

- WISE ROADS 2021 -

Gravel Road Research



Wednesday, October 13, 2021
WDEA Annual Meeting

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Research conducted by the North Dakota Local Technical Assistance Program (NDLTAP), a Program of the Upper Great Plains Transportation Institute, in partnership with the Western Dakota Energy Association (WDEA) and the North Dakota Department of Transportation (NDDOT).



NDSU

UPPER GREAT PLAINS
TRANSPORTATION INSTITUTE
NORTH DAKOTA LOCAL TECHNICAL ASSISTANCE PROGRAM

Wise Roads

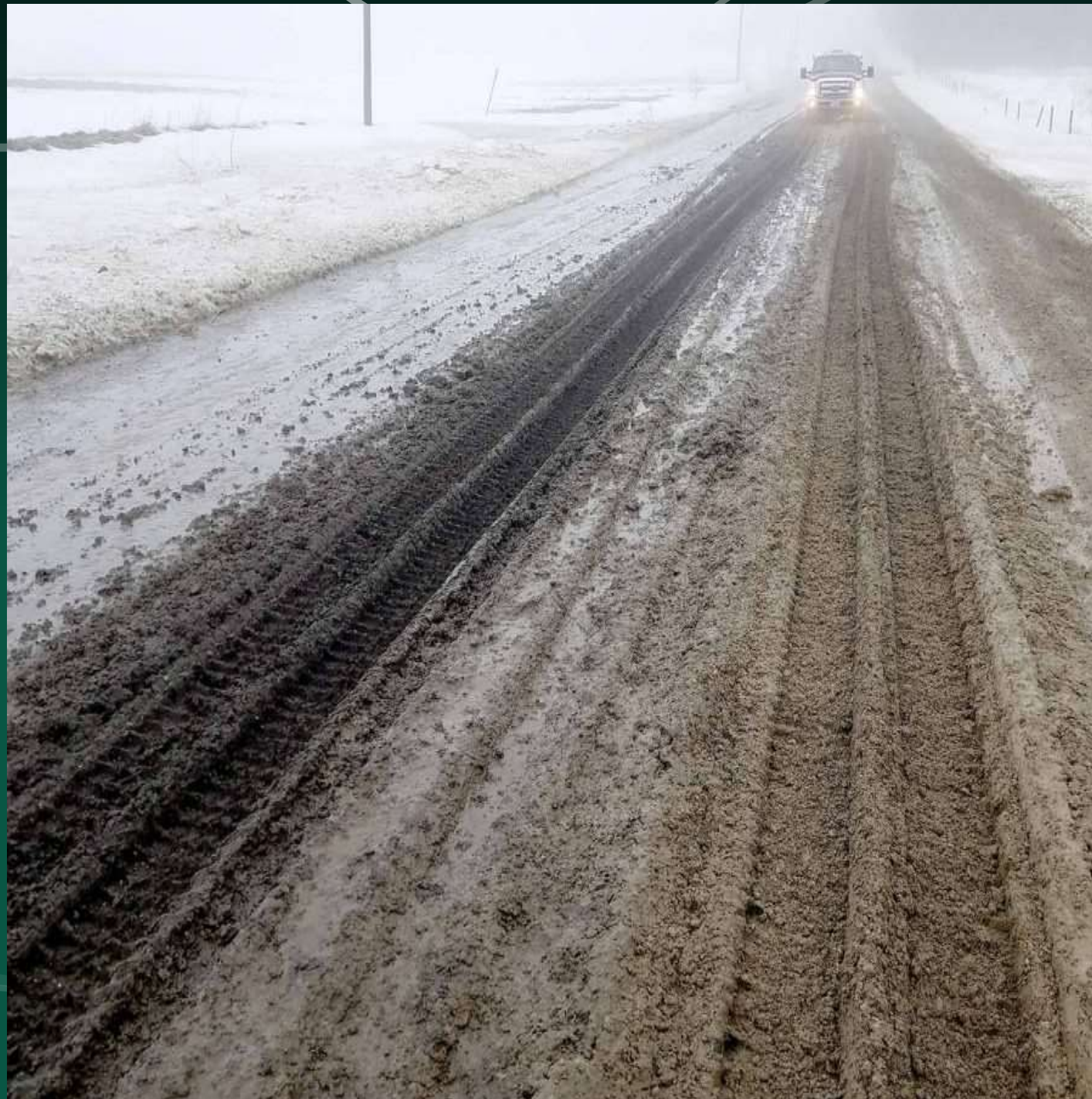
*'Weather Information System to Effectively
Reduce Oilfield Delays and Disruptions'*



Problem:

Muddy Gravel Roads Can't Carry Loads

When inclement weather strikes, local governments impose weight restrictions on gravel roads that prohibit the movement of oilfield truck traffic until road conditions improve.

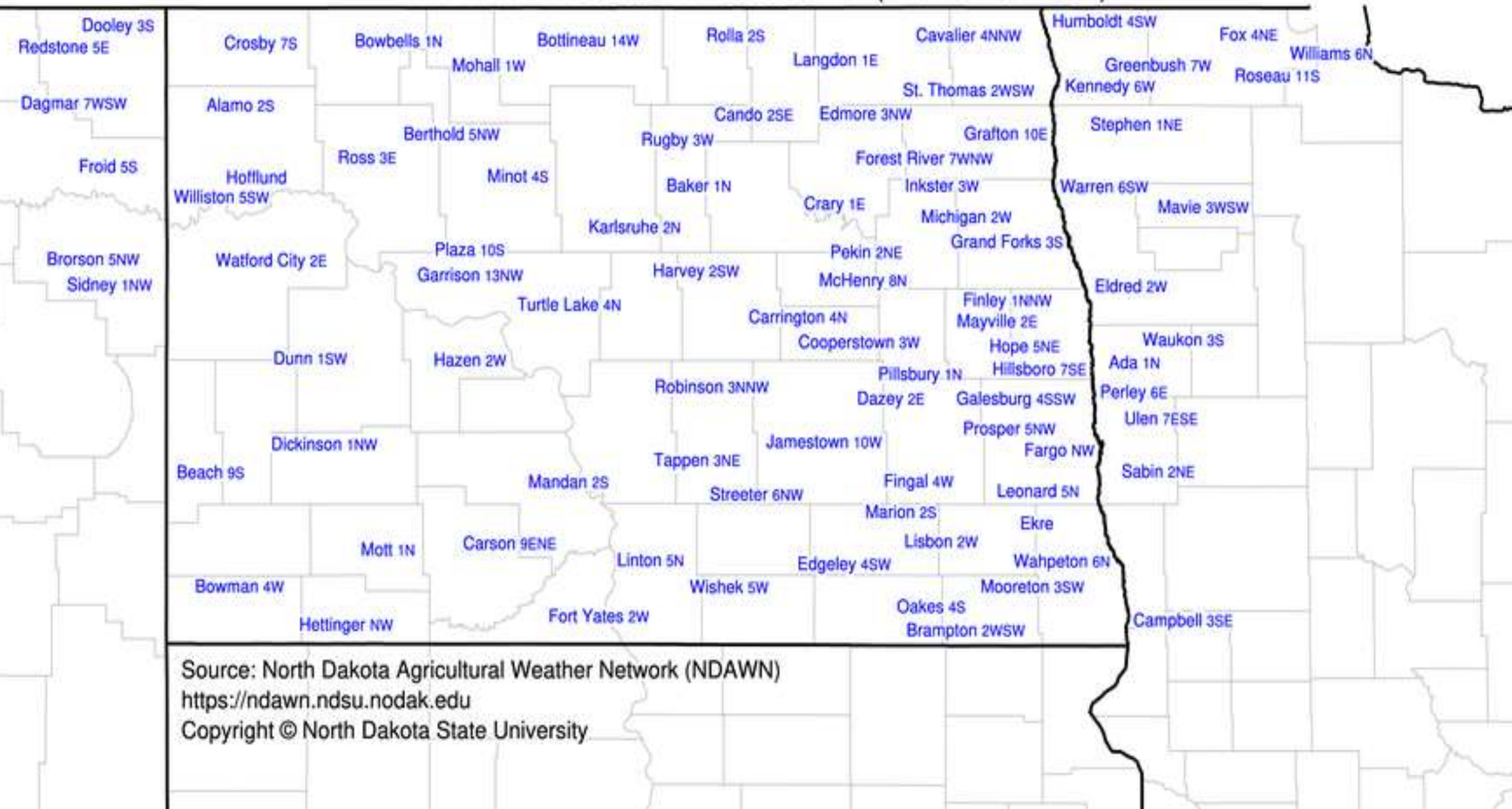


How can
technology turn
this into a
**Smart
Road?**





NDAWN Station Locations (2019-07-02)



Source: North Dakota Agricultural Weather Network (NDAWN)

<https://ndawn.ndsu.nodak.edu>

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Wise Roads Project

- ✓ Work with research partners, agriculture, and Industry to maximize benefit
- ✓ Install research-grade weather stations in areas with heavy oilfield traffic
- ✓ Make data publicly available through NDAWN, LoadPass and other sites
- ✓ Provide training to road managers through LTAP



Toward
365



History

- Watford City Western Energy Roundtable
- Industrial Commission Funds Wise Road Launch
- 2019 – 18 weather stations added
- 2020 – 14 weather stations, 2 road probes added
- 2021 – 10 weather stations, 1 road probe added to date

2019-07-17 05:20:41 PM



NDAWN - 5NW Charbonnet

2019-07-17 05:19:40 PM



NDAWN - 9N Amegard

2019-07-17 05:19:41 PM



Rain Events are
often isolated

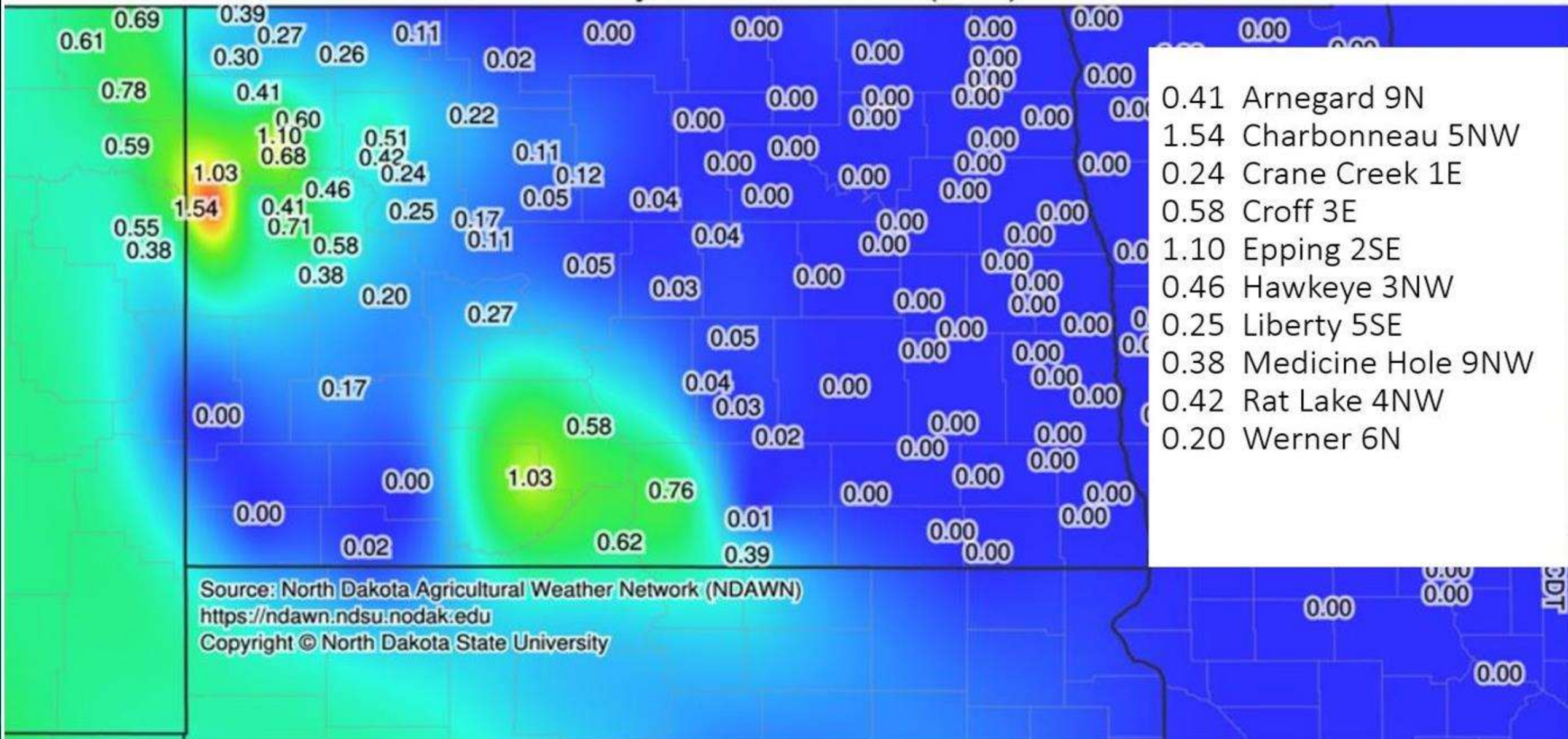
NDAWN - 3E Croff

2019-07-17 05:19:41 PM



NDAWN - 3NW Hawkeya

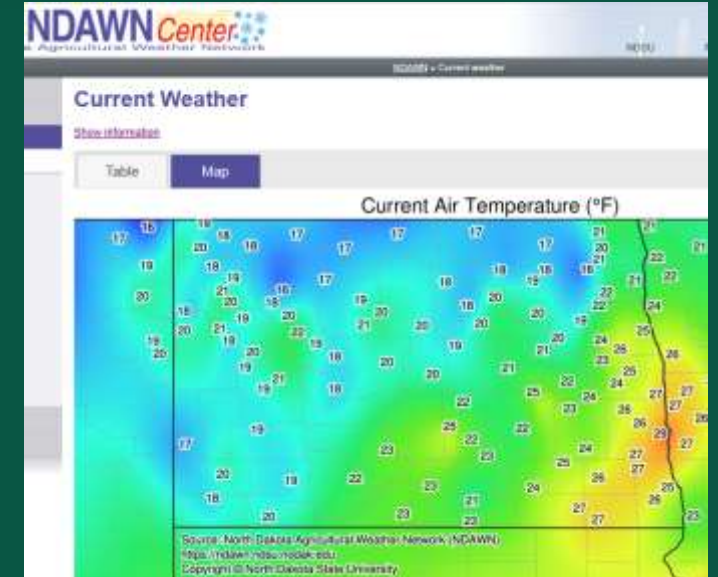
Today's Total Rainfall (inch)

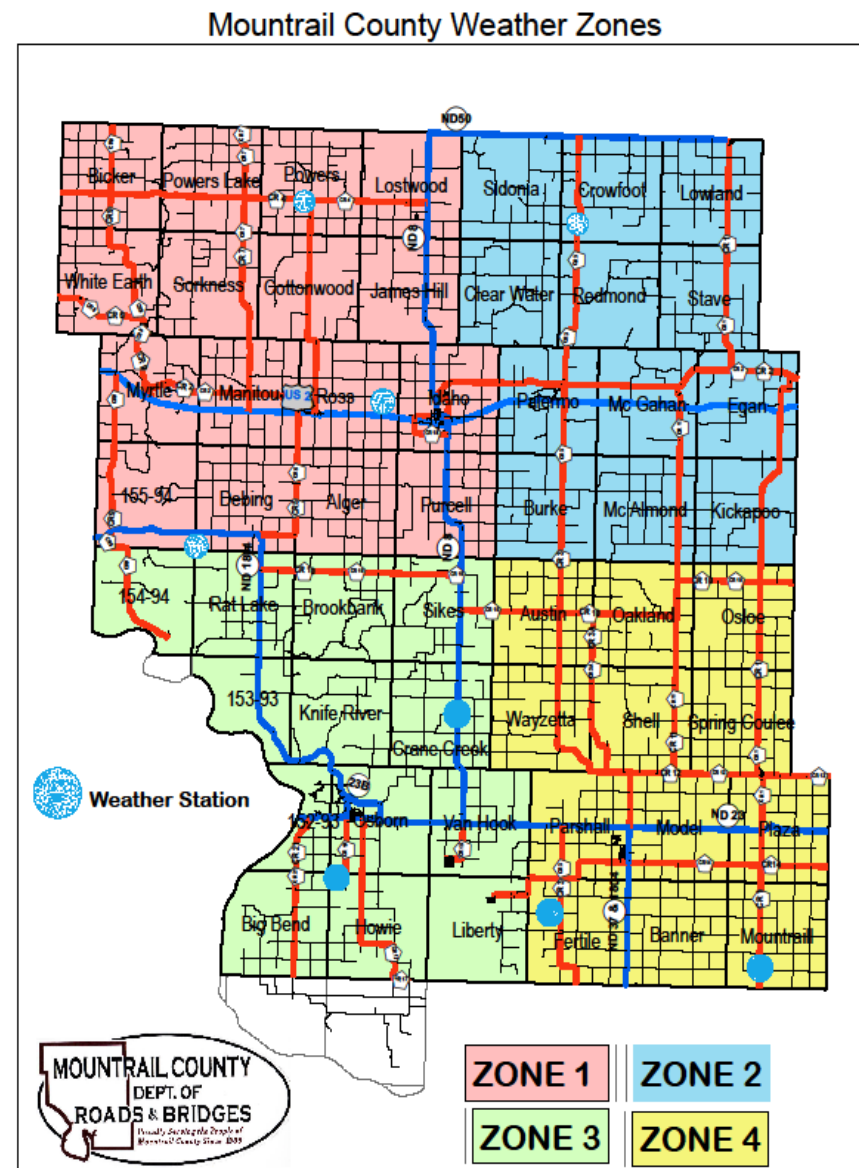
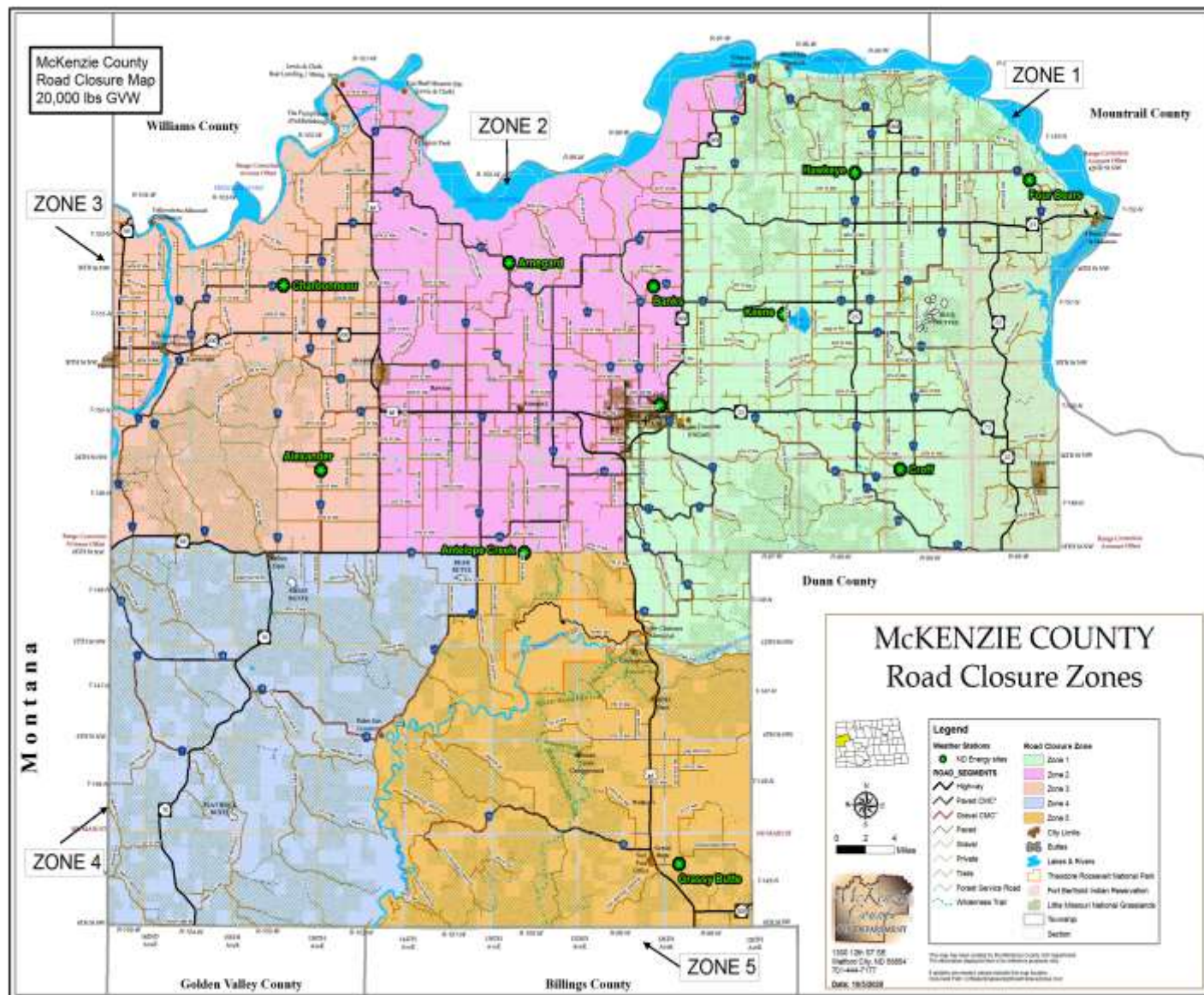


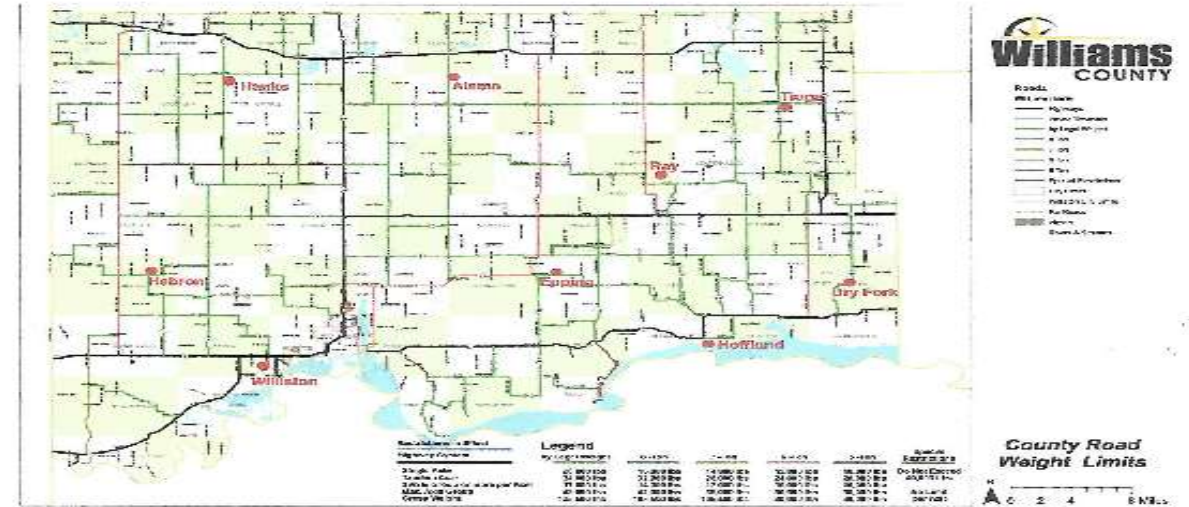
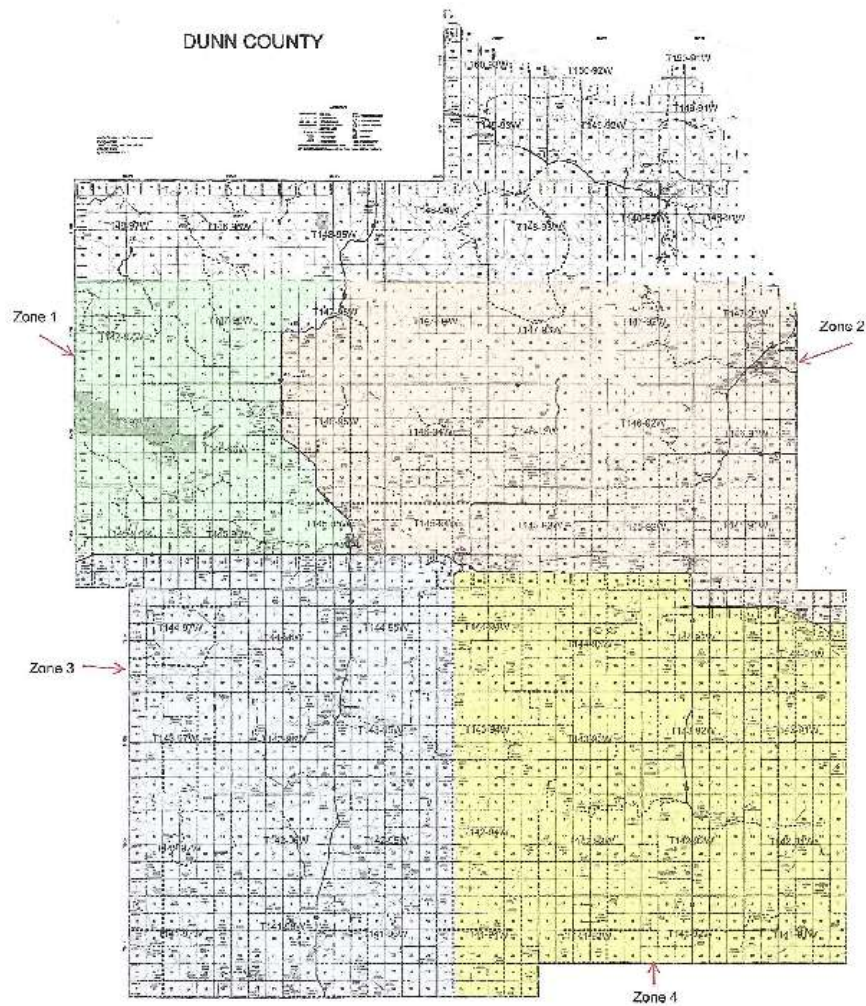
The new stations can be identified by the precipitation numbers on the map. The names are either related to a nearby community or the township in which the station is located.

EXPECTATIONS OF THE PROJECT

- ▶ County Road Departments can use the weather data to determine the area of impact for weight restrictions
- ▶ County Road Departments use weather station locations to create/modify road “zones” for issuing restrictions
- ▶ Forecast and weather accessible from:
 - ▶ Ndenergy.org and LoadPassPermits.com
 - ▶ NDAWN (ndawn.ndsu.nodak.edu)
 - ▶ County Websites
 - ▶ UGPTI - GRIT







GRAVEL ROAD WARRIOR

NDSU UPPER GREAT PLAINS
TRANSPORTATION INSTITUTE

Better Gravel = Better Roads =
SAFER ROADS

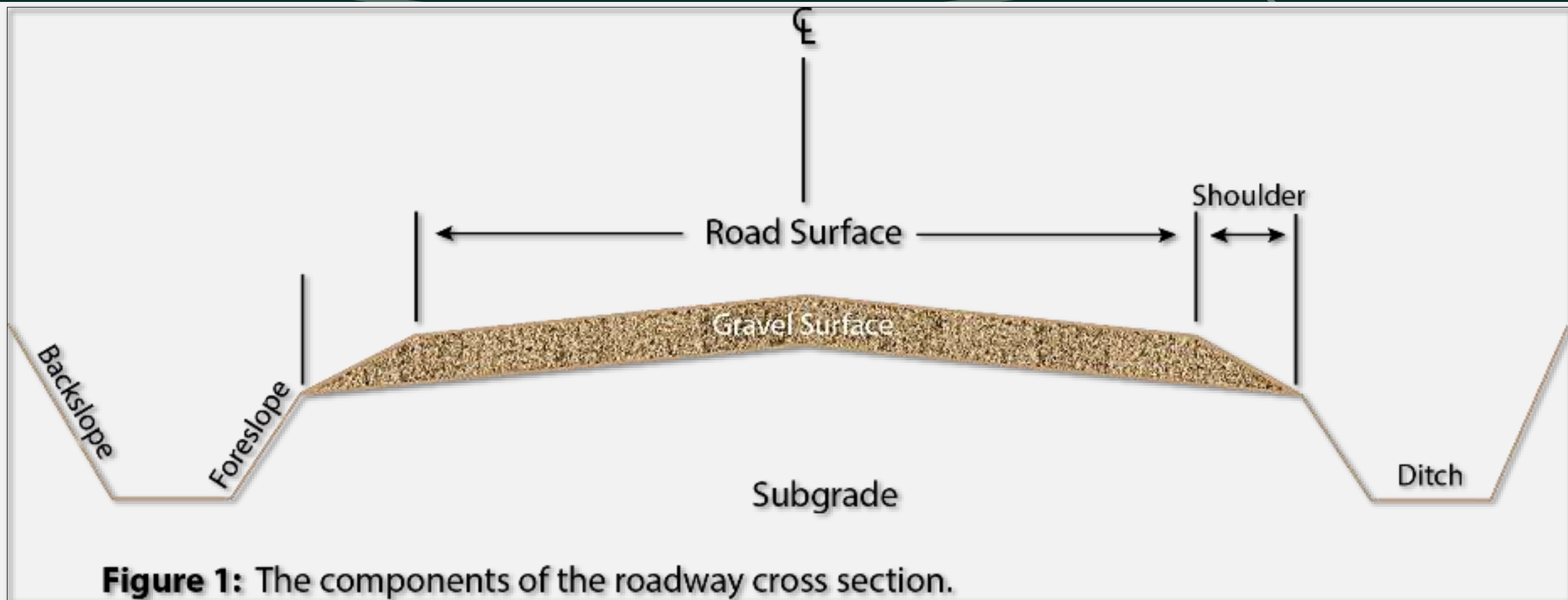


www.ndltap.org/resources/

**VISION
ZERO**
Zero Fatalities. Zero Injuries.

Roadway Condition Assessments





Gravel Depth

05/20/2020 13:20

Roadway Slope



05/20/2020 13:14

INSTRUMENTS THAT HELP YOU MAKE THE GRADE

SLOPE METER NO. 2

THIS PRECISION INSTRUMENT MOUNTED ON HIGHWAY
CONSTRUCTION MACHINERY WILL SHOW THE
SETTING OF THE BLADE FOR A DESIRED SLOPE.

MANUFACTURED BY

SLOPE METER, INC.

MINNEAPOLIS, MN 55432

U.S. PATENT NO. 2,357,817 SEPT. 12, 1944; CANADIAN NO.

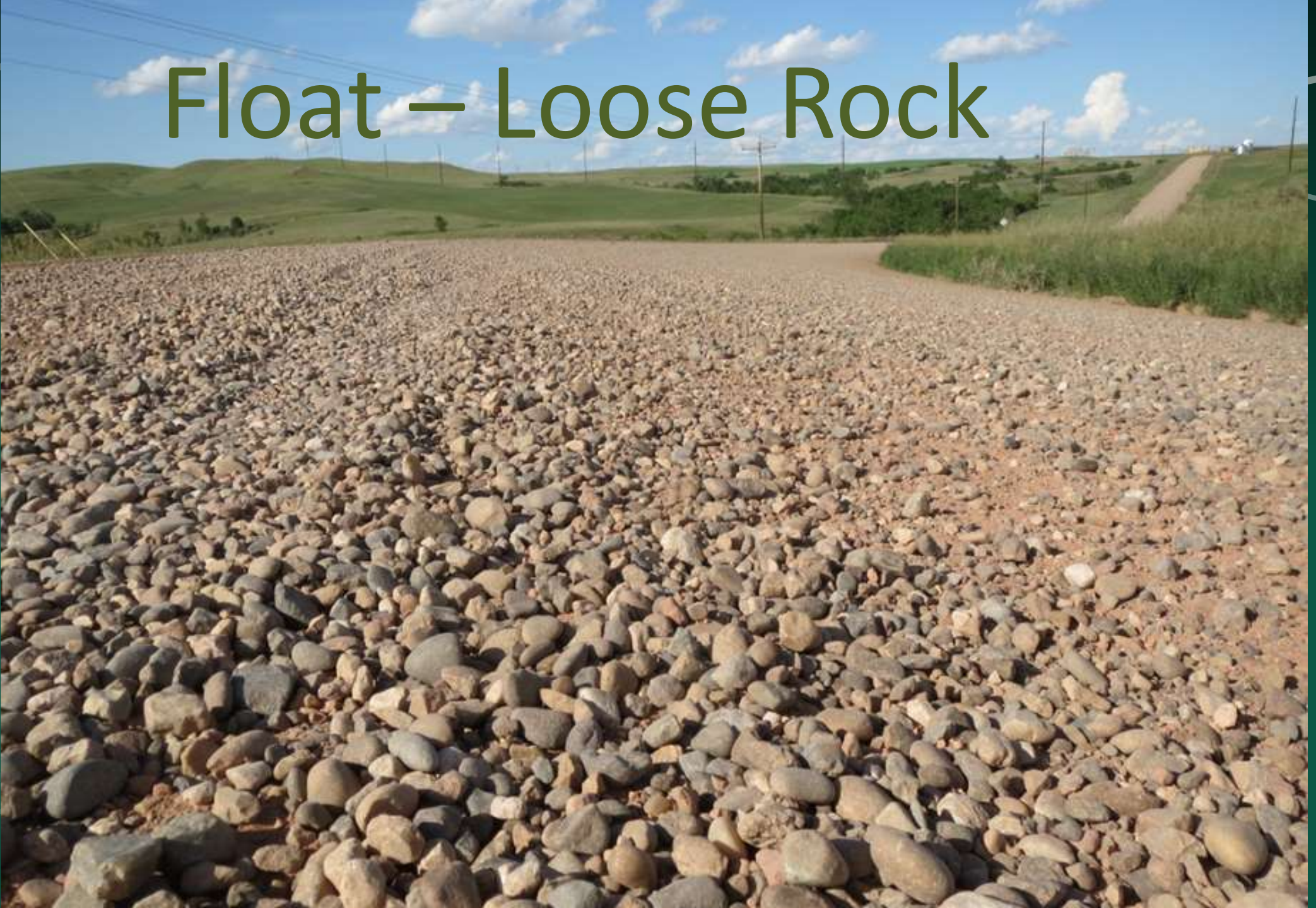
U.S.A.

437,280 OCT. 8, 1946; BRITISH NO. 581,873 JULY 6, 1944

4% Slope on Gravel

10 8 6 4 2 0 2 4 6 8 10 12

Float – Loose Rock



Float



05/20/2020 14:00

Corrugations = Wash Boarding



Gravel

Material Assessment



526 10th St NE, Suite 300
PO Box 485
West Fargo, ND 58078
Phone: 701-232-8701

Client:
Western Dakota Energy Association
1661 Capitol Way
Bismarck, ND 58501

Project:
H21005445
NDSU-LTAP
Lab Testing
<Blank>, <Blank>

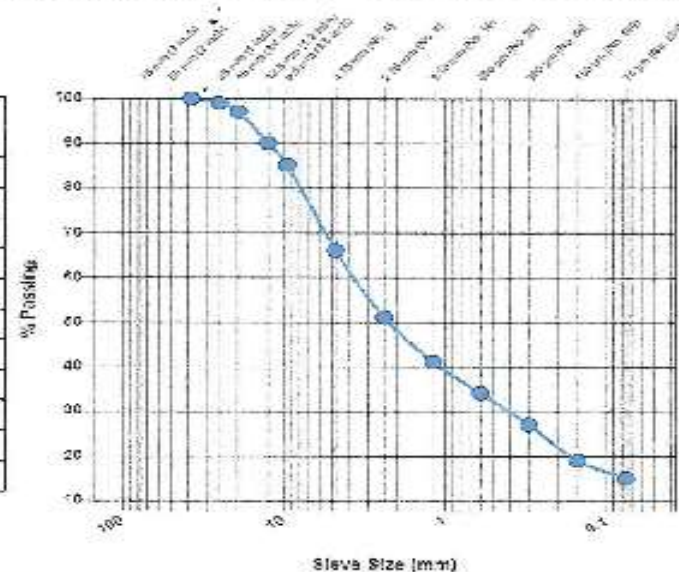
Sample Information

Sample Number:	317316	Alternate ID:	G-01
Sample From:	Unknown	Source:	Existing Material
Location Details:	Hawkeys #1	Sampled By:	Client
Specification:	For Informational Purposes Only		
Sample Date:	08/12/2020		
Received Date:	08/12/2020	Lab:	526 10th Street NE, Suite 300, West Fargo, ND
Tested Date:	08/18/2020	Tested By:	Lage, Andrew

Laboratory Data

Sieve Size	Passing %	Specification
37.5 mm (1.5 inch)	100	100
25 mm (1 inch)	99	70-100
19 mm (3/4 inch)	97	
12.5 mm (1/2 inch)	93	
9.5 mm (3/8 inch)	85	
4.75 mm (No. 4)	66	38-70
2.36 mm (No. 8)	51	22-62
1.18 mm (No. 16)	41	
600 µm (No. 30)	34	12-45
300 µm (No. 60)	27	
150 µm (No. 100)	19	
75 µm (No. 200)	15.3	10-17

Test Method: Single Sieve Set
Split At What Size: 4.75 mm (No. 4)

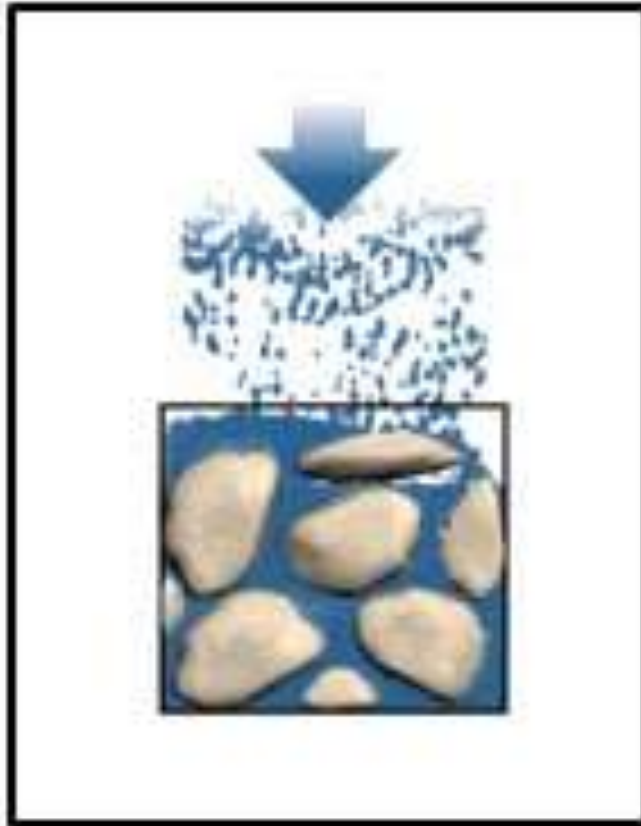


General

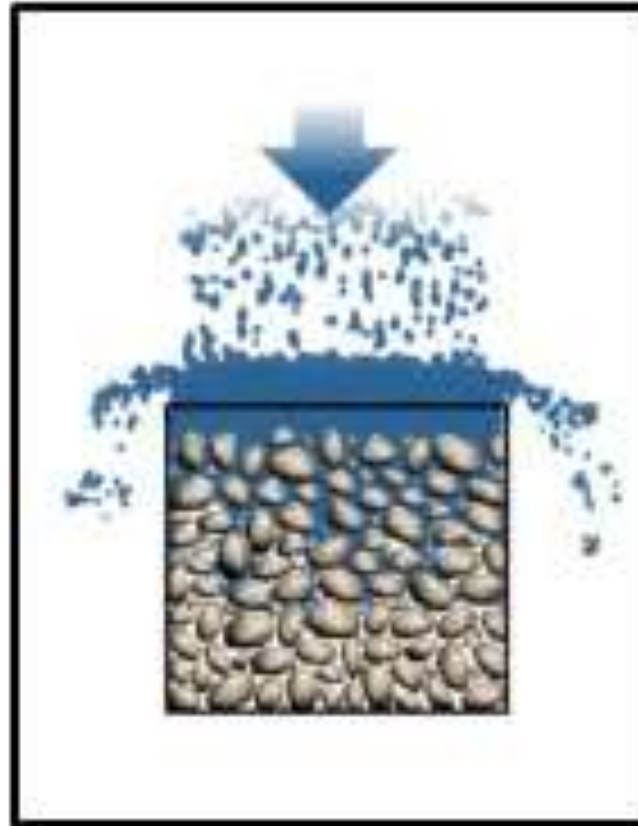
Results: The test is for informational purposes.
Remarks: Atterberg Limit = Non Plastic.

Gravel Quality – Gradation and Binder

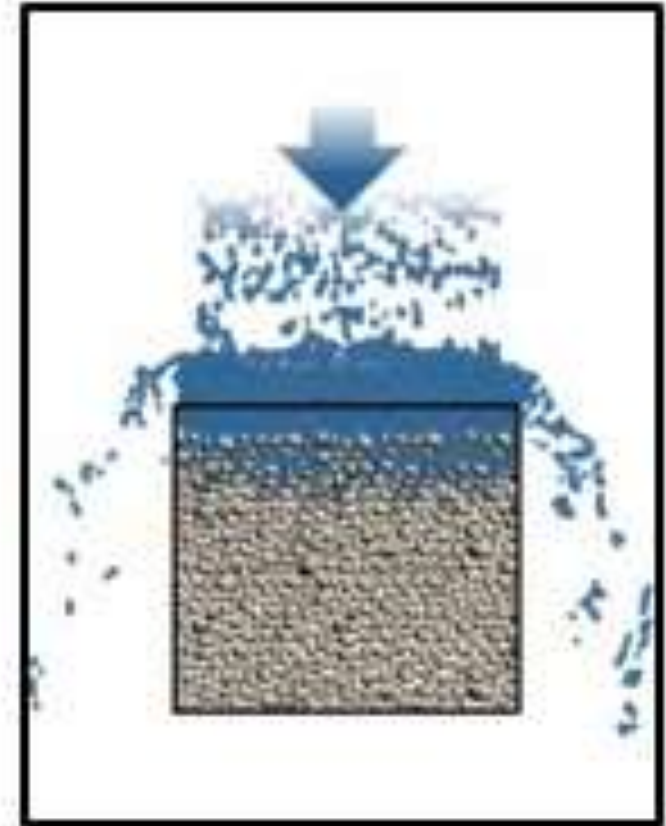
Infiltration Variations by Soil Texture



Sand



Silt



Clay

©The COMET Program



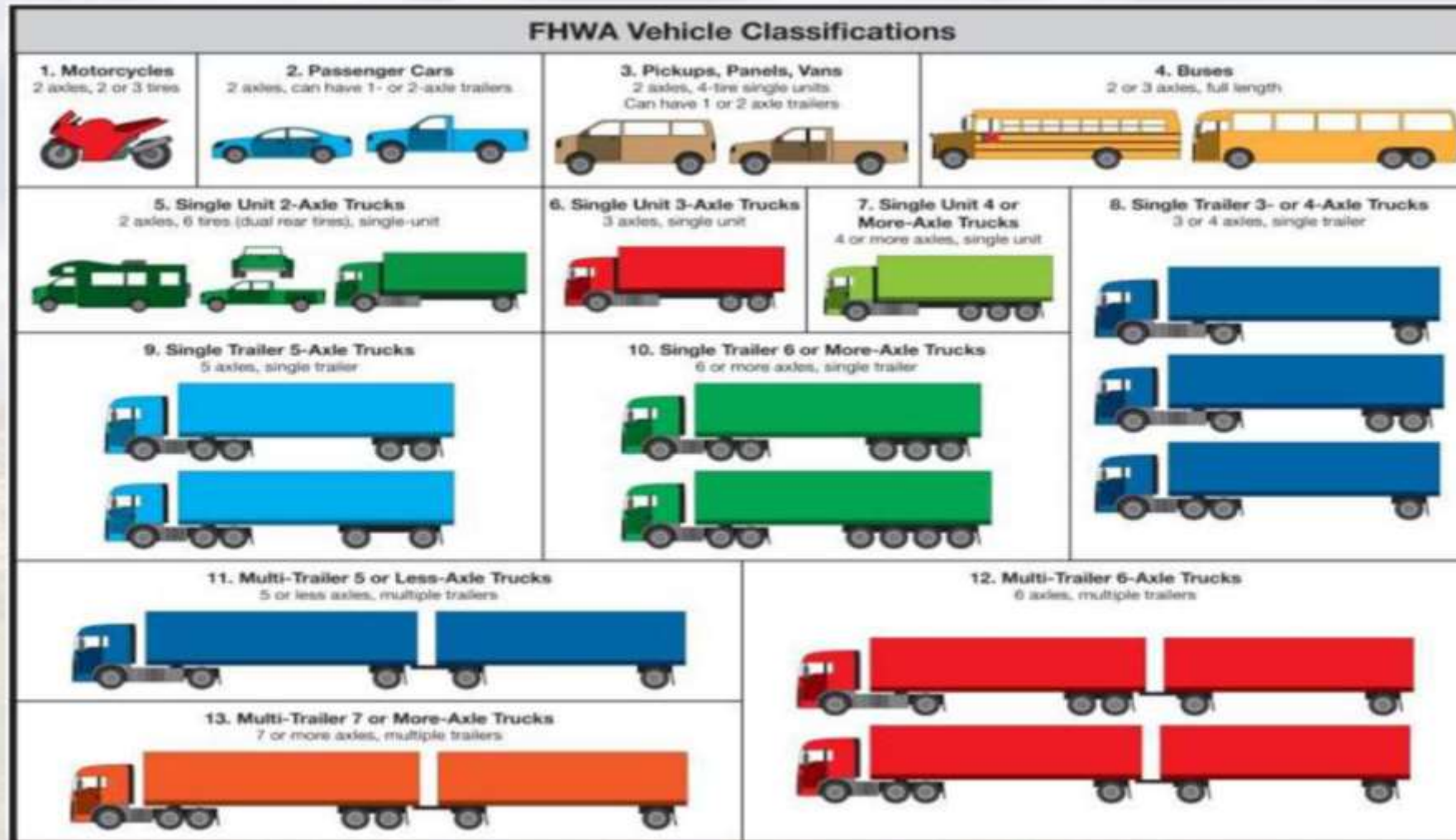
Traffic Counts




WISE Roads Traffic Count Data

Location					Start Date Time	End Date Time	Day 1 ADT	Day 2 ADT	Ave ADT	Clas s 1	Class 2	Class s 3	Clas s 4	Clas s 5	Class 6	Class s 7	Class 8	Class s 9	Class 10	Class 13	Tot al
Medicine Hole, Dunn Co 115th Ave. NW					8/5/2020 0:00		162	N/A	162	5	93	2	1	17	7	0	28	2	1	6	162
Hawkeye WISE Road site 43rd St. NW Co. #55					8/5/2020 0:00	8/7/20 0:00	219	157	188	1	115	11	2	13	9	0	19	5	4	11	188
Epping WISE road] Williams Co. Road #6					8/5/2020 15:00	8/6/20 15:00	132	149	281	0	206	38	1	15	7	1	7	2	1	3	281

Vehicle classes



A photograph of a person in a black jacket and blue jeans using a penetrometer on a dirt surface. The person is bent over, holding the vertical rod of the device. The background is a field of green grass with yellow wildflowers. The text 'Subgrade Strength' is overlaid in green on the right side of the image.

Subgrade Strength

Subsurface probes – moisture and temperature



Jonathan Rosencrans - Meteorologist



MEDICINE HOLE PROBE INSTALLATION 2020







PEPPING PROBE
INSTALLATION 2020





EPPING PROBE INSTALLATION



McKenzie Location Banks 2021



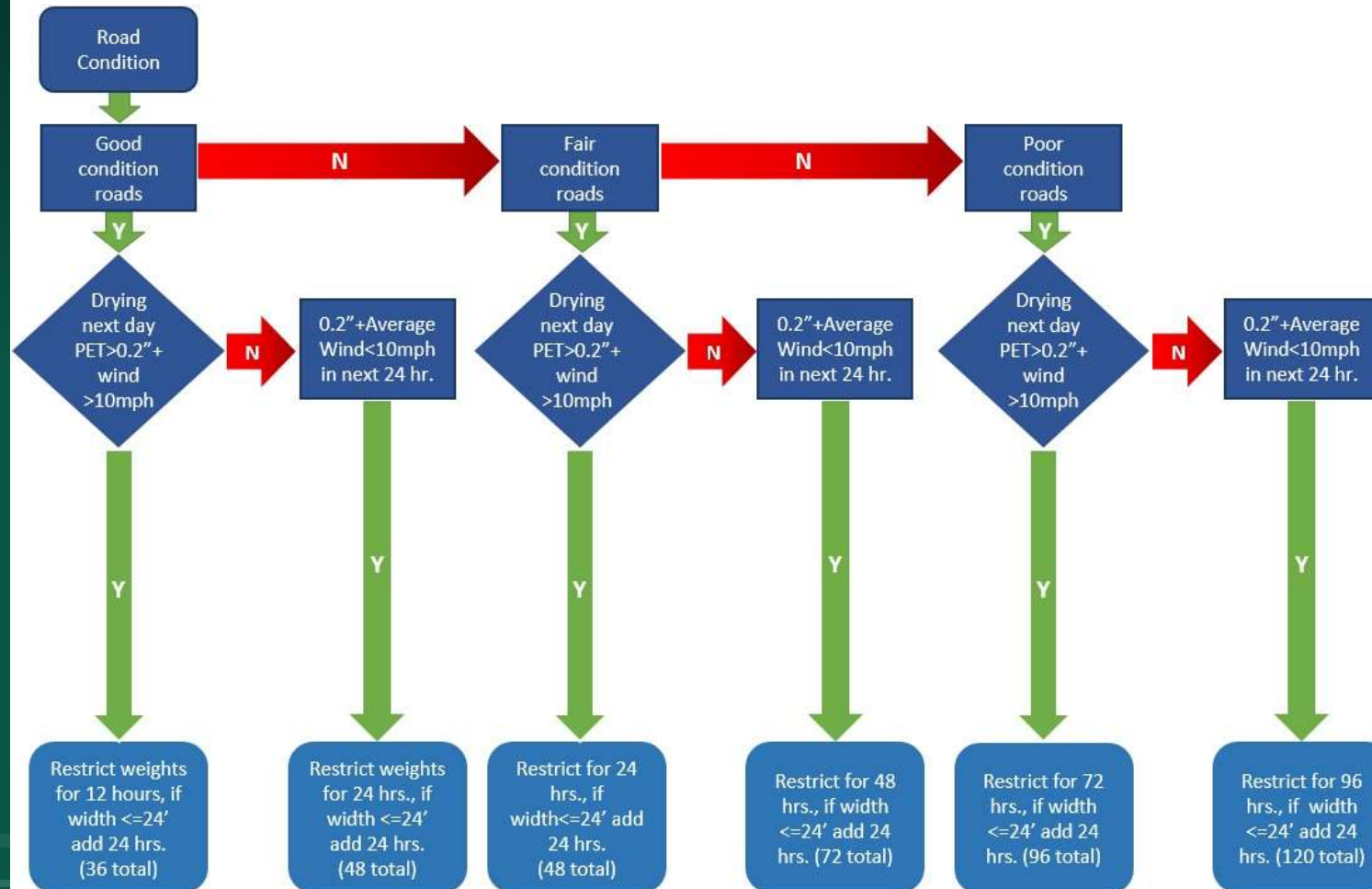


Restriction Results 2021

County	Road	Restriction	Rainfall	Start		End		
				Date	Time	Date	Time	
McKenzie	All gravel roads	20,000 GVW		5/8/2021	3:00 PM	5/9/2021	4:00 PM	
Dunn	All gravel roads	12,000 GVW		5/8/2021	3:00 PM	5/9/2021	5:00 PM	
Mountrail	Liberty Twsp roads	20,000 GVW		5/21/2021	9:00 AM	5/22/2021	8:30 AM	
Divide	All gravel roads	12,500 GVW		5/21/2021	Noon	5/23/2021	8:30 AM	
McKenzie	CR 55 from ND 23 to ND 1806	Closed		5/22/2021	1:00 PM	5/24/2021	Noon	
Dunn	28th St SW from Hwy 22 to 98th Ave SW	12,000 GVW		5/22/2021	2:00 PM	5/24/2021	2:30 PM	
Divide	CR 10	12,500 GVW		5/23/2021	8:30 AM	5/27/2021	6:00 PM	
Dunn	All gravel roads	12,000 GVW		5/23/2021	6:00 PM	5/24/2021	8:00 AM	
Billings	All gravel roads	12,000 GVW		5/23/2021	7:30 PM	5/24/2021	8:00 AM	
McKenzie	All gravel roads	20,000 GVW		5/23/2021	10:00 PM	5/24/2021	Noon	
McKenzie	CR 55 from ND 23 to ND 1806	20,000 GVW		5/24/2021	Noon	5/28/2021	Noon	
Divide	All gravel roads	12,500 GVW		5/24/2021	8:00 AM	5/24/2021	2:00 PM	
Williams	All gravel roads and chip seal roads	20,000 GVW		6/11/2021	6:00 AM	6/12/2021	6:00 AM	
Mountrail	All gravel roads	No Over Weight		6/11/2021	6:45 AM	6/14/2021	8:30 AM	
Divide	All gravel roads	12,500 GVW		6/11/2021	7:45 AM	6/12/2021	10:00 AM	
Williams	Strandahl Township roads	No Over Weight		6/11/2021	8:00 AM	6/15/2021	7:30 AM	
Burke	All gravel roads	12,500 GVW		6/11/2021	9:00 AM	6/12/2021	1:00 PM	
Burke	93rd St NW between 75th & 76th Ave NW	Closed		6/11/2021	9:20 AM	6/18/2021	1:00 PM	* Culvert washed out
McKenzie	All gravel roads	20,000 GVW		6/11/2021	#####	6/12/2021	10:00 AM	
Williams	70th St NW from 112th to 110th Ave NW (Co 19)	Closed		6/11/2021	12:30 PM	6/14/2021	3:15 PM	* Power lines over the road
McKenzie	45th St NW between US 85 and 148 T Ave NW	Reduced Speeds		6/11/2021	2:00 PM	6/16/2021	11:00 AM	* Soft and washed out road shoulders
McKenzie	36th St NW between 159th & 158th Ave NW	Closed		6/11/2021	4:00 PM	6/21/2021	4:00 PM	* Culvert washed out
Mountrail	69th Street between 93rd Ave and 94th Ave	Closed		6/11/2021	4:30 PM	6/14/2021	10:30 AM	* Downed trees across roadway
Mountrail	CR4 (74th St) at CR7 (91st Ave) to CR5 (87th Ave)	12,000 GVW		6/11/2021	5:30 PM			
Mountrail	96th Ave between ND1804 and 51st Street	6 Ton/axle - 80,000 max		6/14/2021	8:30 AM			
Mountrail	CR19 between ND23 and 36th Street	8 Ton/axle - 80,000 max		6/14/2021	8:30 AM			
Mountrail	99th Ave from US 2 to S to 60th St	20,000 GVW		6/28/2021	2:00 PM	6/29/2021	4:30 PM	* Culvert collapsed
Mountrail	CR4 (74TH Street) from CR7 (91st Ave) East to CR5 (87th Ave)	12,000 GVW		7/9/2021	9:30 AM	7/12/2021	10:30 AM	

Data Driven Decisions

WISE Roads Decision Tree for post spring thaw period after $\geq \frac{1}{2}$ " rain in 24 hrs.



Gravel Roadway Properties

plus

Rainfall Event Data

Equates to refined roadway condition data:

TOWARD 365 Prediction Model

Poster

(Available at the NDLTAP booth)

WISE ROADS

(Weather Information System to Effectively Reduce Oilfield Delays and Disruptions)

Protecting Roads and Keeping Traffic Moving in Oil Country

Township and county gravel roads are the backbone of the ND economy, particularly its western oil counties. Oil production is a 365-days-per-year effort and can be hampered by roadway structural deficiencies resulting from moisture. Gravel surfacing and subgrade may become so saturated that any trucks quickly damage or destroy the roadway. Consequently, timely placement and removal of road weight restrictions balances the need to prevent costly road rebuilding with road users' needs. WISE Roads weather stations (<https://wiseroadsnd.com>) with sub-surface probes provides detailed weather conditions and forecasts along with sub-surface moisture and temperatures to help roadway owners make more refined decisions.



Toward 365 Project

Toward 365 Project allows counties to use site-specific weather and roadway information to limit loads only on roads impacted by weather while allowing full use of non-impacted roads.

Enhancing NDDOT's Transportation Management System

In 2019, the NDDOT began implementing a TMC (Transportation Management System) to manage and create a "one-stop shop" for transportation data. NDLTAP and NDDOT are integrating WISE Road and NDAWN weather information with NDDOT's Road Weather Information System, resulting in a quantum leap forward for the TMC. The integrated information is available on NDDOT's ND Roads web page at <https://travel.dot.nd.gov> and expand the Weather link.



WISE ROADS was developed in a partnership between the Western Dakota Energy Association, NDLTAP and the ND Agricultural Weather Network (NDAWN) at NDSU. Another energy-based improvement, developed to benefit all of North Dakota.

WISE ROADS 2021

Weather Information System to Effectively
Assess Rain Influenced Gravel Road Conditions



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Project is funded and supported by: NDAWN,
WDEA/LoadPass, UGPTI/NDLTAP and a grant from the Oil
and Gas Research Council

