NDLTAP (North Dakota Local Technical Assistance Program)

Gravel Preservation

Wednesday, January 26, 2022
North Dakota Local Roads Conference
Dickinson, ND

North Dakota Association of County Engineers

Dale C. Heglund, PE/PLS, North Dakota LTAP Director
701-318-6893 – dale.heglund@ndsu.edu

NDSU | UPPER GREAT PLAINS TRANSPORTATION INSTITUTE
NORTH DAKOTA LOCAL TECHNICAL ASSISTANCE PROGRAM

NDIRF NORTH DAKOTA INSURANCE RESERVE FUND

For North Dakota. For Local Government. For You.

www.ndirf.com

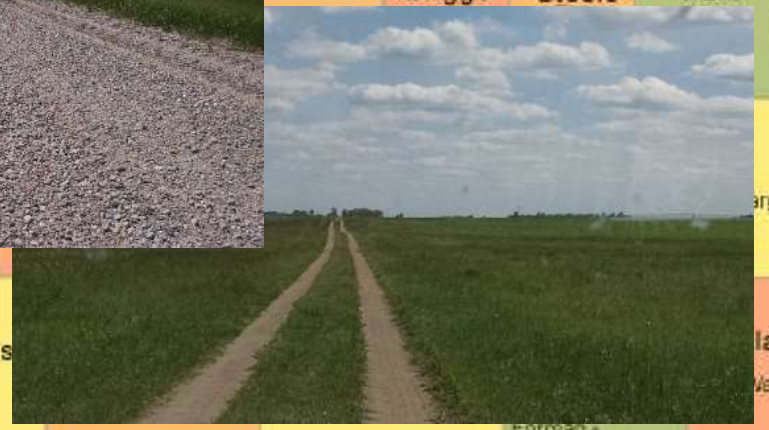
53 counties

1,360 organized townships

357 communities

WESTERN DAKOTA ENERGY ASSOCIATION

U.S. Department of Transportation Federal Highway Administration



THE ASSOCIATED GENERAL CONTRACTORS North Dakota

NDSU UPPER GREAT PLAINS TRANSPORTATION INSTITUTE

NORTH Dakota | Transportation

Be Legendary.™


WANTED
Good
Gravel

North Dakota Road Conference

Pre-Conference Workshop – Gravel Preservation

(sponsored by NDLTAP)

Gravel Surfacing Workshop: Specifications, Production and Roadway Performance

Presenters/Topics – 1:00 to 4:30 PM MT

Dale Heglund, ND LTAP - **Gravel preservation concept**

Steve Monlux, Gravel Guru - **Gravel basics** (virtual)

Greg Vavra, SD LTAP – **South Dakota gravel study, gravel specifying and testing process**

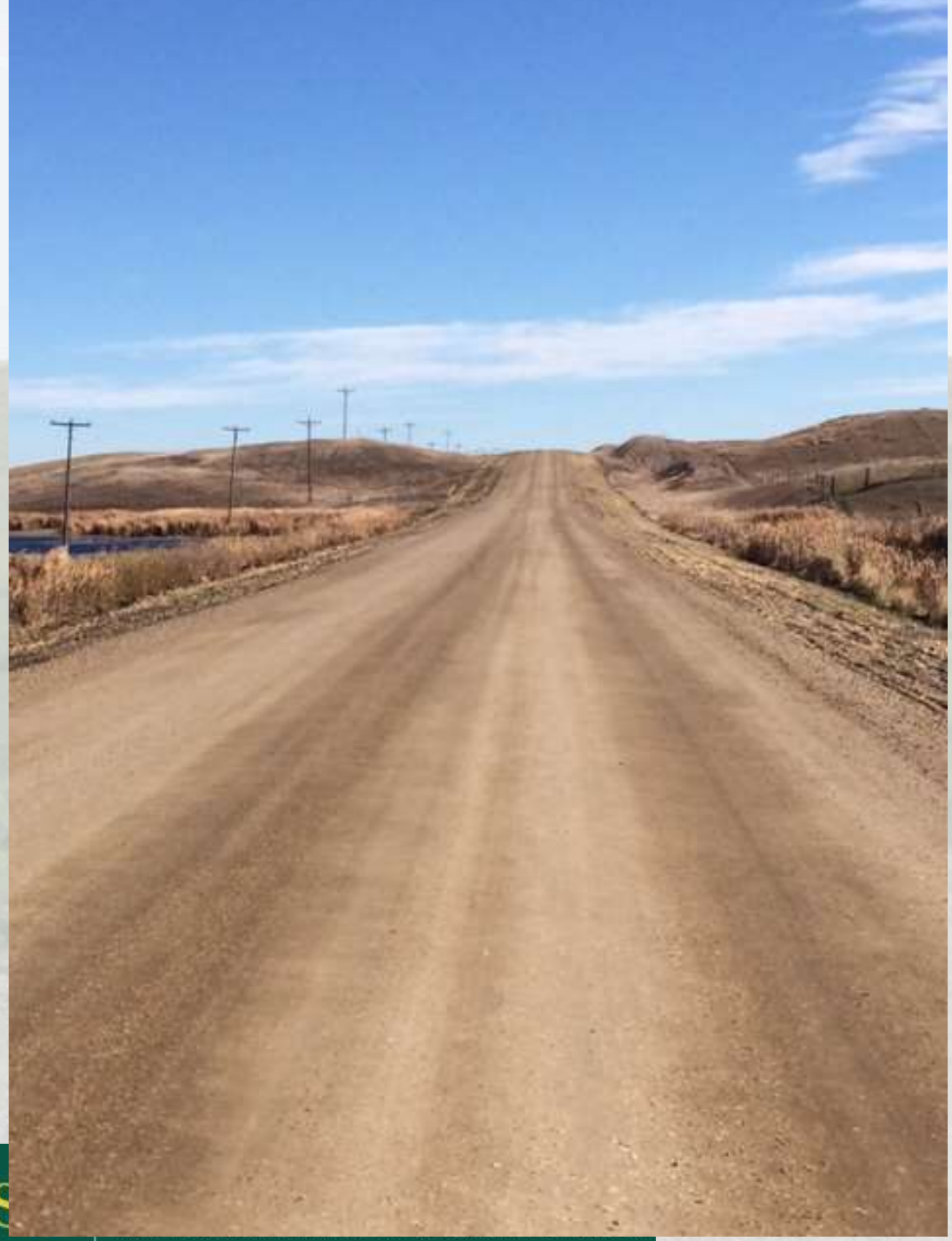
Mike Njos, Highlands Engineering – **Sampling and testing tips, test timelines, and PI test review**

Bryon Fuchs, NDDOT - **SSP 6 Gravel Surfacing Special Provision, plan notes, specification tips**

Rob Rebel, Knife River, Gravel Production Expert - **Options to improve gravel surfacing quality, Together we Can!**

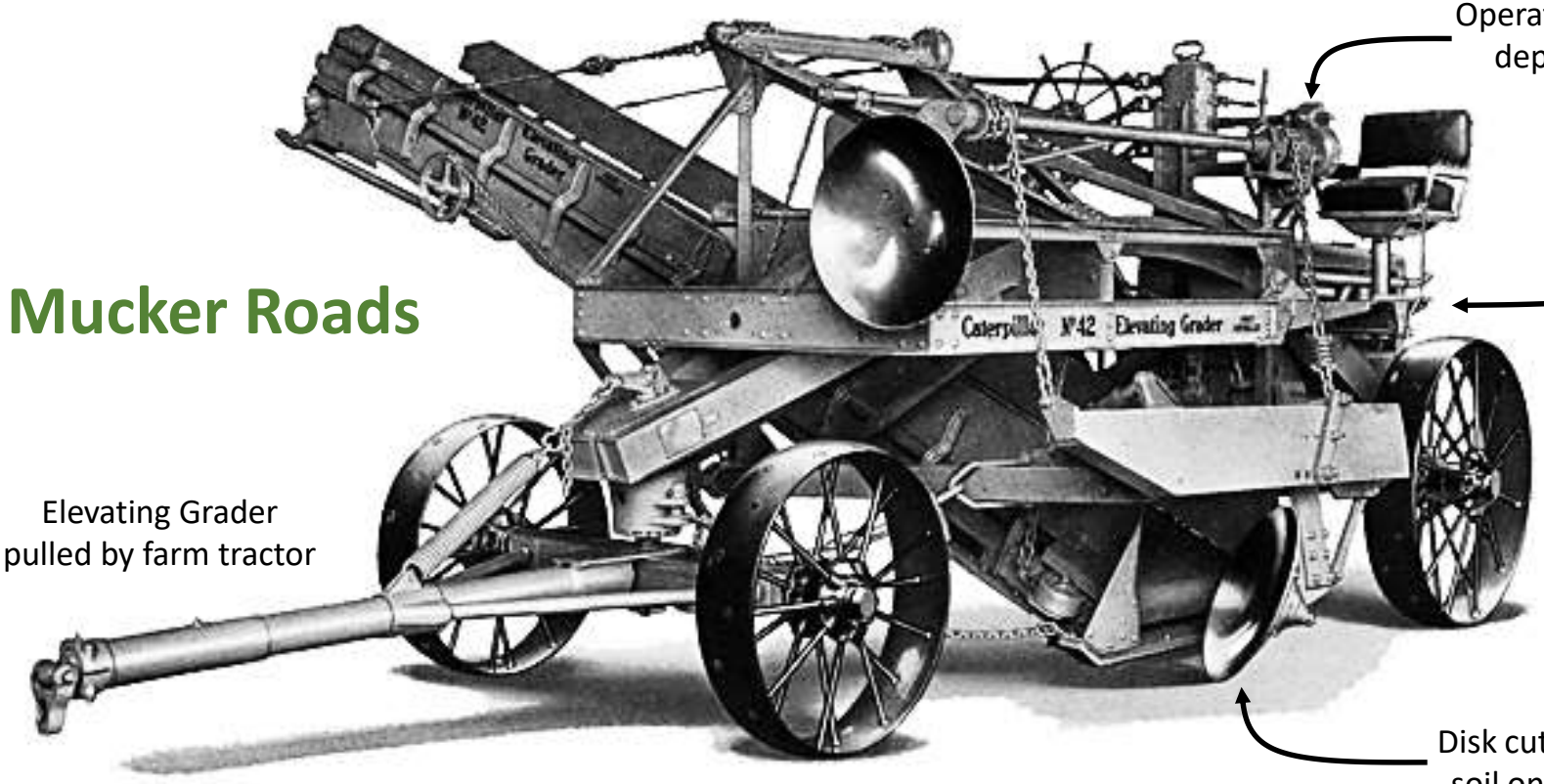
John Sauber, Sauber Engineering – **How pit exploration and plan notes/info provide better bids and better gravel**

NDSU | UPPER GREAT PLAINS TRANSPORTATION INSTITUTE
NORTH DAKOTA LOCAL TECHNICAL ASSISTANCE PROGRAM



The Machine Used for Building “Elevator Roads”

Mucker Roads



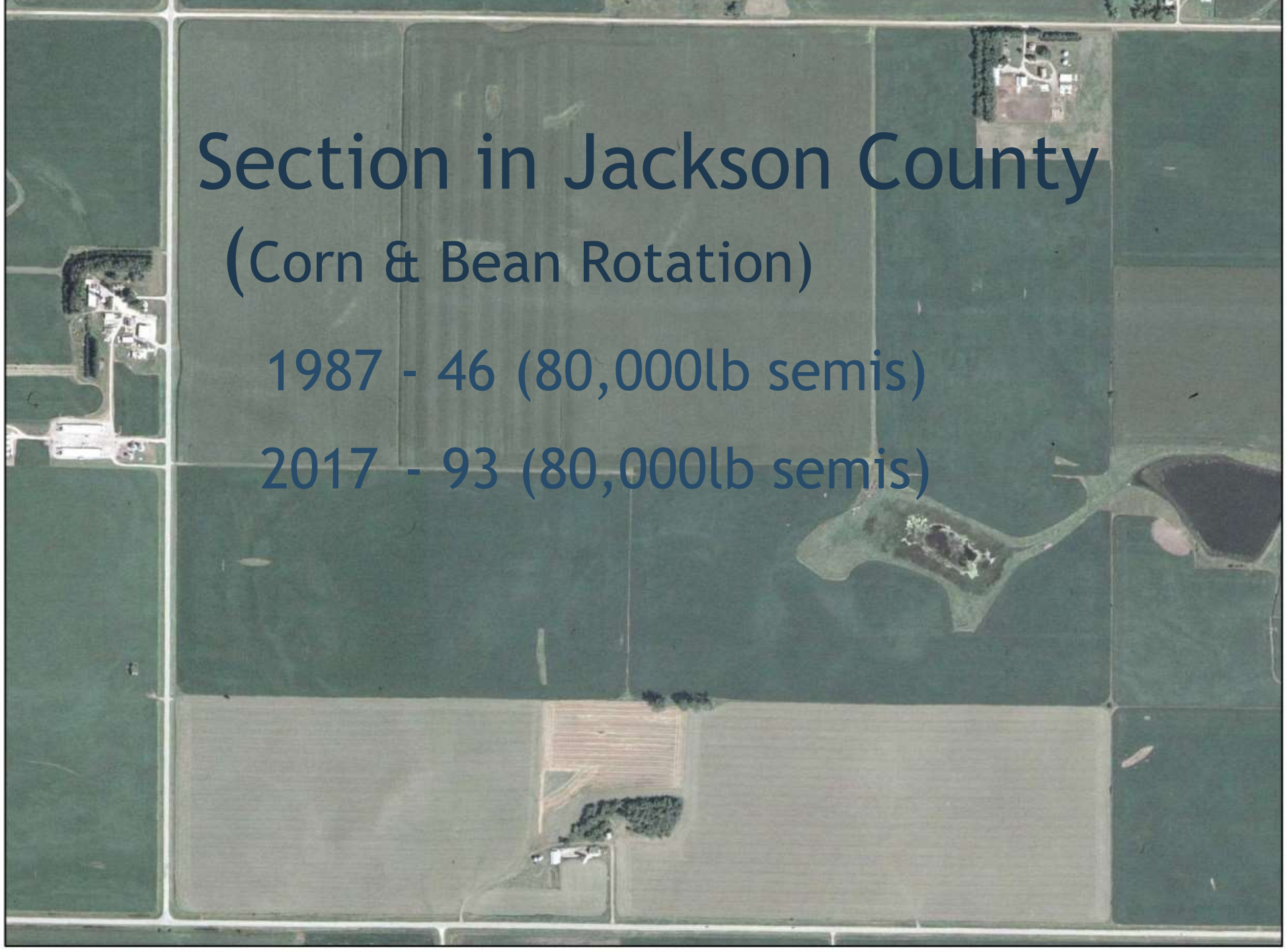
Operator controls depth of cut

Engine powers conveyor belt

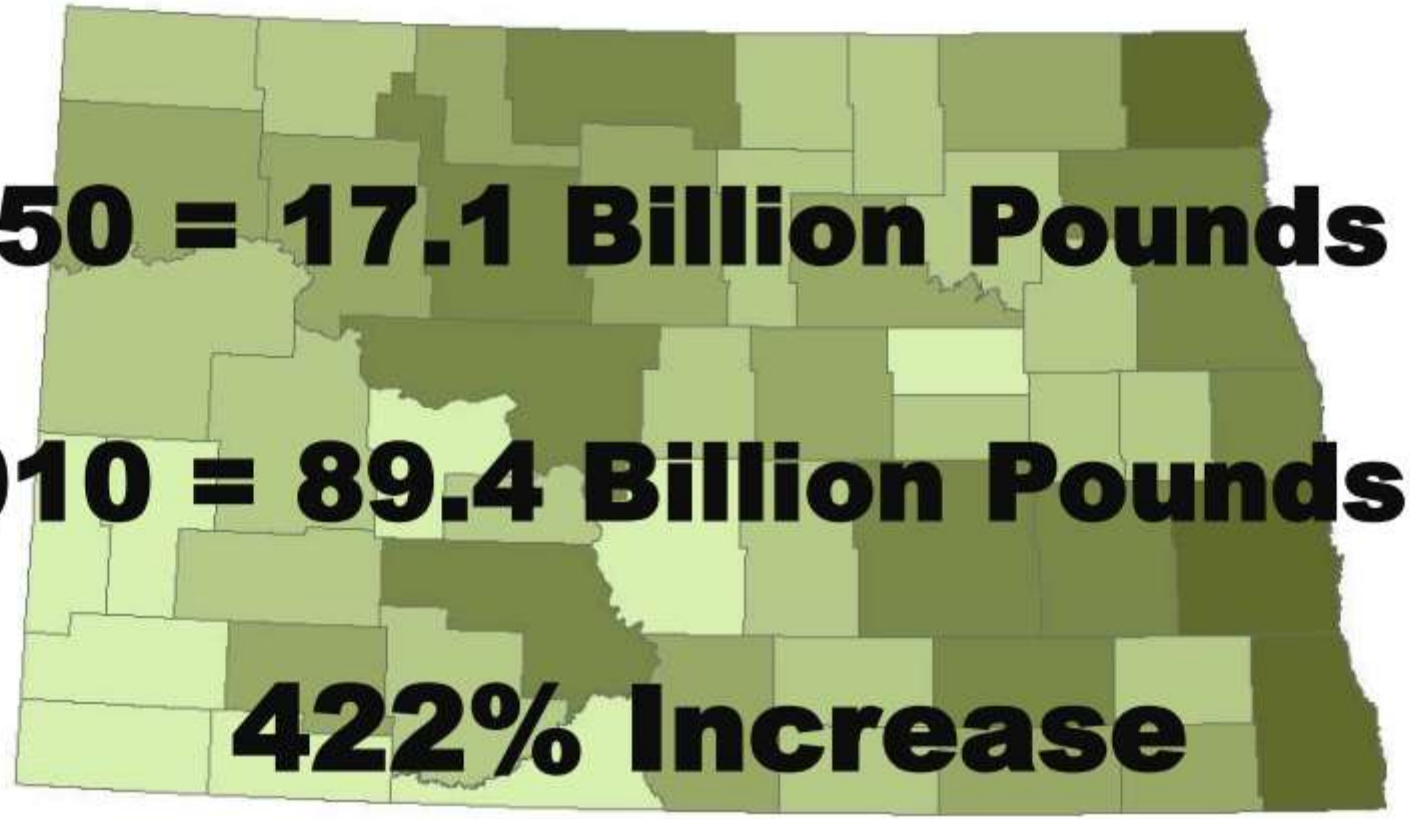
Elevating Grader pulled by farm tractor

Disk cuts and moves soil onto conveyor

No 42 elevating grader


Section in Jackson County
(Corn & Bean Rotation)
1987 - 46 (80,000lb semis)
2017 - 93 (80,000lb semis)

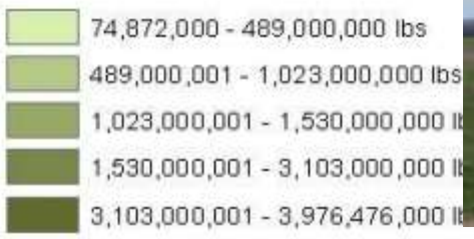
Agricultural Growth 1950-2010



1950 = 17.1 Billion Pounds

2010 = 89.4 Billion Pounds

422% Increase



NDSU

NDDOT
North Dakota Department of Transportation

Table 4.2. Suggested gravel layer thicknesses for new or reconstructed rural roads.

Estimated daily no. of heavy trucks	Subgrade support condition[1]	Suggested minimum gravel layer thickness, mm (in)
0 to 5	Low	165 (6.5)
	Medium	140 (5.5)
	High	115 (4.5)
5 to 10	Low	215 (8.5)
	Medium	180 (7.0)
	High	140 (5.5)
10 to 25	Low	290 (11.5)
	Medium	230 (9.0)
	High	180 (7.0)
25 to 50	Low	370 (14.5)
	Medium	290 (11.5)
	High	215 (8.5)

Notes. [1] Low subgrade support: average CBR ≤ 3 percent; medium subgrade support: 3 percent < average CBR ≤ 10 percent; high subgrade support: average CBR > 10 percent. [2] CBR = California Bearing Ratio of the in-place subgrade soils. Methods of estimating CBR are discussed in section 7 of this document.

CUBIC YARDS PER MILE

Width of the roadway in feet

Compacted depth of material in	12	14	16	18	20	22	24	26	28	30
1	244.44	285.19	325.93	366.67	407.41	448.15	48[illegible]89	529.63	570.37	611.11
1.5	366.67	427.78	488.89	550	611.11	672.22	73[illegible]33	794.44	855.56	916.67
2	488.89	570.37	651.85	733.33	814.81	896.3	97[illegible]78	1059.3	1140.7	1222.2
2.5	611.11	712.96	814.81	916.67	1018.5	1120.4	12[illegible].2	1324.1	1425.9	1527.8
3	733.33	855.56	977.78	1100	1222.2	1344.4	14[illegible].7	1588.9	1711.1	1833.3
3.5	855.56	998.15	1140.7	1283.3	1425.9	1568.5	17[illegible].1	1853.7	1996.3	2138.9
4	977.78	1140.7	1303.7	1466.7	1629.6	1792.6	19[illegible].6	2118.5	2281.5	2444.4
4.5	1100	1283.3	1466.7	1650	1833.3	2016.7	[illegible]00	2383.3	2566.7	2750
5	1222.2	1425.9	1629.6	1833.3	2037	2240.7	24[illegible].4	2648.1	2851.9	3055.6
5.5	1344.4	1568.5	1792.6	2016.7	2240.7	2464.8	2[illegible].9	2913	3137	3361.1
6	1466.7	1711.1	1955.6	2200	2444.4	2688.9	29[illegible].3	3177.8	3422.2	3666.7
6.5	1588.9	1853.7	2118.5	2383.3	2648.1	2913	3[illegible].8	3442.6	3707.4	3972.2
7	1711.1	1996.3	2281.5	2566.7	2851.9	3137	34[illegible].2	3707.4	3992.6	4277.8
7.5	1833.3	2138.9	2444.4	2750	3055.6	3361.1	3[illegible].7	3972.2	4277.8	4583.3
8	1955.6	2281.5	2607.4	2933.3	3259.3	3585.2	[illegible]	4237	4563	4888.9
8.5	2[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	4155.6	4501.9	4848.1	5194.4
9	2200	2566.7	2933.3	3300	3666.7	403[illegible].3	[illegible]	4766.7	5133.3	5500
9.5	2322.2	2709.3	3096.3	3483.3	3870.4	4257.4	4644.4	5031.5	5418.5	5805.6
10	2444.4	2851.9	3259.3	3666.7	4074.1	4481.5	4888.9	5296.3	5703.7	6111.1
10.5	2566.7	2994.4	3422.2	3850	4277.8	4705.6	5133.3	5561.1	5988.9	6416.7
11	2688.9	3137	3585.2	4033.3	4481.5	4929.6	5377.8	5825.9	6274.1	6722.2
11.5	2811.1	3279.6	3748.1	4216.7	4685.2	5153.7	5622.2	6090.7	6559.3	7027.8
12	2933.3	3422.2	3911.1	4400	4888.9	5377.8	5866.7	6355.6	6844.4	7333.3

Note: To convert cubic yards to tons multiply the yards by 1.4 (this is approximate)

This chart uses a compaction factor of 25%.

Investment Strategies - Alternatives

Agency Cost Parameters Setup

HMA | AST | Gravel | Dust Control | Stabilized Gravel

HMA

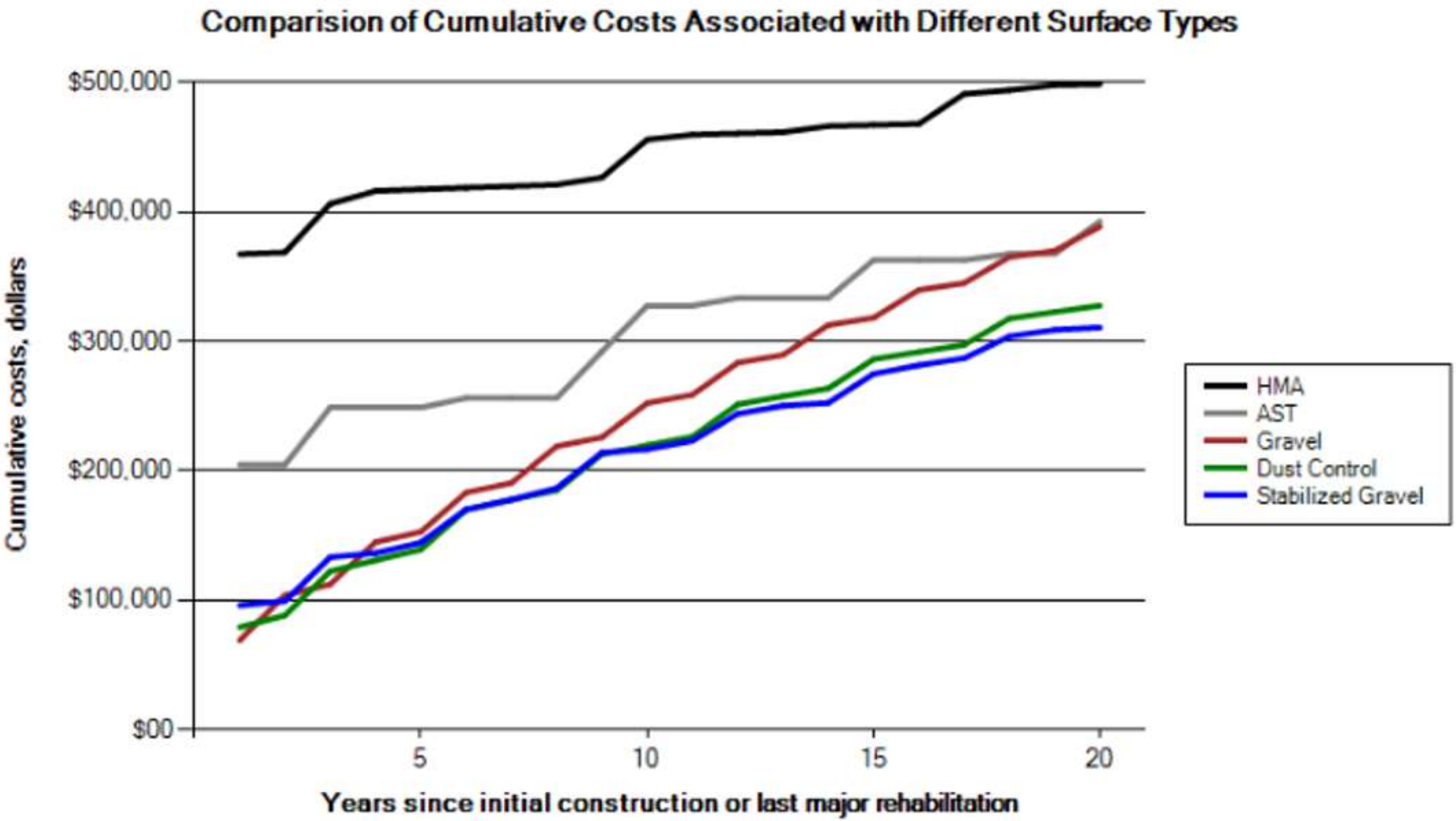
INITIAL COST

Total Initial Cost ($/mile): $ 725,115 Initial Costs Calculator

Treatment Selection	Treatment Name	MAINTENANCE COST Application Times Per Year	Year Interval Between Applications	Application Start Year	Unit Cost (dollars)	Unit Selection
☑	Crack Sealing	1	4	6	10000	per mile
☑	Seal Coat	1	7	3	20000	per mile
☑	Thin Lift OverLay	1	20	20	250000	per mile
☑	Striping and Marking	1	3	3	2000	per mile
☑	Patching/Maintenance	1	3	3	3000	per mile
☐	Other	1	1	1	0	per mile

Reset

NDSU UPPER TRANS


Comparision of Cumulative Costs Associated with Different Surface Types
$500,000
$400,000
$300,000
$200,000
$100,000
$00
Cumulative costs, dollars
5
10
15
20
Years since initial construction or last major rehabilitation
HMA
AST
Gravel
Dust Control
Stabilized Gravel

North Dakota Local Technical Assistance Program

Page | Inbox | Appointments | Notifications 1 | Insights | Publishing Tools

North Dakota Local Technical Assistance Program

@ndltap

- Home
- About
- Services
- Photos
- Videos
- Posts
- Community

Promote

Manage Promotions

Liked | Following | Share | ...

North Dakota Local Technical Assistance Program added 2 new photos.

Published by Dale Heglund · June 13, 2017

North Dakota soy beans are poised to enhance rural road safety. How? Jim Bahr, NDSU Researcher, is helping the ND Soybean Council develop soy-based roadway dust control agents. Reduced dust on gravel roads means safer roads. In 2015 NDLTAP linked up with Jim to assist with Health Department process review and application approval, finding county test site options and planning, specifying dust control measuring equipment, and developing a process to evaluate the product. ... See More

https://ndsoybean.org/innovations/

https://www.ndltap.org/events/soy/

NDSU UPPER GREAT PLAINS TRANSPORTATION INSTITUTE

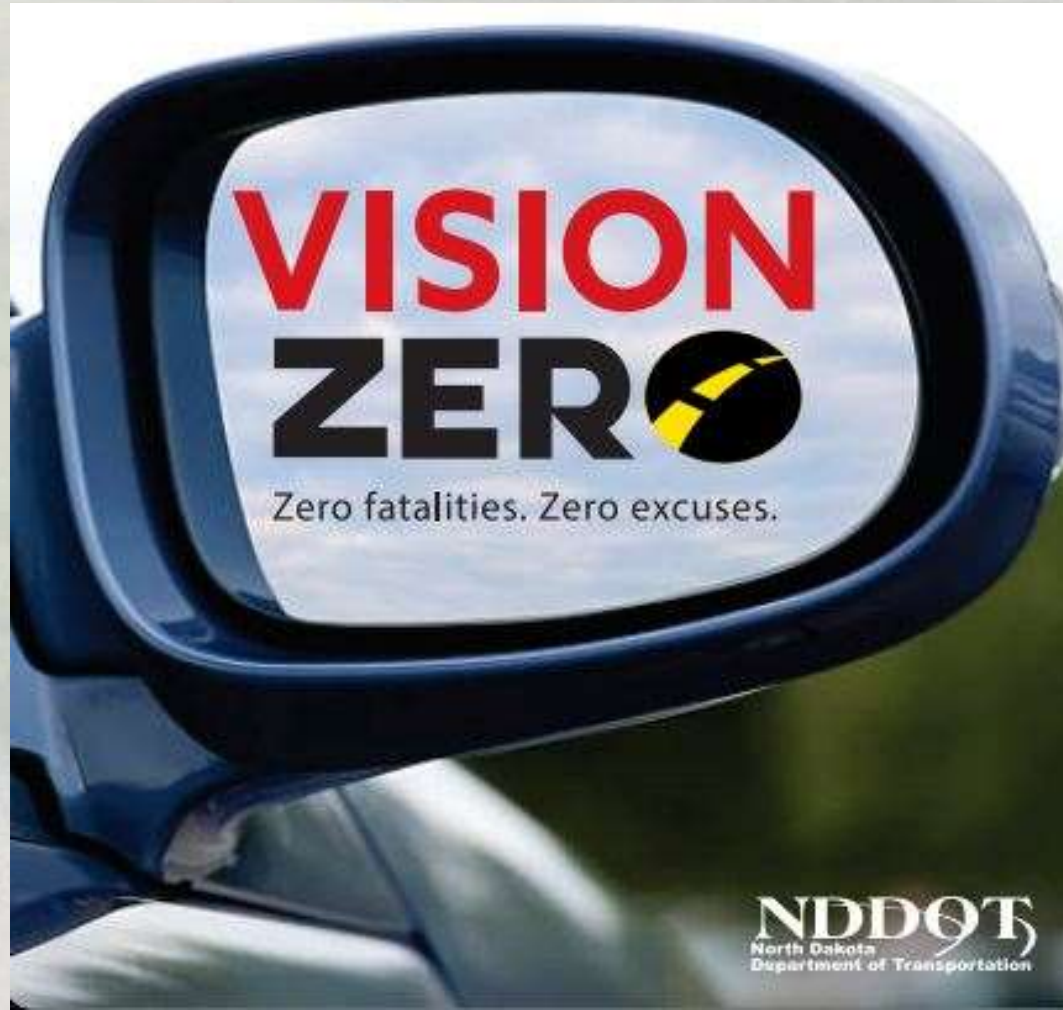
1 vehicle

1 year

1 ton dust per mile

Each mile with 100 cars per day
- 100 tons of fines per year!

Better Gravel – Better Roads
Better Roads – Safer Roads

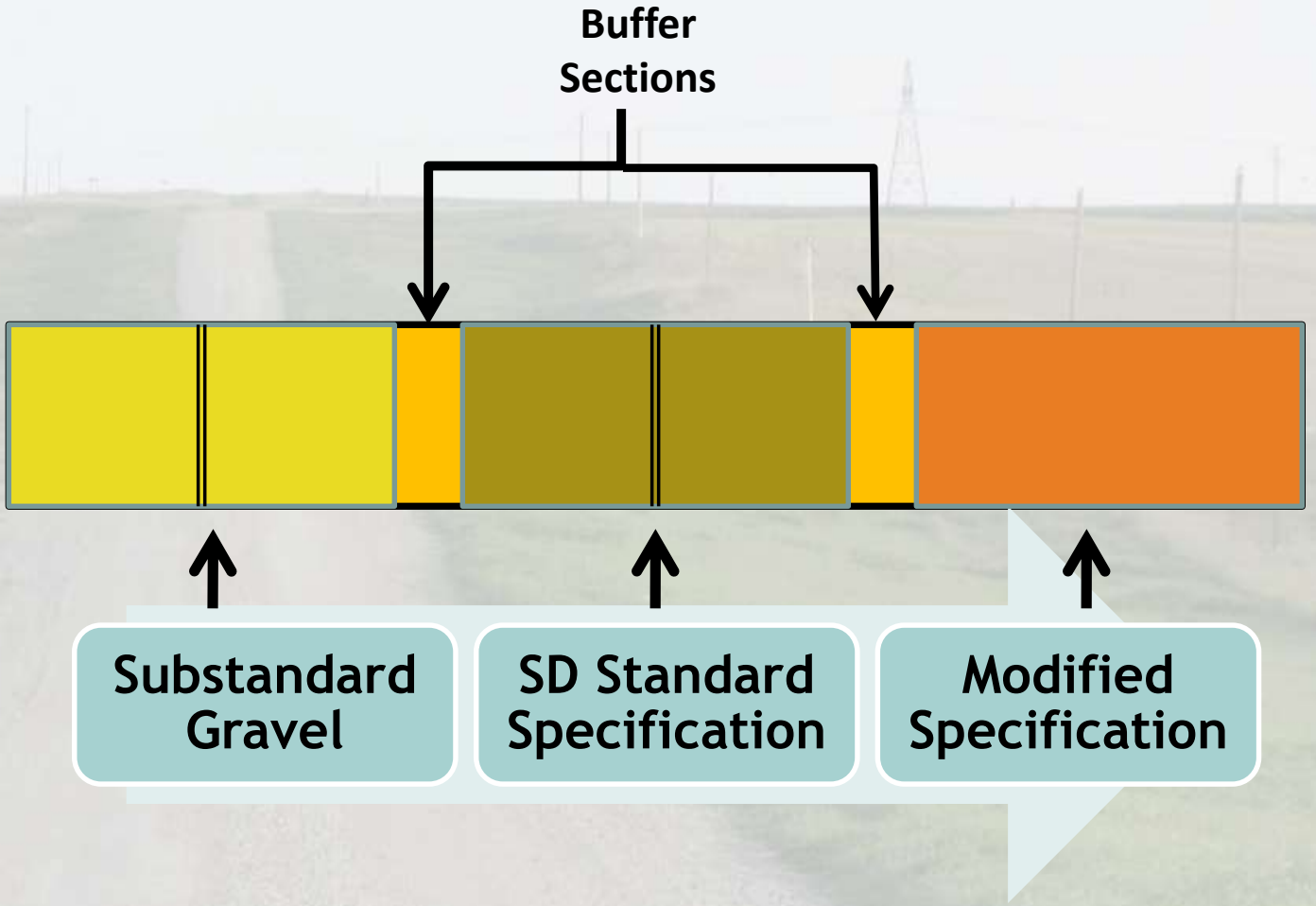


The #1 problem with a gravel road:

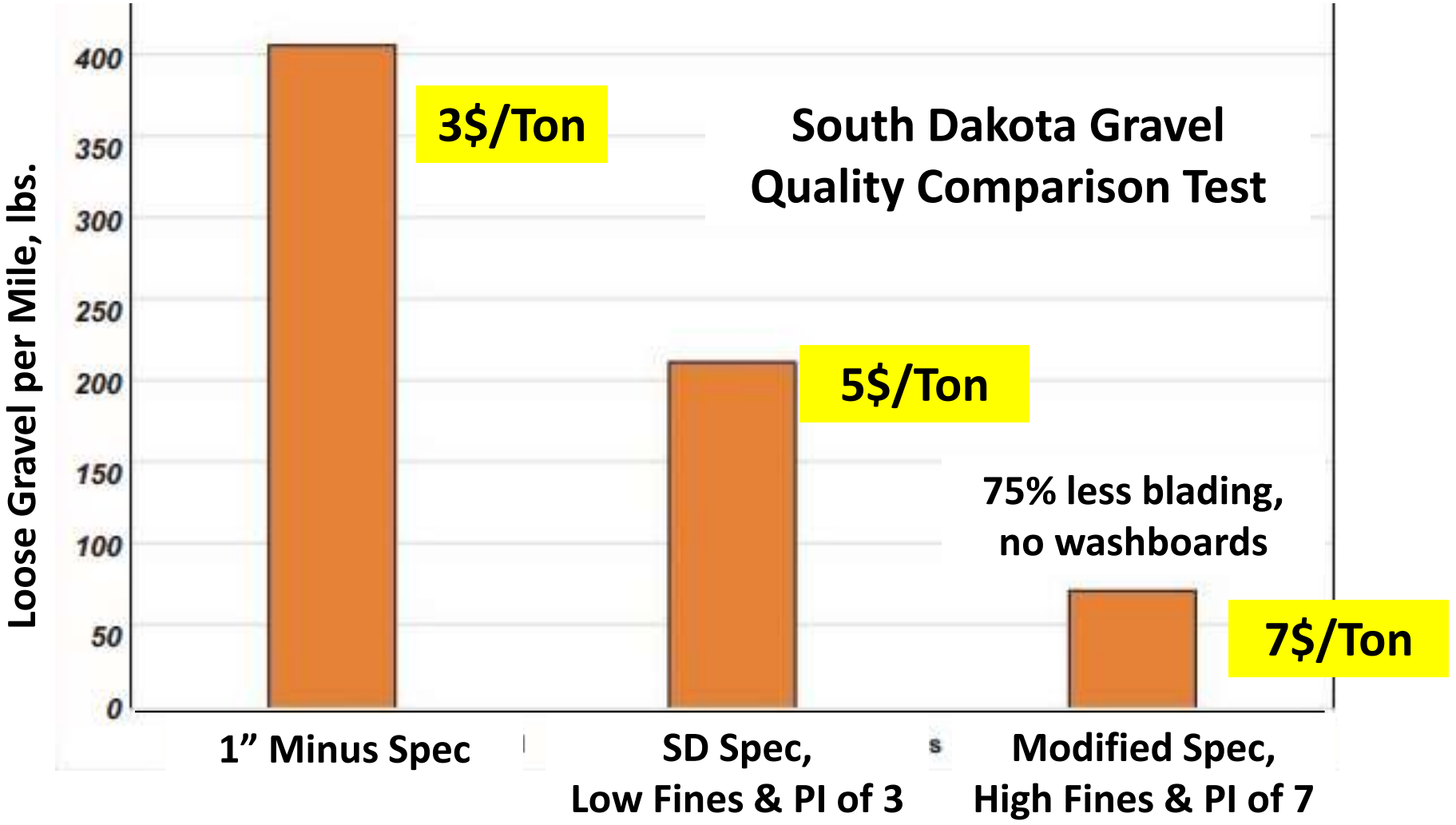
It’s not a paved road!


MUDDY
WHEN
WET
DUSTY
WHEN
DRY

South Dakota Gravel Study



Better Gravel = Less Blading, Gravel Replacement, etc.



What does your gravel spec look like?

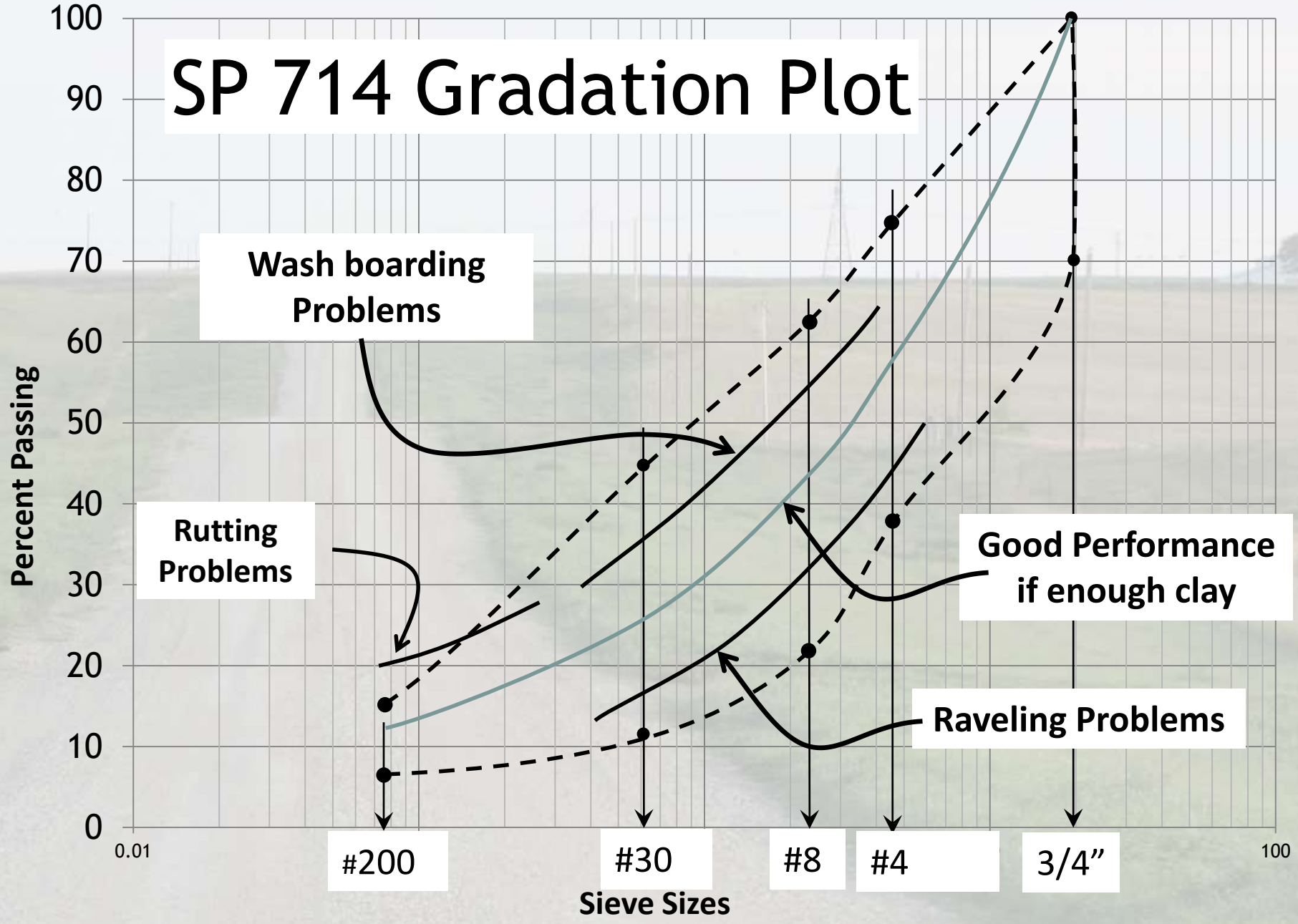
Sieve Size	NDDOT Cl 13	MT Gravel Surfacing	SD/FHWA Gravel Roads Manual	Proposed Gravel Surfacing
1”	100	100		100
3/4”	70-100	80-90	100	70-100
1/2”		60-80		
3/8”				
No. 4	38-75	50-70	50-78	38-75
No. 8	22-62	37-60	37-67	22-62
No. 10				
No. 30	12-45			12-45
No. 40		13-35	13-35	
No. 200	7-15	4-18	4-15	7-15
PI		4-12	4-12	4-9
Shale (max %)	12.0			12.0
LA Abrasion (max %)	50		40	50
NDDOT 4, Fractured Faces	10			10

Too much coarse rock, lacking coarse sands – will ravel badly

Too much coarse sand, too little rock, will washboard badly

Good gravel surfacing (good representation of sizes to fill voids, high enough minus #200 to create road crust, will hold chlorides well

SP 714 Gradation Plot



Unpaved Road Chemical Treatment Selection Tool

UCPRC City and County Pavement Improvement Center

Home | Instructions | Treatment Selection | Results Interpretation | About

Road ID 57 **Details** Good County North Dakota

Material Test Results

%Passing 1"	100	%Passing #40	30
%Passing #4	70	%Passing #200	18
%Passing #8	56	PI (or BLSx2)	3

Objective

- Short-term dust control (spray-on)
- Long-term fines preservation (spray-on)
- Long-term fines preservation (mix-in)
- Long-term stabilization (mix-in)

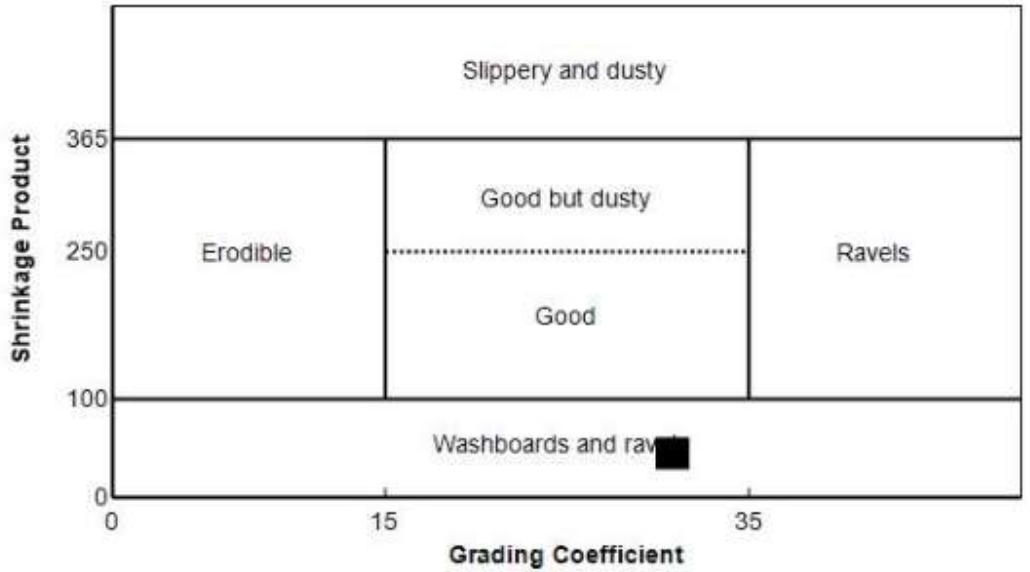
Roadway Parameters

Traffic (AADT): < 100 | Climate: Dry

- [x] More Than 10% Trucks
- [ ] Steep Grades
- [ ] Sharp Curves

Compute Ratings | Environmental & Other Influences

Predicted Material Performance for Untreated Road



Treatment Ratings

Treatment	TR	CL	PI	FC	HV	SG	SC	Rating
Synthetic Fluid + Binder	1	1	1	1	1	0	0	1.0
Petroleum Resin	1	1	1	1	2	0	0	2.0
Synthetic Polymer	1	1	1	1	2	0	0	2.0
Asphalt Emulsion	1	1	1	2	2	0	0	2.2
Magnesium Choride	2	2	2	2	1	0	0	2.4
Lignosulfonate	2	1	2	2	2	0	0	2.4
Tall Oil	2	1	2	2	2	0	0	2.4
Concentrated Liquid Stabilizer	1	1	3	2	1	0	0	3.0
Clay Additive	1	1	2	3	2	0	0	3.0
Calcium Chloride	2	3	2	2	2	0	0	3.1
Sodium Chloride Brine	2	3	2	2	2	0	0	3.1
Water	3	3	3	3	3	0	0	NA
Water + Surfactant	3	3	3	3	3	0	0	NA
Glycerin Based	3	3	3	3	3	0	0	NA
Molasses/Sugar	3	3	3	3	3	0	0	NA
Plant Oil	3	3	3	3	3	0	0	NA
Base Oil	3	3	3	3	3	0	0	NA
Synthetic Fluid	3	3	3	3	3	0	0	NA

TR: Traffic; **CL:** Climate; **PI:** Plasticity; **FC:** Fines Content; **HV:** More Than 10% Trucks
SG: Steep Grades; **SC:** Sharp Curves; **Rating:** Treatment Performance Ratings

Suppliers | Print

NDSU UPR TRA ... Center

Unpaved Road Chemical Treatment Selection Tool

UCPRC City and County Pavement Improvement Center

Home | Instructions | Treatment Selection | Results Interpretation | About

Road ID 57 **Details** Good County North Dakota

Material Test Results

%Passing 1"	100	%Passing #40	30
%Passing #4	70	%Passing #200	18
%Passing #8	56	PI (or BLSx2)	9

Objective

- (•) Short-term dust control (spray-on)
- ( ) Long-term fines preservation (spray-on)
- ( ) Long-term fines preservation (mix-in)
- ( ) Long-term stabilization (mix-in)

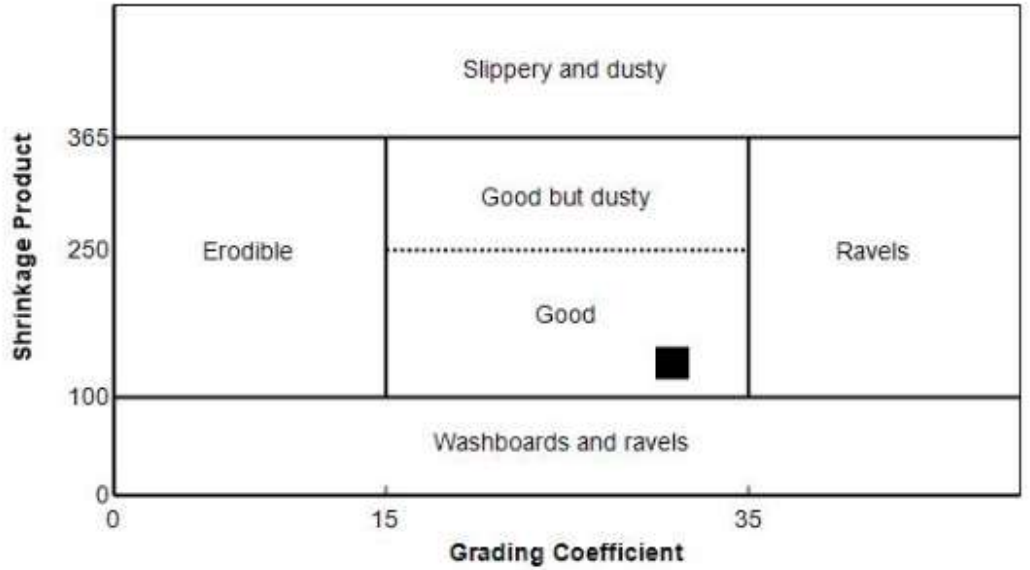
Roadway Parameters

Traffic (AADT): < 100 | Climate: Dry

- [x] More Than 10% Trucks
- [ ] Steep Grades
- [ ] Sharp Curves

Compute Ratings | Environmental & Other Influences

Predicted Material Performance for Untreated Road



Treatment Ratings

Treatment	TR	CL	PI	FC	HV	SG	SC	Rating
Glycerin Based	1	1	1	1	1	0	0	1.0
Lignosulfonate	1	1	1	1	1	0	0	1.0
Tall Oil	1	1	1	1	1	0	0	1.0
Petroleum Resin	1	1	1	1	1	0	0	1.0
Synthetic Fluid	1	1	1	1	1	0	0	1.0
Synthetic Fluid + Binder	1	1	1	1	1	0	0	1.0
Magnesium Choride	1	2	1	1	1	0	0	2.0
Molasses/Sugar	1	1	1	1	2	0	0	2.0
Plant Oil	1	1	1	1	2	0	0	2.0
Base Oil	1	1	1	1	2	0	0	2.0
Synthetic Polymer	2	2	2	2	2	0	0	2.6
Calcium Chloride	1	3	1	1	1	0	0	3.0
Sodium Chloride Brine	1	3	1	1	1	0	0	3.0
Water	2	3	1	1	2	0	0	3.0
Water + Surfactant	2	3	1	1	2	0	0	3.0
Asphalt Emulsion	1	1	2	2	3	0	0	3.0
Concentrated Liquid Stabilizer	3	3	3	3	3	0	0	NA
Clay Additive	3	3	3	3	3	0	0	NA

TR: Traffic; **CL:** Climate; **PI:** Plasticity; **FC:** Fines Content; **HV:** More Than 10% Trucks
SG: Steep Grades; **SC:** Sharp Curves; **Rating:** Treatment Performance Ratings

Suppliers | Print

NDSU UPPER TRAN… Center

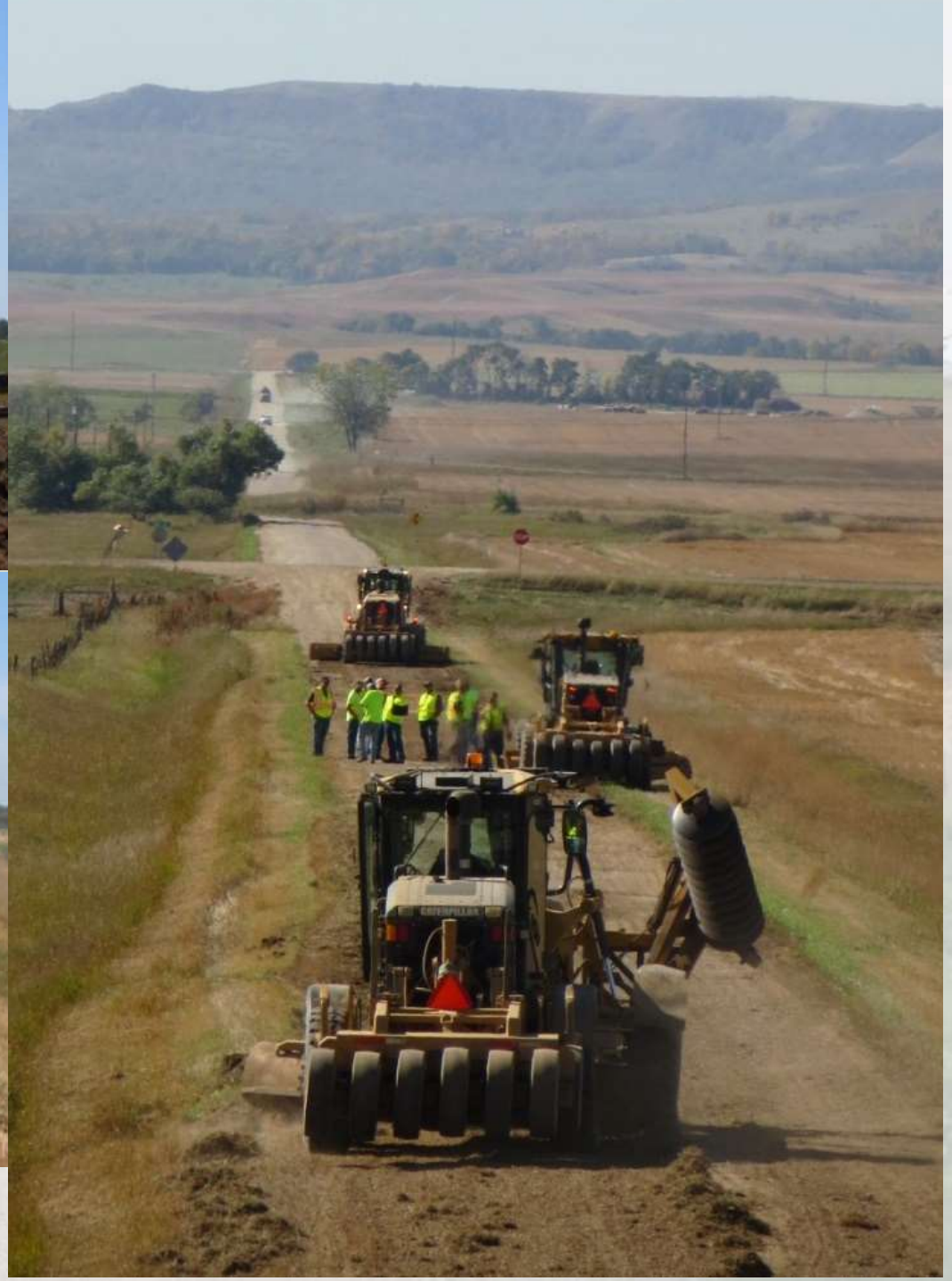
North Dakota has 107,000 miles of roadway

NDDOT - 7,400 miles of road

No Gravel Roads

County/Local - 59,000 miles gravel


NDSU | NDLTAP
GRAVEL ROAD WARRIOR






More Clay needed on Deving Township Roads

Curt Glasoe, Technical Support Representative recently met with Charlie Sorenson, Deving Township Supervisor – Mountrail County to discuss township road issues. Charlie is looking for innovative ways to improve the roads in Deving Township. Sorenson stated there is good spec gravel, on the roads, but with no or little plasticity index (PI).

Good surface gravel needs a percentage of plastic material, usually natural clays, which will give the gravel a "binding" characteristic and hence a smooth driving surface.

Binder for gravel:

- Improves road crust durability
- Can reduce dust & subgrade soft spots
- Improves life of chloride salt dust abatement
- Improves performance of some proprietary dust abatement and stabilization products

Some other benefits of Clay binder is it fills voids in gravel, forms road crust, sheds rain, retains chloride and chloride keeps clay from dusting.

More information on Clay binder can be found in several resources on the NDLTAP website.
https://www.ndltap.org/resources/motorgrader.php


160H

Industry Comments:

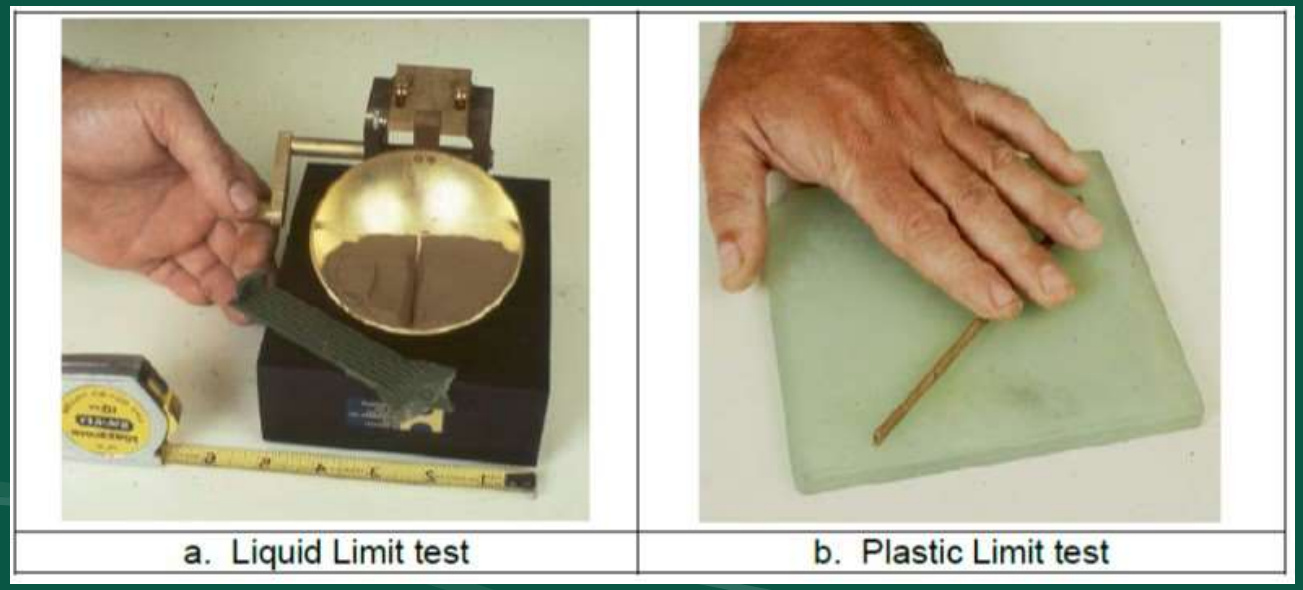
- county specs vary great
- expectations are at times not realistic
- difficulty of making gravel with binder
- support better material efforts, safer roads

Plasticity Index - Clay

The glue that holds the rocks and sand together

NDSU | NDLTAP
GRAVEL ROAD WARRIOR

PI
Hydrometer
Sand Equivalent
Bar Linear Shrinkage



a. Liquid Limit test

b. Plastic Limit test

NDLTAP (North Dakota Local Technical Assistance Program)

Gravel Preservation

Wednesday, January 26, 2022
North Dakota Local Roads Conference
Dickinson, ND

North Dakota Association of County Engineers

Dale C. Heglund, PE/PLS, North Dakota LTAP Director
701-318-6893 – dale.heglund@ndsu.edu

2019 Dakota - Gravel Road Test Track

Combining the efforts of South Dakota and North Dakota LTAPS

NDSU UPPER GREAT PLAINS TRANSPORTATION INSTITUTE

Amount of Bank Run Clay Needed to Fix Existing Gravel Problems

Existing Gravel Problems (Loose Rock, Dust and Washboards)	**% Bank Run Clay,** by Weight Gravel	**Gravel Mix Depth,** Inches	**Bank Run Clay Application Rates,** #/SY	**Bank Run Clay,** Tons per Road Mile for Treatment Width of 20 ft **(a)**
Low	3	1	3.0	20
Moderate	4.5	1.5	6.9	40
High	6	2	12.3	70
Extreme	7.5	2.5	18.9	110

$$\text{Target Spread Length (ft)} = \frac{\text{(Belly Dump Load, Ton) x 2000 x (Parts clay) ÷ (Parts Gravel +1)}}{\text{(Road width, ft) x (Mixing Depth in inches ÷ 12) x (Gravel Density of 135 lbs/CF) x (ClayTarget \%) ÷ 100}}$$

GRAVEL SURFACE SPECIFICATIONS

Sieve Size	SD Gravel Surface Spec % Passing	ND Aggregate Surface Spec (Class 13) % Passing
1"	-	100
¾"	100	70 – 100
#4	50 – 78	38 – 75
#8	37 – 67	22 – 62
#30	-	12 – 45
#40	13 – 35	-
#200	4.0 – 15.0	7 – 15
P.I.	4 – 12	-
LA Abrasion	40%	50%
Shale	-	12%
Process Required	crushed	-
Fractured Faces	-	10%*

ANSWERS FROM AN EXPERT

Application Rate of MagChloride Used for DUST Abatement

By Ken Skorseth, SD LTAP Special Projects Manager
Author: Gravel Roads Maintenance & Design Manual & Gravels Construction & Maintenance Guide

CO LTAP received the following technical assistance question. Gravel Roads expert, Ken Skorseth, submitted the following reply and supplemental photos.

What is the recommended amount and application rate of Magnesium Chloride used for DUST abatement for a second treatment applied about a year later?

[Ken] It is hard to give a concise answer due to these factors:

- The quality of the surface gravel has so much impact on this. Good surface gravel prepared well for MagChloride ($MgCl_2$) generally performs well, but ---
- The rate of application of *initial* treatment also has an impact on following treatments. We generally use between 0.45 and 0.6 gallons per square yard for the initial treatment.
- Thereafter, traffic volume and moisture received through the season will have some impact on the succeeding year as well.
- Having said all of the above, we often see second year treatment at the same rate as the first year, or 0.1 to 0.2 gallons per square yard ***less*** than the initial treatment.
- In succeeding years, we sometimes see treatments down to half of original application rates.
- The local agencies who do this very well nearly always say something like this, "there isn't a set rate for treatment; you have to observe the road and use field judgement to determine it."
- These photos show several different situations to demonstrate.

1/4
GOOD: 6-6-13 Just after treatment at 0.5 gal per sq yd. Commercial dairy road. Heavy truck traffic ^AADTT 30 - 40. Road looks good.

2/4
POOR: 7-16-13 Same road, already failing!

3/4
POOR: 7-16-13 Almost total dust control failure

4/4
POOR: 10-7-13 After another 0.3 gal per was applied same season still not performing well. This is such poor surface material it won't go into a bound state no matter how you maintain it. There is no way the $MgCl_2$ can work even with 0.8 gal per sq yd applied in one year!

Here's the critical issue: It was applied to poor material (reclaimed concrete) usually not compatible with chloride treatment.

GOOD: Residential road. Initial treatment 0.5 gal per sq yd. Same treatment Year 2. Gets 0.25 - 0.3 gal treatments in succeeding years. Treated annually 10 yrs. Performs very well.

GOOD: Treated with $MgCl_2$ continuously since 1988. Initial treatments of 0.5 gal per sq yd in first 2 years; 0.25 to 0.4 treatments since. Applied in May. 1,000 ADT

ROAD READY R3 RESEARCH

DEC 2020 NO. 2

RESEARCH REVIEW: Dust Control on Gravel Roads: Traditional Methods Using Magnesium and Calcium Choloride

by Curtis Glasoe, PE/PLS, NDLTAP Technical Support Representative

"Dust control for gravel roads has been practiced for many years now in our region and around the world. Dust generated by traffic on a gravel road creates many concerns including: safety issues for the traveling public by reducing visibility, degrading air quality, increasing road maintenance costs due to loss of fines in the gravel and reducing crop yields. Dust control products are a great tool to use for gravel preservation. The increased cost of mining, processing & hauling specified surfacing gravel plus the fact that its availability is limited are good reasons to have a policy on dust control that is connected to the average daily traffic counts for various road segments in your county or township. The reduction in re-graveling and blading costs should be considered as a savings when adding dust control projects into the road budget when planning widespread applications."

Kelly Bengtson PE, NDSU UGPTI LTAP Bridge & Pavement Engineer

Gravel roads are dusty. For many roadways, the dust creates unsafe driving conditions. Additionally, the loss of fine material degrades the ability of the driving surface aggregate to bond together and shed water.

Logically, increased traffic volumes result in increased dust. So what can we do to reduce the dust? As traffic volumes exceed 100 average daily traffic (ADT), consideration should be given to the application of dust control.

Your county should consider having a policy to follow that includes ADT, length of strip applications for rural homes or for road intersections susceptible to dust issues. A policy can reduce your liability and improve the safety of the traveling public. Several counties already have a policy and LTAP can help you develop one.

Spot applications in front of residences near roadways may suffice for some roadway segments. As traffic volumes increase, dust control for full roadway sections should be considered. According to various studies, the volume of gravel material that is blown away or lost from the surface can be estimated at 1 ton of material per mile/vehicle/year. To put it another way, consider a sample roadway with a traffic volume of 250 vehicles per day, we can estimate a loss of 250 tons of gravel per mile/year. That is 10 semi loads of gravel on a mile section of roadway!

In addition to the obvious safety problem of sight distance with dust, a bigger problem is that existing gravel sources are being depleted and not many new sites are being found to provide adequate aggregate to surface roads. Some counties in the state are already going outside county boundaries to secure aggregate surfacing. This serious situation must be addressed through changes in the way we do business.

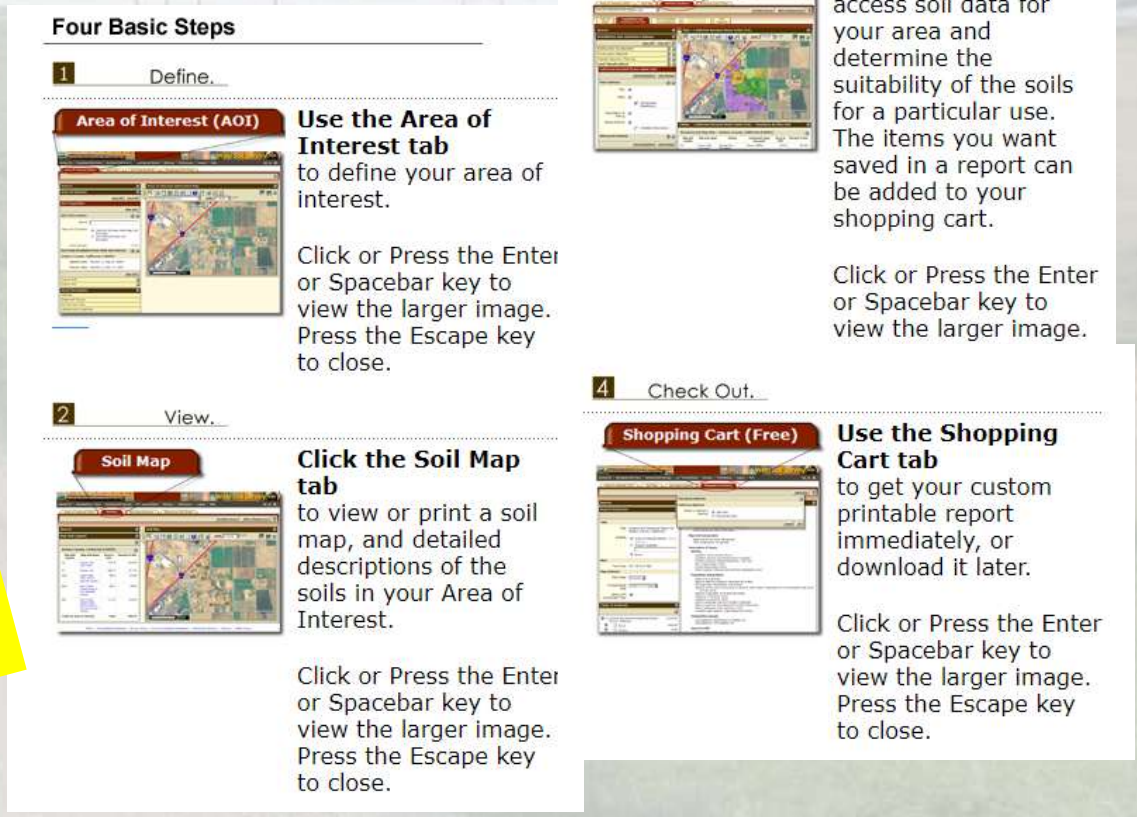
NDSU | UPPER GREAT PLAINS TRANSPORTATION INSTITUTE
NORTH DAKOTA LOCAL TECHNICAL ASSISTANCE PROGRAM

Locating Gravel Sourc

Accessing the NRCS Web Soil Survey (WSS) Website

1. Google NRCS
2. Technical Resources
3. Soil Survey & Resource Assessments
4. Web Soil Survey (WSS)
5. Start WSS
6. Select land “Area of Interest” (AOI) under 100,000 acres (156 square miles)
7. Search Keyword “Gravel Source”
8. Look at matches and look at most promising
9. Print out results for land area of int

This process can be put into a one to two page ‘tutorial’ which county personnel could use, rather than hire a consultant



BURLEIGH COUNTY HIGHWAY DEPARTMENT

8100 43RD AVENUE NE
BISMARCK, ND 58503
701-204-7748
FAX 701-204-7749
www.burleighco.com

Dust Control Policy

Approved by the Burleigh County Commission
(February 3, 2014)

OVERVIEW

As the area around the City of Bismarck grows, residents on the township and county roadway system have experienced increases in traffic. It has long been the desire of the Burleigh County Board of Commissioners and the Highway Department to promote the paving of new subdivisions that are developed; however, in older subdivisions and on section line roadways in the growth area, that have not been paved, we are receiving more calls requesting some type of dust control.

The loss of fines (dust) from our gravel roads is not only a nuisance to residents, but it can also be a health hazard to individuals with emphysema or asthma. It also decreases the effectiveness of our gravel by creating greater segregation within our roadway surfacing. This requires us to gravel more often. Chemical treatment of gravel roads with either Calcium Chloride or Magnesium Chloride has been proven to reduce the loss of fines from gravel roadways. In general, Magnesium Chloride has been found most effective in our climate. Other types of chemical treatments have been tested but none have been found as effective as Magnesium Chloride.

It is the Highway Department's desire to implement a Dust Control Policy to help direct the use of chemical treatment of both township and county roadways. The following guidelines would be used in administering the application of dust control chemicals:

OPERATING PROCEDURES

On county roads:
Dust control will be applied to gravel roadways meeting the following criteria:

1) Roadways with Average Daily Traffic (ADT) counts of 200 or greater will receive solid application.

2) Roadways with ADT counts between 50 and 200 will receive application in front of homes and buildings.

3) Roadways with ADT counts less than 50 will receive application in front of homes if the resident of the home has health (breathing) issues, and provides us documentation of such.

4) Application in front of homes will only be done if the home is within 1,000 feet of the roadway. The application distance in front of homes will be for a maximum of 1,500 feet.

On township roads:

1) The township must request dust control application, and

2) The township agrees to pay all costs associated with application, and

3) The township agrees with the same application criteria as laid out for county roads.

4) The County Commissioner holding the Highway Department portfolio will approve/deny all requests for dust control application on unorganized township roadways.

The County Highway Department will determine the application rates and the type of dust control chemical used on an annual basis.

INFORMATION

Questions or concerns regarding Burleigh County Dust Control Policy may be directed to the Burleigh County Highway Department in Bismarck at (701) 204 - 7748.

302-P01 AGGREGATE SURFACE COURSE CL 13 (MODIFIED): This item shall be modified as follows:

Class 13 (Modified)	
Sieve Size or Testing Method	Percent Passing or Testing Requirement
1"	100
3/4"	90-100
3/8"	50-90
No. 4	35-65
No. 8	22-55
No. 30	12-45
No. 200	8-15*
% Shale and Soft Rock	Max. 15%
L.A. Abrasion Loss	Max. 15%
Plasticity Index	7-13%
Fractured Faces	10%

*The material passing the #200 sieve should be able to be rolled into a ribbon when moistened, indicating adequate clay material in the fines.

Wold Engineering, P.C.
Consulting Engineers & Land Surveyors

Trial Project

- Defense Access Road Program
  - Funding for maintenance of TE Routes
  - 300 miles of gravel roads in 8 Counties in ND
  - FHWA works with the Air Force
  - NDDOT typically manages the projects
- 2016 Graveling project
  - 40 miles in 5 counties
  - Modified Cl 13 specified
    - PI requirement of 4-9
  - FHWA and the Air Force will monitor the project

NDDOT
North Dakota
Department of Transportation

How do you make the Transition to good gravel?

- Changing the specification?
  - Get NDDOT to change the Cl 13 spec (add PI), or
  - Add a plan note in your plans to modify the spec, or
  - Modify the gravel spec in each county to what works for each county?
- Do some training on blading/maintenance with the different material!

How do you make the Transition to good gravel?

- Change your specification and start using it, or
- Need to try it first
  - Get someone else to pay for it
    - Like the Air Force

Spread Bank Run Clay with Belly Dump

Concept: Add bank run clay and gravel to belly dump to help clay flow and spread uniformly during high speed spreading

Details: Refer to one page guide

Note: If spread is poor, lower clay moisture or add more gravel

General Process:

1. Locate bank run clay source, dig holes to check moisture
2. Pulverize clay with blade, rotary mixer, disc, etc. & windrow with blade
3. Spread gravel windrow next to clay windrow and blade together
4. Reload belly dump with gravel clay mixture
5. Spread on 300 to 500 feet of road surface → If uneven spread, use more gravel on next load
6. Blade mixture into existing gravel

Gravel Spec

Sieve Size Or Testing Method	Aggregate Gravel Surfacing 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%

[1]Minimum weight percentage allowable for the portion of the aggregate retained on a No. 4 sieve having at least 1 fractured face.

"Binder" Clay Requirement

"Gradation" Requirement

Permazyme ---------- ----- $12,000- $16,000/ mile

Base One ---------- $0.28-$0.55/sy yd/inch of depth

Corn Oil Acrylic Resins ----- $0.14-$0.15sy yd, $16,000/ mile

Calcium Chloride ---------- - $455/ton, 1.5-2lb/sq yd; $1.26/gallon

Magnesium Chloride -------- $8,000/mile (1st trmt)
$4,900/mile (addl trmt)

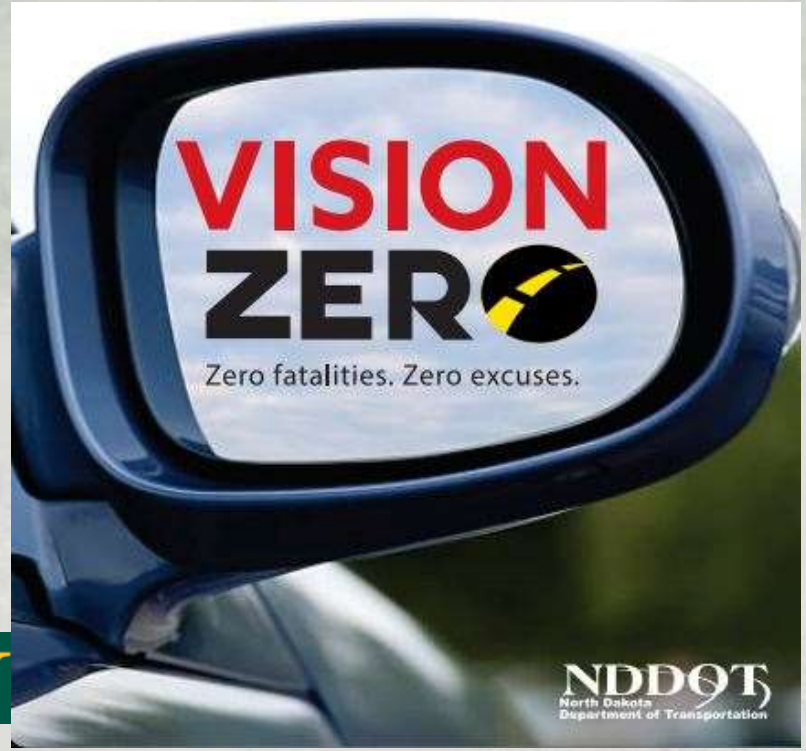
Oil Field Salt Brine ---------- Product is free,
$135-$500/hr to apply

Cement ---------- $60,000-$250,000/mile (depending on depth)

Stabilock ---------- $15,000/mile

Dust Control North Dakota
Schwindt 2012

HANNAFORD – Two semi drivers were seriously injured Tuesday afternoon when their rigs crashed into each other in a blinding dust on a county road in northeast North Dakota.



Two injured after semis crash in Griggs County

HANNAFORD – Two semi drivers were seriously injured Tuesday afternoon when their rigs crashed into each other in a blinding dust on a county road in northeast North Dakota.

At 4:43 p.m., Patrick Kraemer, 60, of McHenry, was westbound on Griggs County Road 26 about 7 miles west of Hannaford when his 2009 Peterbilt semi collided with a 2004 Peterbilt driven by Taylor Rose, 29, of Wimbledon, according to a news release from the North Dakota Highway Patrol. Both were flown by helicopter to hospitals with unknown injuries.

Due to calm conditions, visibility was "greatly reduced" at the time of the crash due to lingering dust and the drivers were unable to avoid impact, according to the release. The crash remains under investigation.

Hannaford is about 35 miles northwest of Valley City.

NDSU UPPER GREAT PLAINS TRANSPORTATION INSTITUTE