
TEAM LAB
"INNOVATIVE SOLUTIONS"
BASE ONE®
BASE STABILIZER
BETTER BASE = BETTER ROADS™

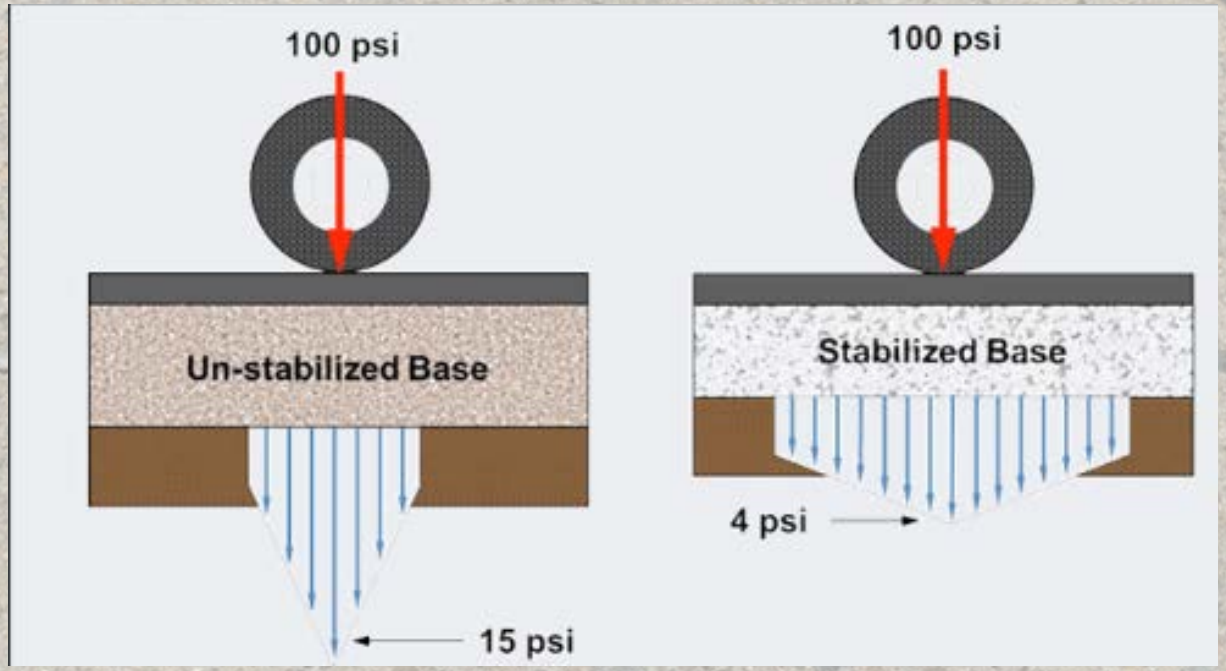
# BASE STABILIZATION

## *Topics Covered:*

1. What is Base Stabilization?
2. Base Material Issues
3. Benefits of Base Stabilization
4. Where to use Base Stabilization
5. What is FDR and SFDR
6. Benefits of SFDR
7. Stabilization Considerations
8. Fundamental Control Factors
9. Project Profiles
10. Construction Procedures

# What is Base Stabilization?

Stabilization is the permanent physical and chemical alteration of soils and aggregates to enhance their engineering properties, thus improving the load bearing capacity of a sub-grade or sub-base to support pavements and foundations (ARRA).



# Base Material Issues

- Limited availability of quality aggregates
- Expensive aggregates costs
- Inadequate structural integrity
- Gravel loss
  - The addition of new aggregate material is the major maintenance operation/cost on unpaved roads.
  - It is estimated that a gravel road losses about 1” material per year.
  - 4 major influences of gravel loss are
    - Weathering
    - Traffic
    - Blading Maintenance
    - Drainage
  - Estimated cost to add 1” new aggregate material= $4,000-$6,000

# Benefits of Base Stabilization

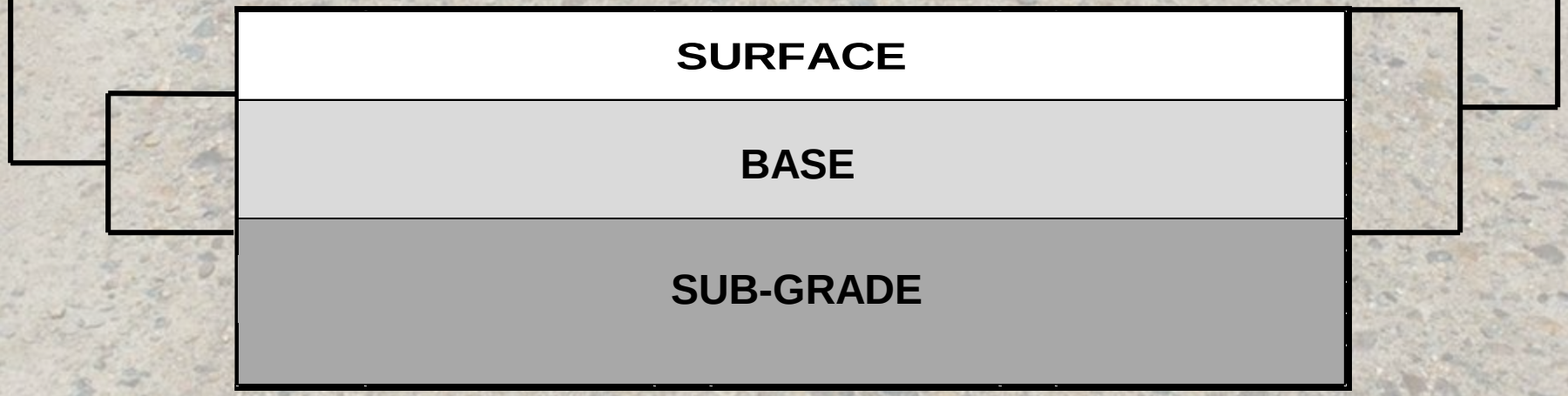
- Can reduce base layer thickness by increasing the structural integrity of the base.
- Can reduce base layer and/or concrete or asphalt surface thickness.
- Enhances existing aggregates.
- Serves as a compaction aid.
- Provides stability to unbound Full Depth Reclamation (FDR) reclaimed asphalt and aggregate materials between final base and paving.
- Provides a good platform for placing pavements
- Enhances the ability to obtain more uniform density in asphalt.
- Helps prevent gravel loss, pot holes, wash-boarding, and helps reduce blading frequency on aggregate surfaced roadways.
- Very user-friendly, application can be performed in various weather conditions.
- Enhances existing base material properties.

# *Where to use Base Stabilization*

Aggregate Surface and Base Material

RAP Approximately 50% Bituminous 50% Aggregate Blend

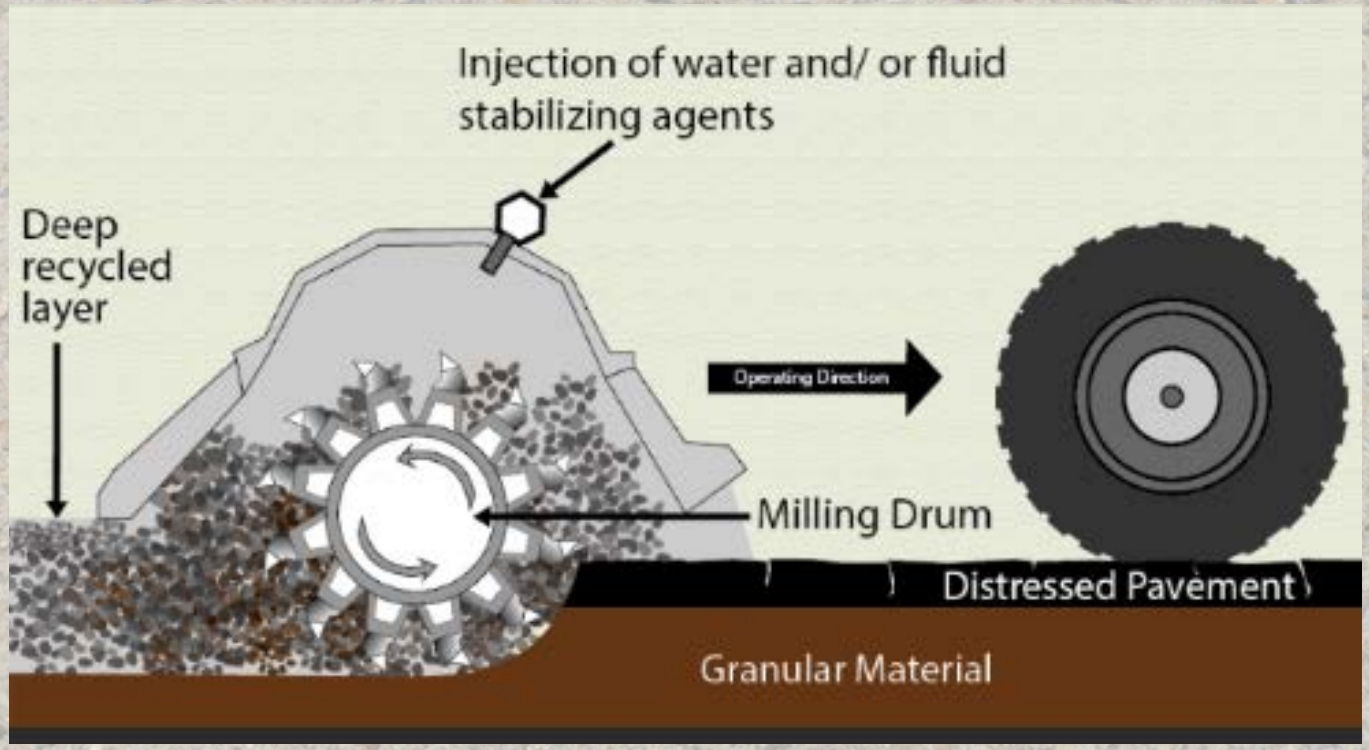
Aggregate Base



# What is FDR & SFDR

*"Full-depth reclamation is a reclamation 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."*

–Asphalt Recycling & Reclaiming Association



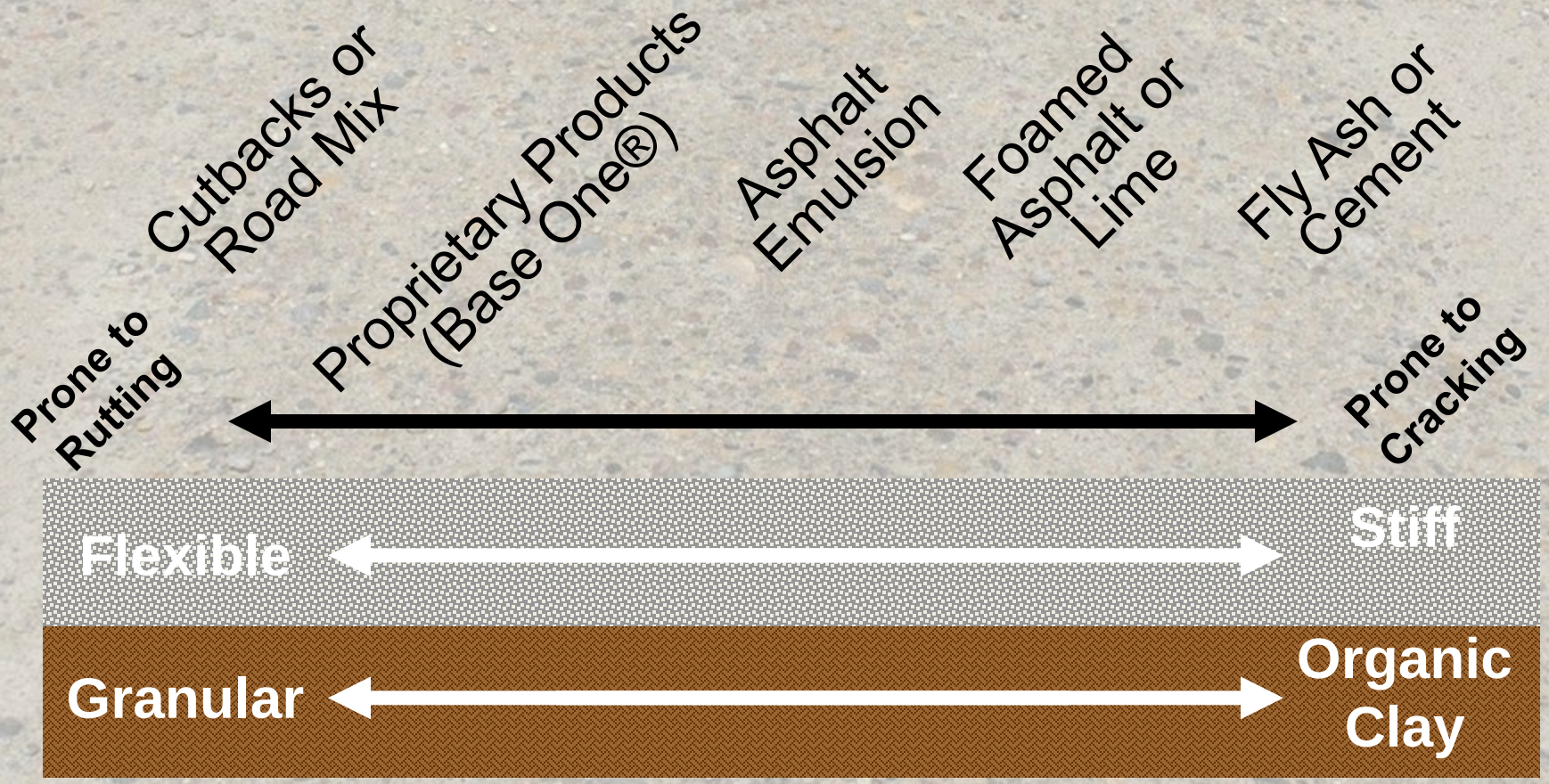

***PPRA Pavement Preservation & Recycling Alliance

# Benefits of SFDR

## Attributes:

- Eliminates all existing surface distresses
- Stabilization turns a deficient pavement structure into a new homogeneous section with increased structural capacity
- Reduces impact on underground utilities and structures
- Conserves non-renewable resources and reduces trucking
- Deteriorated subgrade or base can be reshaped to restore surface profile and drainage
- Cost savings compared to other rehabilitation methods
- Reduces community impacts, traffic disruptions and user inconvenience
- Reduces contractor change orders resulting  from unstable soil/base conditions

# Stabilization Considerations



# *FUNDAMENTAL CONTROL FACTORS*

## *SET YOUR PROJECT UP FOR SUCCESS*

*1.) Proper Aggregate Material (spec on next slide)*

*2.) Proper Stabilizing Agent*

*3.) Proper Mixing of Stabilizing Agent and Aggregate Material*

*4.) Proper Compaction/Optimum Moisture Content*

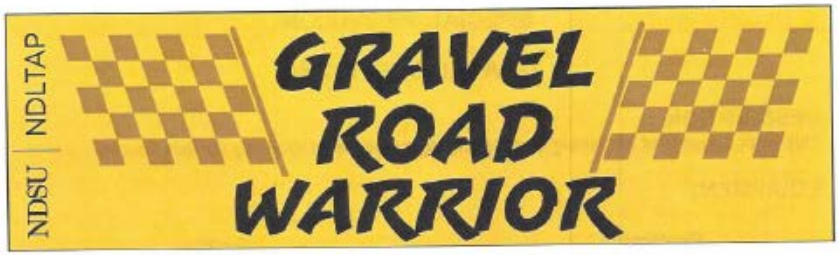
*HIGHER COMPACTION EFFORT RESULTS IN A HIGHER DENSITY AT A LOWER MOISTURE CONTENT*

*5.) Proper Crown- about 4%*

*6.) DRAINAGE-DRAINAGE-DRAINAGE*

## Gravel Surfacing – New Specification

By Dale C. Heglund, NDLTAP




In 2014, NDLTAP launched an effort to improve gravel roads in the state. With approximately 60,000 miles of local county, township and city gravel roadway miles in the state, the need to provide outreach became a core focus item for the NDLTAP team. Blade training was developed to help operators understand the need for a 4% cross slope (i.e., twice the slope of a paved road), the importance of binder in quality gravel, roadway shape, equipment technologies, motor grader maintenance, gravel road failure mechanisms, pretend blading and much more. Special thanks to Bryon Fuchs, Justin Ramsey and Eric Gaasland, NDDOT team members, for their efforts to create the new Gravel Surfacing specification.

### NDDOT Special Provision – Gravel Surfacing SP 714(14)

| Sieve Size Or Testing Method | Aggregate<br>Gravel Surfacing<br>Percent passing or Test Limit |
|---|---|
| 1" | 100 |
| ¾" | 70 – 100 |
| No. 4 | 38 – 75 |
| No. 8 | 22 – 62 |
| No. 30 | 12 – 45 |
| No. 200 | 7 - 15 |
| Plasticity Index (PI) | 3 - 9 |
| ND T 113, Shale (max %) | 12.0% |
| AASHTO T 96, L.A. Abrasion (max %) | 50% |
| NDDOT 4, Fractured Faces[1] | 10% |

Continuous improvement, a way of life for local leaders.

October 1, 2018

Dale C. Heglund

# Project Profiles

# New and Reconstruction

PROJECT PROFILE

# BASE ONE®

## Base Stabilizer

**LOCATION**
Mountrail County, ND

**PROJECT**
BIA #6 Loop

**PROJECT TYPE**
New Construction

**APPLICATION METHOD**
Reclaim/Inject BASE ONE®

**PROJECT DATE**
2015

**PROJECT DETAIL**
BIA #6 original design was 6” of Superpave FAA45 over 18” aggregate base on top of 12” cement treated subgrade (SN=3.96).

A Value Engineering Proposal was accepted with a new design of 6” Superpave FAA45 over 8” stabilized aggregate base with BASE ONE® on top of 12” cement treated base (SN=4.68).

By eliminating 10” of aggregate base, the customer was able to save approximately $2,000,000 on the 11.5 mile project.

American Engineering & Testing, Inc. conducted testing in 2015. Results are as follows:

| Design Parameter | Range | Test Results with BASE ONE® |
|---|---|---|
| AASHTO Structural Layer Coefficient (Granular Base) | 0.11-0.14 | .28 |
| MnDOT Effective Granular Equivalency (Granular Base) | 0.8-1.0 | 1.8 |
| MnPAVE ME Resilient Modulus (Granular Base) | 9,720 - 27,540 | 234,000 |
| Tonnage | Design 10 | 11.2 |



PROJECT PROFILE

# BASE ONE®

## Base Stabilizer

**LOCATION**
Richland County, ND

**PROJECT**
County Road #8

**PROJECT TYPE**
Reconstruction

**APPLICATION METHOD**
Blade Mix

**PROJECT DATE**
2009

**PROJECT DETAIL**
County stabilized top 6” of new 12” aggregate base with BASE ONE®. County added 5” bituminous surface.

County was able to omit 3” of aggregate base material by using a structural layer coefficient number given to BASE ONE® through test results. County was able to save $499,500 on the 9 mile project.

American Engineering & Testing, Inc. conducted testing in 2013. Results are as follows:

| Design Parameter | Range | Test Results with BASE ONE® |
|---|---|---|
| AASHTO Structural Layer Coefficient (Granular Base) | 0.11-0.14 | .22 |
| MnDOT Effective Granular Equivalency (Granular Base) | 0.8-1.0 | 1.6 |
| MnPAVE ME Resilient Modulus (Granular Base) | 9,720 - 27,540 | 123,000 |
| Tonnage | Design 10 | 11.9 |

PROJECT PROFILE

# BASE ONE®

## Base Stabilizer

**LOCATION**
Kandiyohi County, MN

**PROJECT**
CSAH #22

**PROJECT TYPE**
Reconstruction Project – 1 mile

**APPLICATION METHOD**
Blade Mix

**PROJECT DATE**
2016 – Reconstruction
2017 – Bituminous Surface

**PROJECT DETAIL**

Kandiyohi County took over this township road and only added BASE ONE® to the north 1/2 mile. They wanted to do a test section to see if they could see a benefit with the addition of BASE ONE®. The original plan was to add BASE ONE® to the south 1/2 mile. However, when construction started, they felt the north 1/2 mile had inferior material, so it was decided to add the BASE ONE® to the north 1/2 mile section.


November 2016


November 2017

American Engineering & Testing, Inc. conducted testing in 2016 and 2018. Results are as follows:

| | | 2016 | 2016 | Spring 2018 | Spring 2018 |
|---|---|---|---|---|---|
| Design Parameter | Range | Test Results with BASE ONE® | Test Results Without BASE ONE® | Test Results with BASE ONE® | Test Results Without BASE ONE® |
| AASHTO Structural Layer Coefficient (Granular Base) | 0.11-0.14 | 0.24 | 0.15 | 0.23 | 0.1 |
| MnDOT Effective Granular Equivalency (Granular Base) | 0.8-1.0 | 1.7 | 1.1 | 1.6 | 1.1 |
| MnPAVE ME Resilient Modulus (Granular Base) | 9,720 - 27,540 | 160,000 | 35,000 | 67,000 | 22,000 |
| Tonnage | Design 9 | | | 13.3 | 12.7 |

2016 testing was before pavement layer - 2018 testing was after pavement layer

# Project Profiles

# Stabilized Full Depth Reclamation

PROJECT PROFILE

# BASE ONE®

## Base Stabilizer

**LOCATION**
Wilkin County, MN

**PROJECT**
County Road #8

**PROJECT TYPE**
Stabilized Full Depth Reclamation

**APPLICATION METHOD**
Reclaim/Inject BASE ONE®

**PROJECT DETAIL**
Fall 2014 - Reclaimed 8" material.

Summer 2015 - Reclaimed and injected BASE ONE® into the 8".

Summer 2015 - Added 3" Class 5 and stabilized with BASE ONE®.

2015 - Added 5.5" bituminous.
**By stabilizing 8" SFDR and the 3" additional Class 5 with BASE ONE® the county was able to reduce the pavement thickness 1.5", a savings of $580,000 on the 10 mile project.

**PROJECT DATE**
2015

American Engineering & Testing, Inc. conducted testing in Spring 2015 (without BASE ONE®) and Spring 2016 (with BASE ONE®). Results are as follows:

| | | Spring 2016 | Spring 2015 |
|---|---|---|---|
| Design Parameter | Range | Test Results with BASE ONE® | Test Results/no BASE ONE® |
| AASHTO Structural Layer Coefficient (Granular Base) | 0.11-0.14 | .24 | .13 |
| MnDOT Effective Granular Equivalency (Granular Base) | 0.8-1.0 | 1.7 | 1.0 |
| MnPAVE ME Resilient Modulus (Granular Base) | 9,720 - 27,540 | 110,000 | 14,600 |
| Tonnage | Design 10 | 15.7 | 5.6 |


PROJECT PROFILE

# BASE ONE®

## Base Stabilizer

**LOCATION**
Mahnomen County, MN

**PROJECT**
CSAH #4

**PROJECT TYPE**
Stabilized Full Depth Reclamation

**APPLICATION METHOD**
Reclaim/Inject BASE ONE®

**PROJECT DATE**
2015

**PROJECT DETAIL**
County reclaimed/injected BASE ONE® in 7” of reclaimed material. Added 4” bituminous surface.

American Engineering & Testing, Inc. conducted testing in 2016. Results are as follows:

| AASHTO | Design Standards | Test Results with BASE ONE® |
|---|---|---|
| Structural Layer Coefficient (Granular Base) | 0.06-0.14 | 0.22 |
| Effective Granular Equivalency (Granular Base) | 0.8-1.0 | 1.6 |
| Resilient Modulus (Granular Base) | 15,000-30,000 | 127,000 |
| Tonnage | 9 | 13.3 |

# BASE ONE®

## Base Stabilizer

**LOCATION**
Pope County, MN

**PROJECT**
CSAH #28 - Lowry

**PROJECT DETAIL**
County reclaimed 8” material – 4” old bituminous and 4” aggregate base.
Stabilized top 4” with BASE ONE®.
Added 3.5” bituminous surface.

**PROJECT TYPE**
Stabilized Full Depth Reclamation

**APPLICATION METHOD**
Blade Mix

**PROJECT DATE**
2008

American Engineering & Testing, Inc. conducted testing in Fall 2011 and Spring 2015. Test results are as follows:

| | | Fall 2011 | Spring 2015 |
|---|---|---|---|
| Design Parameter | Range | Test Results with BASE ONE® | Test Results with BASE ONE® |
| AASHTO Structural Layer Coefficient (Granular Base) | 0.11-0.14 | 0.24 | 0.21 |
| MnDOT Effective Granular Equivalency (Granular Base) | 0.8-1.0 | 1.7” | 1.5” |
| MnPAVE ME Resilient Modulus (Granular Base) | 9,720 - 27,540 | 147,000 | 102,000 |
| Tonnage | Design 9 | 16.8 | 14.6 |

PROJECT PROFILE

# BASE ONE®

## Base Stabilizer

**LOCATION**
Lake of the Woods County, MN

**PROJECT**
CSAH # 8

**PROJECT TYPE**
Stabilized Full Depth Reclamation

**APPLICATION METHOD**
Blade Reclaim/Inject

**PROJECT DATE**
2017

**PROJECT DETAIL**
- County reclaimed 4” of old bituminous and 4” of underlying aggregate base.
- Stabilized the top 4” with BASE ONE®.
- Added 4” of new bituminous surface.
- BASE ONE® was NOT added to the last ½ mile of the project.

American Engineering & Testing, Inc. conducted testing in Spring 2018. Test results are as follows:

| Design Parameter | Range | Test Results with BASE ONE® | Test Results/no BASE ONE® (1/2 mile) |
|---|---|---|---|
| AASHTO Structural Layer Coefficient (Granular Base) | 0.11-0.14 | .20 | .14 |
| MnDOT Effective Granular Equivalency (Granular Base) | 0.8-1.0 | 1.5 | 1.0 |
| MnPAVE ME Resilient Modulus (Granular Base) | 9,720 - 27,540 | 84,000 | 27,400 |
| Tonnage | Design 10 | 14.9 | 12.6 |

# Project Profiles

# Thin Surface Overlay Treatments

PROJECT PROFILE

# BASE ONE®

## Base Stabilizer

**LOCATION**
Pettis County, MO

**PROJECT**
Hughesville Rd.

**PROJECT TYPE**
Stabilized Full Depth Reclamation

**APPLICATION METHOD**
Reclaim/Inject BASE ONE®

**PROJECT DATE**
2016

**PROJECT DETAIL**

Reclaimed existing chip seal and base 8”.
Reclaimed/injected BASE ONE® 3” in depth.
Added a 1” chip seal surface.

American Engineering & Testing, Inc. conducted testing in 2017. Results are as follows:

| Design Parameter | Range | Test Results with BASE ONE® |
|---|---|---|
| AASHTO Structural Layer Coefficient (Granular Base) | 0.11-0.14 | .20 |
| MnDOT Effective Granular Equivalency (Granular Base) | 0.8-1.0 | 1.5 |
| MnPAVE ME Resilient Modulus (Granular Base) | 9,720 - 27,540 | 99,000 |
| Tonnage | Design 7 ton | 8.7 |

PROJECT PROFILE

# BASE ONE®

## Base Stabilizer

**LOCATION**
Township

**PROJECT**
Deroxe Road

**PROJECT TYPE**
Base Stabilization / Otta Seal & Chip Seal

**APPLICATION**
Blade Mix/Spray Truck

**PROJECT DATE**
2010

**PROJECT DETAILS**

Added 4” of new base material
Stabilized top 4” with BASE ONE®
Applied an Otta Seal surface treatment
Added a chip seal the following year

Bid to add base material and place a bituminous surface on this section was $299,000.
The stabilized base and Otta Seal/Chip Seal cost $115,000, saving the township $184,000.

| Design Parameter | Range | Test Results with BASE ONE® |
|---|---|---|
| AASHTO Structural Layer Coefficient (Granular Base) | 0.11-0.14 | .20 |
| MnDOT Effective Granular Equivalency (Granular Base) | 0.8-1.0 | 1.5 |
| MnPAVE ME Resilient Modulus (Granular Base) | 9,720 - 27,540 | 99,000 |
| Tonnage | Design 7 ton | 8.7 |

PROJECT PROFILE

# BASE ONE®

## Base Stabilizer

**LOCATION**
Beltrami County, MN

**PROJECT**
CSAH 34

**PROJECT TYPE**
Stabilized Full Depth Reclamation – 6 miles

**APPLICATION**
Reclaim and Inject BASE ONE®

**PROJECT DATE**
2014

**PROJECT DETAILS**

2014
- County reclaimed existing 4” of old bituminous and 4” underlying base
- Added 2” new aggregate base material
- Reclaimed/injected BASE ONE® into top 4” of the 10” blended material
- Added double chip seal

2015
- Added one more chip seal

| Design Parameter | Range | Test Results with BASE ONE® |
|---|---|---|
| AASHTO Structural Layer Coefficient (Granular Base) | 0.11-0.14 | .21 |
| MnDOT Effective Granular Equivalency (Granular Base) | 0.8-1.0 | 1.6 |
| MnPAVE ME Resilient Modulus (Granular Base) | 9,720 - 27,540 | 102,000 |
| Tonnage | Design 7 | 10.3 |

# Project Profiles

# Gravel Surface Stabilization

PROJECT PROFILE

# BASE ONE®

## Base Stabilizer

**LOCATION**
Polk County, MN

**PROJECT**

**PROJECT TYPE**
Gravel Surface Stabilization

**APPLICATION METHOD**
Blade Mix

**PROJECT DATE**

**PROJECT DETAIL**

Polk County Engineer Rich Sanders started a 5 year gravel stabilization program several years ago.

County requested bids to have 15 - 20 miles of gravel road per year stabilized with BASE ONE®.

Each project mile selected gets 4” of new Class 5 Modified aggregate base material that is stabilized with BASE ONE®.

Goal: To reduce the regraveling cycles and annual blading maintenance.

*Successful Results:*

- Polk County was able to skip a regraveling cycle in 2018 on the projects stabilized with BASE ONE®, saving the county over $150,000 in 2018.
- Blading was reduced to one time per month vs one time per week, saving the county wear and tear on equipment.
- Gravel roads that were impassable, muddy, and sloppy in the spring are now nice stabilized gravel roads.

PROJECT PROFILE

# BASE ONE®

## Base Stabilizer

**LOCATION**
Cass County, ND

**PROJECT**
Cass County #3

**PROJECT TYPE**
11.4 Mile Gravel Road Stabilization

**APPLICATION METHOD**
Reclaim/Inject BASE ONE®

**PROJECT DATE**
2016

**PROJECT DETAIL**
The county first installed drain tile a couple of years ago to address the subgrade moisture issues. This increased performance somewhat, but they still had structural issues. The county mixed in 5.5% of Portland cement into 12" of the subgrade just above the drain tile to address the subgrade issues. To increase performance of the driving surface, the county reclaimed/injected BASE ONE® in 4.5" of ND Modified Class 13 aggregate surface material. A light coat of chloride was added to the surface to minimize dust.

American Engineering & Testing, Inc. conducted testing in June 2017. Test results are as follows:

| AASHTO | Design Standards | Test Results with BASE ONE® | Test Results with Soil Cement |
|---|---|---|---|
| Structural Layer Coefficient (Granular Base) with BASE ONE® | 0.06-0.14 | 0.22 | |
| Resilient Modulus (Granular Base) with BASE ONE® | 15,000-30,000 | 114,000 | |
| Structural Layer Coefficient (Soil Cement Subgrade) | 0.12-0.18 | | 0.17 |
| Resilient Modulus (Soil Cement Subgrade) | 15,000 | | 51,000 |
| Tonnage | | 11.8 | 11.8 |

# BASE ONE®

## Base Stabilizer

**LOCATION**
Wilkin County, MN

**PROJECT**
County Road #17

**PROJECT TYPE**
Gravel Based Stabilization

**APPLICATION METHOD**
Blade Mix

**PROJECT DATE**
2017 – County tiled County Rd.17
2018 – County brought in 2” of new Class 5 material and 2” of millings.

**PROJECT DETAIL**
Wilkin County does several miles of tiling per year. The following year they stabilized the material with BASE ONE®.
The county blade mixed the 2” of Class 5 and 2” recycled millings together and then stabilized the 4” of mixed material with BASE ONE®. With the new BASE ONE® stabilized mixed material Wilkin County was able to save on material loss and also reduce the amount of annual blading.

# BASE ONE®

# *CONSTRUCTION*

# *PROCEDURE*

# BASE ONE®

## *PRE-CONSTRUCTION PROCEDURE*

1. Material gradation should be performed prior to any stabilization work to verify the rock and binder content meet requirements.

   A. Approximately 6-15% passing the #200 sieve. Perform Hydrometer on aggregate to determine amount of clay or plastic fines

   B. Of the material passing the #200 sieve, we prefer 3% be clay or plastic material

   C. Gradation can be reviewed on a case by case basis

2. Determine the appropriate amount of BASE ONE® for your project.

# BASE ONE®

## *CONSTRUCTION PROCEDURE*

---

## *APPLICATION TECHNIQUES USED TO APPLY BASE ONE®*

# Reclaim and Inject Base Material

- Reclaim and inject stabilizer to designed depth in one pass (Example:  reclaimed and stabilized 12” material)
- Compact to density specs
- Shape to grade
- Finalize compaction

.

# Reclaim and Inject – 2 Pass Method

- Reclaim to designed depth on first pass
- Reclaim and inject on second pass to designed stabilized depth (Example: stabilized 6” of 12” total material)
- Compact to density specs
- Shape to grade
- Finalize compaction

.

# ZIPPER APPLICATION

- Used for smaller projects and patch work
- Can be injected or surface applied

# Blade Mix Application

The blade mix method may be used after reclamation, or it may also be used when adding base material during a new construction, reconstruction, or regraveling project.

1. Spray It

2. Spread It

3. Mix It

4. Compact It

# COMPACTION

*General Pad Foot Width Recommendations for Reclaimed Material:*

- Nothing less than 66” on any project

- Minimum 66” pad foot roller for 4” to 6” depth reclamation projects

- 84” pad foot roller for 6” to 12” depth reclamation projects

# COMPACTION

Steel Drum Roller

Vibrating and Static Mode

Pneumatic Roller

# Things to Consider When Writing Bid Specifications

- ✓ It is important to make specifications clear and precise for all parties involved in the project.
- ✓ Require contractors to have experienced personnel onsite and to also have offsite support.
- ✓ Require product suppliers to have knowledge of their product and experience in its uses, have support staff, and examples of completed projects.

# Things to Consider When Writing Bid Specifications

- ✓ Require outside engineering firms and others involved in the implementation of the project to have working knowledge of everything involved.
- ✓ The more resources you have in place, the greater the chance you will obtain a successful project in a timely manner.

# The Fundamental Control Factors for Base Stabilization are:

- ✓ Proper chemical content/dosage
- ✓ Adequate moisture content
- ✓ Thorough mixing
- ✓ Adequate compaction
- ✓ Proper curing
- ✓ Proper granular material

# BASE ONE® is:

- ✓*Patented!*
- ✓*Safe!*
- ✓*Economical!*
- ✓*Easy to use!*

**BASE ONE®**

*BUILD A BETTER ROAD FROM THE BOTTOM UP!*

TEAM LAB

"INNOVATIVE SOLUTIONS"

**To order**

**BASE ONE®**

**Base Stabilizer**

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**Web: www.baseone.net**

**Email: sales@teamlab.net**