & Compact



Transportation



Spreading



Mixing



Compacting







# FDR Full depth reclamation The Process



## Finish Static Roll



Pre-pulverization



Shape & Compact



Transportation



Spreading



Mixing



Compacting



Grading





# Soil stabilization/ modification definition

**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** 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 stabilization/ modification cross section



**Unstable Wet Subgrade**



**Stabilized 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

NDSU

- **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

KEY:	GOOD	Fine-Grained: More than 35% Passing No. 200					Coarse-Grained: Less than 35% Passing No. 200			
	FAIR	Plasticity Index (PI)					Plasticity Index (PI)			
	POOR	0	10	20	30	40 +	0	10	+	
Portland Cement		GOOD	GOOD	GOOD	GOOD	POOR	GOOD	GOOD	GOOD	
Lime		POOR	FAIR	GOOD	GOOD	GOOD	POOR	FAIR	GOOD	
Kiln Dust		FAIR	GOOD	GOOD	GOOD	FAIR	FAIR	GOOD	GOOD	
Class C Fly Ash		GOOD	GOOD	GOOD	FAIR	POOR	GOOD	GOOD	GOOD	
Bituminous* <small>* Special Applications</small>		FAIR	Not Applicable					FAIR	N/A	



Soil stabilization/ modification  
the process



# Transportation





# Soil stabilization/ modification the process



Transportation



## Spreading







# Soil stabilization/ modification the process



Transportation



Spreading



## Mixing & Water





# Soil stabilization/ modification the process



Transportation



Spreading



Mixing & Water



## Compaction





# 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 In-Place Recycling **Live Demo**
- Alternative Road Designs
- Cold Planing **Live Demo**
- Full Depth Reclamation **Live Demo**
- Mix Designs
- Hot In-Place Recycling **Live Demo (WI Only)**
- Soil Stabilization **Live Demo**

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](http://WWW.ARRA.ORG)