
WELCOME TO
NORTH
Dakota
Be Legendary.™


Little Missouri
Scenic River
GhostsofNorthDakota.com

Thanks to Jason Benson, Cass County, Reed Oien, Steele County and Nick West, Grand Forks County, for their Contributions.

Bridge/Culvert Basics

Water, Weight and Aging

Bryon Fuchs, PE
Local Government, NDDOT

Dale C. Heglund, PE/PLS
Program Director, NDLTAP

Great Plains Tribal Transportation Training Workshop

Newtown – August 18, 2021

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

U.S. Department of Transportation Federal Highway Administration

NORTH Dakota | Transportation
Be Legendary.

North Dakota's Culvert Health

NDSU

UPPER GREAT PLAINS
TRANSPORTATION INSTITUTE
NORTH DAKOTA LOCAL TECHNICAL ASSISTANCE PROGRAM

Local Roads Corrugated Metal Pipe (CMP) Workshop

Join Us!

NDLTAP

&

TrueNorth Steel

August 25, 2021 – McLean County, Washburn

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

I can buy 55 gal. drums and weld them end-to-end for less than $100 each. I know the galvinized culverts will last longer than the drums - even in the Ozarks - but have any of you had experience with the drums and how long did they last in rocks and clay? A "newbie" who has read Cattle Today for four years and this is the first question. Thanks in advance!

Culvert Types

Families file claim against BIA over deadly washout

2 died in July 2019 incident on Standing Rock Reservation

TRAVIS SVIHOVEC
Bismarck Tribune

The families of two people who died a year ago in a road washout on the Standing Rock Reservation are seeking unspecified monetary damages from the federal Bureau of Indian Affairs and better maintenance of roads in Indian Country.

The bureau knew for several years that a culvert on BIA Road 3 was unsafe, and the agency's failure to replace it led to the deaths of two people when the culvert and road above it washed out in July 2019, tims' families allege.

The Tribune reached out to the BIA on Wednesday for comment.

Bismarck attorney Tim Purdon filed the administrative claims Wednesday on behalf of the families of Trudy Peterson, 60, and Jim Vander Wal, 65, both of Mobridge, S.D., who died in the chasm left behind when the culvert and road washed away.

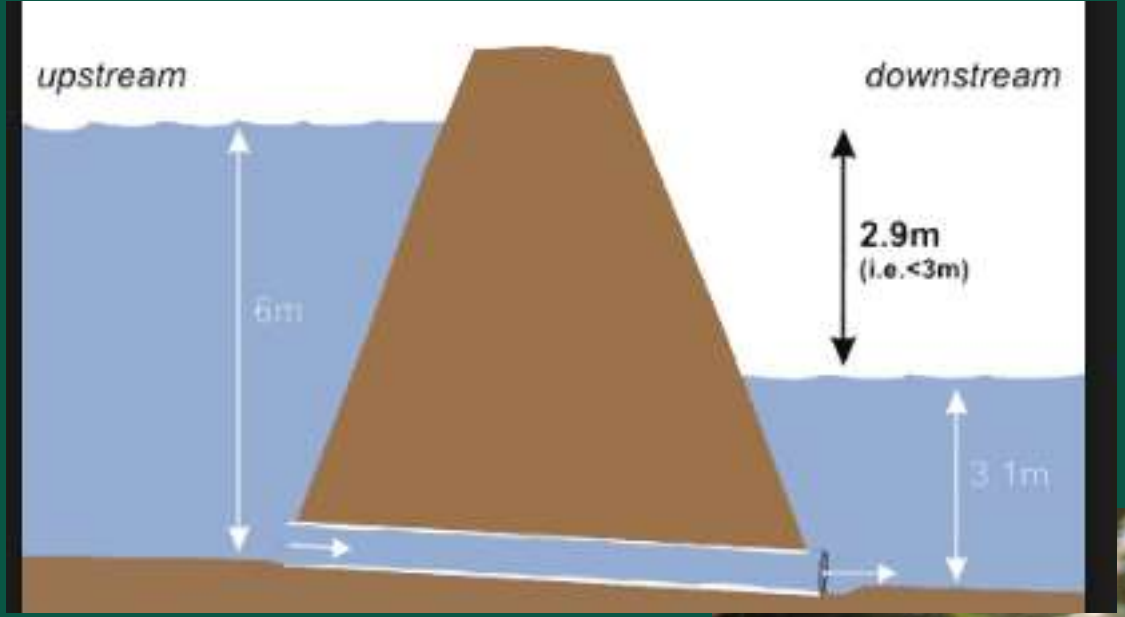
Purdon also represents the drivers of two other vehicles — one an empty Sitting Bull College bus — who had to be rescued from the washout. Steven Willard and Evan Thompson were flown to Bismarck hospitals for treatment of what Purdon said were permanent injuries.

PROVIDED

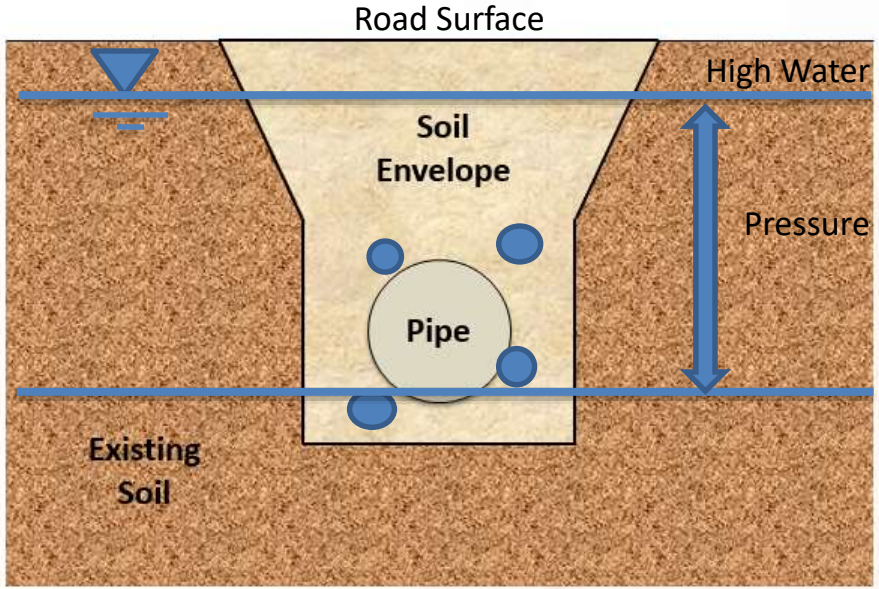
Heavy rain washed out a section of a highway on the Standing Rock Reservation in July 2019, killing two people and injuring two others. The culvert

Sioux County - July 2019


Roads are dams


upstream
downstream
2.9m
(i.e.<3m)
6m
3.1m

Water Pressure – What is Piping?



Program


09/25/2019

Stream Rules

North Dakota's Laws

Stream Crossings Statutes & Rules

Office of the
North Dakota State Engineer
900 East Boulevard
Bismarck, North Dakota 58505

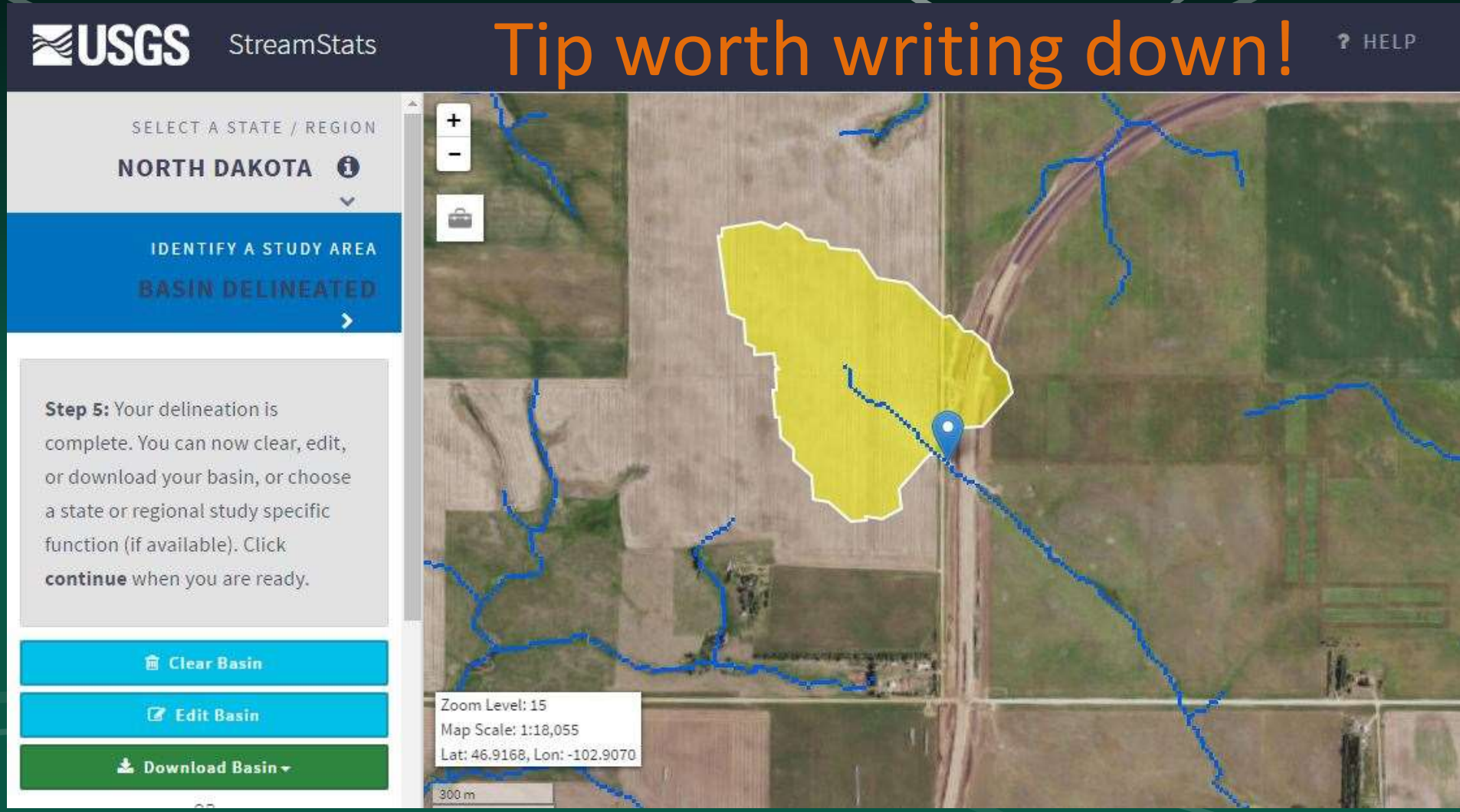
North Dakota Department of Transportation
608 East Boulevard
Bismarck, North Dakota 58505

January 1, 2015

North Dakota Stream Crossing Standards

89-14-01-03. Design flood frequency. The following table provides the minimum design standard recurrence interval of the event for which each type of stream crossing must be designed. Nothing contained in this chapter is intended to restrict an entity from providing greater capacity.

Type of Crossing	State Highway System						County	
	Urban System		Rural System				Rural System	
	Regional	Urban Roads	Principal Arterial		Minor Arterial	Major Collector	Major Collector	Off System
			Interstate	Other				
Bridges & Reinforced Concrete Boxes	25 year[2]	25 year[2]	50 year[2]	50 year[2]	50 year[2]	25 year[2]	25 year[2, 3]	15 year[2, 3]
Roadway Culverts	25 year[2]	25 year[2]	50 year[2]	25 year[2]	25 year[2]	25 year[2]	25 year[2, 3]	15 year[2, 3, 5]
Storm Drains	10 year[1]	5 year[1]	10 year[2]	10 year[2]	10 year[2]	10 year[2]		
Underpass Storm Drains	25 year[1]	25 year[1]	50 year[2]	25 year[2]	25 year[2]	25 year[2]		


USGS
StreamStats
Tip worth writing down!
HELP
SELECT A STATE / REGION
NORTH DAKOTA
IDENTIFY A STUDY AREA
BASIN DELINEATED
Step 5: Your delineation is complete. You can now clear, edit, or download your basin, or choose a state or regional study specific function (if available). Click continue when you are ready.
Clear Basin
Edit Basin
Download Basin
Zoom Level: 15
Map Scale: 1:18,055
Lat: 46.9168, Lon: -102.9070
300 m

100 – Year Storm

- 100-year storm refers to rainfall totals that have a one percent chance of occurring at that location in that year

- Encountering a "100-year storm" on one day does not decrease the chance of a second 100-year storm occurring in that same year or any year to follow

Gambling – the odds are always in your favor

Mama always said:
Life was like a box of chocolates.
You never know what you're gonna get."

- Forrest Gump


09/09/2013

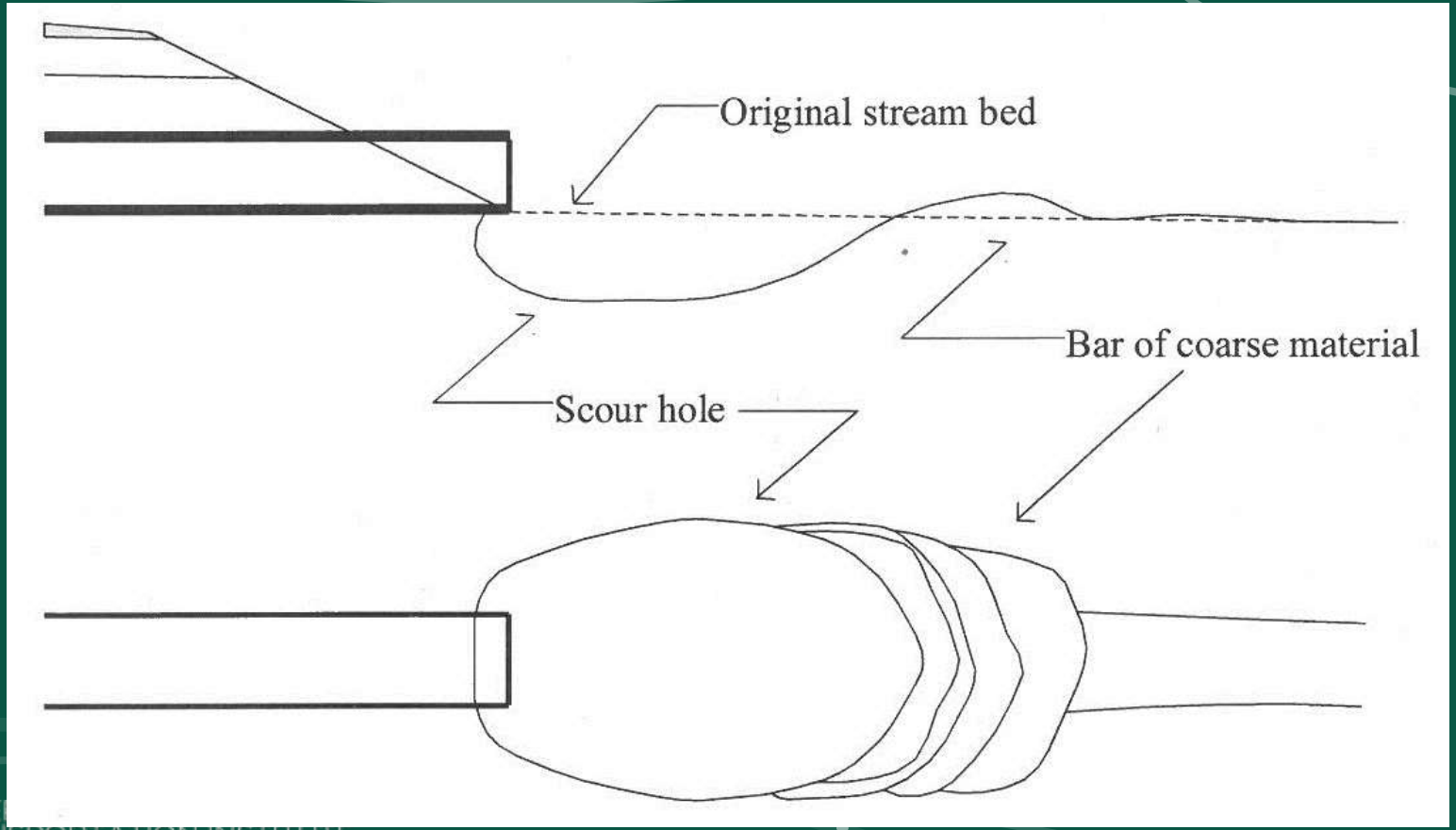
Flow Rate of Water – Velocity Checks

Bridge - 5 feet per second (walk)

Culvert – 10 feet per second (run)

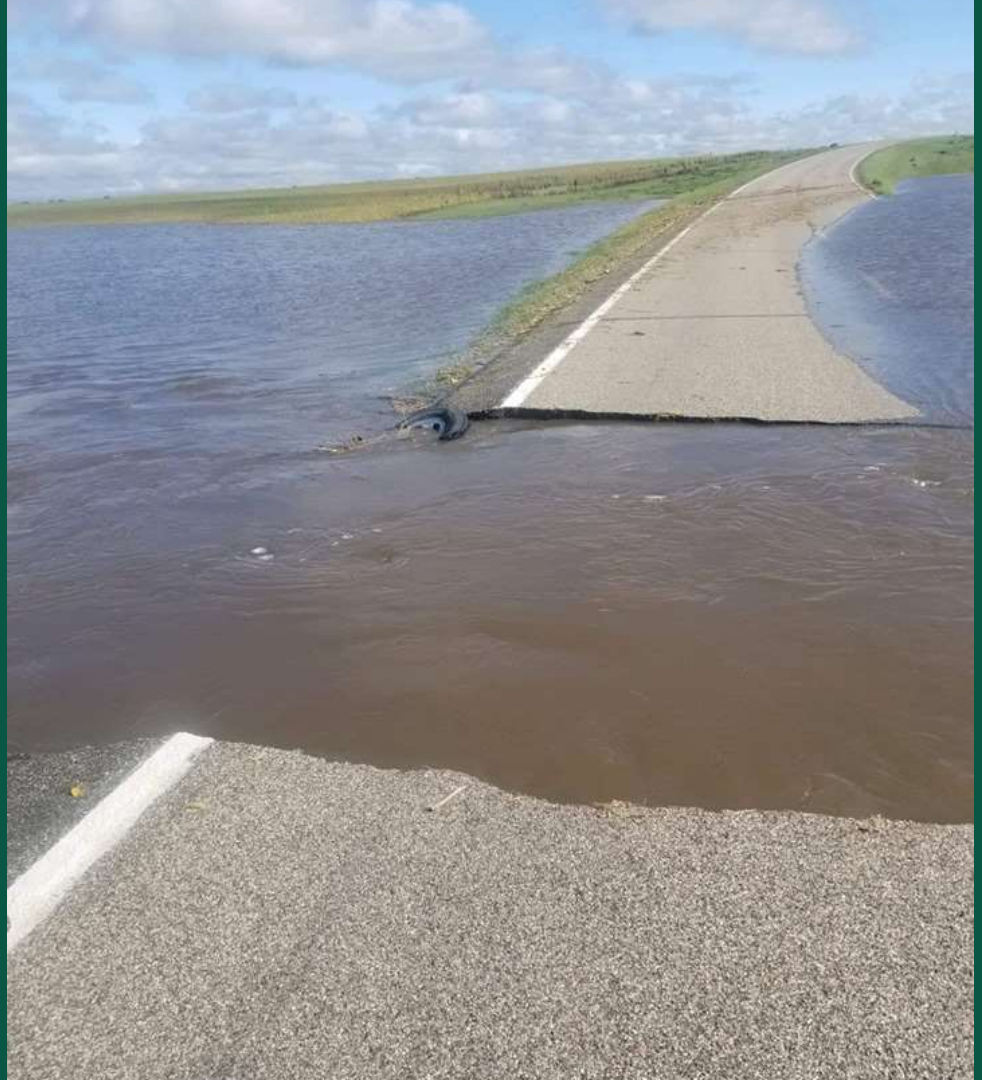
(USFS uses 7 fps in the Badlands – (jog))

Outlet Scour




04/07/2009

Technical Assistance



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0:05
2:30


FLARE: 24"
FLARE: 18"

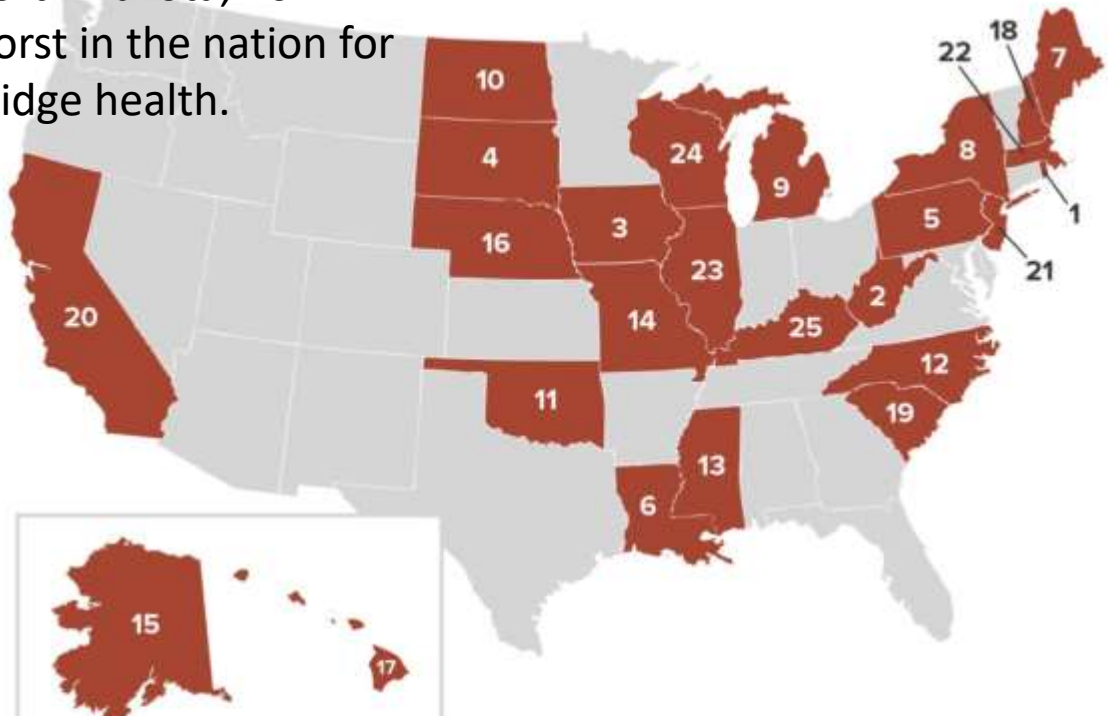
North Dakota's Bridge Health

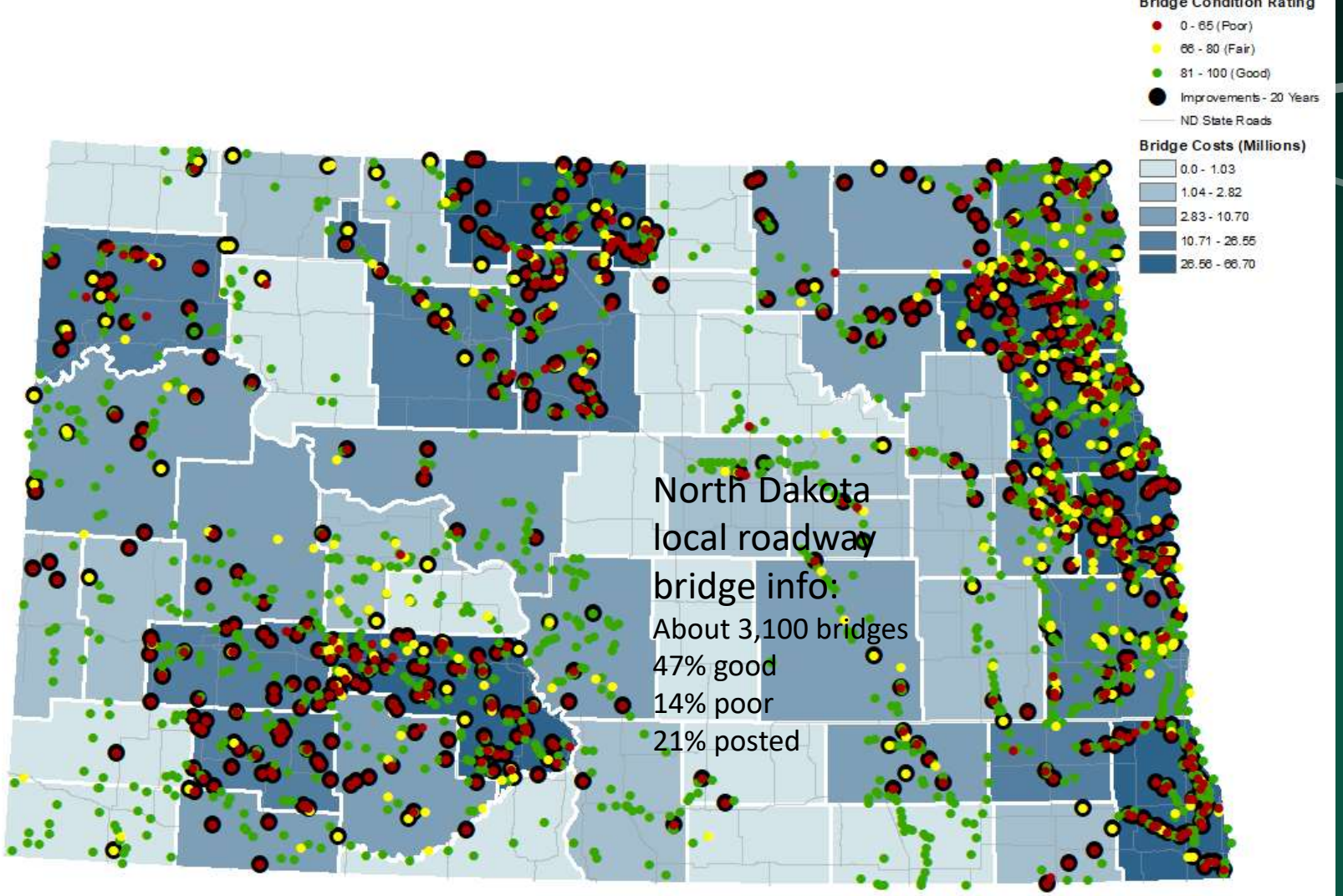
NDSU
UPPER GREAT PLAINS TRANSPORTATION INSTITUTE
NORTH DAKOTA LOCAL TECHNICAL ASSISTANCE PROGRAM

9% of Nation's 614,400 Bridges are Structurally Deficient (NBI, 2016)
(75% of those deficient bridges are on Rural Roads)

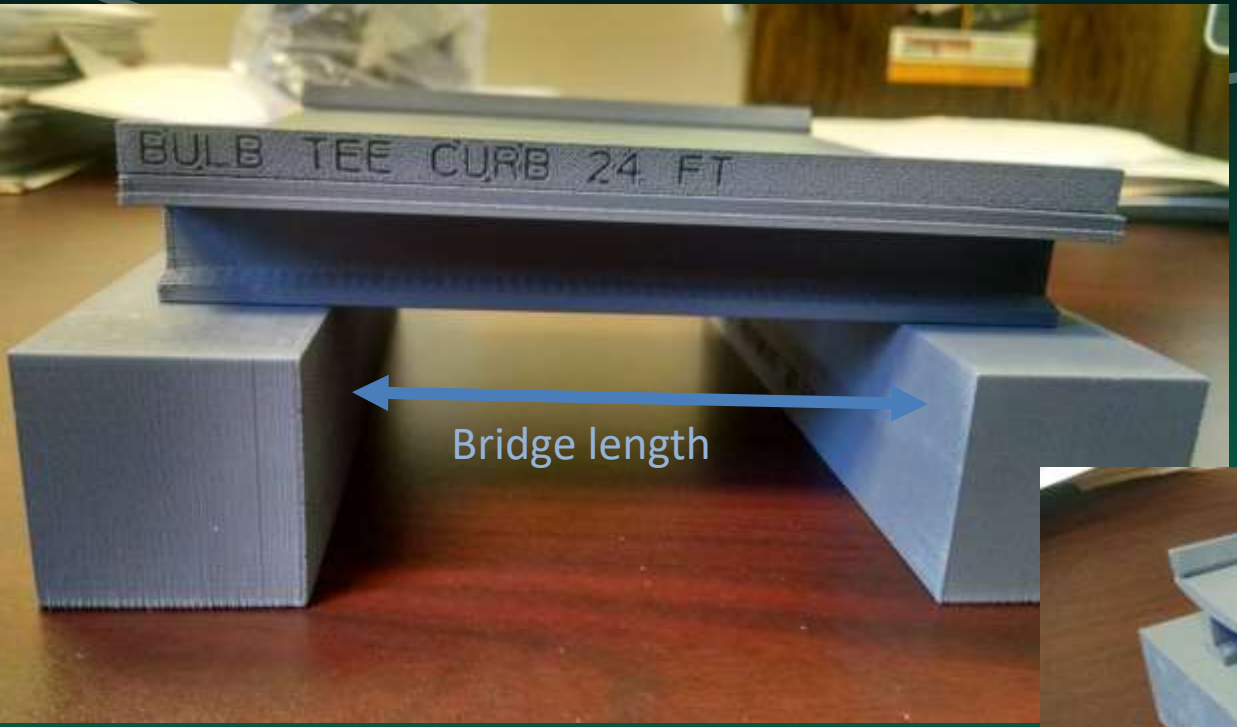
TOP 25 STATES WITH HIGHEST PERCENTAGE OF POOR/STRUCTURALLY DEFICIENT RURAL BRIDGES

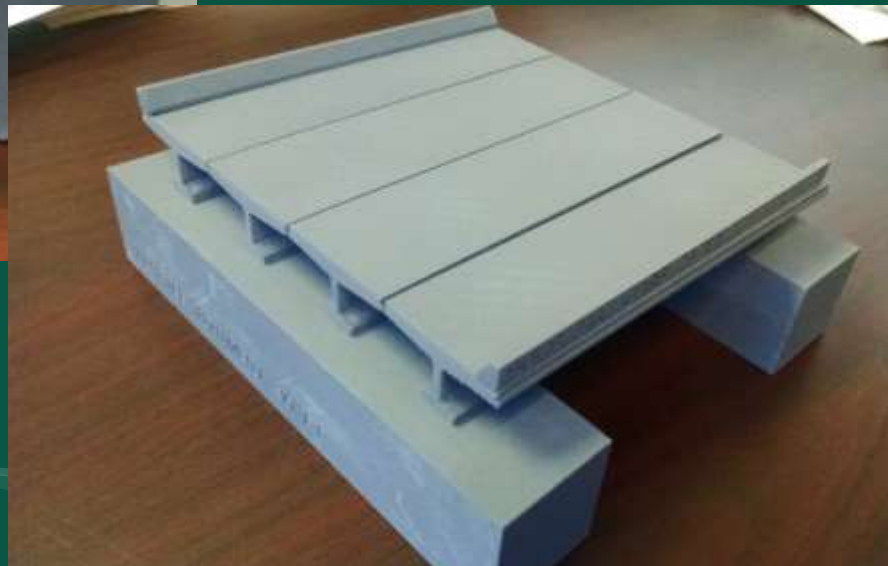
North Dakota, 10th worst in the nation for bridge health.




Bridge Condition Rating
0 - 65 (Poor)
66 - 80 (Fair)
81 - 100 (Good)
Improvements - 20 Years
ND State Roads
Bridge Costs (Millions)
0.0 - 1.03
1.04 - 2.82
2.83 - 10.70
10.71 - 26.55
26.56 - 66.70
North Dakota local roadway bridge info:
About 3,100 bridges
47% good
14% poor
21% posted

Tip worth writing down!

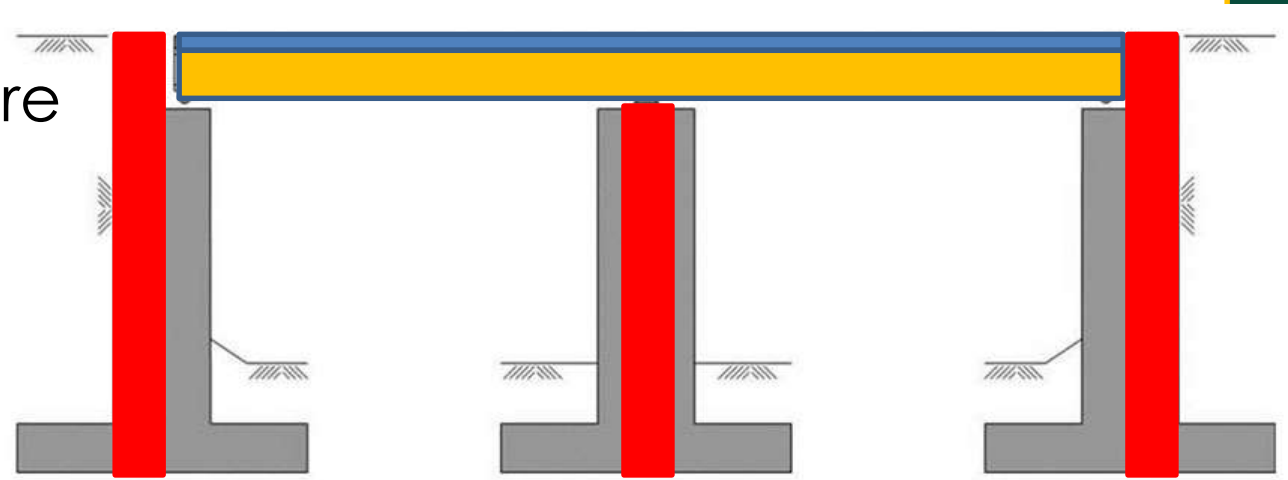

BULB TEE CURB 24 FT
Bridge length

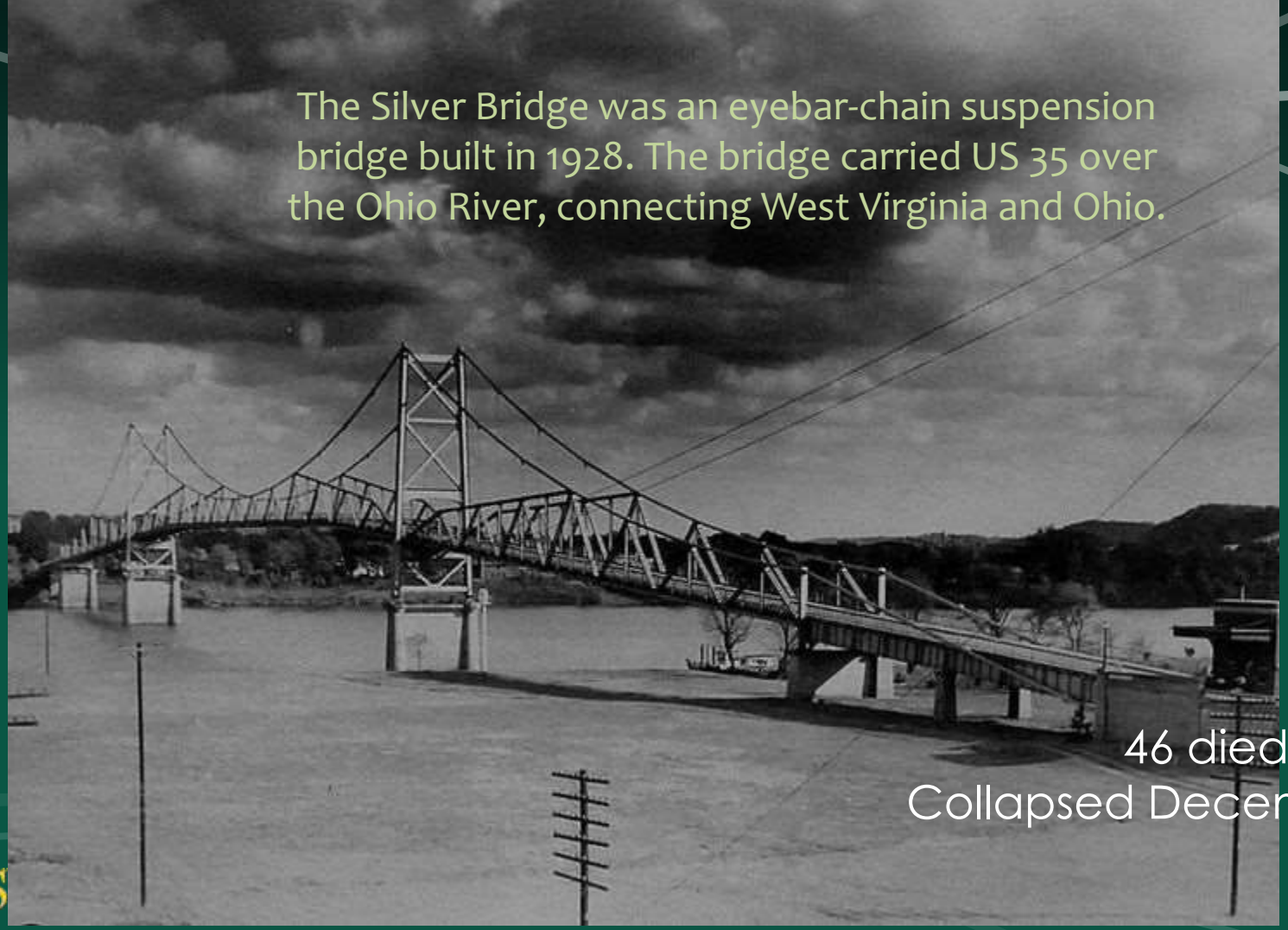



20’ minimum
< 1/2 dia

Bridge Components and Terms

- Three Major Bridge Components
  - Deck
  - Superstructure
  - Substructure




The Silver Bridge was an eyebar-chain suspension bridge built in 1928. The bridge carried US 35 over the Ohio River, connecting West Virginia and Ohio.
46 died
Collapsed December 1967

NDS

I-35 W in Minneapolis – 2007

https://www.youtube.com/watch?v=74JNl5n-YdI

https://www.youtube.com/watch?v=O6ommRCUcsg

Bad Day

Really Bad Day

http://www.myndnow.com/news/minot-news/bridges-destroyed-in-bottineau-county-flooding/686441852

Flood Plan of Action

When to check

What bridges to check

When to close

Who to Inform

Actions to Save Bridge

Bridge Photos – Photography 101

1. Roadway across Bridge

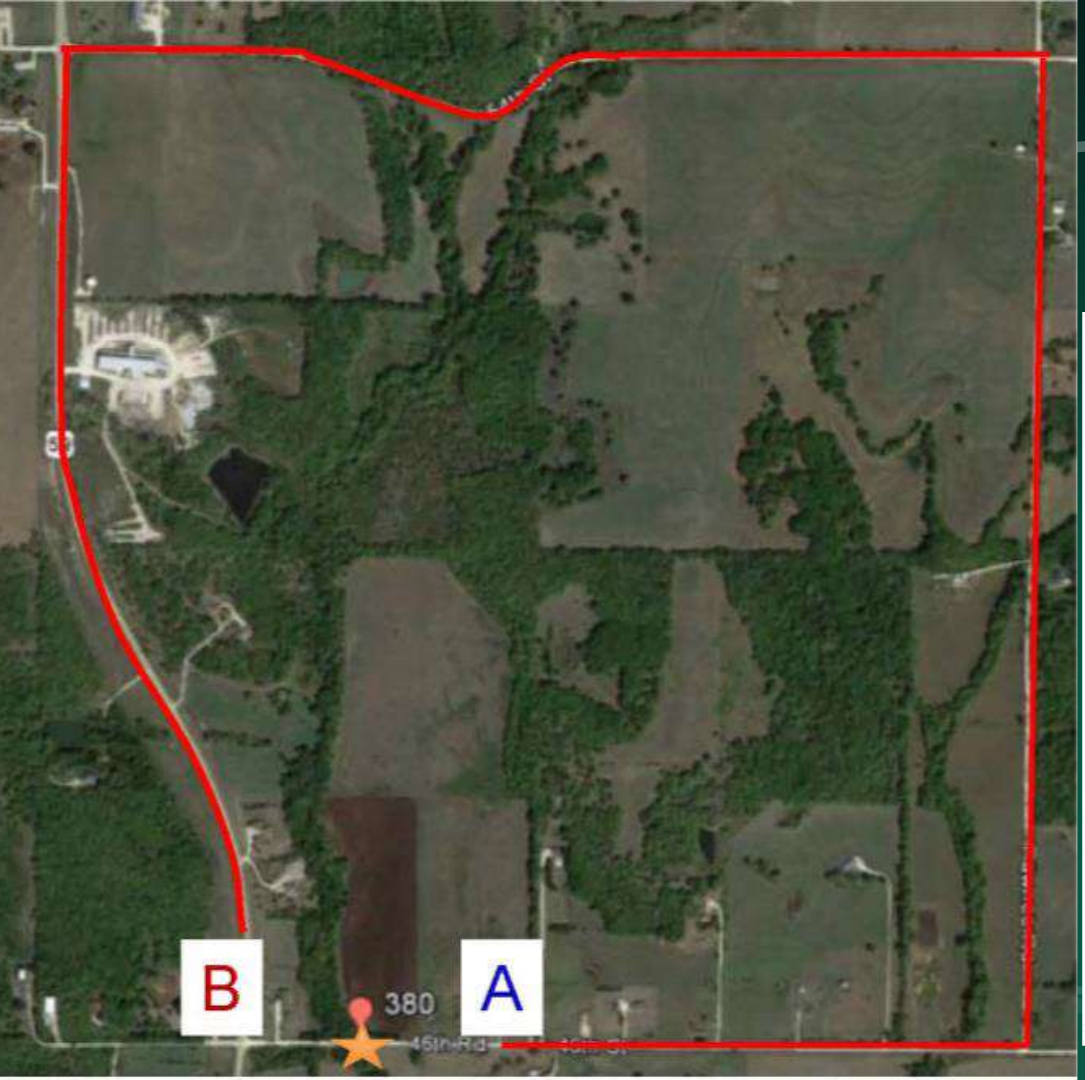
2. Side Elevation View

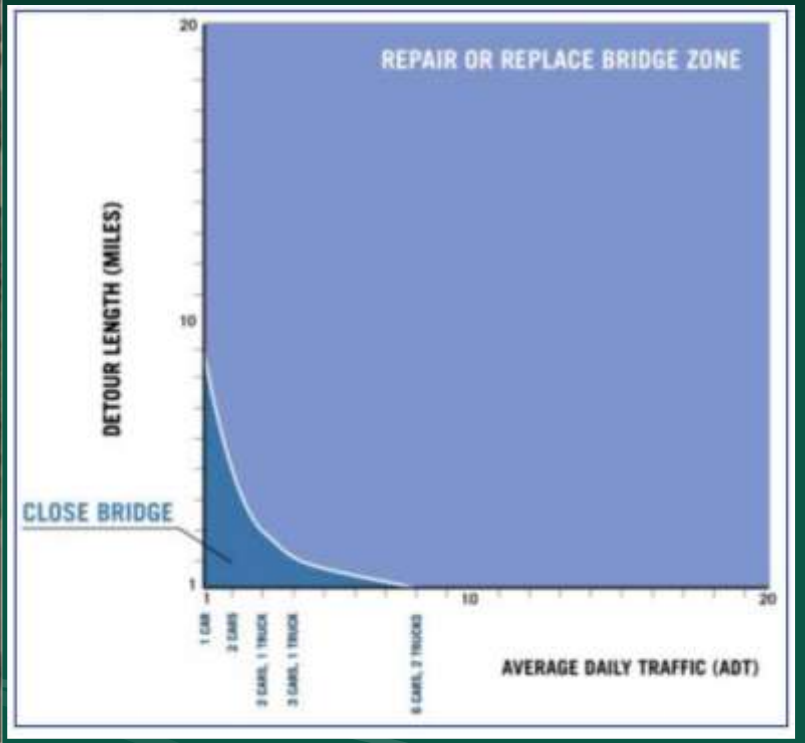
3. Underside View

Upstream – Downstream – Roadway both ways

Underwater Inspections

Detour Length – Closures





Detour Length

Cass County Bridge Structures

- 564 Total Structures
- 231 Major Structures (Greater than 20 feet in length)
- 333 Minor Structures (Less than 20 feet in length)
- County Culvert Policy

CASS COUNTY
GOVERNMENT

Bridge Costs

- Concrete Bridge - $275 Per Square Foot or approximately $800,000 for a 28’ x 100’ bridge
- Concrete Box Culvert
  - Major Structure by Contractor - $250k-$300k
  - Minor Structure by Contractor - $200k
  - Minor Structure by County Forces - $75k-$150k
- Bridge Bundling (internal and with neighbors)
- County Forces versus Contractors

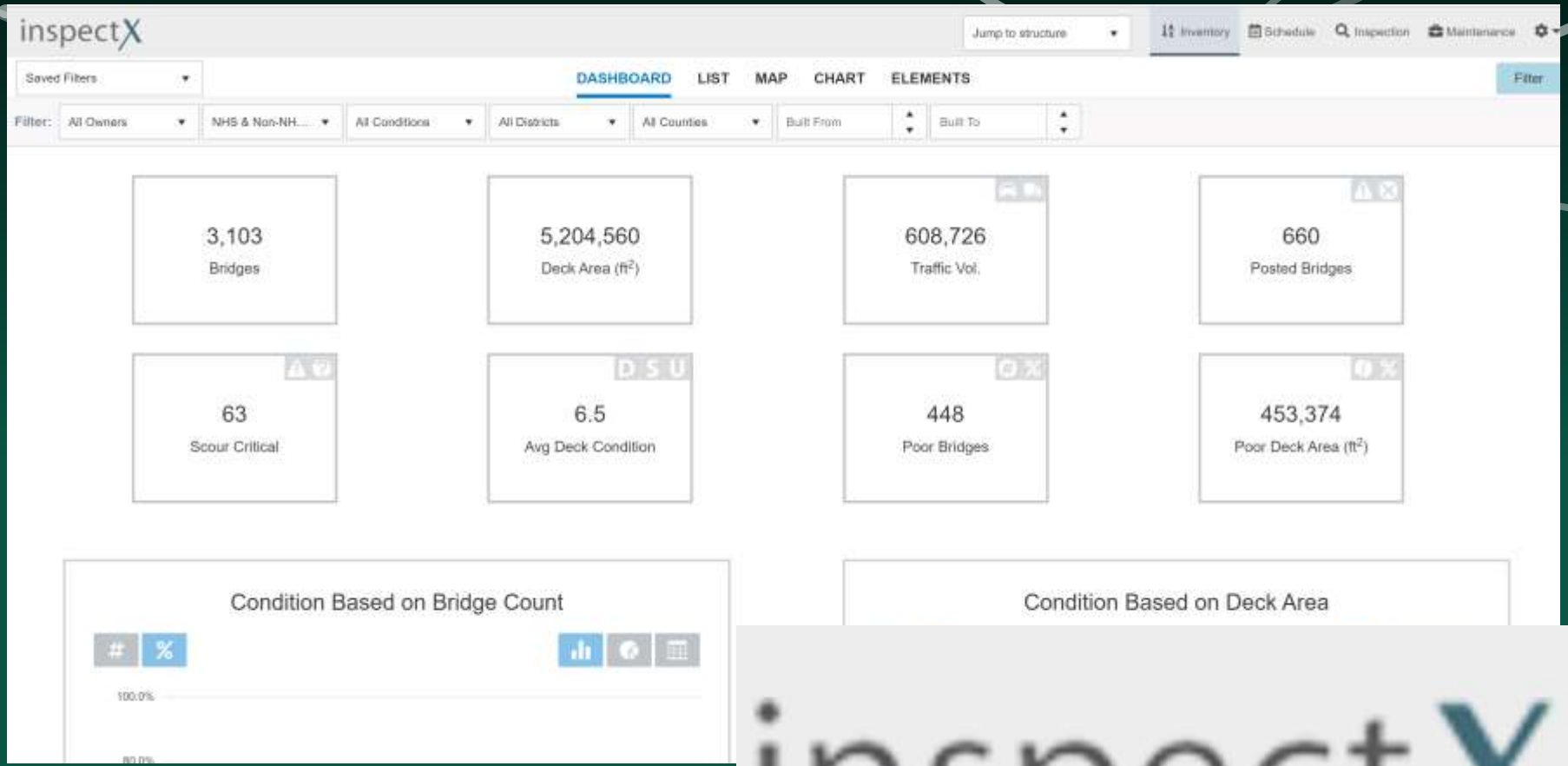
CASS COUNTY GOVERNMENT

Bridge Life

- Concrete or Steel Bridge – 70 years
- Concrete Box Culvert – 70 years
- Steel Culverts – 30 to 50 years

- With 564 structures with an average 70-year life span I need to replace 8 structures every year just to keep up!

CASS COUNTY
GOVERNMENT



inspectX

NDSU UPPER GREAT PLAINS TRANSPORTATION INSTITUTE

GRIT Team – Office and On-Site Assistance

Brad Wentz – Leanna Emmer – Kelly Bengton – Ed Ryen

SELECT County
All Counties

Type
All

Material
All

Condition
All

Age
All

Span
0 feet +

Number of Cells
All

Cell Diameter
0.0 feet +

Cell Length
0 feet +

Selected Structures - 6.2k

Average Age - 34.9

Total Replacement Costs - 45.9M

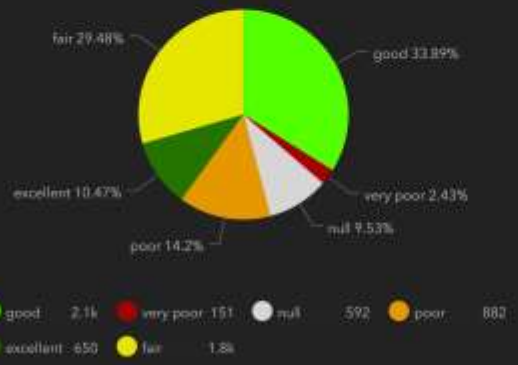
Age (1 to 10 Years) - 198 or 3%

Age (21 to 40 Years) - 219 or 4%

Age (41 to 100 Years) - 328 or 5%

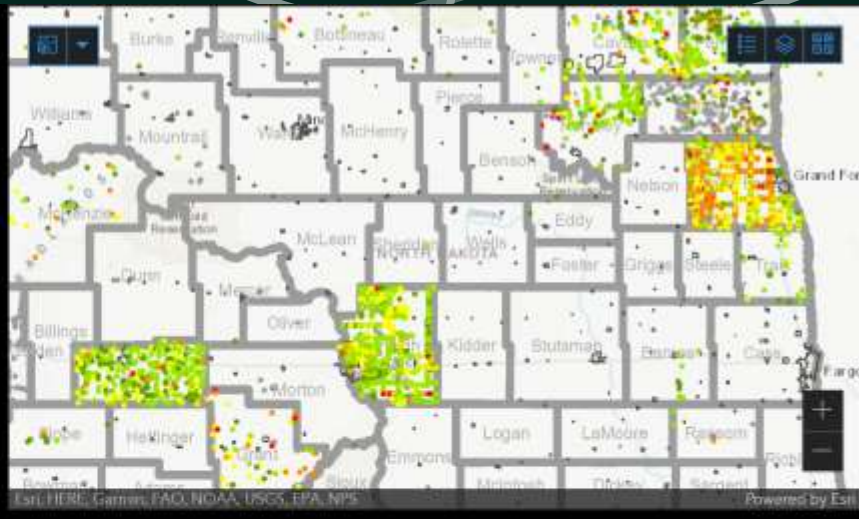
Age (No Data) - 5.3k or 86%

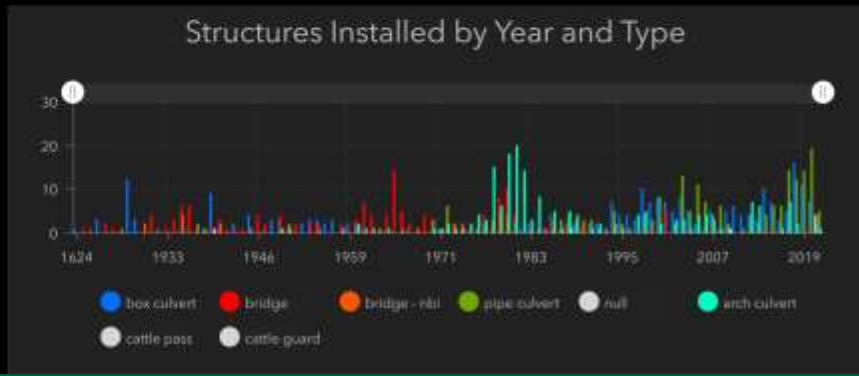
Replacement Cost (No Data) - 6.8k or 95%



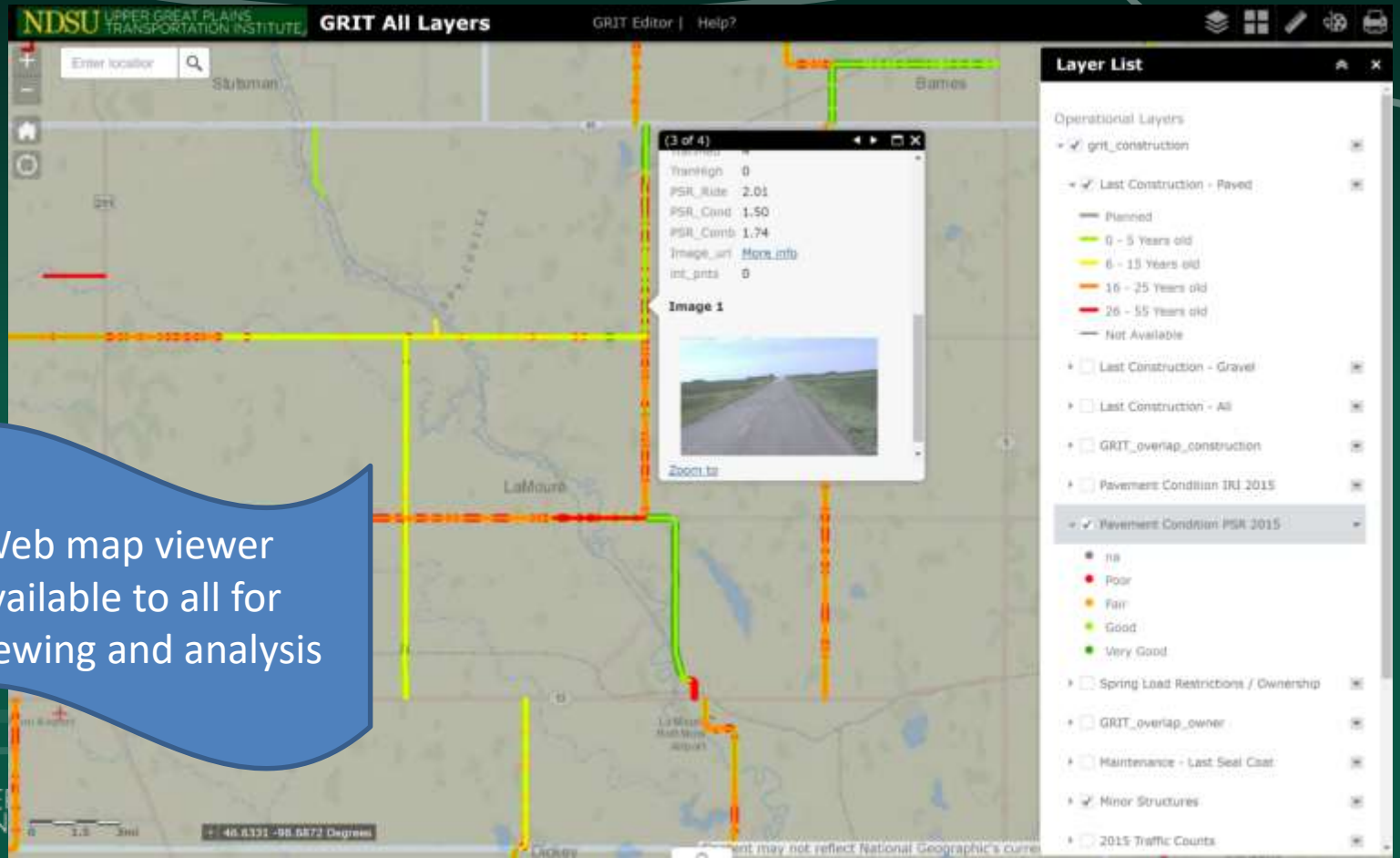
Select slice to see on map.

MS Condition | MS Material | MS Type





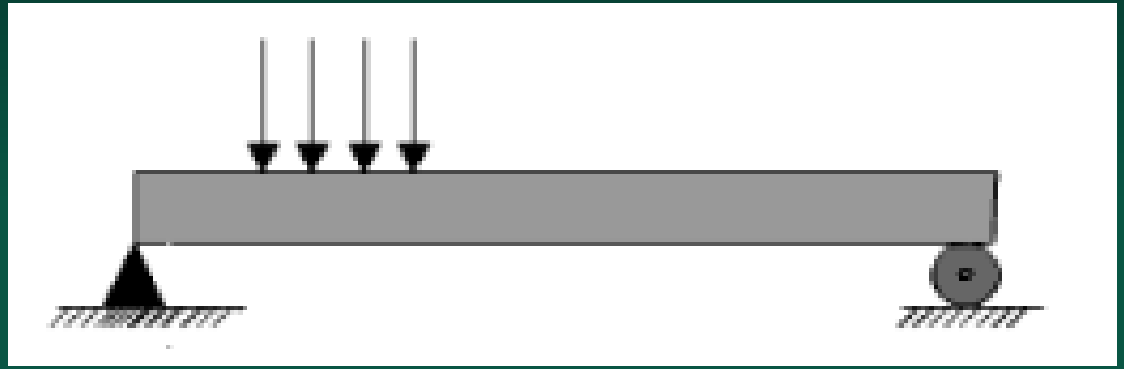
GRIT – Geographic Roadway Information Tool

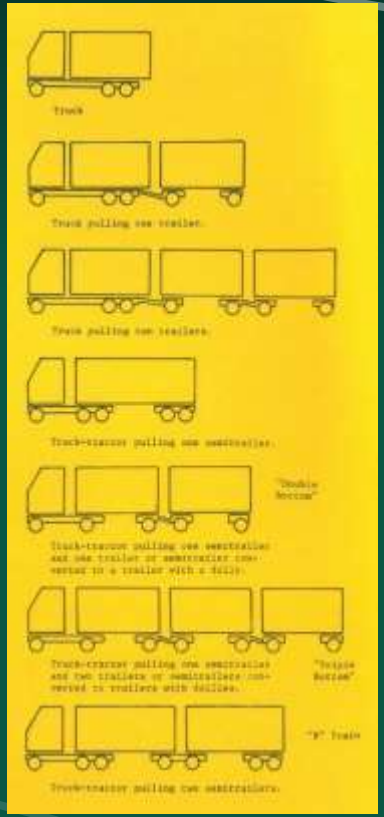


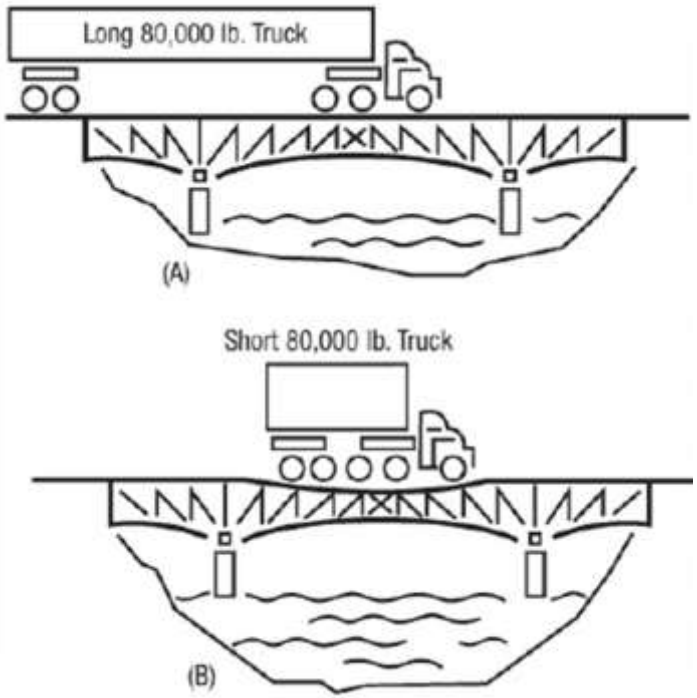
Web map viewer available to all for reviewing and analysis

NDSU UPPER TRAN

Load Rating of Bridges







Axle spacing is as important as axle weight in designing bridges. In Figure A, the stress on bridge members as a longer truck rolls across is much less than that caused by a short vehicle as shown in Figure B, even though both trucks have the same total weight and individual axle weights. The weight of the longer vehicle is spread out, while the shorter vehicle is concentrated on a smaller area.

NDSU


140H

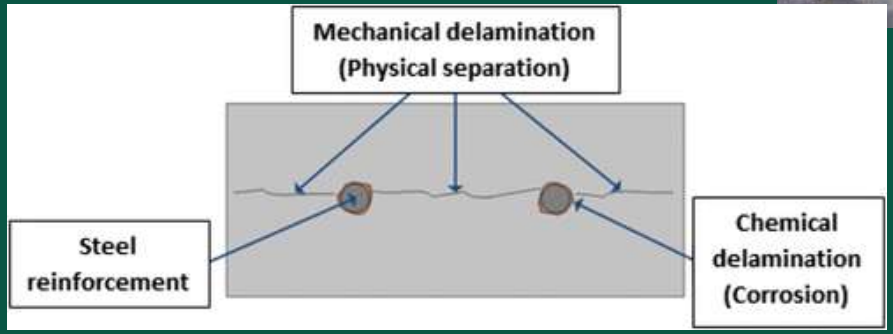
Caterpillar 140M3 Motor Grader typical weight is abou**22 tons.**

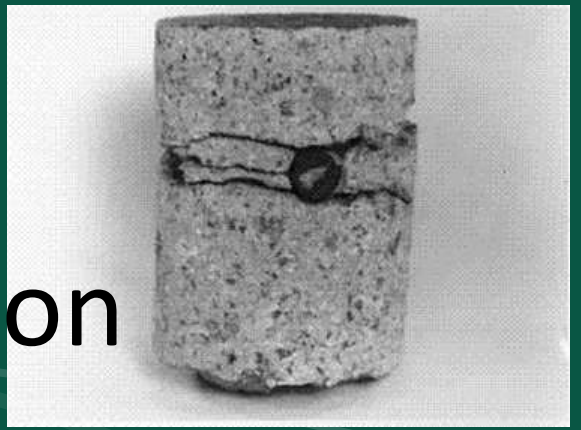

WEIGHT LIMIT
4 TONS PER AXLE
11 TONS GROSS

CASS COUNTY GOVERNMENT

North Dakota | Transportation

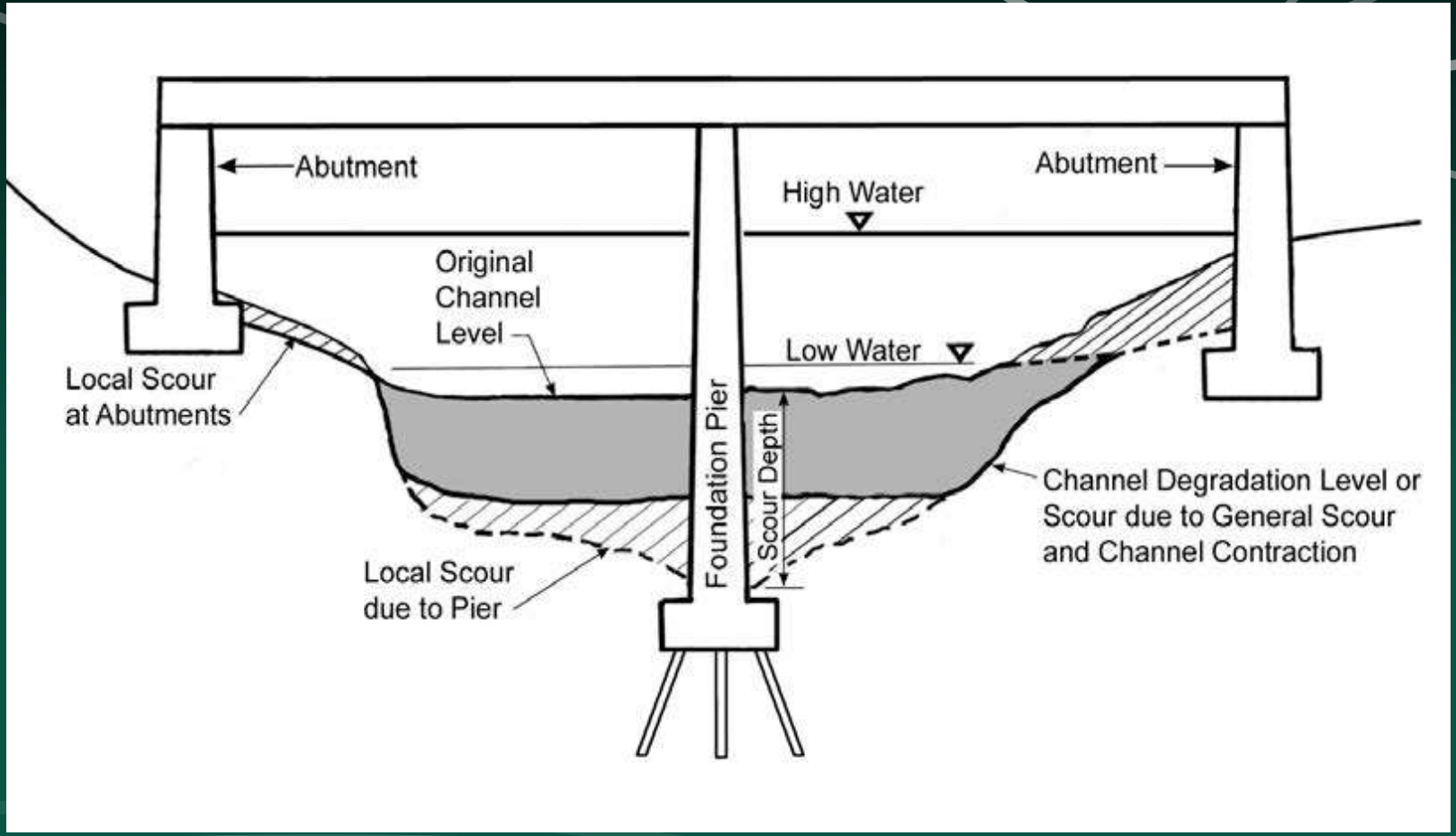

Pack Rust Expansion 7X

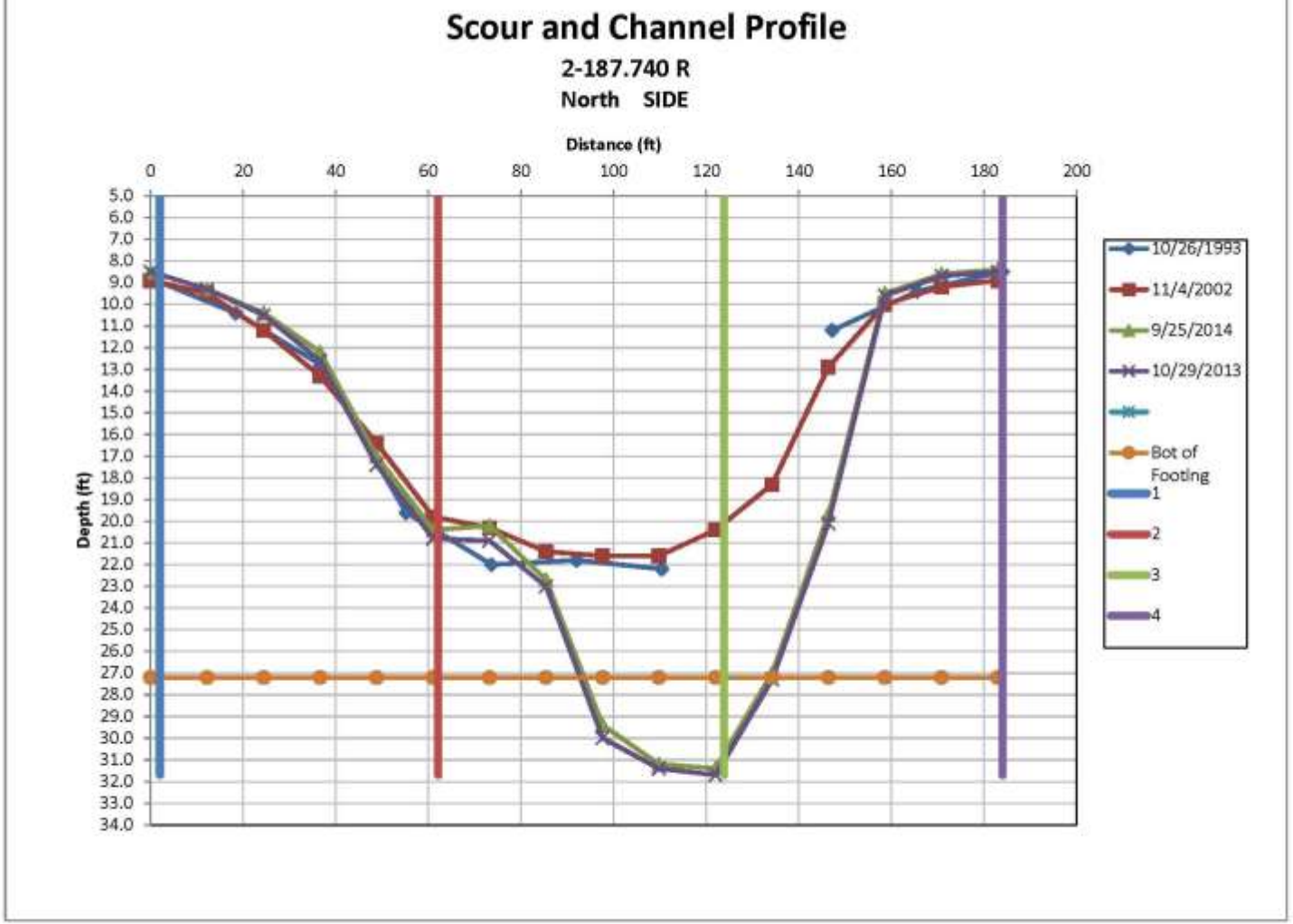




Concrete Delamination

NDSU


Abutment
Abutment
High Water
Original
Channel
Level
Low Water
Local Scour
at Abutments
Foundation Pier
Scour Depth
Channel Degradation Level or
Scour due to General Scour
and Channel Contraction
Local Scour
due to Pier


Scour and Channel Profile
2-187.740 R
North SIDE
Distance (ft)
0
20
40
60
80
100
120
140
160
180
200
Depth (ft)
5.0
6.0
7.0
8.0
9.0
10.0
11.0
12.0
13.0
14.0
15.0
16.0
17.0
18.0
19.0
20.0
21.0
22.0
23.0
24.0
25.0
26.0
27.0
28.0
29.0
30.0
31.0
32.0
33.0
34.0
10/26/1993
11/4/2002
9/25/2014
10/29/2013
Bot of Footing
1
2
3
4

How to Close a Bridge

When to Close

Why Close

Who to Inform

NDSU


BRIDGE OUT
TOP STORY
Bottineau County Flooding


TOP STORY

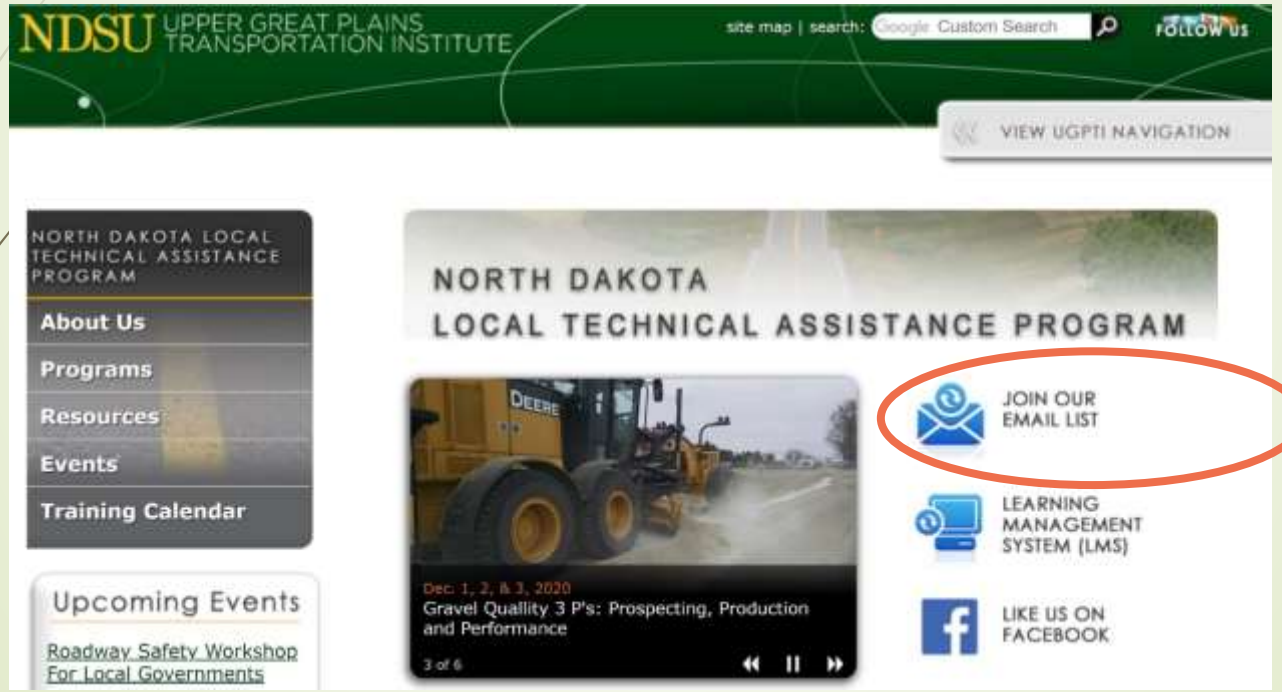

TOP STORY


TOP STORY
Rich Gimbel
BOTTINEAU COUNTY ROAD SUPERINTENDENT

NDLTAP – Classes, Newsletters, Info and more.

Join our Email list and let the learning begin…..

North **D**akota **L**ocal **T**echnical **A**ssistance **P**rogram - **(NDLTAP)**



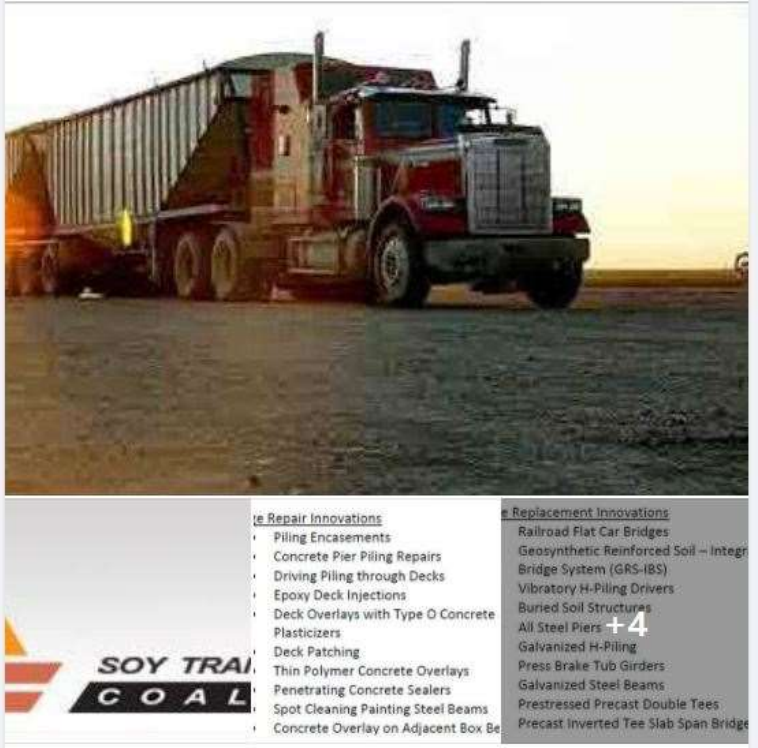
SOY TRANSPORTATION COALITION

BRIDGE REPLACEMENT INNOVATIONS

NDSU UPPER GREAT PLAINS TRANSPORTATION INSTITUTE

North Dakota Local Technical Assistance Program
Published by Dale Heglund · Just now ·

The Soy Transportation Coalition (STC) released their latest study today, "Top 20 Innovations for Rural Bridge Replacement and Repair." When Mike Steenhoek, STC Exec Dir, reached out to UGPTI/NDLTAP requesting help to find new and innovative materials and methods for local leaders to consider for bridges, we jumped at the opportunity. Why? Sadly, North Dakota ranks 42nd (i.e., not good) for bridges in the nation based upon the number of structurally deficient bridges, (i.e., bridges that have load postings). With a strong desire to help improve our local bridge system, Kelly Bengtson, PE, UGPTI Bridge and Pavement Engineer, shared his expertise as one of the three anaylsts on this national effort. Impresssive project with a goal to help local leaders find new and cost-effective ways to resuscitate our ailing bridge network and provide enhanced farm to market opportunities. Thank you STC for the opportunity and well done Kelly! Looking forward to seeing this crop of ideas sprout. Check out the news release at www.soytranpsortation.org. Dale



Greetings from the NDLTAP Team









Presentation Partners

NDIRF NORTH DAKOTA INSURANCE RESERVE FUND
For North Dakota. For Local Government. For You.
www.ndirf.com

U.S. Department of Transportation
Federal Highway Administration

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LoadPass PERMITS

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VISION
ZERO
Zero fatalities. Zero excuses.

Together, we do great things!

o.

Bridge/Culvert Basics

Water, Weight and Aging

Bryon Fuchs, PE
Local Government, NDDOT
701-204-0302 – blfuchs@nd.gov

Dale C. Heglund, PE/PLS
Program Director, NDLTAP
701-318-6893 – dale.heglund@ndsu.edu

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Newtown – August 18, 2021

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Happy Trails

Truck Overweight Permit System

LoadPass PERMITS

http://dotsc.ugpti.ndsu.nodak.edu/TWC/

FREE APP

North Dakota

TRUCK-WEIGHT CALCULATOR

- The **Truck Weight Calculator** helps the motor carrier industry, agricultural producers and others determine the maximum legal weight that any set of axles on a vehicle/vehicle combination may carry on North Dakota interstate and state highways.
- The **formula** for the calculator is a weight-to-length ratio.
- The **app** features simple picture explanations for intuitive use.
- The **calculator** generates a printable report with truck weight calculation results.

Weight calculations for a vehicle traveling on North Dakota's state highways and local roads are slightly different from the weight calculations for vehicles traveling on North Dakota's interstate system.

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NORTH DAKOTA LOCAL TECHNICAL ASSISTANCE PROGRAM

ND Truck Weight Calculation Results

1/22/2016

Given Information for Weight Calculator

Highway Type	Interstate Highway
Axle Count	6

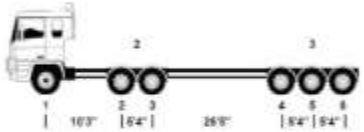
Truck Info

Unit Name	2000 WG64T
Serial No. (VIN)	10265845962
Year/Make	2012 / Volvo
Customer or Company Name	Black Hills

Axle Details - Weights

Legal GVW - Interstate:	**86,000 lbs.**
The maximum legal gross vehicle weight for this vehicle/vehicle combination.	
Maximum gross weight legal on axle #2 through the rearmost trailer axle shall not exceed 74,500 lbs.	
Weight (per bridge length chart):	86,000 lbs.

Truck image with the Axle Group Number above axle group and Axle Number below each axle.
Distances (the linear measurement from axle center to consecutive axle center) are shown below the axle numbers of the truck image.
A black-centered wheel denotes two tires per axle and a white-centered wheel denotes four tires per axle.



Axle Group Weights

Axle Group Number	Axle Number(s) in Group	Legal Axle Group Weight
1	1	20,000
2	2 - 3	34,000
3	4 - 6	44,500