

NDSU UPPER GREAT PLAINS TRANSPORTATION INSTITUTE





1


UGPTI Programs

- **Advanced Traffic Analysis Center (ATAC)**
- **Center for Surface Mobility Applications & Real-time Simulation environments (SMARTSeSM)**
- **DOT Support Center (DOTSC)**
- **Mountain-Plains Consortium (MPC)** *Focus Areas: agricultural freight, rural traffic analysis, tribal outreach*
- **North Dakota Local Technical Assistance Program (NDLTAP)**
- **Rural Transportation Safety and Security Center (RTSSC)**
- **Small Urban and Rural Center on Mobility (SURCOM)**
- **Transportation Learning Network (TLN)**
- **Commercial Vehicle Safety Center (CVSC)**

2

2

Asset Management Tools and AI



Presentation Outline


- Quick overview of the Surface Selection Tool
- Overview of GRIT
- New Layers – Sign Inventory
- Integration of Artificial Intelligence
- Examples of AI impacts to Asset Management
- Questions

Brad Wentz, P.E.
Upper Great Plains Transportation Institute
North Dakota State University

3

3

Overview of Local Road SST



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Local Road Surface Selection Tool

[Home](#) | [Analysis](#) | [Administration](#) | [Help](#) | [Contact](#)

Agency Cost Parameters Setup

HMA | **AST** | Gravel | Dust Control | Stabilized Gravel
INITIAL COST

Total Initial Cost (\$/mile): \$ 372,615 Initial Cost Calculator

Treatment Selection	Treatment Name	MAINTENANCE COST			Unit Cost (dollars)	Unit Selection
		Application Times Per Year	Year Interval Between Applications	Application Start Year		
<input checked="" type="checkbox"/>	Crack Sealing	1	7	4	4000	per mile
<input checked="" type="checkbox"/>	Seal Coat	1	7	3	40000	per mile
<input checked="" type="checkbox"/>	Thin Lift Overlay	1	20	21	200000	per mile
<input checked="" type="checkbox"/>	Striping and Marking	1	1	2	1500	per mile
<input checked="" type="checkbox"/>	Patching/Maintenance	1	5	9	8000	per mile
<input type="checkbox"/>	Other	1	1	1	0	per mile

Reset

Next Surface
Back to Common Parameters Setup
View Analysis Summary
Help

4

Overview of Local Road SST

Maintenance Costs Default Values U

Select region you want to update: **East Area**

TMA: **AST** | Gravel | Dust Control | Stabilized Gravel

Select a treatment: **Seal Coat**

HMA: Seal Coat

ADT Level (vehicles/day)	Times per Year (County AVG)	Year Interval (County AVG)	App Start Year in order (County AVG)	Unit Cost (County AVG) (\$/mile)
0-99	1 (1)	7 (3)	3 (3)	1000 (1000)
100-199	1 (1)	7 (3)	3 (3)	1000 (1000)
200-299	1 (1)	7 (3)	3 (3)	1000 (1000)
300-399	1 (1)	7 (3)	3 (3)	1000 (1000)
400-499	1 (1)	7 (3)	3 (3)	1000 (1000)
500-599	1 (1)	7 (3)	3 (3)	1000 (1000)
> = 600	1 (1)	7 (3)	3 (3)	1000 (1000)

Buttons: Set To County Average, Restore Region Default, Save All Changes To Database, Back to Administration Page

NDSU Local Road Surface Selection Tool

Agency Cost Short Summary - Per Mile

Surface Type	MSLA	SSS	Control	Dust Control	Stabilized Gravel
Total Initial Cost	\$ 172,000	\$ 24,204	\$ 42,200	\$ 46,200	\$ 98,200
Total Maintenance Cost	\$ 126,200	\$ 188,000	\$ 225,540	\$ 268,170	\$ 223,200
Total Salvage Value	\$ 0	\$ 0	\$ 0	\$ 0	\$ 0
Total Agency Cost	\$ 298,200	\$ 432,204	\$ 467,740	\$ 514,370	\$ 321,400

Comparison of Cumulative Costs Associated with Different Surface Types

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<https://dotsc.ucpti.ndsu.nodak.edu/SurfaceSelection/>

5

Geographic Roadway Inventory Tool

GRIT - Inventory

Inventory

- Collect
- Maintain
- History

Web Maps

Information

- What's out there
- Day to day use

Dashboards

Decisions

- Planning
- Optimization
- Project Selection

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6

GRIT

GRIT - Inventory

- Easy to use forms with google maps
- Easy to access – Web based
- Inventory & Maintenance data
- Simple tools

Layers: All | Becker (MN)

ConstructionHistory

Inventory | Maintenance | Performance

Location: Last Project Surface

Last Project Type: Overlay

Last Project Surface: Bituminous

Bituminous Type: Hot Bituminous (Class 27, 29, etc.)

Last Project Year: 1997

Last Project Surface Depth (inches): 1.50

Total Surface Depth (inches): 3.00

Last Project Cost Per Mile

Buttons: New, Edit, Cancel

7

GRIT

GRIT - Inventory

- Several Layers
- Many Data Items (Useful)
- Growing as requested
 - New - Signs

Construction History	Construction Planning	Bridges	Load Restrictions	Maintenance
Location	Location	Location	Location	Const History
Highway	Highway	Highway	Highway	Segments
Surface Type	Project Type	Type	Owner	Bituminous
Proj Type	Project #	Material	Func. Class	Seal Coat
LP Year	Planned Year	Span	Maintenance	Crack Seal
LP Depth	Status	Cell Diameter	Road Type	Patching
Total Depth	Bid Open Date	Cell Width	Seas. Load Limit	Striping
Base Type	Cost	Cell Height	Seas. Gross Lmt	Year
Base Depth	Start Date	Length	Yr Rnd Limit	Cost
Base Year	Public Impact	Year Installed	Yr Rnd Gross	Gravel
Base Treatment	Restrictions	Cover Depth	Replace Cost	Blading
SubGrd Strength	Detour	Restrictions	Replace Cost	Regravel
Treatment	Comments	Condition		Reshape
Lane Width	Funding Srce	Rating Date		Spot Repair
Shoulder Width	Funding Splits	GVV Limit		Dust Control
Grade Year	Fund Commit	Axle Limit		Frequency
Striping				Cost
Rumble Strips				Concrete
Curbs				Cracks
Inslope				CPR
RGW				Cost
Owner				

Becker County

Layer Select

none

Construction History

Owner/Load Limits

Minor Structures

Construction Planning

Cost Per Mile: 160

Times per Year: 40

With Roller: Yes

Completed By: Contractor

Buttons: New, Edit, Cancel

8

GRIT – Construction History

GRIT - Inventory

ConstructionHistory

Inventory Maintenance Performance

Location Last Project Surface Base Cross Section

Last Project Type
Overlay

Last Project Surface
Bituminous

Bituminous Type
Super Pave

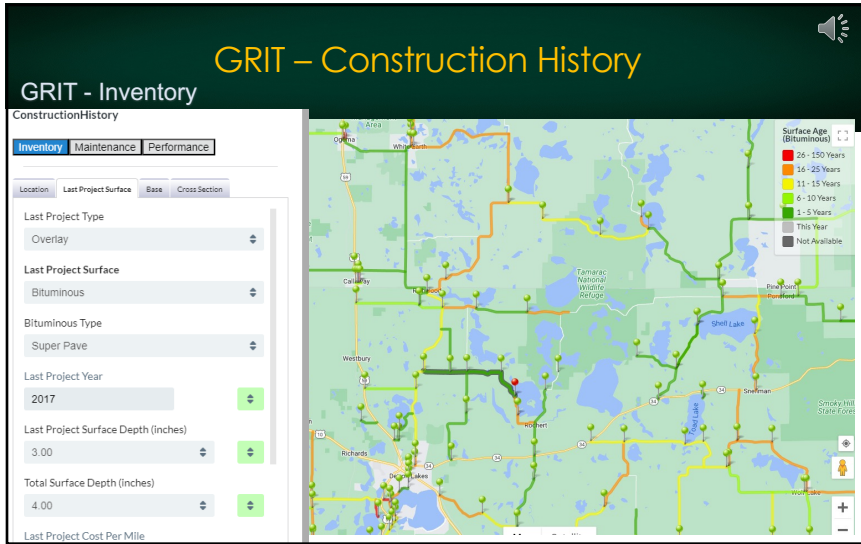
Last Project Year
2017

Last Project Surface Depth (inches)
3.00

Total Surface Depth (inches)
4.00

Last Project Cost Per Mile

Surface Age (Bituminous)
26 - 50 Years
14 - 25 Years
11 - 15 Years
6 - 10 Years
1 - 5 Years
This Year
Not Available



9

GRIT – Construction History

GRIT - Maintenance

Layers

All Becker (MN)

ConstructionHistory

Inventory Maintenance Performance

Gravel

Blade Regravel Reshape SpotRep DustControl

Blade
1 of 2 New Delete

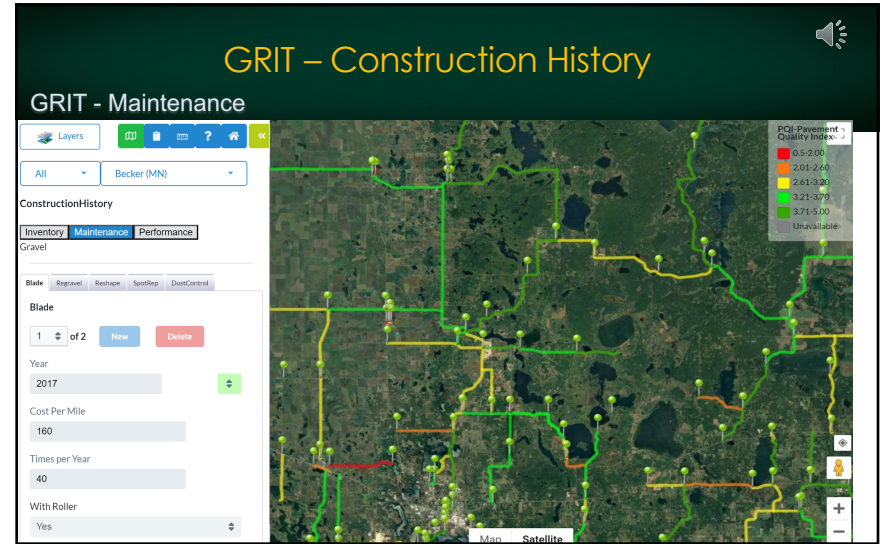
Year
2017

Cost Per Mile
160

Times per Year
40

With Roller
Yes

PQI Pavement Quality Index
0.5-2.00
2.01-2.60
2.61-3.20
3.21-3.79
3.71-5.00
Unavailable



10

GRIT – Sign Inventory

GRIT - Inventory

Signs

Inventory Activity

Location Panel Support Condition Photo Gallery

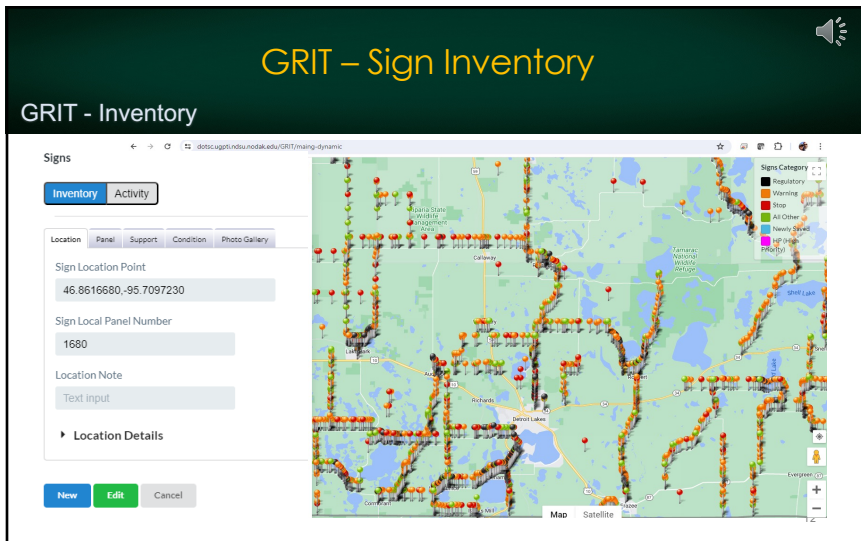
Sign Location Point
46.8616680,-95.7097230

Sign Local Panel Number
1680

Location Note
Text input

Location Details

Signs Category
Regulatory
Warning
Stop
All Other
New Sign
High Visibility



12

GRIT – Sign Inventory

GRIT - Inventory

Signs

Inventory Activity

Location Panel Support Condition Photo Gallery

Primary of 1 New Delete

Sign Type # Description
R1-1 Stop

Message
Text input

Last Installed/ Replaced Date
2019-11-21

Facing Direction
West

Material
type V

Height (in.) Width (in.)
30 30



13

GRIT – Sign Inventory

GRIT - Inventory

14

14

Dashboards GRIT

GRIT Performance Forecasting Dashboard

16

16

AI for Transportation Asset Management

- Data Collection – IOT
- Data Processing/Model
- Digital Twin
- Information Sharing

17

17

AI for Asset Management – Example 1

- Sign Inventory/Management
 - MUTCD Reflectivity Requirements
 - Becker County 10,000+ Signs
 - Difficult to rate and complete Inv.
- AI to assist Data Collection
 - Train ML based on existing Inventory & Photos
 - Small App to take photo and upload to server
 - AI Automatically extracts data from photo and updates GRIT
 - Future ver will also rate condition
- AI models will forecast and make recommendations for sign management.

Train AI on Existing Data

Build AI Model to Extract Info

18

18

AI for Asset Management – Example 2

- Gravel Road Inventory/Management
 - Life Cycle 3 days to 3 months
 - Many factors affect condition
 - Need condition and traffic - daily
- AI to assist Data Collection
 - Train ML to count vehicles and rate condition from camera images.
 - Build in-expensive IOT camera that can run model during the Summer.
 - Processed data uploaded to GRIT and combined with other data.
- AI models will forecast and make recommendations for GR management.



19

Geographic Roadway Inventory Tool



Brad Wentz, P.E.
Program Director –
NDSU/UGPTI
Bradley.wentz@ndsu.edu

<https://www.ugpti.org/resources/grit/>

21

10/23/24

21