Information for this class was provided in part by the NDDOT, UGPTI, NDLTAP, MDOT, MnDOT and TRB.
With contributions from Nancy Huether, NDDOT, Nick West, Grand Forks County, and Andrew Wrucke, West Fargo.

Bridge 201

Devils Lake – June 22, 2021
Watford City – June 24, 2021

Bryon Fuchs, PE
Local Government, NDDOT

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

Matt Luger, PE
Bridge, NDDOT

NORTH Dakota | Transportation
Be Legendary.™

Subject Matter Experts
Wes Dickhut – Geostabilization
Matt Gregg – Wheeler
Reed Oien – Steele County
Nancy Huether – NDDOT Bridge
Kelly Bengtson – UGPTI/NDLTAP

Good Morning!!!

Welcome from our host county!


McKenzie County
North Dakota
Welcome from our host county!

Presentation Partners

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For North Dakota. For Local Government. For You.
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U.S. Department of Transportation
Federal Highway Administration

NORTH Dakota | Transportation
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Wheeler

TrueNorth Steel®

GSI
GeoStabilization International®
Geohazard Mitigation Experts

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NORTH DAKOTA LOCAL TECHNICAL ASSISTANCE PROGRAM

Greetings from the NDLTAP Team



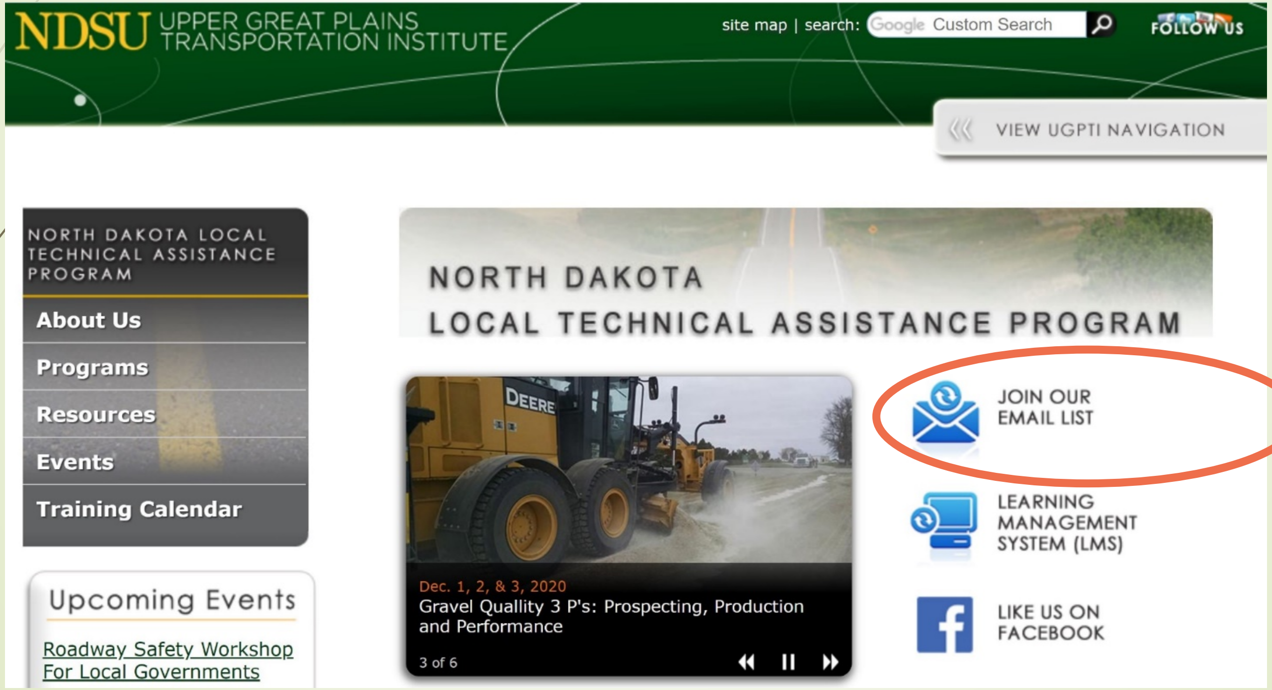




NDLTAP – Classes, Newsletters, Info and more.

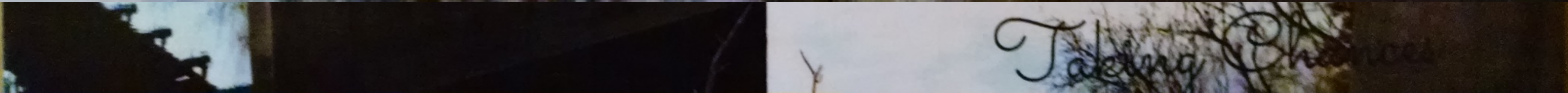
Join our Email list and let the learning begin…..

North Dakota Local Technical Assistance Program - (NDLTAP)

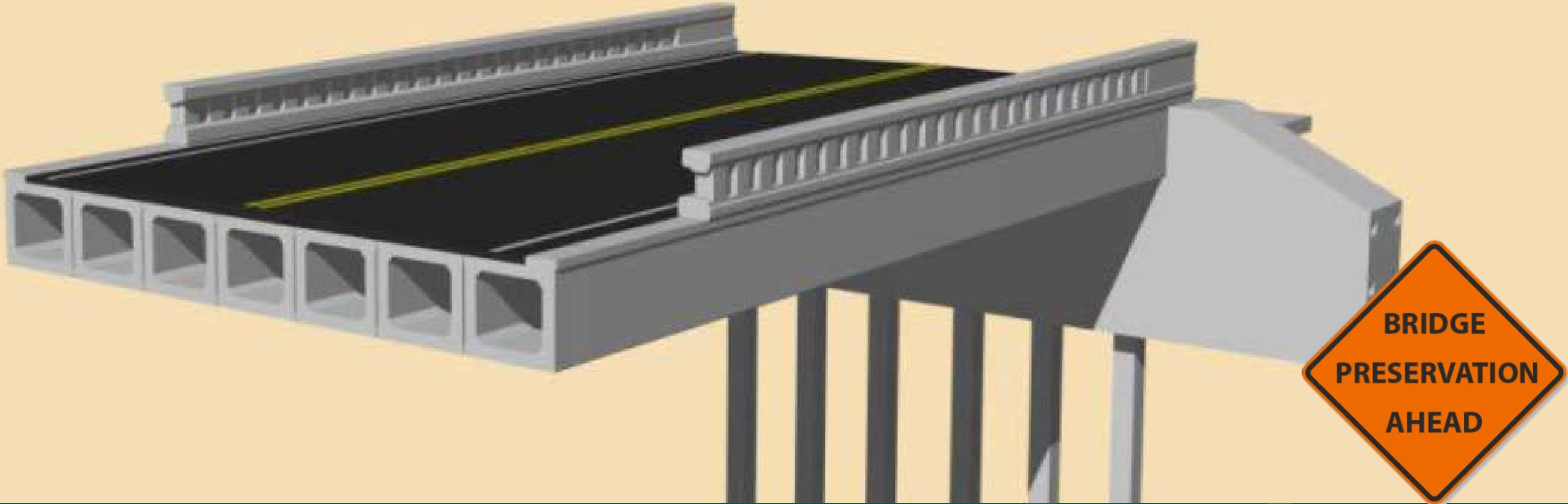



Little Missouri
Scenic River
GhostsofNorthDakota.com


Taking Ch

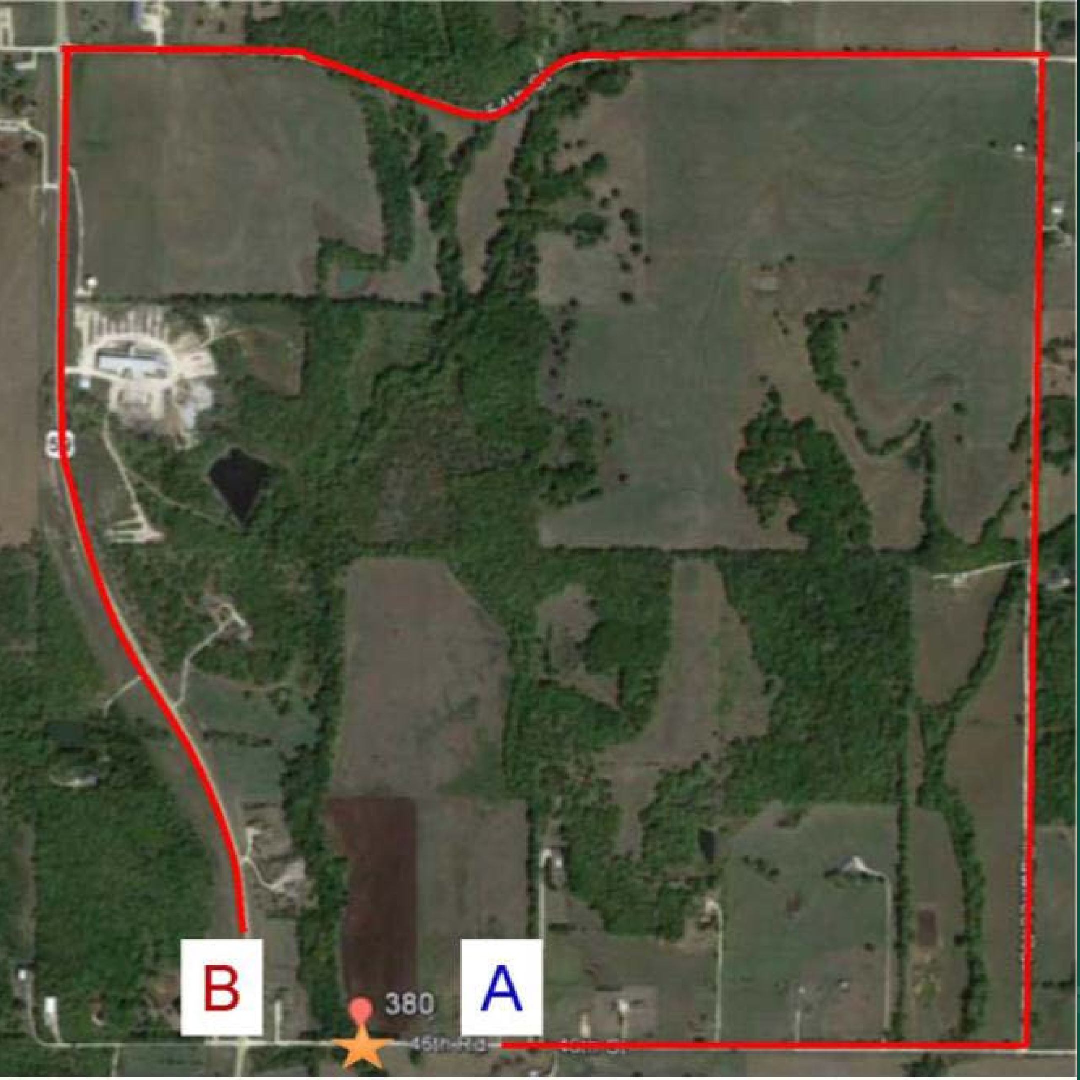

Taking Chances

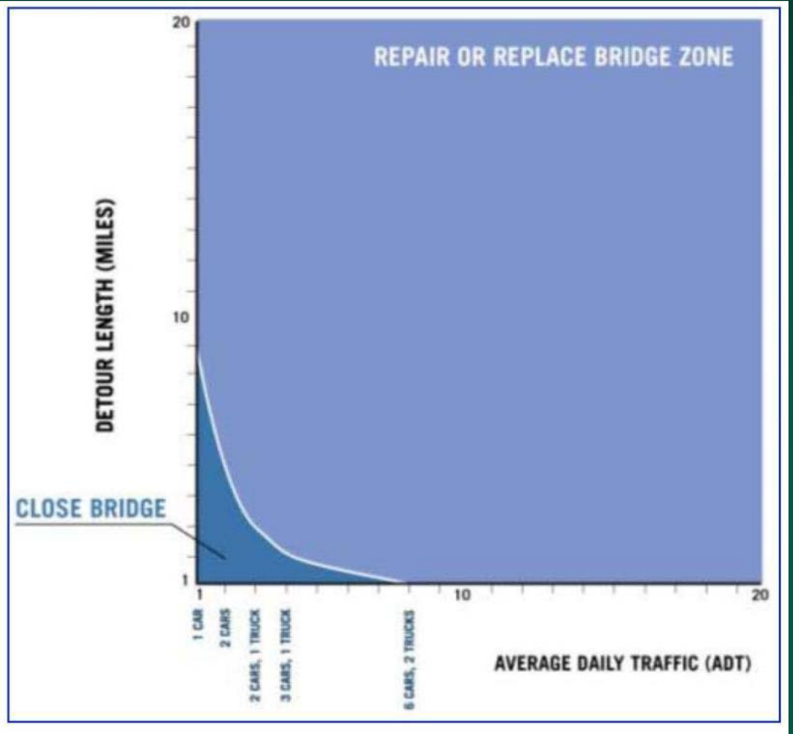
What is a Bridge?



NDS

Detour Length – Closures

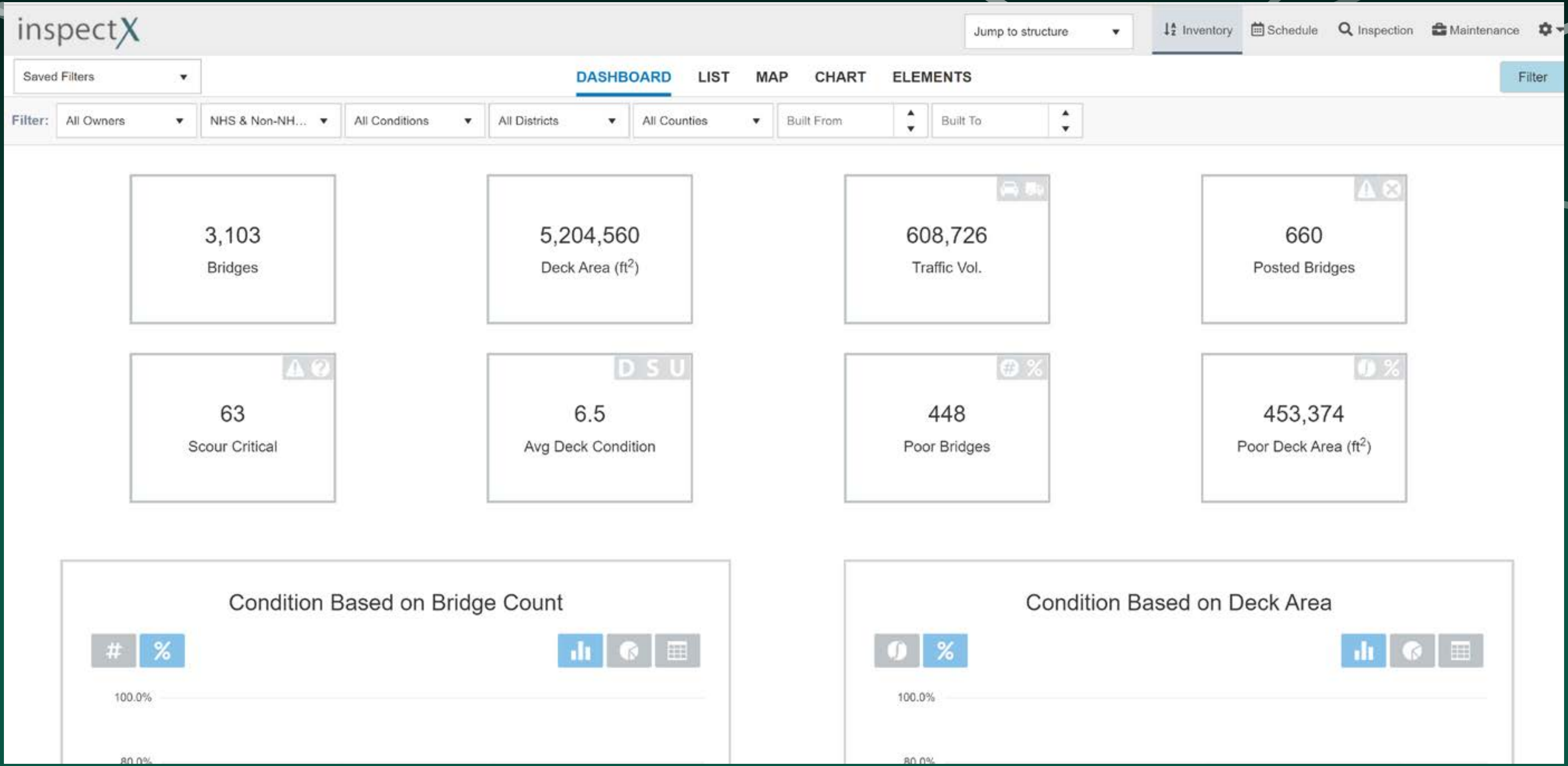




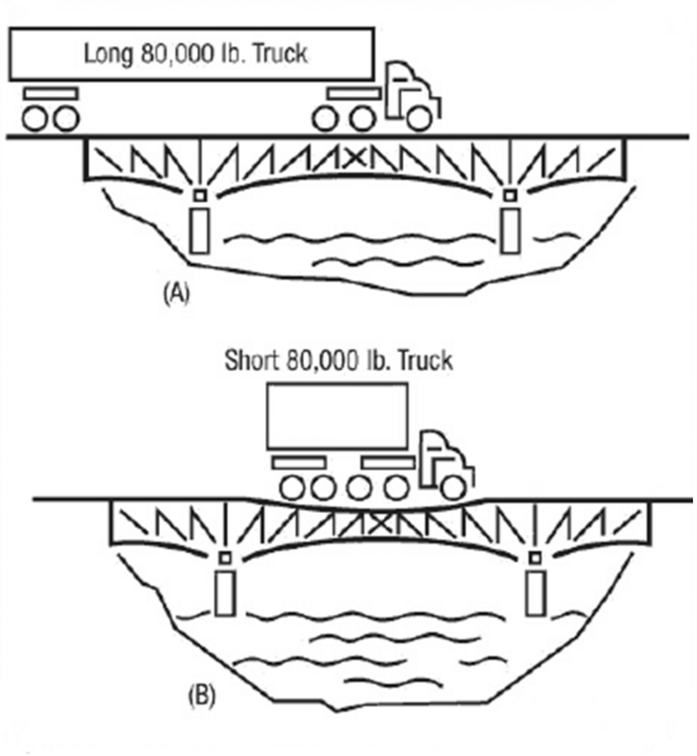
LTBP

InfoBridge

http://infobridge.fhwa.dot.gov



inspectX
Jump to structure
Inventory
Schedule
Inspection
Maintenance
Saved Filters
DASHBOARD
LIST
MAP
CHART
ELEMENTS
Filter
Filter:
All Owners
NHS & Non-NH...
All Conditions
All Districts
All Counties
Built From
Built To
3,103
Bridges
5,204,560
Deck Area (ft2)
608,726
Traffic Vol.
660
Posted Bridges
63
Scour Critical
D S U
6.5
Avg Deck Condition
448
Poor Bridges
453,374
Poor Deck Area (ft2)
Condition Based on Bridge Count
100.0%
80.0%
Condition Based on Deck Area
100.0%
80.0%



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.

NDS


NDDOT
North Dakota
Department of Transportation

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

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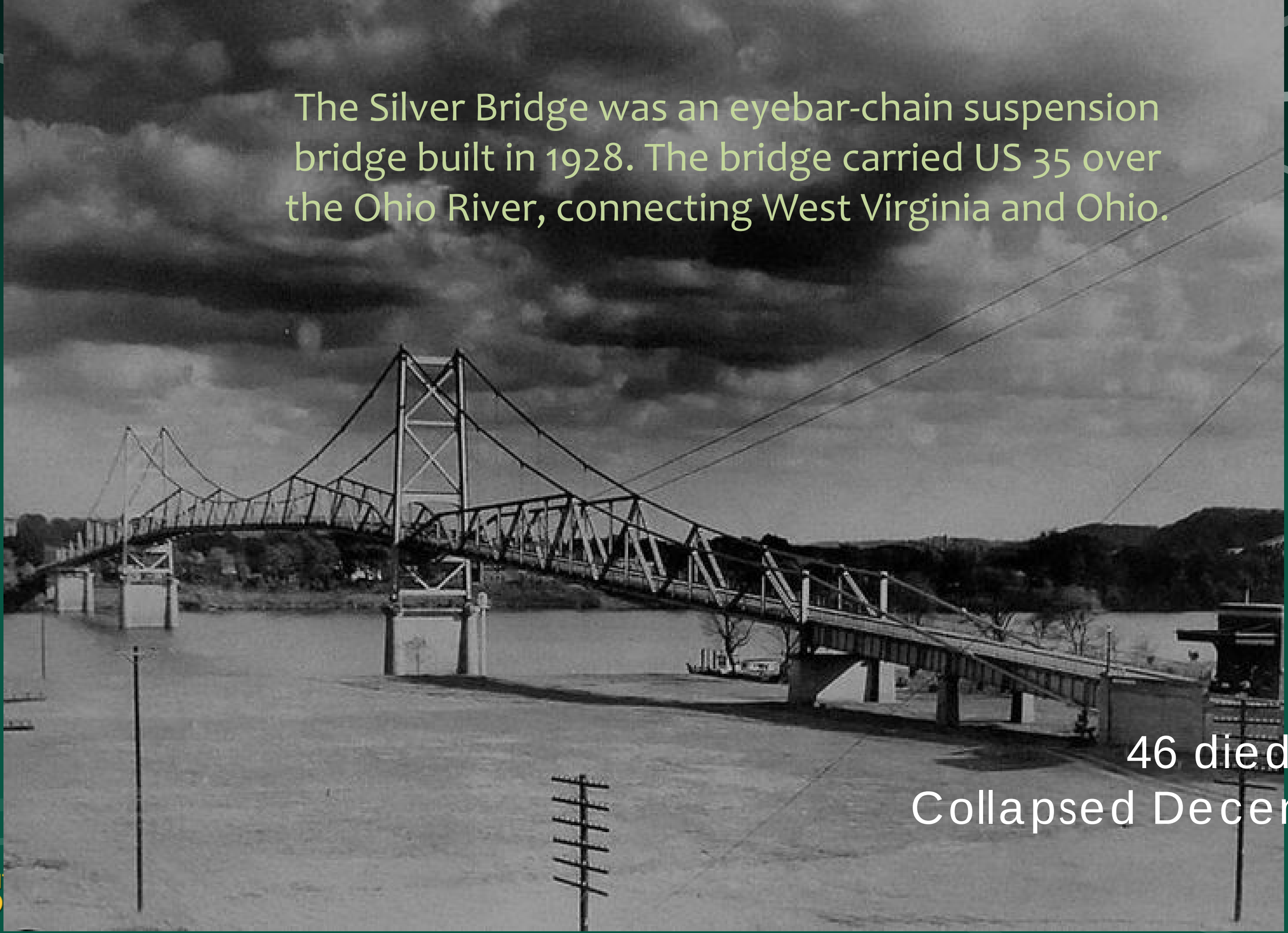
Summer is Here!!

What is a Bridge?

Murna Hauck – North Dakota Township Officer – “When I was a kid, my Dad stopped at a ‘weak’ bridge. My brothers, sisters, Mom and I walked across the bridge first and then he drove the car over.”

NDSU



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

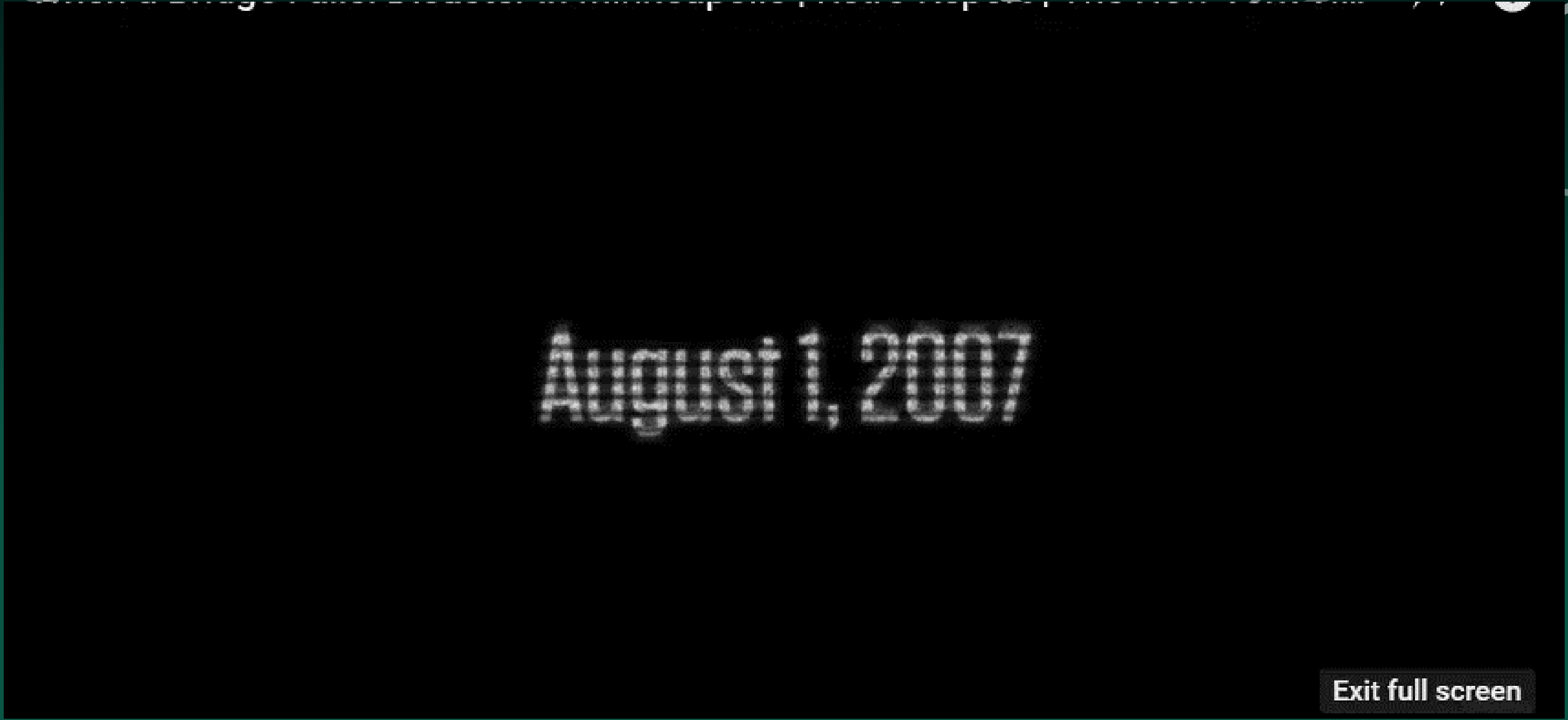
Collapsed December 1967

I-35 W in Minneapolis - 2007

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

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

13 died


August 1, 2007
Exit full screen

Video Take-Aways

- Design for 75 to 100-year life
- Fracture Critical
- Bridge in America should not collapse
- Bridge movement
- Underfunded and overworked
- Fatalities
- Lesson – You’ve got to maintain bridges

Bad Day

- 1968 – National bridge inspection (NBI) program initiated (requiring regular and periodic inspections)
- 1971 – National bridge inspection standards (NBIS) adopted (prescribe how, with what frequency, and by whom bridge inspections must be completed)
- 1987 – Schoharie Creek collapse (scour)
- 2007 – Minnesota I-35W collapse (undersized gusset plate design)

1985 – Adopted 20’+ major structures and dropped minor structure inspections

FLORIDA

PEDRO PORTAL, MIAMI HERALD VIA AP

Emergency personnel respond after a brand-new pedestrian bridge collapsed onto a highway Thursday at Florida International University in Miami.

Pedestrian bridge falls; multiple people killed

At least eight vehicles crushed when span falls near university

ADRIANA GOMEZ LICON
Associated Press

MIAMI — A pedestrian bridge that was under construction collapsed onto a busy Miami highway Thursday, crushing at least eight vehicles under massive slabs of concrete and steel and killing multiple people, authorities said.

Search-and-rescue crews drilled holes into the debris and used dogs to look for survivors. They had to work carefully because part of the structure was still unsafe.

The Miami-Dade County fire chief says four people have been found dead in the rubble of a collapsed pedestrian bridge in South Florida.

Fire Chief Dave Downey said on their conditions.

The 950-ton bridge had been assembled by the side of the highway and moved into place Saturday to great fanfare. The span stretched almost 200 feet to connect Florida International University with the city of Sweetwater. It was expected to open to foot traffic next year.

"We have a national tragedy on our hands," Sweetwater Mayor Orlando Lopez said.

Jacob Miller, a senior at FIU, was visiting a friend in a dorm when he heard sirens and horns honking. He went to a balcony and could see rubble coming down.

"I saw there were multiple cars crushed under the bridge. It was just terrible. I saw some people stopping their cars, trying to get out, trying to assess the situation to see if there is anything they could do to help," he said.

The National Transportation Safety Board sent investigators to vestigation after rescue efforts are complete.

An accelerated construction method was supposed to reduce risks to workers and pedestrians and minimize traffic disruption, the university said.

Cristina Rodriguez, a junior at FIU, said the bridge seemed to be built too quickly "to support everything that was on there." Rodriguez was not on campus Thursday but drives through the intersection almost daily.

Renderings of the project showed a tall, off-center tower with cables attached to the walkway to support it. When the bridge collapsed, the main tower had not yet been installed, and it was unclear what the builders were using as temporary supports.

Robert Bea, a professor of engineering and construction management at the University of California, Berkeley, said it was too early to know exactly what happened, but

Really Bad Day

Sioux County - July 2019

S

NDSU

Standin 2019

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https://www.youtube.com/watch?v=XhdVW6lp7yQ

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


BRIDGE OUT
TOP STORY
Bottineau County Flooding


TOP STORY


TOP STORY


TOP STORY
Rich Gimbel
BOTTINEAU COUNTY ROAD SUPERINTENDENT


COFFEE? YOU MEAN STARTER FLUID FOR THE MORNING IMPAIRED?
GOOD MORNIN' Y'ALL

NDSU

North Dakota's

Bridge Health

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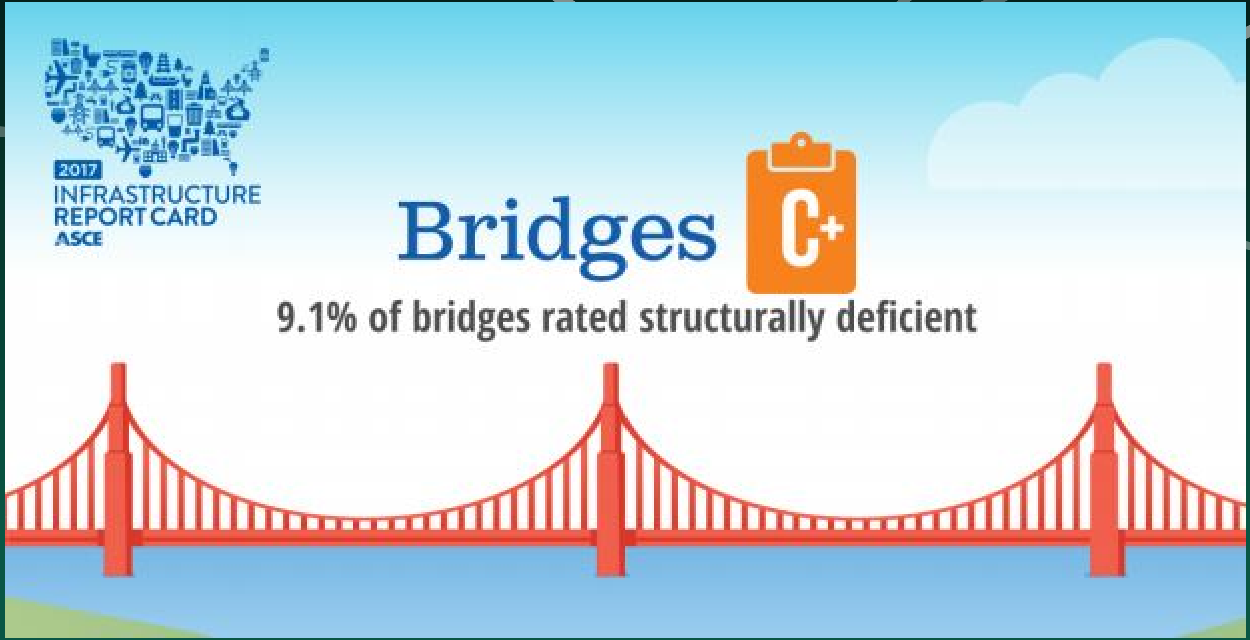
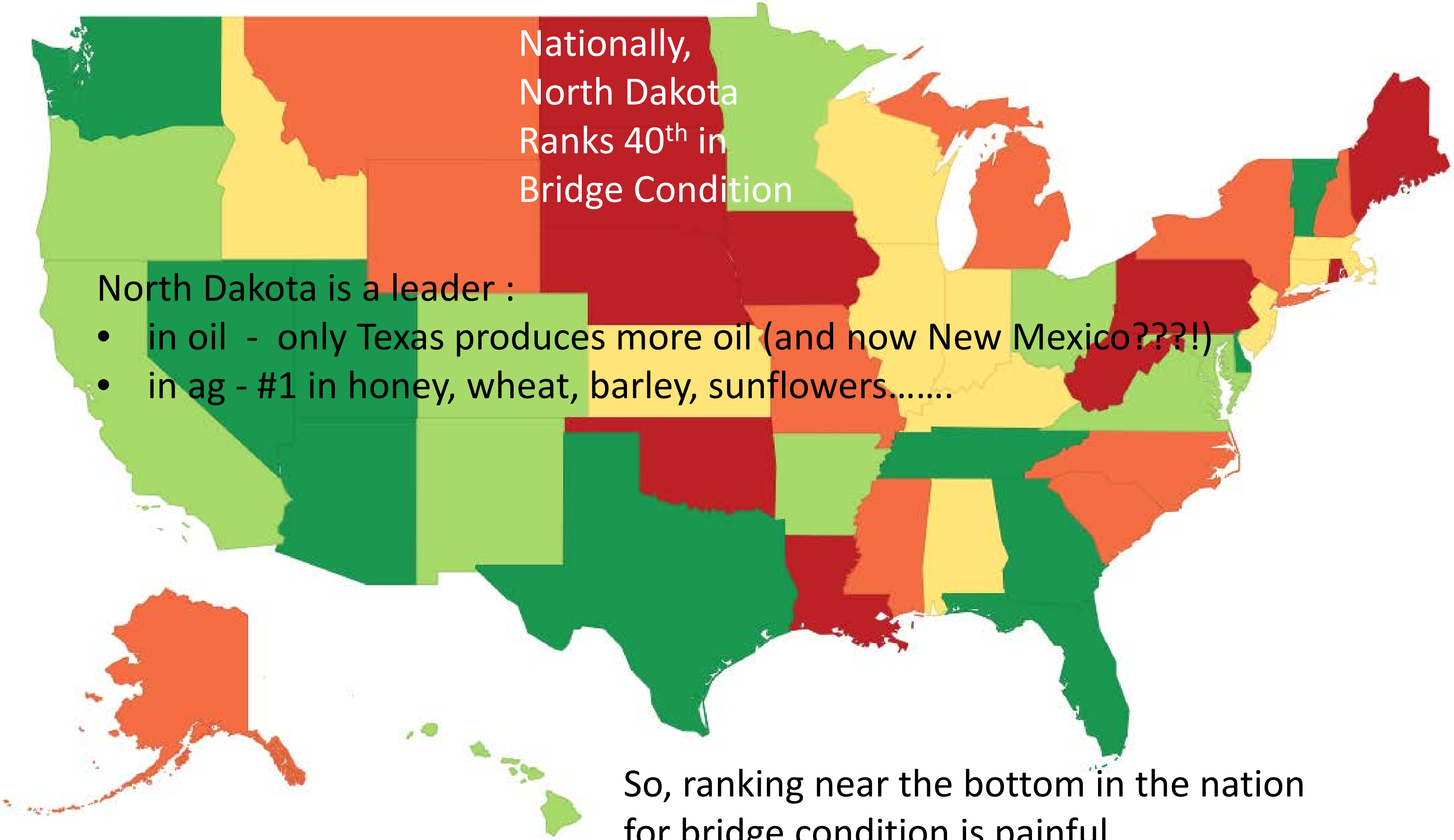
NORTH DAKOTA LOCAL TECHNICAL ASSISTANCE PROGRAM



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

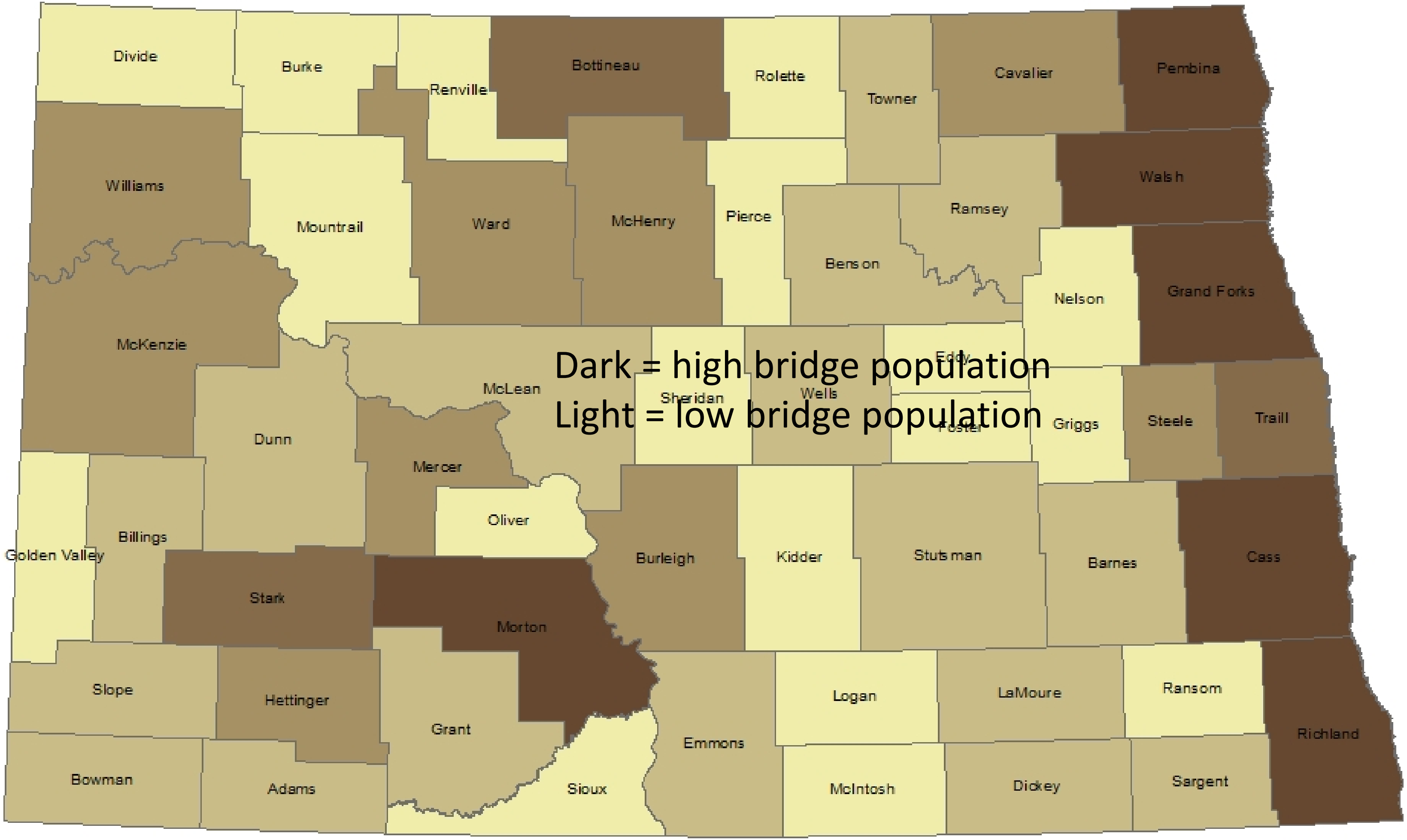


Nationally,
North Dakota
Ranks 40th in
Bridge Condition

North Dakota is a leader :

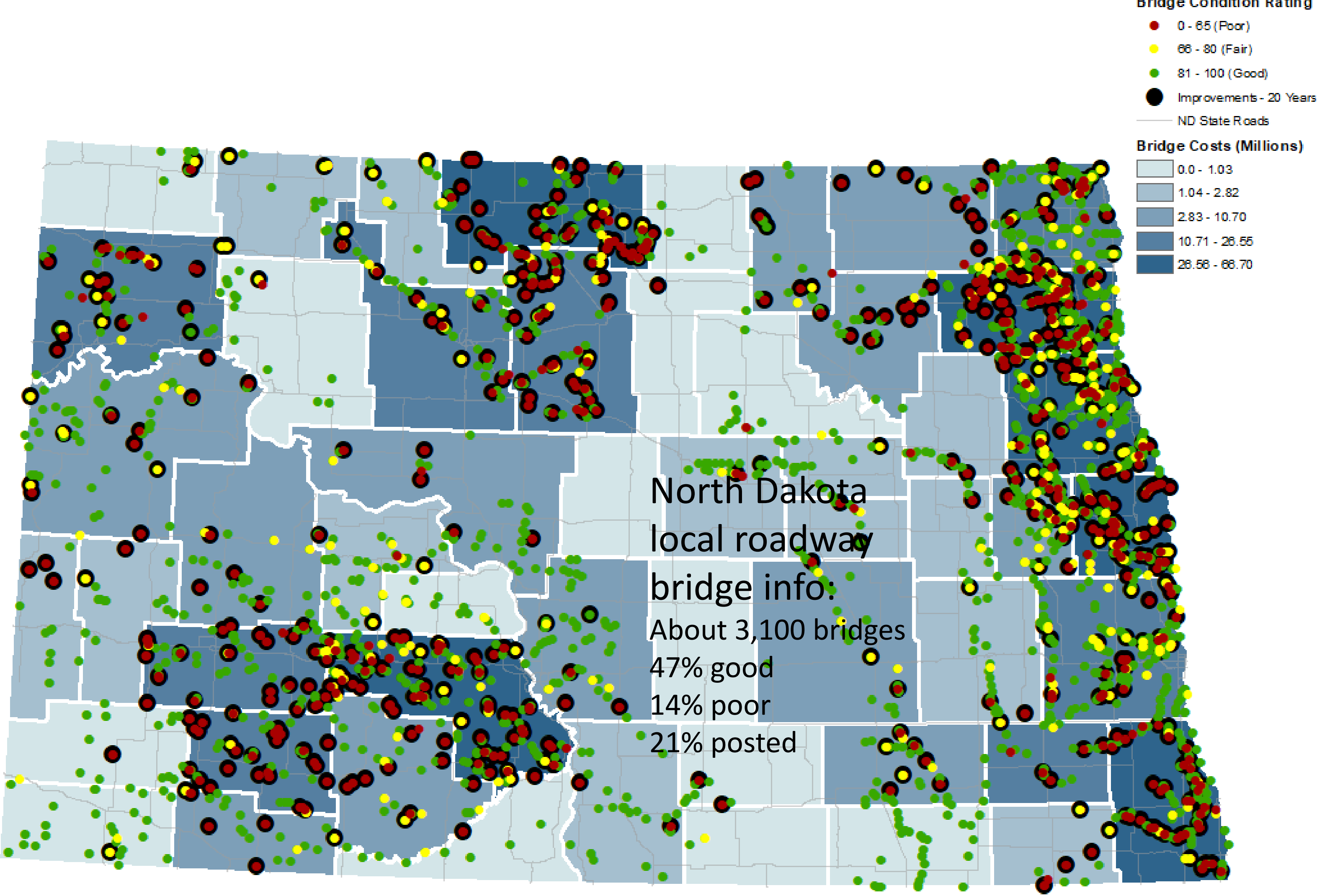
- in oil - only Texas produces more oil (and now New Mexico???!)
- in ag - #1 in honey, wheat, barley, sunflowers…….

So, ranking near the bottom in the nation for bridge condition is painful



Dark = high bridge population

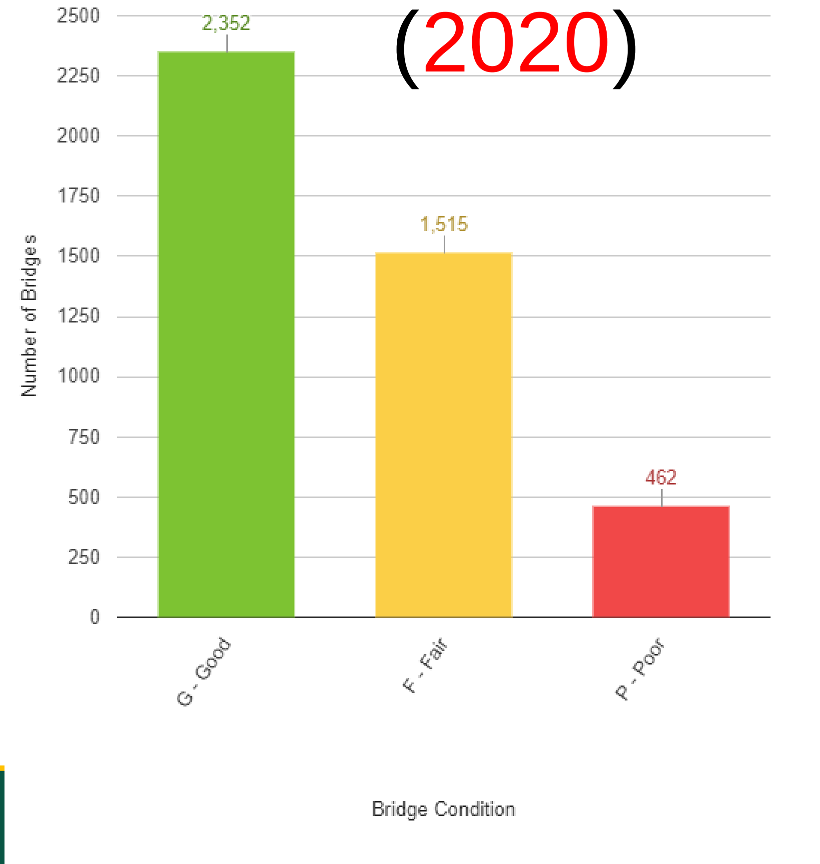
Light = low bridge population



North Dakota local roadway bridge info:

About 3,100 bridges
47% good
14% poor
21% posted

North Dakota Bridge conditons (2020)

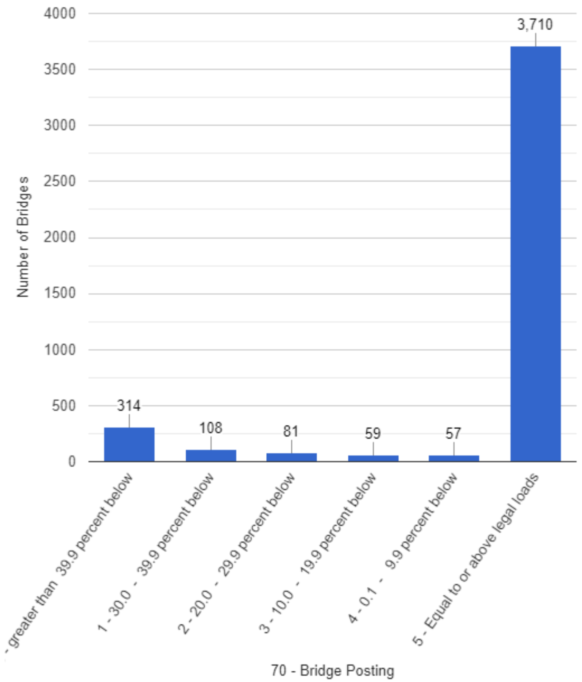


A bridge is a structure with a total opening of greater than 20 feet in length.

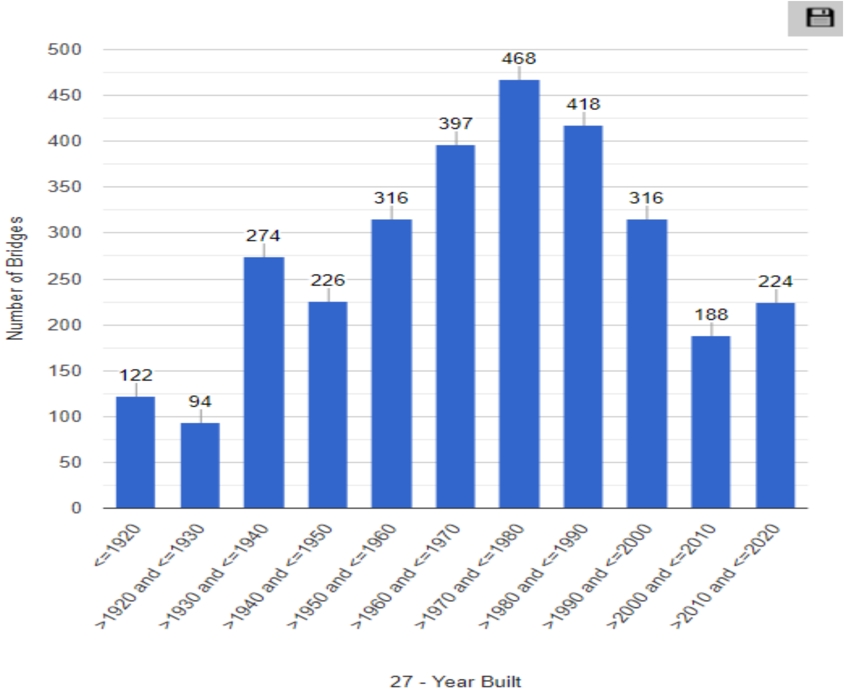
Bridges in North Dakota

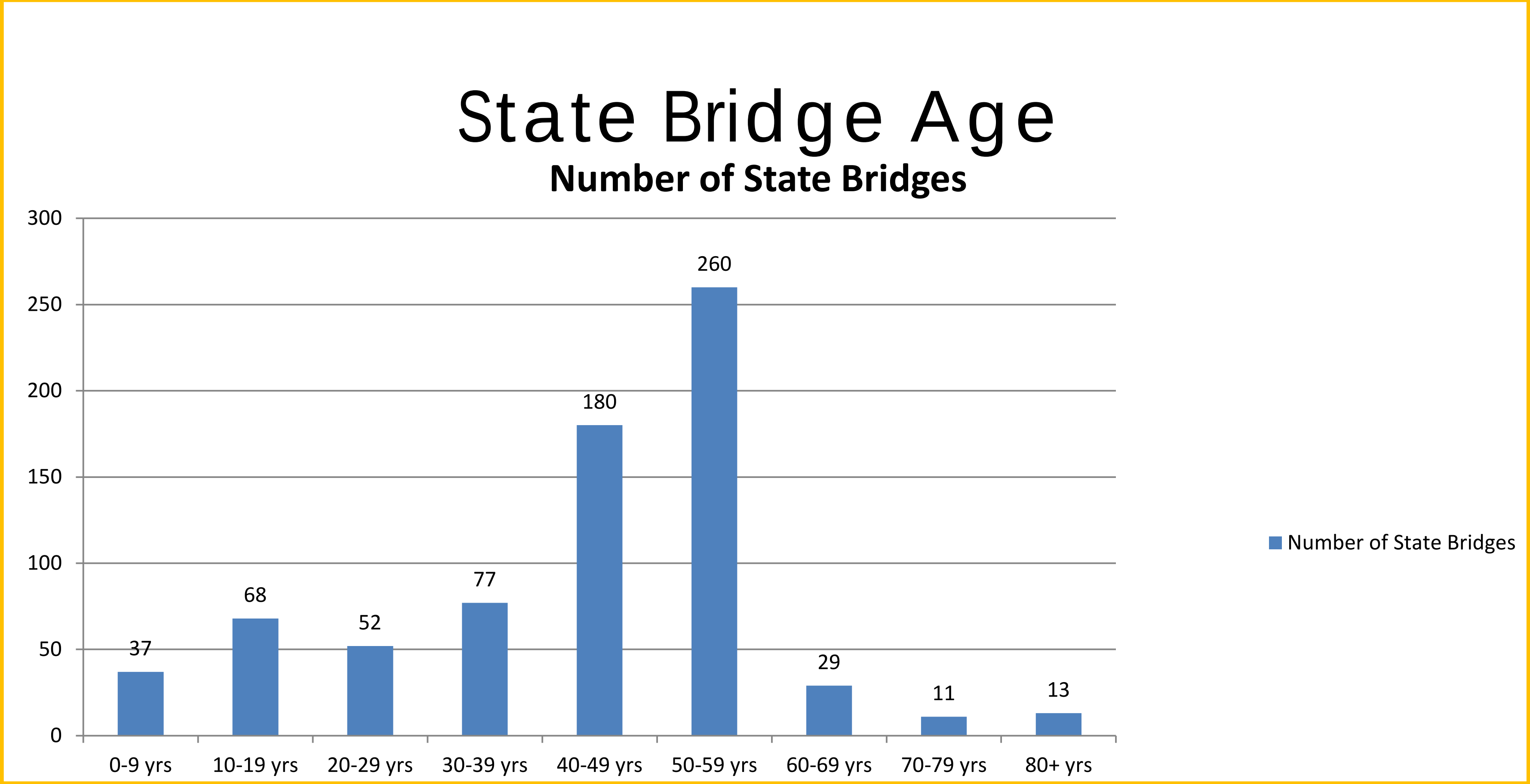
NDDOT	1,365 >=20’
City/County	3,287 >=20’
Total	5,252

Bridges Posted in ND (2020)



County Bridges Year built (2020 NBI)





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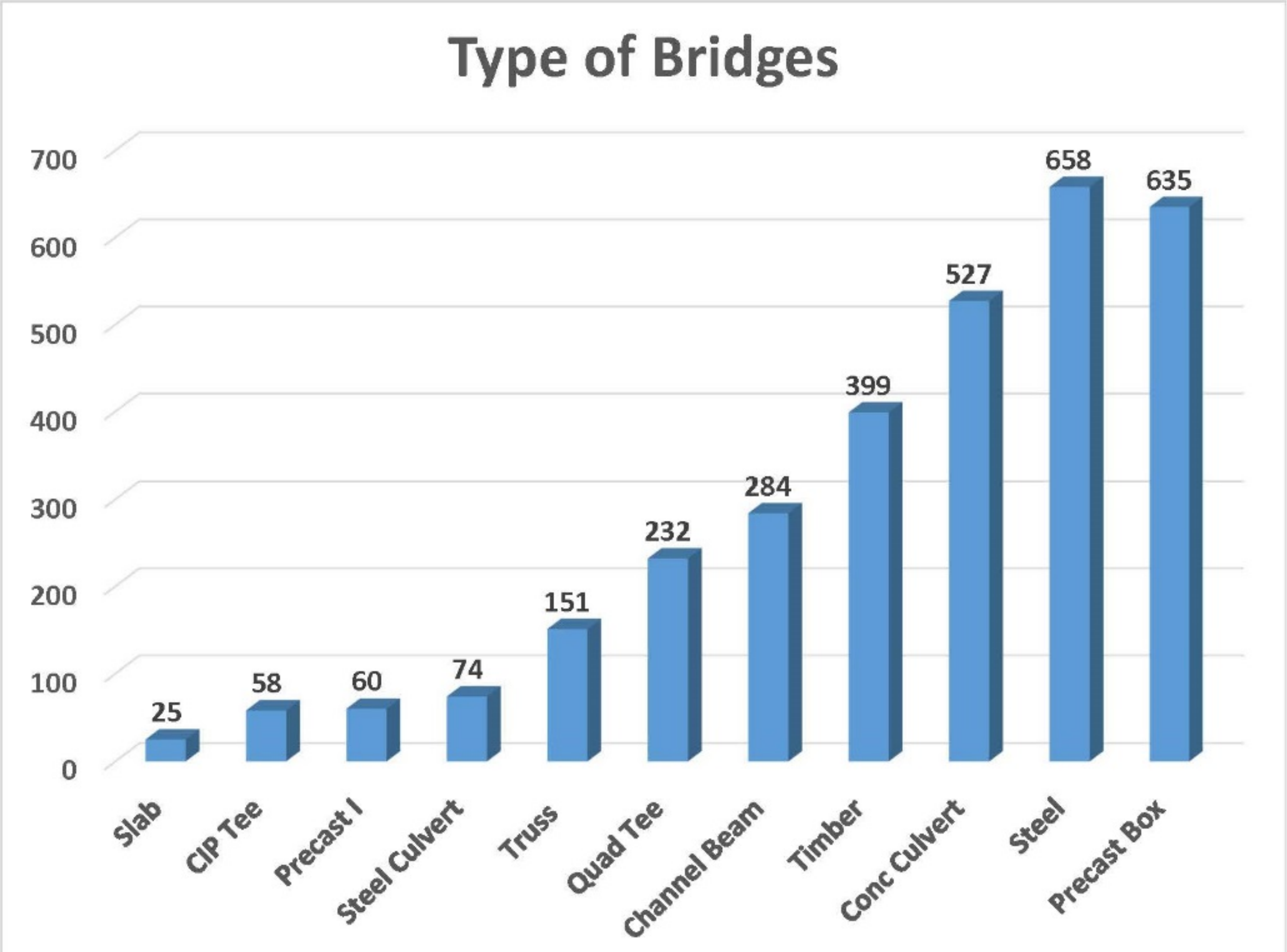
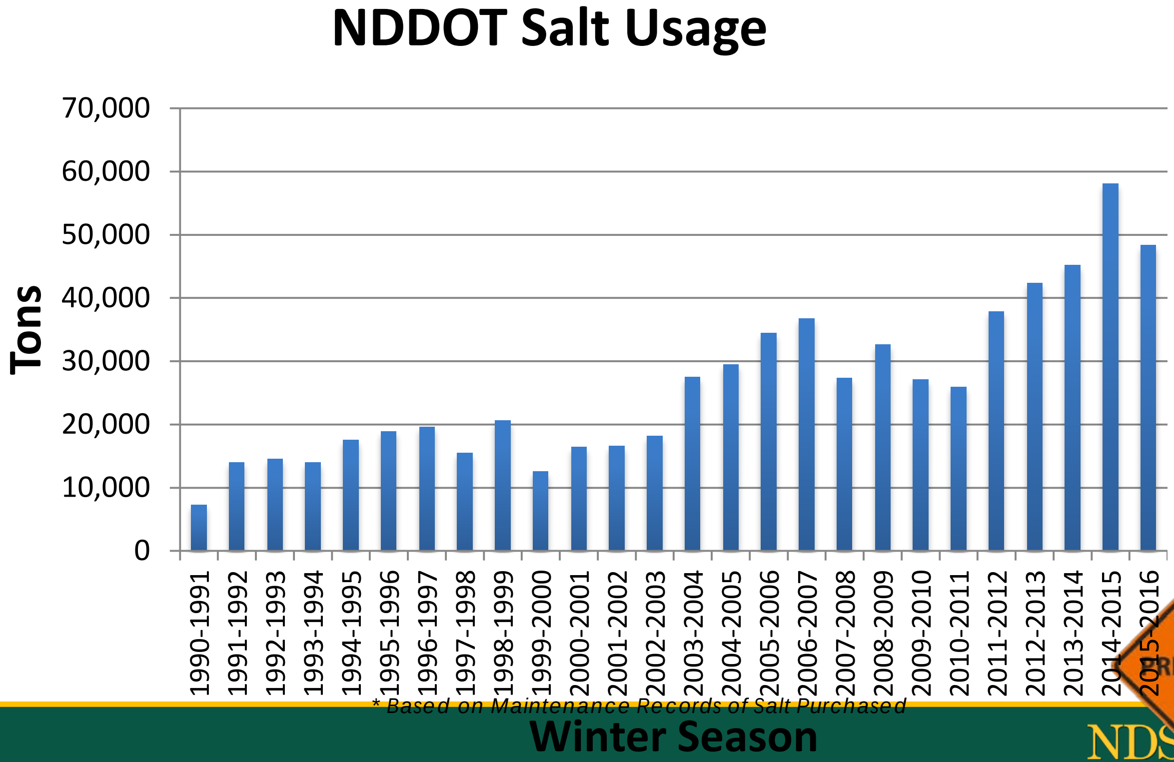

Type of Bridges
700
600
500
400
300
200
100
0
25
58
60
74
151
232
284
399
527
658
635
Slab
CIP Tee
Precast I
Steel Culvert
Truss
Quad Tee
Channel Beam
Timber
Conc Culvert
Steel
Precast Box

Increased Road Salt!



Bridges in North Dakota

NDDOT >=20’	1,365 (1,134)
City/County/Twp >=20’	3,287 (3,125)

US Bureau of Reclamation..........18

US Fish & Wildlife......................12

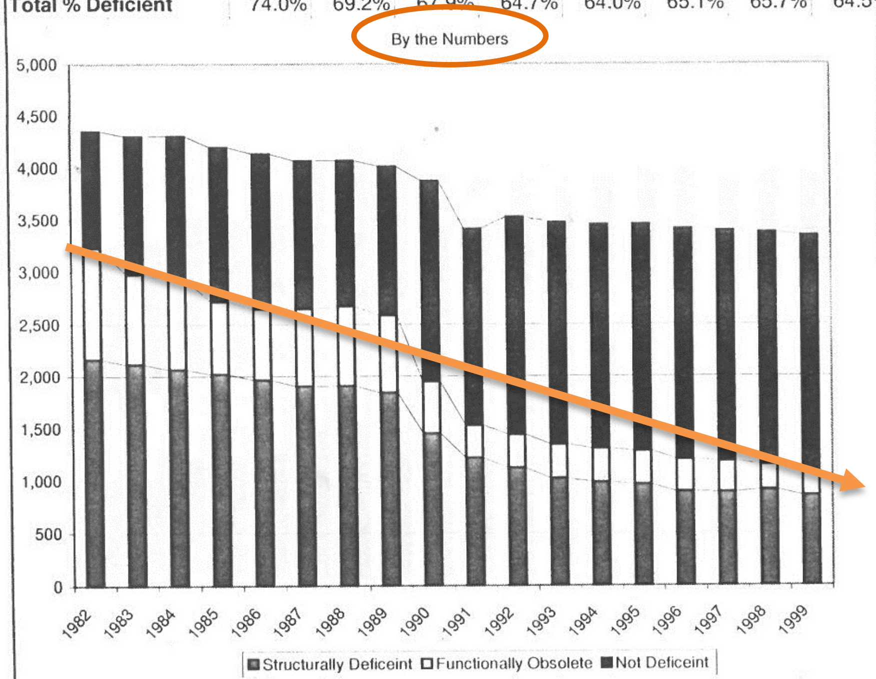
Private, RR, BIA, USACOE,

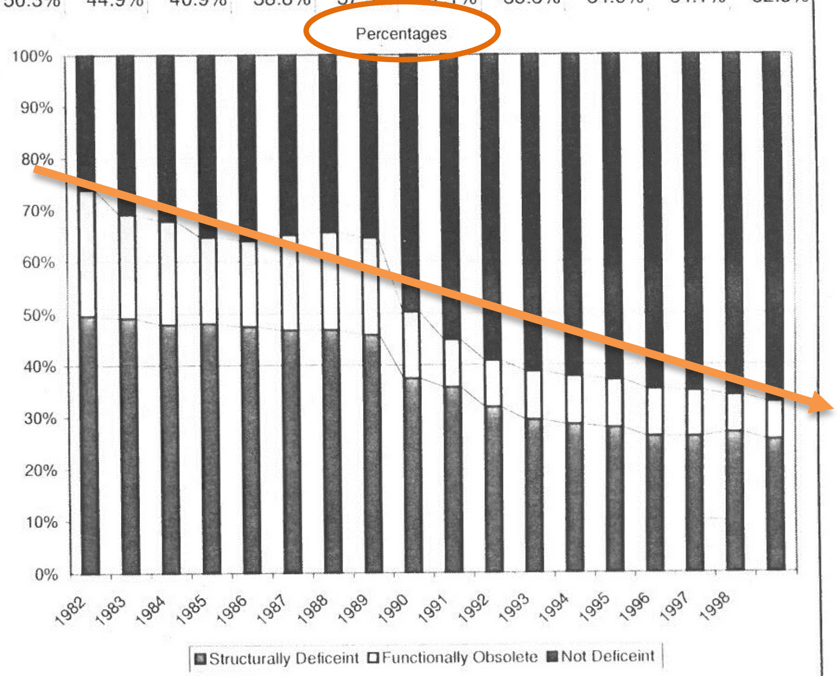
USAF, Parks, US Forest.................. 40

Total	5,252 (4,329)

NBI Condition History of All County Bridges in ND Since 1982

Year	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
Total Bridges	4356	4304	4307	4197	4133	4065	4068	4011	3874	3408	3524	3472	3450	3452	3409	3391	3374	3340
Not Deficient	1134	1327	1382	1480	1488	1417	1397	1423	1925	1878	2084	2126	2144	2170	2205	2206	2223	2244
Structurally Deficeint	2160	2113	2063	2018	1963	1901	1905	1837	1449	1215	1,121	1021	983	961	892	886	908	851
% SD	49.6%	49.1%	47.9%	48.1%	47.5%	46.8%	46.8%	45.8%	37.4%	35.7%	31.8%	29.4%	28.5%	27.8%	26.2%	26.1%	26.9%	25.5%
Functionally Obsolete	1062	864	862	699	682	747	766	751	500	315	319	325	323	321	312	299	243	245
%FO	24.4%	20.1%	20.0%	16.7%	16.5%	18.4%	18.8%	18.7%	12.9%	9.2%	9.1%	9.4%	9.4%	9.3%	9.2%	8.8%	7.2%	7.3%
Total SD + FO	3222	2977	2925	2717	2645	2648	2671	2588	1949	1530	1440	1346	1306	1282	1204	1185	1151	1096
Total % Deficient	74.0%	69.2%	67.9%	64.7%	64.0%	65.1%	65.7%	64.5%	50.3%	44.9%	40.9%	38.8%	37.9%	37.1%	35.3%	34.9%	34.1%	32.8%





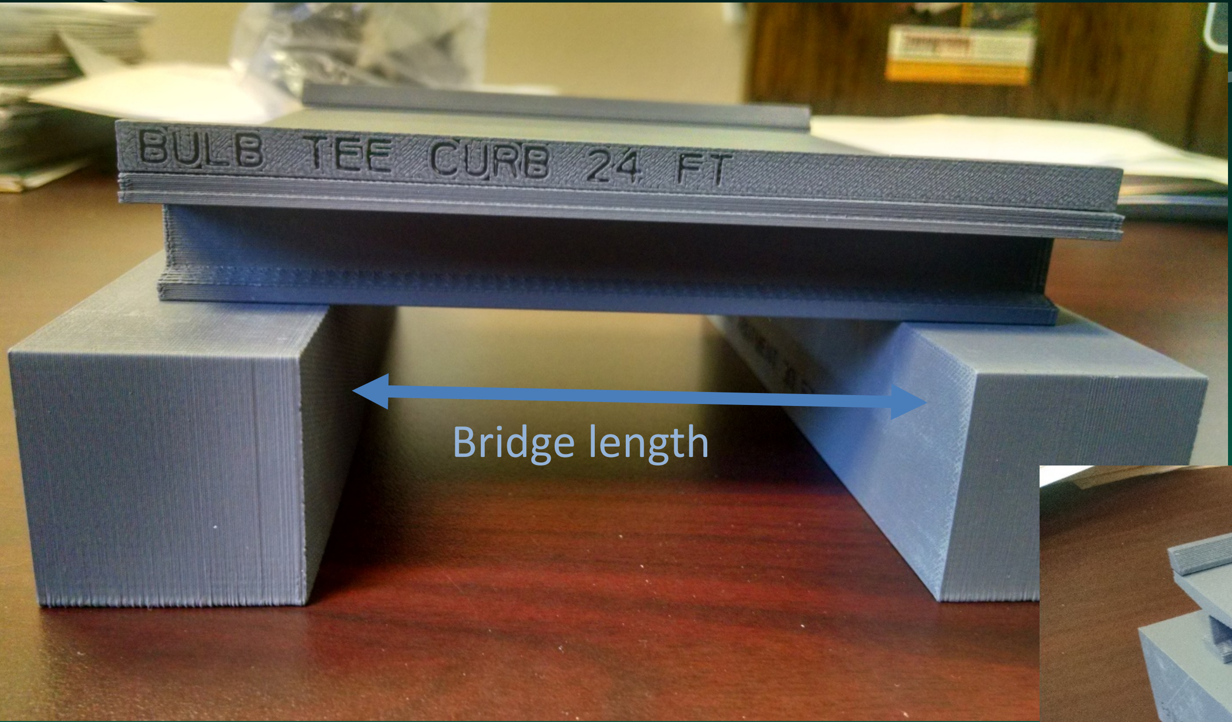
NBI Condition History of All County Bridges in ND since 1982

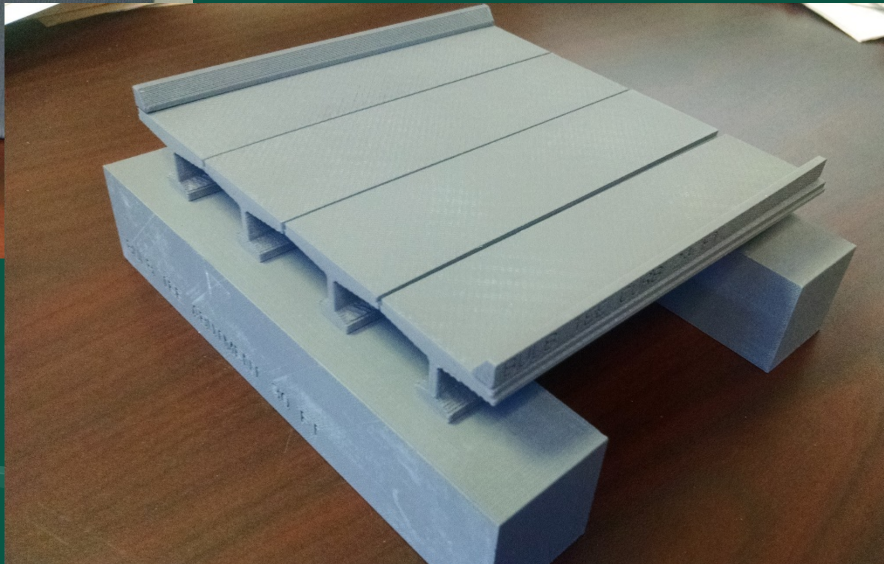
Year	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
Total Bridges	3314	3301	3281	3279	3265	3237	3233	3202	3187	3163	3155	3147	3150	3139	3125	3098	3092	3066
Not Deficient	2237	2228	2226	2234	2248	2252	2249	2253	2265	2265	2250	2242	2251	2265	2271	2267	3092	3066
Structurally Defieient	831	833	820	805	777	749	750	720	693	675	686	697	697	678	656	646	615	580
% SD	25.1%	25.2%	25.0%	24.6%	23.8%	23.1%	23.2%	22.5%	21.7%	21.3%	21.7%	22.1%	22.1%	21.6%	21.0%	20.9%	19.9%	18.9%
Functionally Obsolete	246	240	235	240	240	236	234	229	229	223	219	208	202	196	198	185		
% FO	7.4%	7.3%	7.2%	7.3%	7.4%	7.3%	7.2%	7.2%	7.2%	7.1%	6.9%	6.6%	6.4%	6.2%	6.3%	6.0%		
Total Deficient (SD + FO)	1077	1073	1055	1045	1017	985	984	949	922	898	905	905	899	874	854	831		
Total % Deficient (SD+FO)	32.5%	32.5%	32.2%	31.9%	31.1%	30.4%	30.4%	29.6%	28.9%	28.4%	28.7%	28.8%	28.5%	27.8%	27.3%	26.8%		

Bridge Cost Estimates

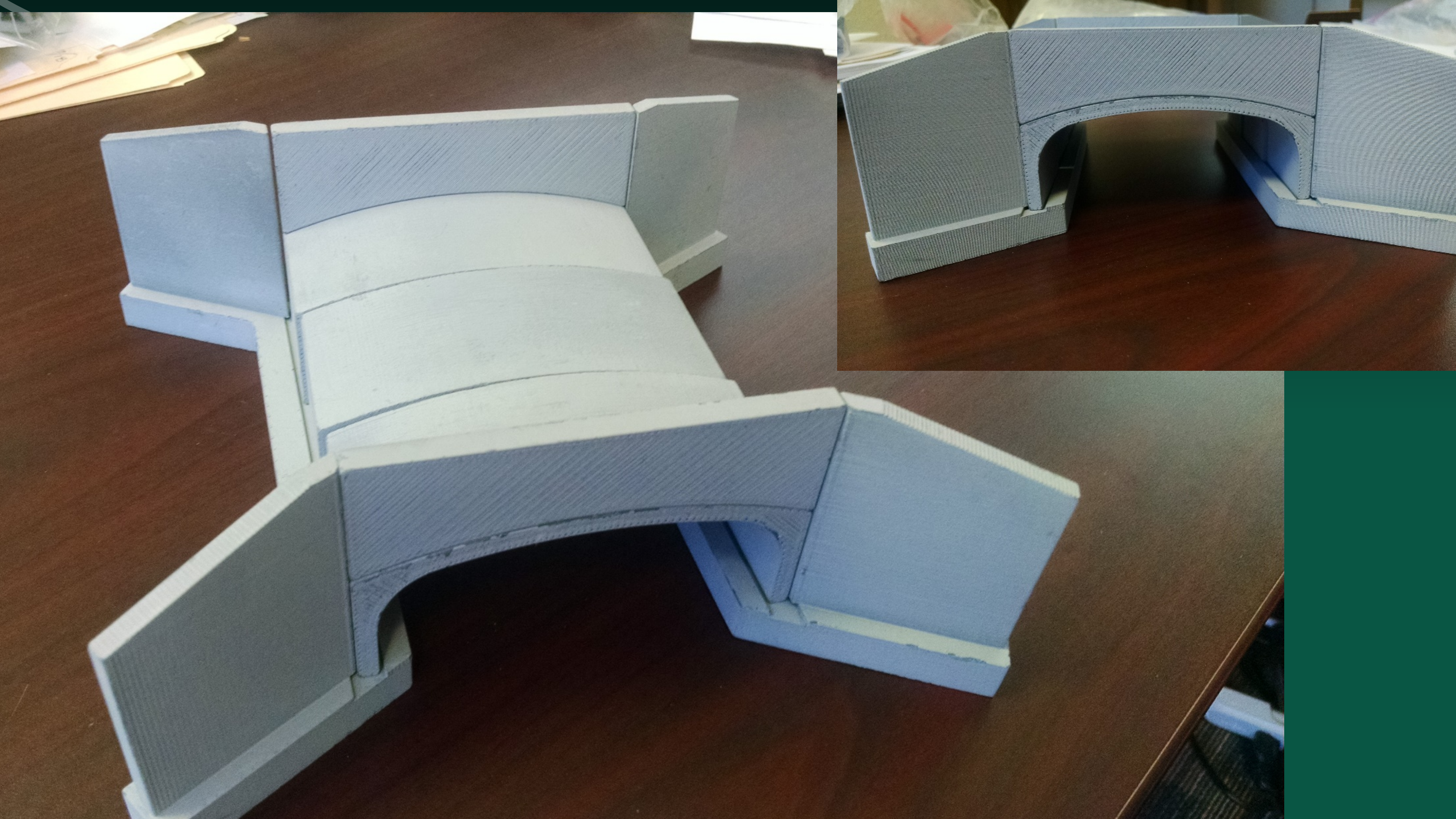
New bridge - $250 (295)/sf
Deck replacement - $75/sf
Treat deck with silane - $0.25/sf
Crack seal deck - $0.10/sf

That means that a 100’ long x 30(32)’ wide bridge will cost $750,000(880,000)!


BULB TEE CURB 24 FT
Bridge length



Buried Bridges



ssistance

Minor Structures

Less than 20’ in length

NORTH DAKOTA DEPARTMENT OF TRANSPORTATION
BRIDGE INVENTORY

ADAMS

COUNTY STRUCTURES - 20 FEET AND LONGER

STRUCTURE NUMBER	STRUCTURE TYPE	SUFF RATE	OPR RATE	RDWAY CURB TO CURB	STRUCT LENGTH	TRAFFIC COUNT	YEAR BUILT	RECONST YEAR	INV RTE	LOCATION
01-110-11.0	CONCRETE CULVERT	99.0	HS60		31	50	1980		0111	5 NORTH OF BUCYRUS
01-111-03.0	PRES CONC CONT SNGLE/SPRD BX BM/G	97.0	HS99	28.0	108	50	1983		0111	6 WEST 16 NORTH HETTINGER
01-113-02.1	PRES CONC TEE BEAM	97.0	HS75	28.0	82	70	1980		0115	18 NORTH 5 WEST HETTINGER
01-115-05.0	PRES CONC CONT SNGLE/SPRD BX BM/G	89.5	HS66	28.0	112	70	1979		0115	14 NORTH 2 WEST HETTINGER
01-115-12.0	CONCRETE CULVERT	99.0	HS60		42	70	1982		0115	2 WEST 7 NORTH HETTINGER
01-119-22.1	CONCRETE CULVERT	99.9	HS75		29	180	2000		0119	2 EAST 1 SOUTH HETTINGER
01-120-08.1	PRES CONC MULTI BOX BEAM/GIRD	83.4	HS51	28.5	130	125	1964		0119	13 NORTH 2 EAST HETTINGER
01-120-12.1	PRES CONC MULTI BOX BEAM/GIRD	90.6	HS58	28.5	40	300	1963		0119	9 NORTH 2 EAST HETTINGER
01-132-13.0	PRES CONC CONT SNGLE/SPRD BX BM/G	91.8	HS74	28.0	150	45	1979		0114	7 NORTH 14 EAST HETTINGER
01-132-20.0	PRES CONC SNGLE/SPRD BX BM/GR	97.0	HS99	28.0	102	50	1985		0122	13 EAST OF HETTINGER
01-135-21.0	PRES CONC TEE BEAM	97.0	HS76	28.0	87	50	1979		0122	17 EAST OF HETTINGER
01-139-16.0	PRES CONC SNGLE/SPRD BX BM/GR	86.8	HS64	28.0	148	140	1975		0139	9 NORTH OF LEMMON
01-143-17.0	STEEL STRINGER OR GIRDER	42.0	HS45	20.1	139	115	1951		0143	2 EAST 8 NORTH OF LEMMON
01-146-11.0	PRES CONC CONT SNGLE/SPRD BX BM/G	96.9	HS99	28.1	126	60	1983		0143	14 NORTH 4 EAST LEMMON SD

COUNTY ON 14

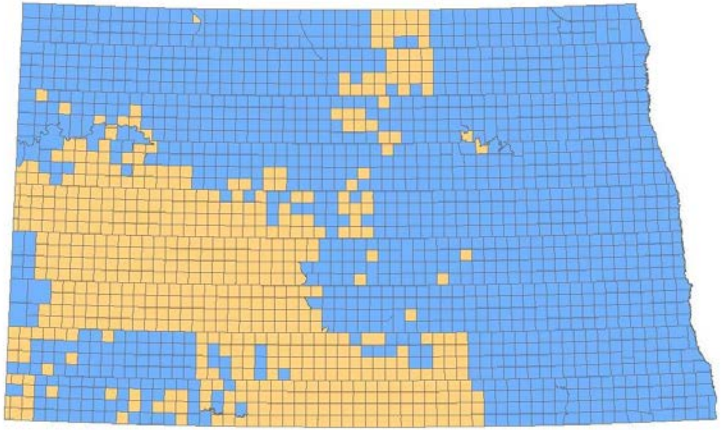
STRUCTURE NUMBER	STRUCTURE TYPE	SUFF RATE	OPR RATE	RDWAY CURB TO CURB	STRUCT LENGTH	TRAFFIC COUNT	YEAR BUILT	RECONST YEAR	INV RTE	LOCATION
01-103-23.0	CONCRETE CULVERT	100.0	HS75		24	60	1996		OFF	10 SOUTH 1 EAST REEDER
01-104-01.0	STEEL STRINGER OR GIRDER	73.4	HS54	22.0	75	35	1931		OFF	12 NORTH OF REEDER
01-104-19.0	STEEL STRINGER OR GIRDER	22.9	HS22	15.3	29	4	1934		OFF	6 SOUTH 1 EAST REEDER
01-104-21.0	STEEL TRUSS - THRU	19.0	HS19	15.1	46	10	1919		OFF	7 SOUTH 2 EAST REEDER
01-105-02.0	STEEL STRINGER OR GIRDER	49.8	HS31	14.0	57	10	1936		OFF	2 EAST 11 NORTH REEDER
01-105-21.0	CONCRETE CHANNEL BEAM	68.0	HS66	21.0	31	45	1940		OFF	8 SOUTH 1 EAST OF REEDER
01-106-22.0	STEEL TRUSS - THRU	26.5	HS20	15.2	46	1	1919		OFF	9 SOUTH 2 EAST REEDER
01-107-22.0	STEEL STRINGER OR GIRDER	36.4	HS44	14.4	24	10	1935		OFF	8 SOUTH 4 EAST OF REEDER
01-107-23.0	STEEL STRINGER OR GIRDER	37.3	HS51	17.0	31	5	1936		OFF	10 SOUTH 4 EAST REEDER
01-108-02.0	STEEL STRINGER OR GIRDER	32.0	HS09	18.0	70	15	1926		OFF	11 NORTH 5 EAST REEDER
01-110-15.0	TIMBER STRINGER OR GIRDER	32.0	HS17	18.6	37	1	1941		OFF	9 WEST OF HETTINGER
01-111-11.0	STEEL STRINGER OR GIRDER	34.7	HS37	16.4	25	10	1935		OFF	5 NORTH 1 EAST OF BUCYRUS
01-113-04.0	STEEL TRUSS - THRU	25.7	HS13	15.0	51	1	1925		OFF	4 WEST 15 NORTH HETTINGER
01-115-03.0	STEEL TRUSS - THRU	29.7	HS21	15.8	40	5	1908		OFF	17 NORTH 2 WEST HETTINGER
01-116-04.0	PRES CONC TEE BEAM	97.0	HS80	28.2	85	50	1979		OFF	17 NORTH 2 WEST HETTINGER
01-122-09.1	CONCRETE CHANNEL BEAM	90.0	HS70	22.2	25	10	1991		OFF	12 N. 4 E. HETTINGER
01-122-12.0	CONCRETE CHANNEL BEAM	90.9	HS60	21.0	31	3	1900	1986	OFF	8 NORTH 3 EAST HETTINGER
01-123-14.0	STEEL STRINGER OR GIRDER	93.0	HS76	19.8	29	10	1938		OFF	5 EAST 6 NORTH HETTINGER
01-125-22.0	STEEL STRINGER OR GIRDER	42.3	HS11	19.0	28	10	1999		OFF	1 WEST OF HAYNES
01-125-23.0	STEEL CONT STRINGER OR GIRDER	27.1	HS36	15.5	26	10	1936		OFF	SOUTH EDGE OF HAYNES
01-127-10.0	STEEL TRUSS - THRU	39.1	HS36	14.7	93	5	1930		OFF	10 NORTH 9 WEST HETTINGER
01-135-16.0	CONCRETE CULVERT	96.0	HS75		23	10	1998		OFF	16 EAST 5 NORTH HETTINGER
01-137-17.0	STEEL TRUSS - THRU	22.5	HS30	17.0	115	3	1908		OFF	19 EAST 3 NORTH HETTINGER
01-143-07.0	CONCRETE CULVERT	100.0	HS60		37	15	1983		OFF	17 NORTH 2 EAST OF LEMMON
01-148-13.0	STEEL STRINGER OR GIRDER	79.0	HS89	18.0	40	5	1938		OFF	7 EAST 11 NORTH LEMMON SD

COUNTY OFF 25

Local Practices

Who has bridge responsibility?

Organized Townships

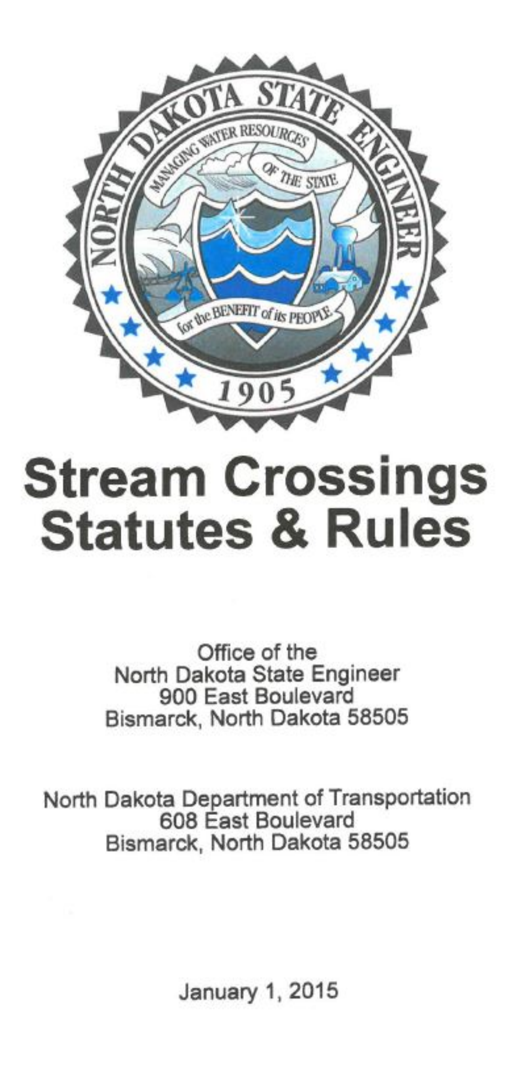


Bee good

NDSU

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[4] 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]		

What is 100 Year Storm?

A 100-year storm refers to rainfall totals that have a one percent probability 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.[1] In other words, there is a 1 in 100 or 1% chance that a storm will reach this intensity in any given year. Likewise, a 50-year rainfall event has a 1 in 50 or 2% chance of occurring in a year. In addition, each locality has its own criteria for how much rain must fall within 24 hours to classify as a particular rain event. See chart below for other rainfall events.

Recurrence intervals and probabilities of occurrences

Recurrence interval, in years	Probability of occurrence in any given year	Percent chance of occurrence in any given year
100	1 in 100	1
50	1 in 50	2
25	1 in 25	4
10	1 in 10	10
5	1 in 5	20
2	1 in 2	50

Gambling – the odds are always in your favor

50-year storm

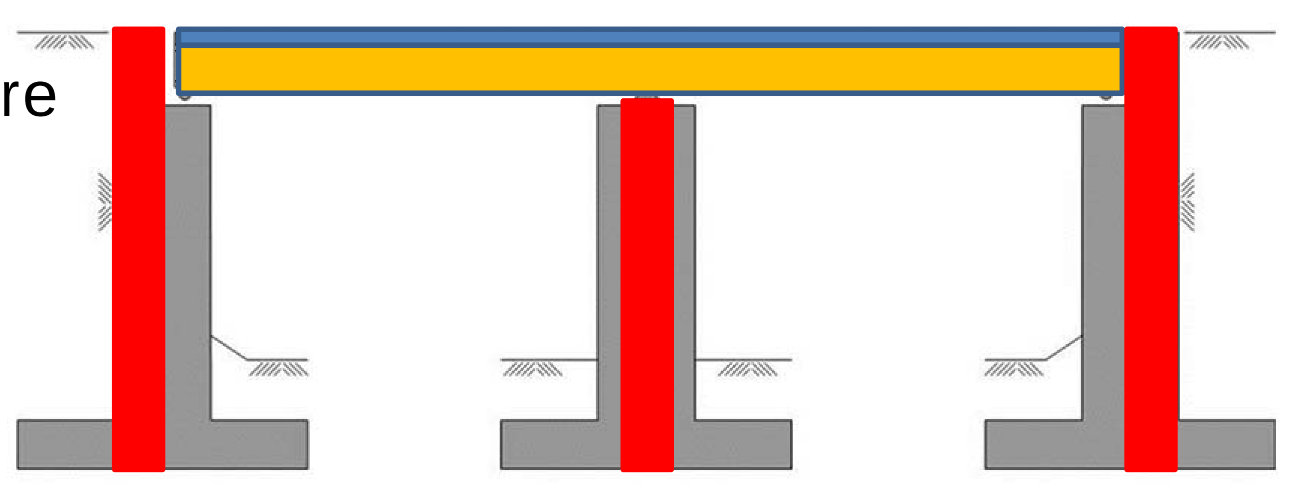
Take a card from a deck of 50 cards (a standard deck without the 2 of clubs and 2 of spades). The chance of picking the Ace of spades is 1/50. If you put the card back in the deck and reshuffle, what are the chances of picking the Ace of spades? Still 1/50, just like the 50-year storm in a given year.

Pick a card

Bridge Parts

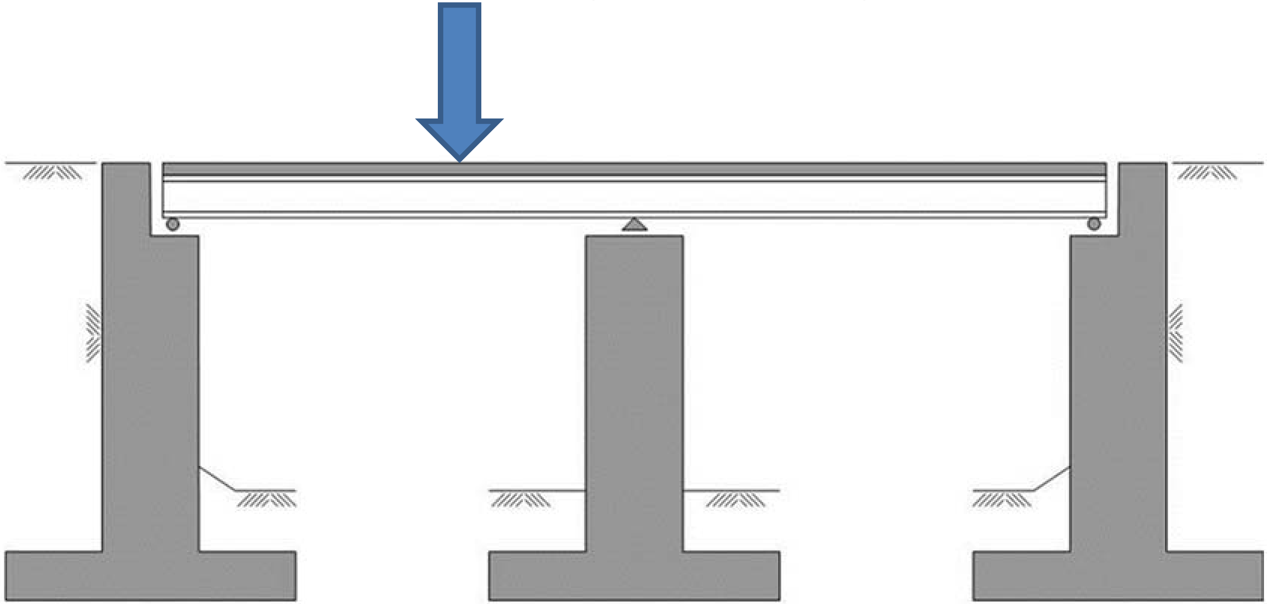
Bridge Components and Terms

- Three Major Bridge Components
  - Deck
  - Superstructure
  - Substructure

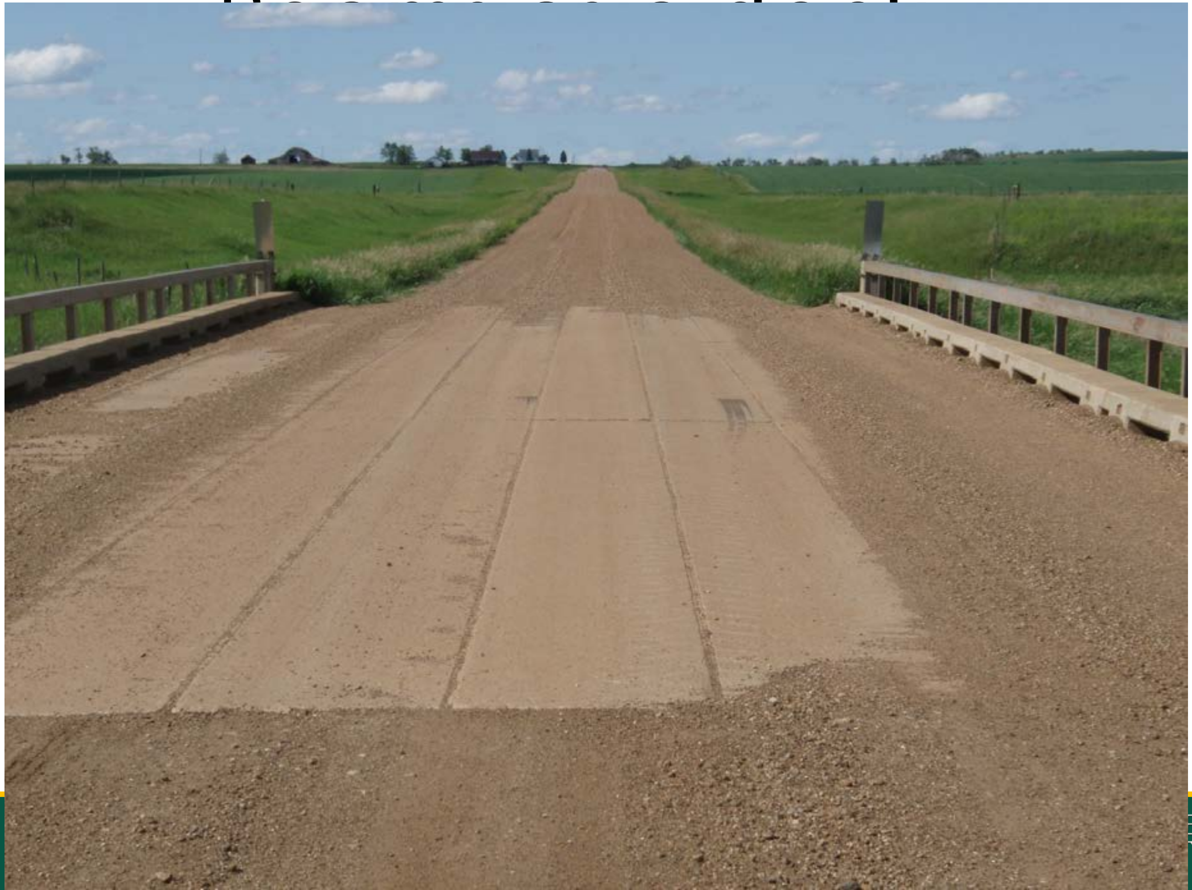


Deck

- Portion of the bridge that you drive on

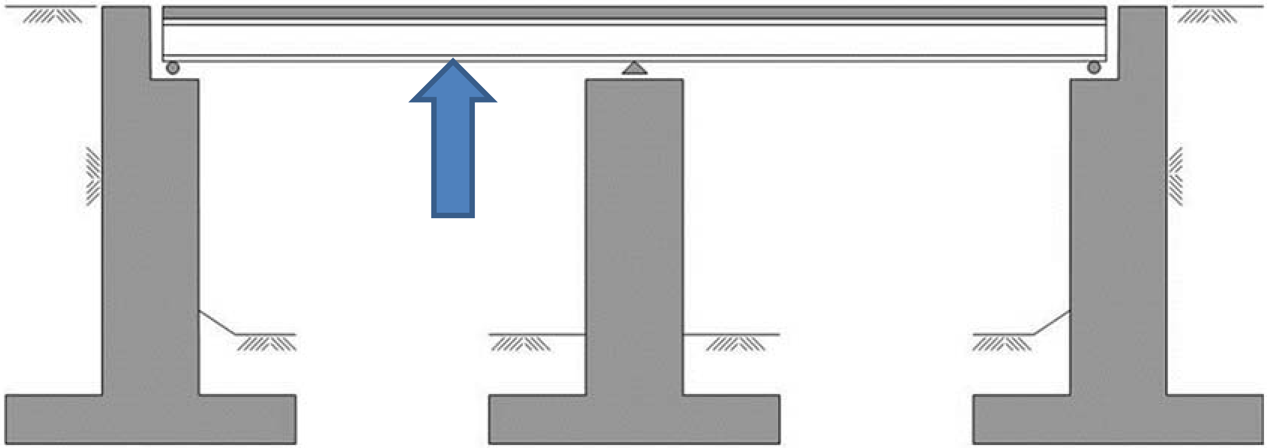


Wooden Deck



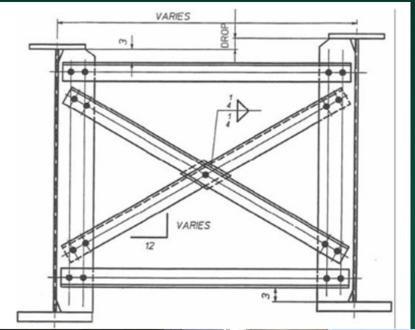
Superstructure

- Portion of the bridge that lies directly below and supports the deck
  – Beams, girders, truss, arch




Top Flange
Web
Bottom Flange

Diaphragms, Cross Bracing and Supports



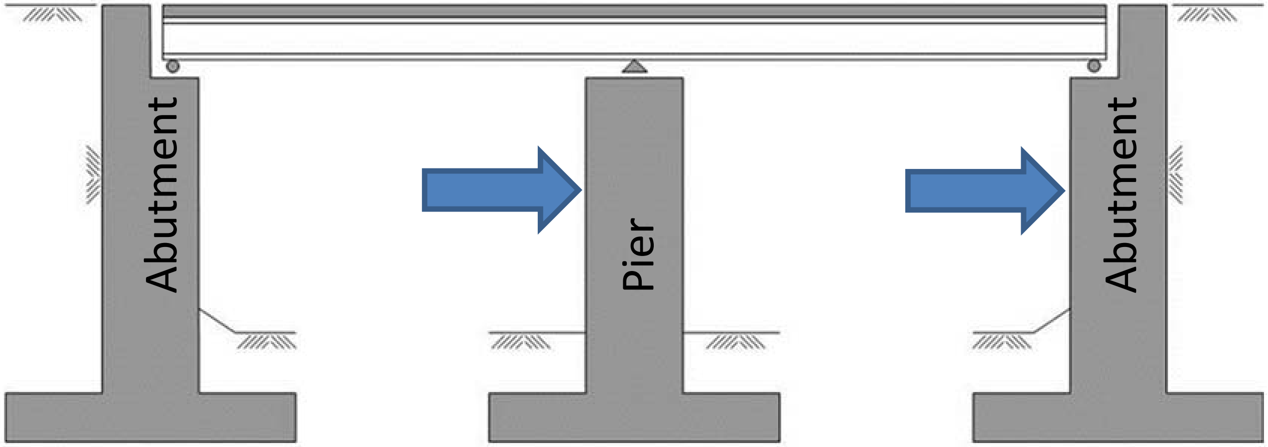
Splice Plate

Gusset Plate

- Connect Truss Elements

Substructure

- Portion of the bridge that supports the deck and superstructure.
  - Abutments, piers



Abutments


Girder
Abutment
Wingwall
Piling
(This should not be exposed!)

Bearings

- Transfer loads from Superstructure to Substructure
- Provide for movement due to expansion, contraction, rotation
- ¾” expansion with 120° F temp change - 100’ bridge

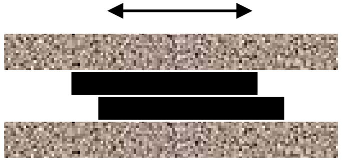
Plate

Rocker Bearing

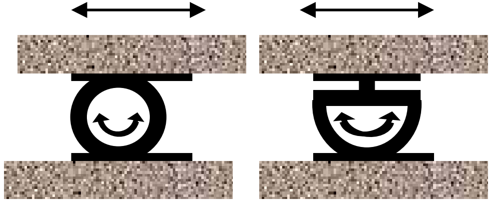
Anchor Bolt

Masonry Plate

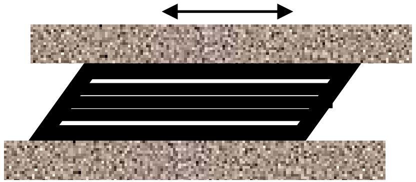
Bearings



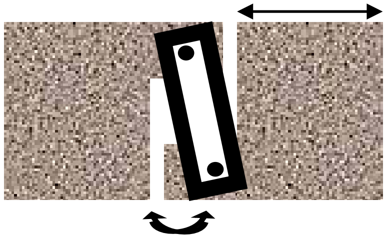
Sliding



Rolling/Rocking



Stretching



Swinging

Foundations
Piling

Wood Pile Foundations

Steel Pile Foundation

Ice Nose

Wing Walls

Metal Railing

W-Beam

Retrofit

Approach Slabs

Key Terms and Topics

Deck
Superstructure
Substructure
Foundation

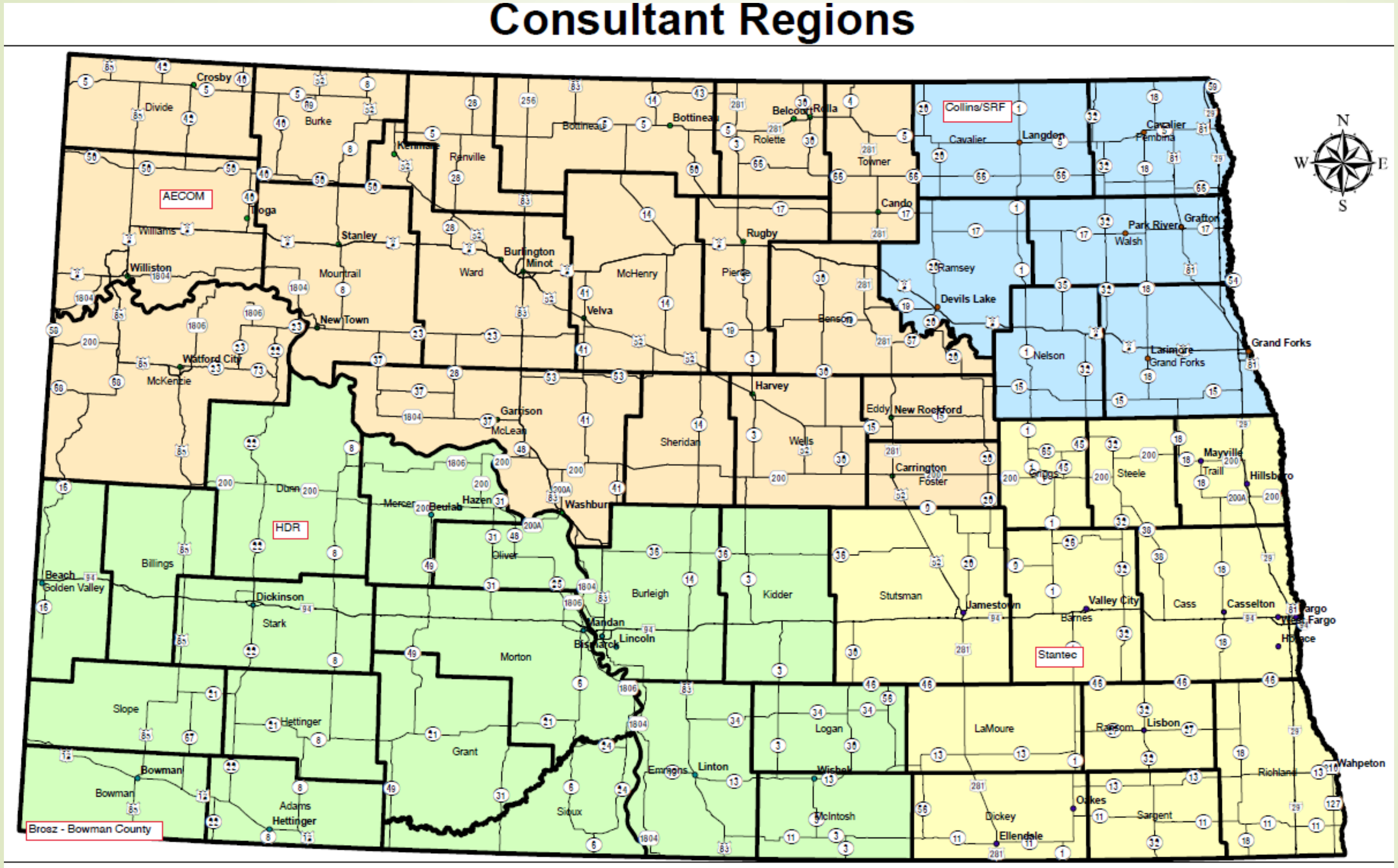

smile.

Bridge Inspections

History

- NDDOT
  - Completing inspections on state and local bridges (>20.0’ in length) since the Bridge Inspection Program began
    - NDDOT internal staff
  - In 2020, moved to Consultants for all locally owned bridges and some state-owned bridges with NDDOT staff managing the contracts
  - NDDOT is still inspecting the majority of the state-owned bridges

Regions



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Funding

- Inspections
  - Federal – 80.93% (Allocations to LPA's)
  - Local match – 19.07%
- Load Rating
  - Federal – 80.93% (NDDOT federal funds)
  - Local match – 19.07%

- Billing Local Match (monthly)
  - Billed after accepted/approved inspection report
  - Billed after accepted/approved load rating

Why we invest so much time, effort, and funds for Inspections/Load Rating?

- Safety is #1!
- Mobility
- Movement of freight (agriculture, oil, etc.)
  - Vital link in the transportation network
- Asset Management

North Dakota's Recent Bridge Collapse's

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North Dakota’s Recent Bridge Collapse’s

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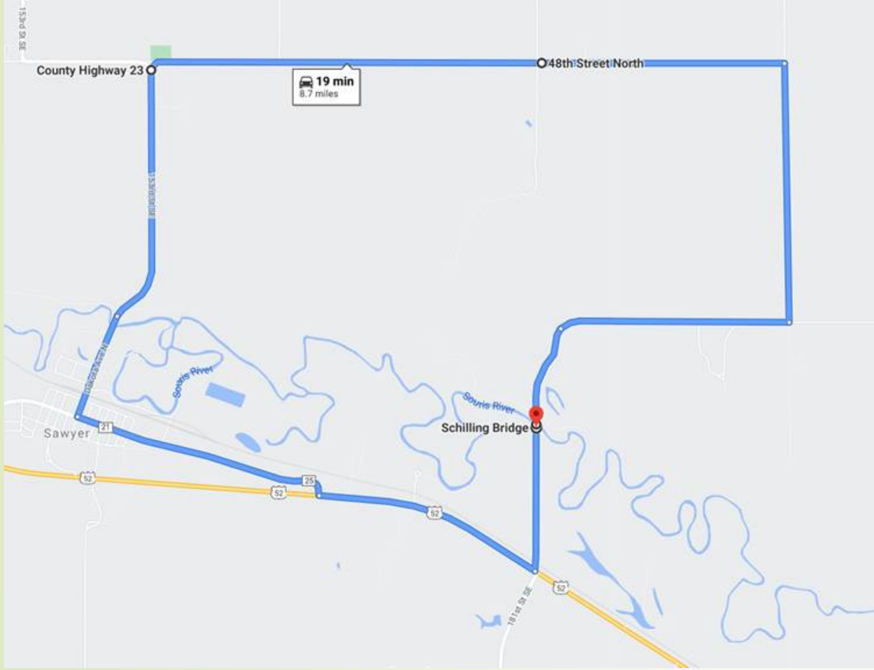
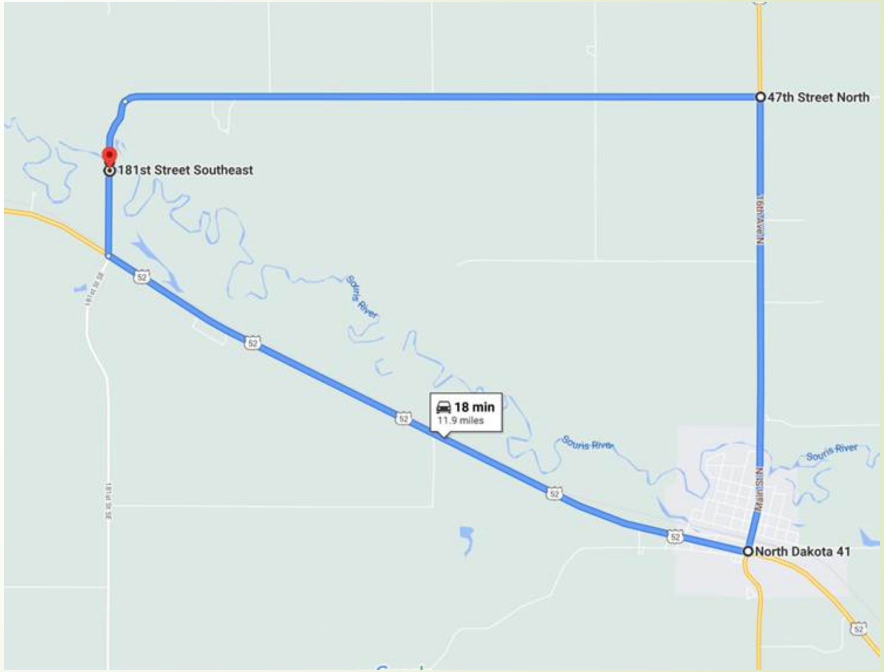
North Dakota’s Recent Bridge Collapse’s

North Dakota's Recent Bridge Collapse's

Mobility





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Movement of Freight

"Each year, North Dakota's freight system moves approximately $173 billion worth of freight. From 2016 to 2045, freight moved annually in North Dakota is expected to increase 128 percent by value (inflation-adjusted dollars), the second highest increase in the nation."

Taken from a News Release published on 10-3-2019 by TRIP (National Transportation Research Nonprofit), can be found at https://tripnet.org/reports/north-dakota-freight-news-release-10-03-2019/

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Asset Management

- Approximately 3,300 bridges (=> 20') owned by a County of City
- Bridges are expensive and Large Asset for any agency
  - Dickey County – 33 bridges, $40 million
  - Bottineau County – 85 bridges, $60 million
  - Williams County – 67 bridges, $35 million
  - Grand Forks County – 285, $169 million

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Inspections Part #2

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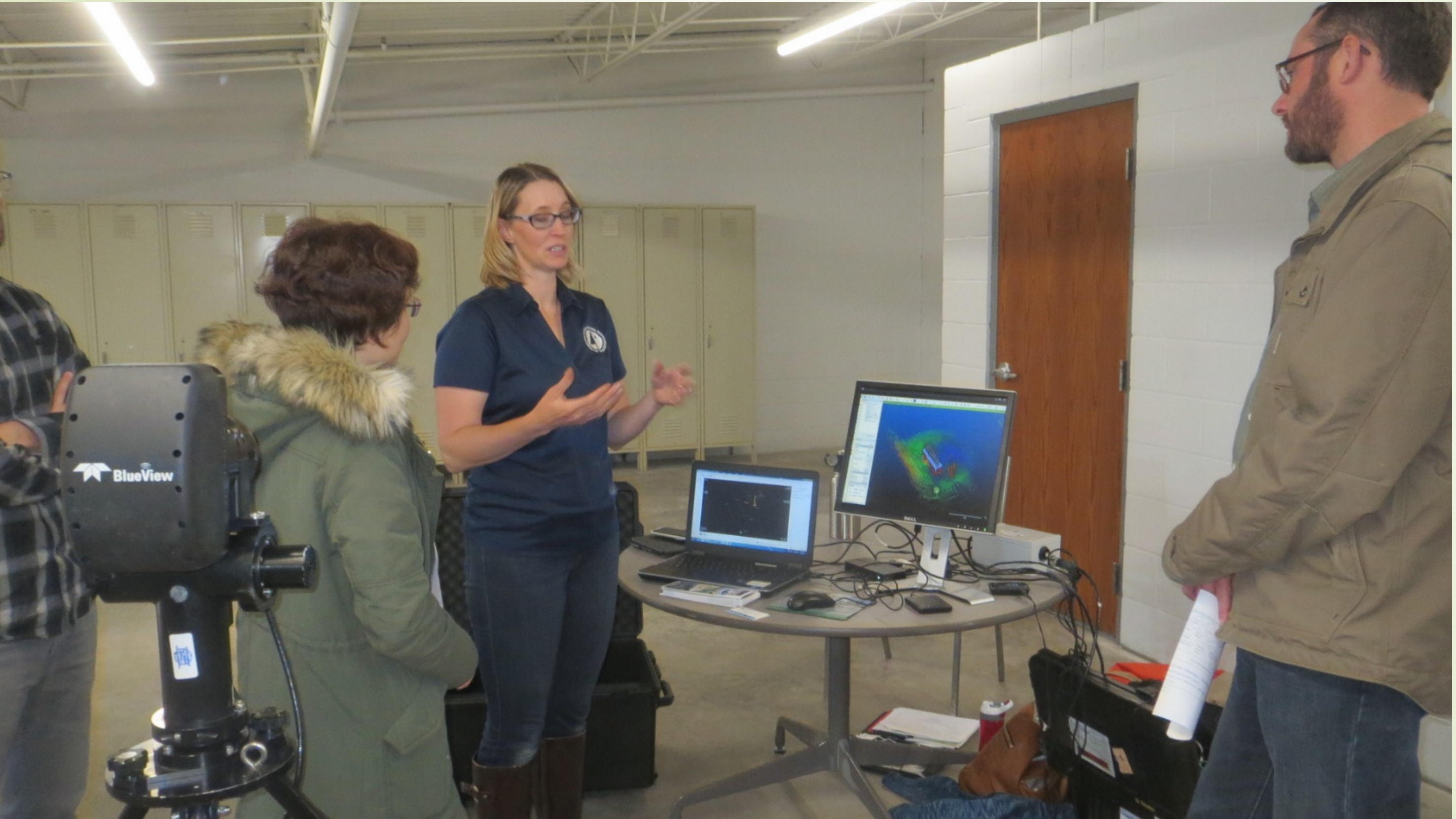
Drone Inspection Video

https://www.youtube.com/watch?v=a4QcwQZPwcU

Underwater Inspections



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Terms

- Sufficiency Rating (SR)
  - Legacy Term - No longer going to used
- Health Index
  - Replaces SR
- Structurally Deficient
  - Legacy Term – No longer going to be used
- Poor
  - Replaces Structurally Deficient
- Alert Code 3
  - No longer using Alert Codes (2021)
- Significant Finding or Critical Finding (2020)
  - Will replace Alert Code 3 in some instances

Significant Finding

- Still working on this and how it should be addressed and look
  - We have had 1 come in this year
    - Email
    - Photos
    - Still required a partial lane closure
- Intent is to put into maintenance recommendations in InspectX

Critical Finding

- Form – SFN 61791
- The following items have seen a Critical Finding
  - Load posting signs
  - Piling damage, Pile Cap load bearing issues, Beam/Girder issues, embankment issues on approach roadways, etc. – close bridge (partial or full), post bridge to X-tons
- These need resolution

Inspections Part #3

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Load Postings

- May be the result of a Critical finding
  - Signs missing, damaged, damage to bridge
  - Notified to do as soon as we receive the CF
- Load Rating
  - List is generated monthly for this
  - 30-days to post
- Requires photos of both signs and the date posted to be sent

FROM: Paul Benning, Local Government

DATE: June 04, 2021

SUBJECT: Bridge Requiring Load Limit Posting

Bridge Number: 27-119-56.0

Location: 12 EAST OF TROTTERS

According to the latest bridge inspection and inventory data on record with the Bridge Division, bridge number 27-119-56.0 was found to have insufficient load carrying capacity or does not have proper Load Limit Signage.

Bridge number 27-119-56.0 has a maximum posting tonnage of 32 Gross Tons. The bridge can be posted at any tonnage as long as long as it is equal to or less than the maximum posting tonnage. Two types of signs (shown on attachment) are recommended in order to provide drivers with more consistent messages statewide.

FHWA Regulations require that bridges be posted within 30 days after a deficiency is discovered. Please have adequate posting signs in place no later than July 04, 2021. Please return this form, with photos of the new signs, as soon as the new signs are installed.

Bridge number 27-119-56.0 is posted at ______________________ Tons.

Type of sign used (R12-1, R12-4, or Other) ______________________

Date Bridge was posted: ______________________

Other Remarks: ______________________

____

____

____

____

____

Work Done By Whom: ______________________ On Date: ____________

1.4.1 Signing Requirements

Regulatory signs must conform to the requirements of the MUTCD manual.

All bridges should be posted using R12-1 or R12-4 as shown below.

R12-1

R12-4

To calculate the axle limits, use the following equation:

0.444 X Max Gross Weight = Max Axle Weight.

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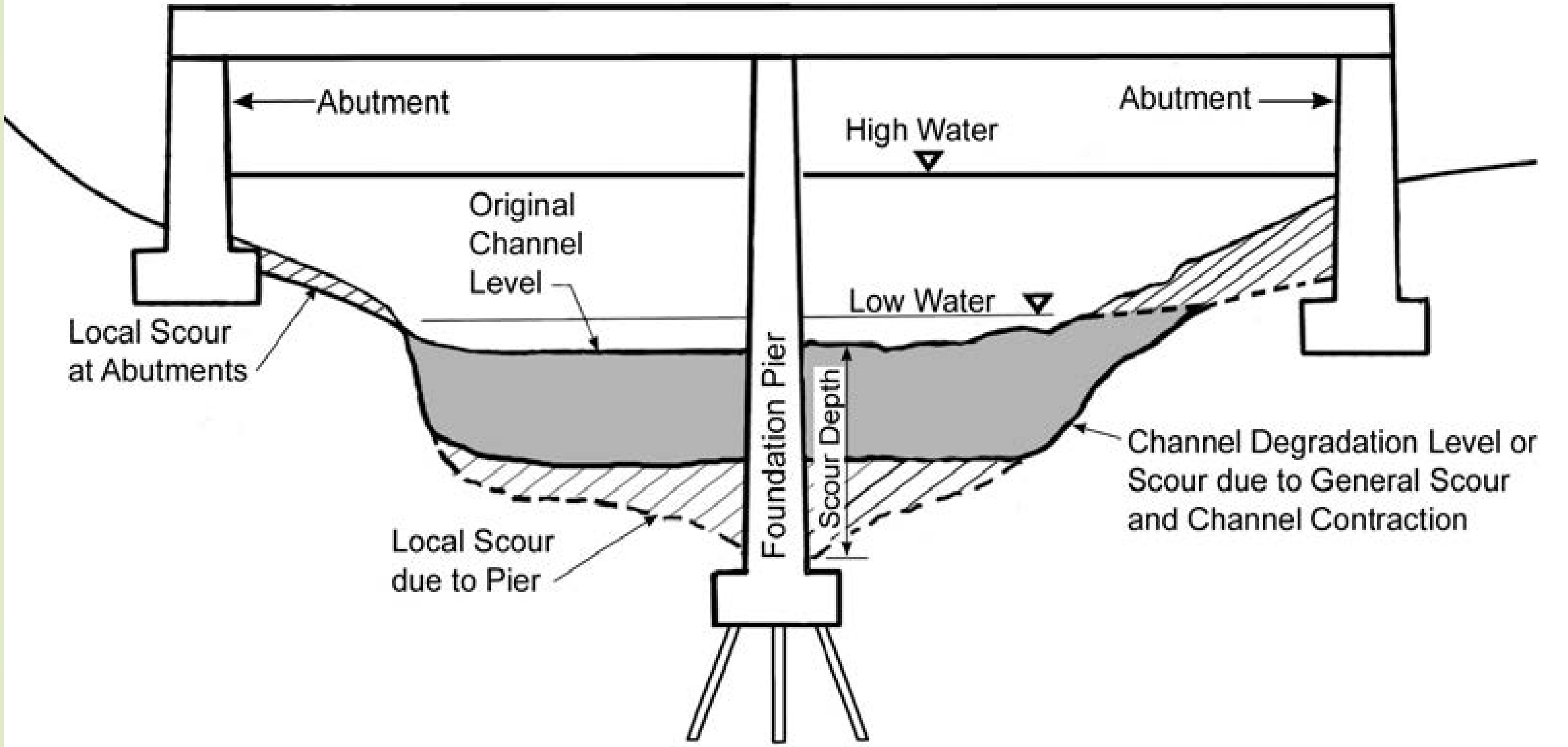
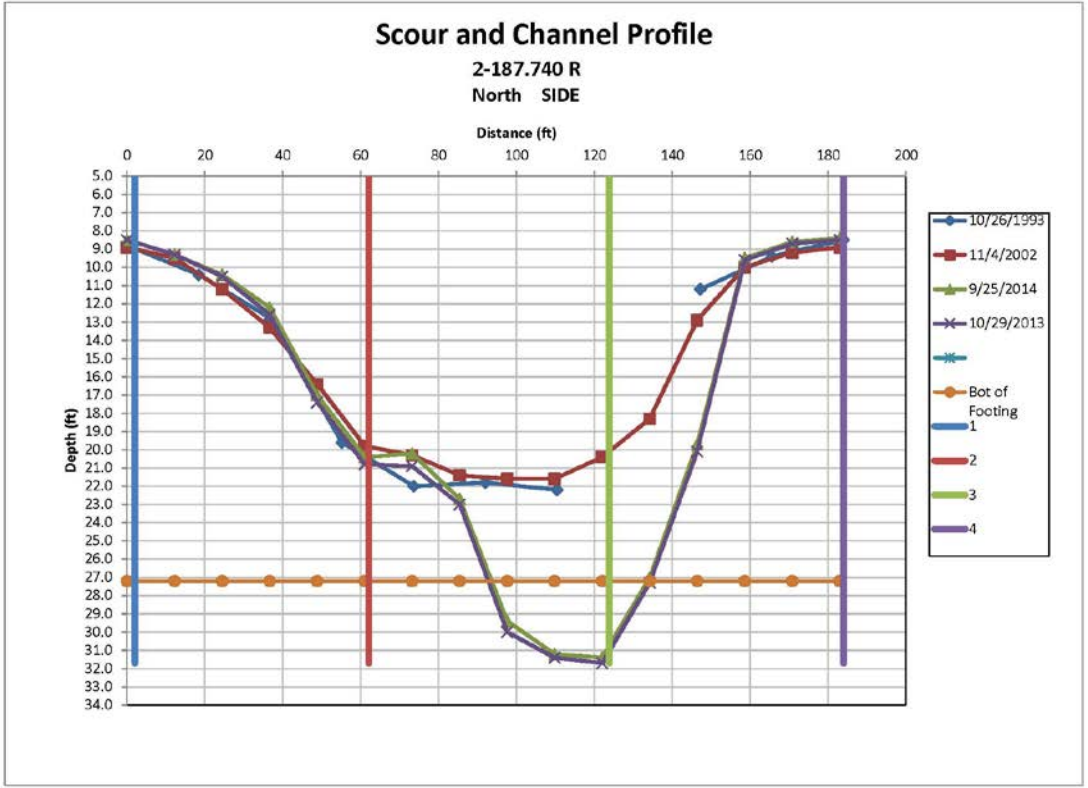
Scour Channel Profiles

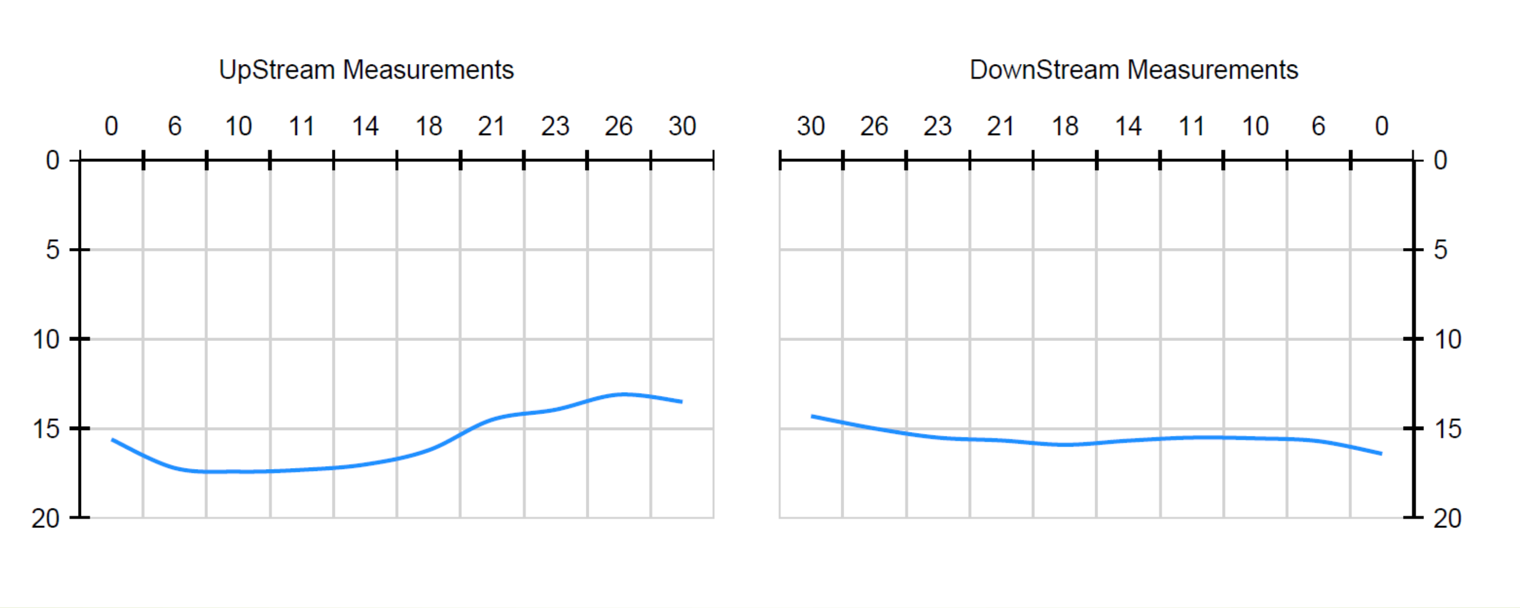
Being done with Inspections

Required every 4 years


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)
Depth (ft)
10/26/1993
11/4/2002
9/25/2014
10/29/2013
Bot of Footing
1
2
3
4



UpStream Measurements
0 6 10 11 14 18 21 23 26 30
0 5 10 15 20
DownStream Measurements
30 26 23 21 18 14 11 10 6 0
0 5 10 15 20

Inspection Report

- Example of Inspection Report

InspectX Demo

- InspectX

Guardrail Clear Zone

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MwRSF

State of the Guardrail Industry: Advances in Longitudinal Barrier Design

Bob Bielenberg

Midwest Roadside Safety Facility
University of Nebraska-Lincoln

NDLTAP Video Conference
February 18, 2015

ncreased Rail Height

- Improved capture
- Reduced rollover potential

North Dakota | Transportation

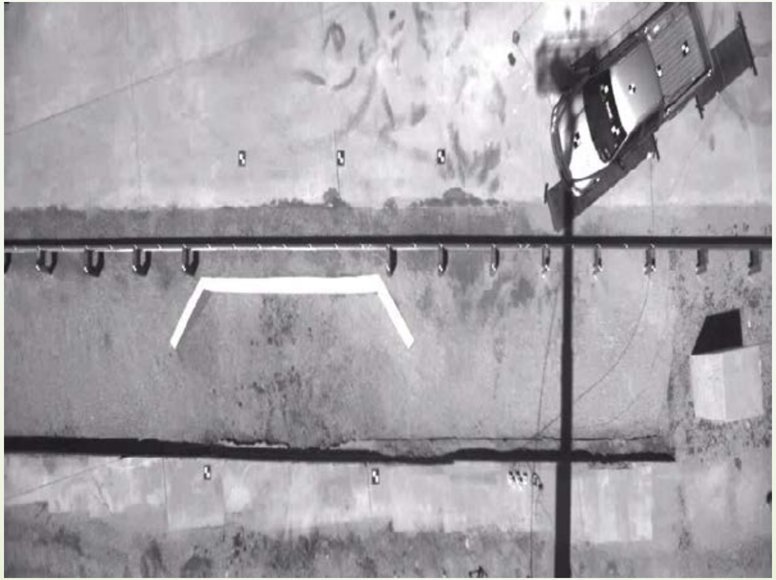
Test No. MGSBR-1

- MASH
  - 3-11
  - 2270P
- Impact conditions
  - 61.9 mph
  - 24.9 deg.
- Dynamic deflection
  - 48.9 in.

Test No. MGSBR-1

Test No. LSC-2

- 2,261-kg Dodge Quad Cab
- 99.6 km/h - 24.9 degrees




MwRSF

https://www.youtube.com/watch?v=P1CNj8aswQ4

Alaska 2-Tube Bridge Rail

- January 2019 – Two-tube successfully passed MASH TL-4 for new installations

Critter Policies

Animal Crossings
We all have them

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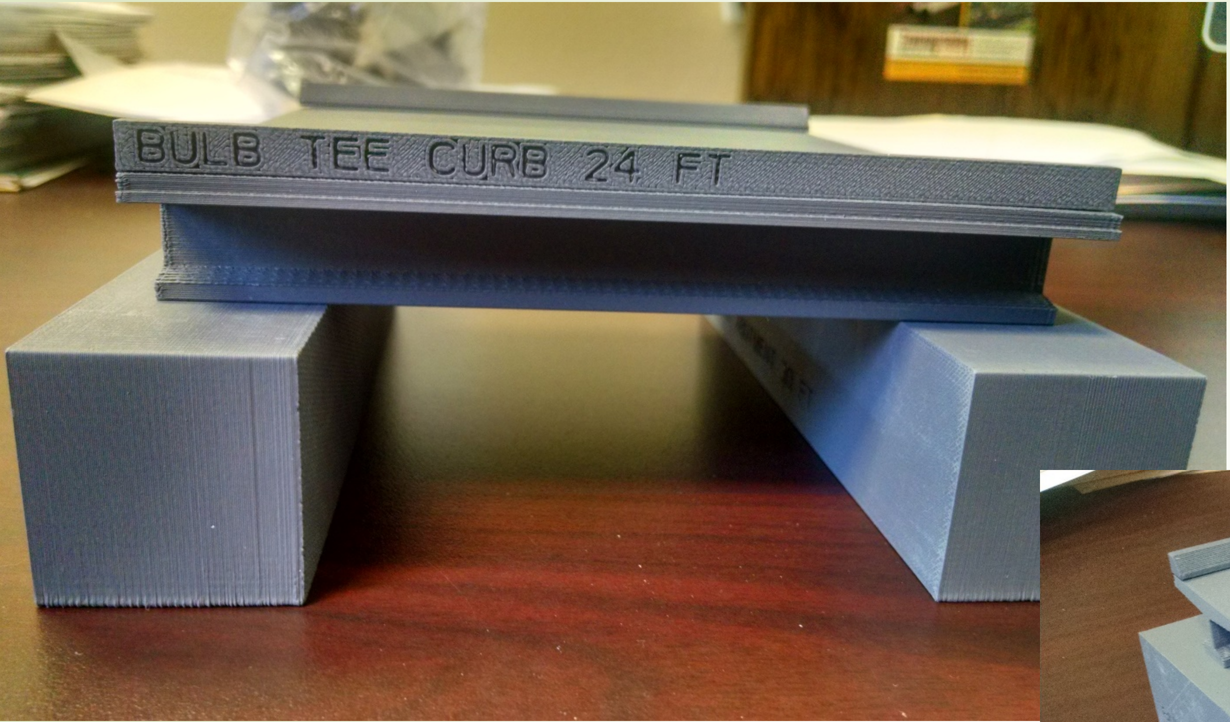
Moose Crossing

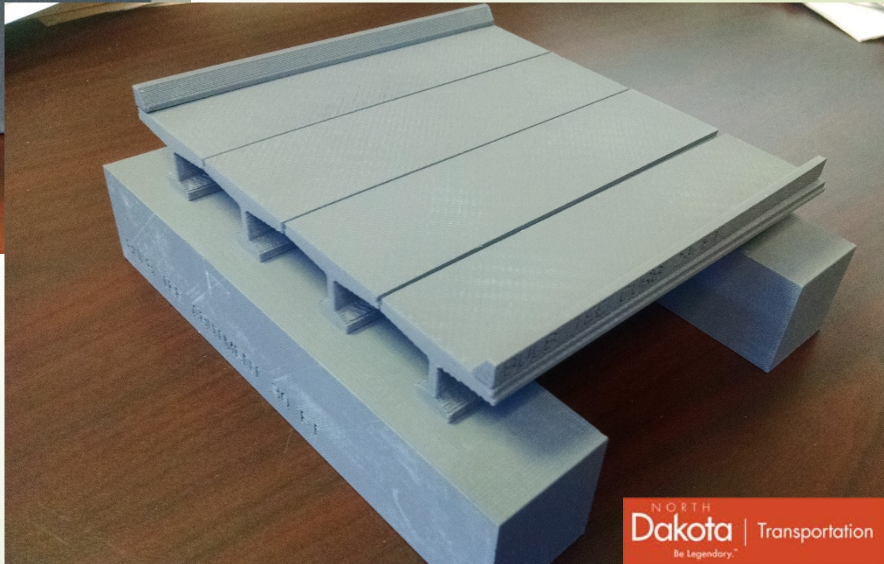
North Dakota | Transportation
Be Legendary.


LONGVIEW, WA. MARCH 19, 1963
NUTTY NARROWS BRIDGE



New Bridge Process

Bridge Removal Process



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Structure Inspection Notification

County	
Structure Number	
Location	
Reason for inspection (new/rehabilitation/repair)	

Who performed the work?			
Was Structure previously closed? (y/n)		**If so, when?**	
Date work was completed		**Curently posted for Load? (y/n)**	

Location of Work Performed

Work performed on the following areas of the Structure			
Deck (y/n)		Pier(s) (y/n)	
Beam/Girder (y/n)		Abutment(s) (y/n)	
Pier/Abutment Caps (y/n)		Channel (riprap) (y/n)	
Other			

Was the work completed due to an Alert Code on the SI&A sheet (y/N)	
If yes, what Alert Code was repaired	

What work was completed on this Structure

Historical Bridges

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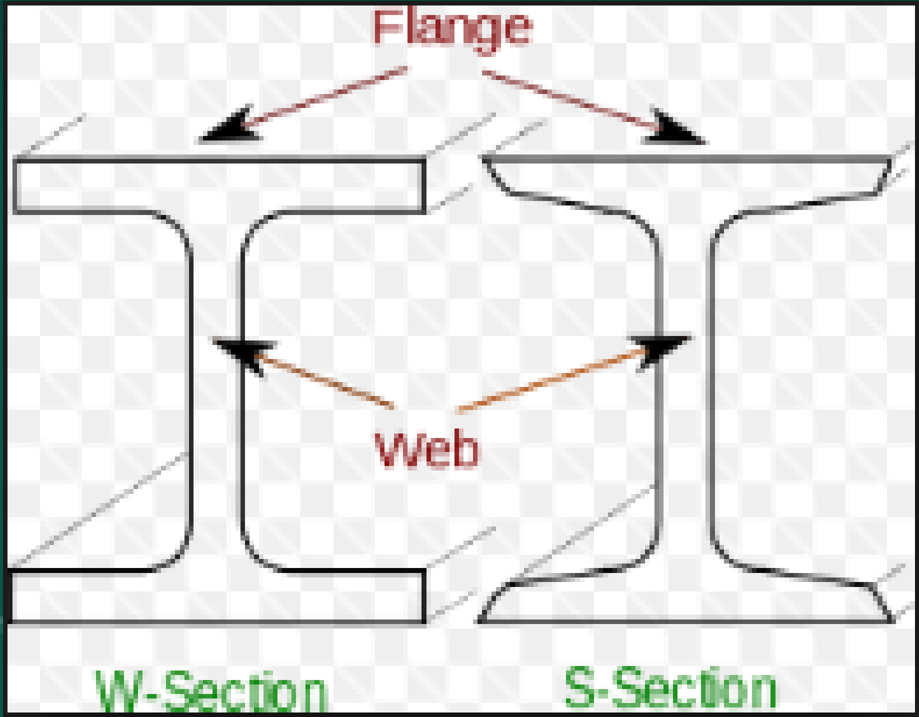
Beam Shapes

NI

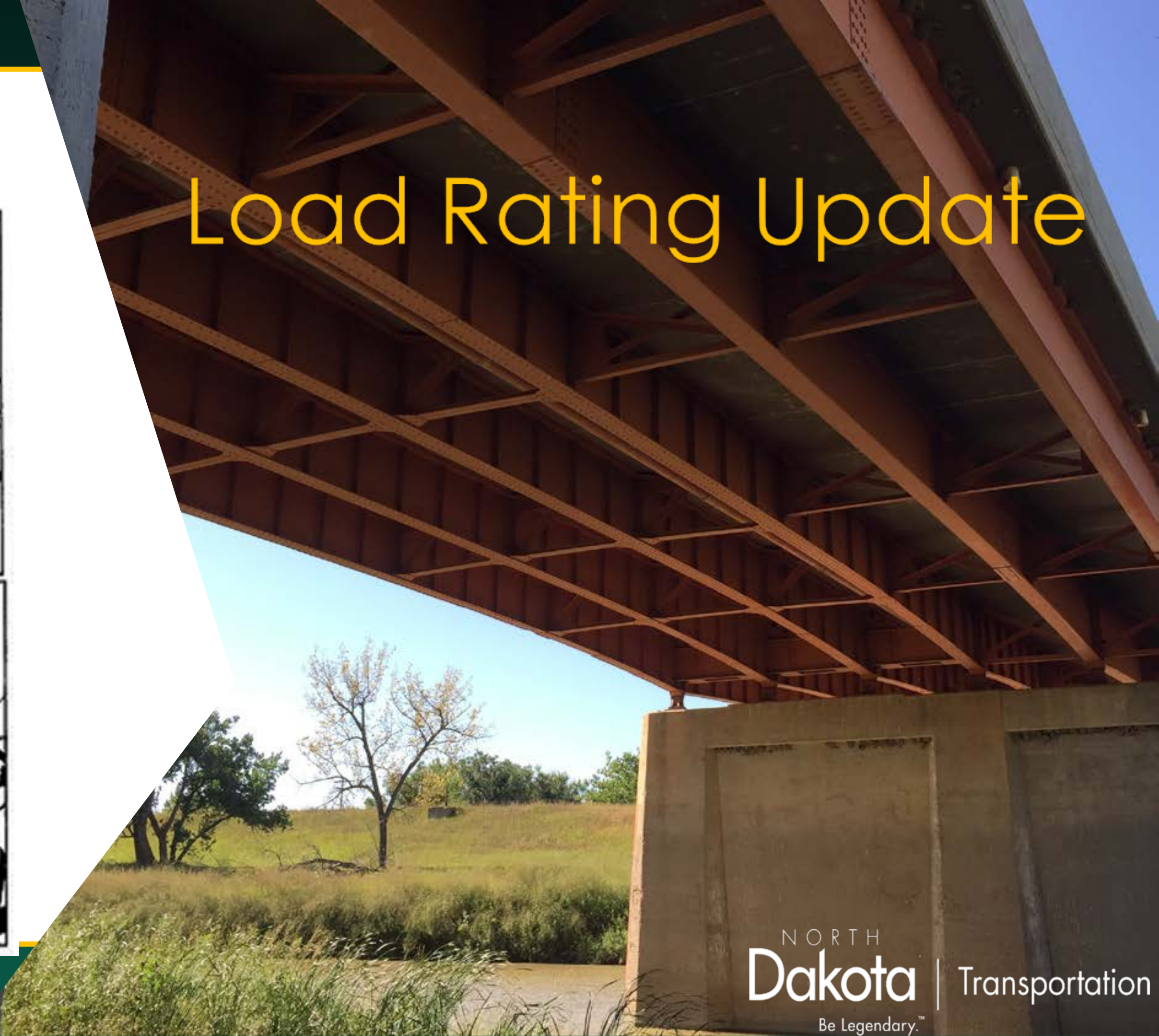
W or H – S or I Shaped



Bridge Loadings


Obligation Of An Engineer
REMEMBER, THERE ARE NO MISTAKES, ONLY LESSONS
Congratulations
Nancy Huether
2017
Employee of the Year Nominee

Load Rating Update



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Why is Load Rating Important?

- Definition
  - The determination of the live-load carrying capacity of an existing bridge.

    -*AASHTO Manual for Bridge Evaluation (MBE) Third Edition*

Load Rating Equation

$$\text{RF} = \frac{CAPACITY - DEAD\ LOAD}{LIVE\ LOAD}$$

Capacity & Dead Load

- Data needed from Plans, Shop Drawings, As-builts
  - Structure Type
  - Span Length
  - Beam Spacing
  - Cross Sections & Beam Sizes
  - Material Properties
  - Reinforcement Size and Locat
  - Deck Type and Thickness

Live Load (Inventory/Operating*)

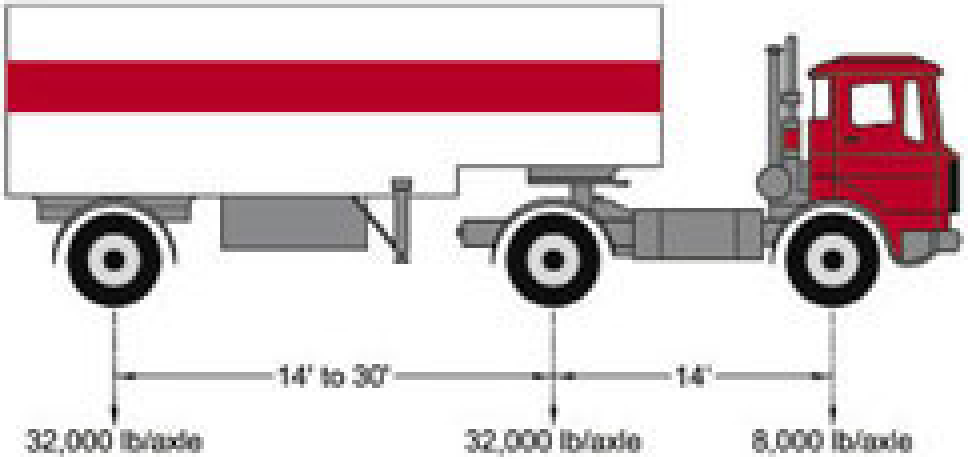
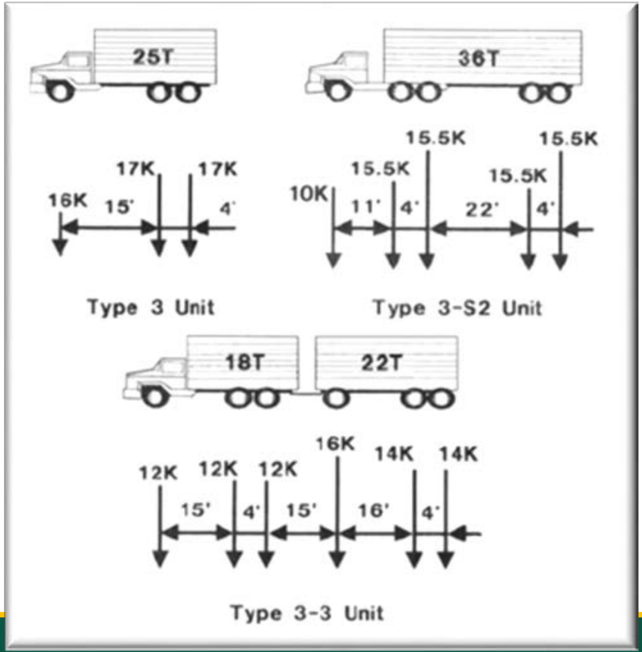


FIGURE 2: HS20 TRUCK

*Also Referred to as Design Level

Live Load (Legal Level/Posting)

AASHTO Legal Vehicles



Special Hauling Vehicles

Special Hauling Vehicles

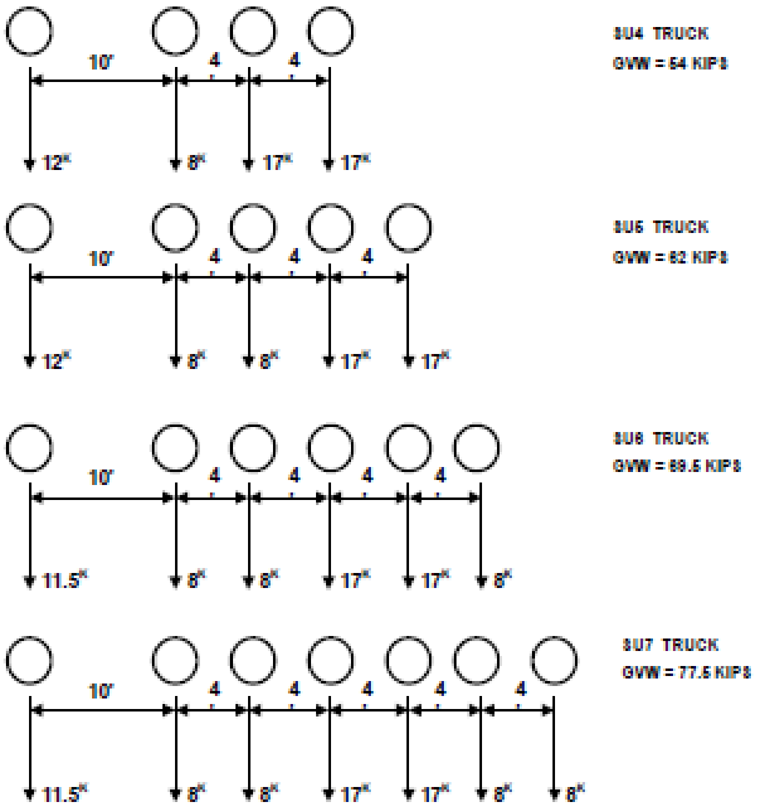


Figure D6A-7—Bridge Posting Loads for Single-Unit SHVs that Meet Federal Bridge Formula B

Inventory Rating

- *Inventory Rating*—Load rating that indicates the live load which can safely utilize an existing structure for an indefinite period of time.
- Per FHWA, Inventory ratings are ALWAYS* reported in terms of the HS20 Design Load.

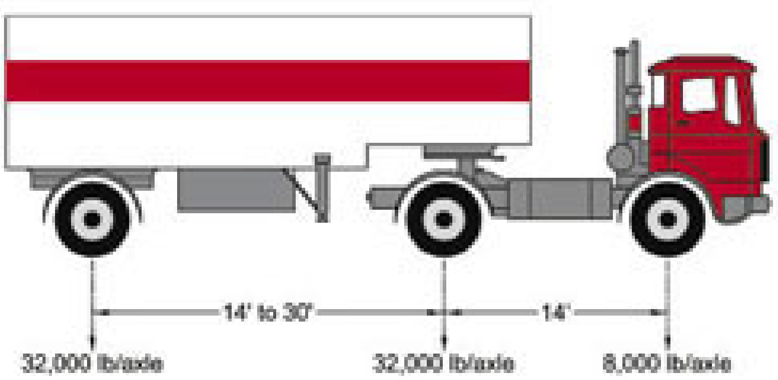


FIGURE 2: HS20 TRUCK

*Existing Structures using LFD Method

Operating Rating

- *Inventory Rating*—Load ratings that indicate the maximum permissible live load to which the structure may be subjected.
- Per FHWA, Operating ratings are ALWAYS* reported in terms of the HS20 Design Load.

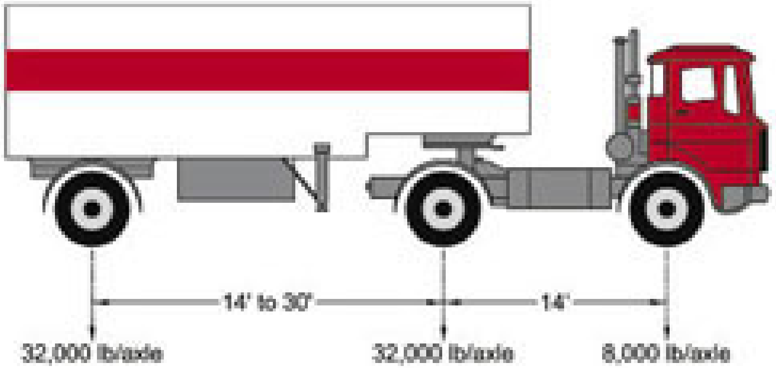


FIGURE 2: HS20 TRUCK

*Existing Structures using LFD Method

Max Posting Tons

- *Lowest Value of the following vehicles:*
  - *HS20 – (Operating)*
  - *Type 3*
  - *Type 3-3*
  - *Type 3-S2*
  - SU4
  - SU5
  - SU6
  - SU7

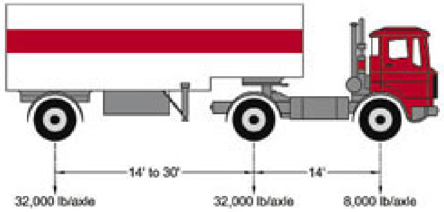
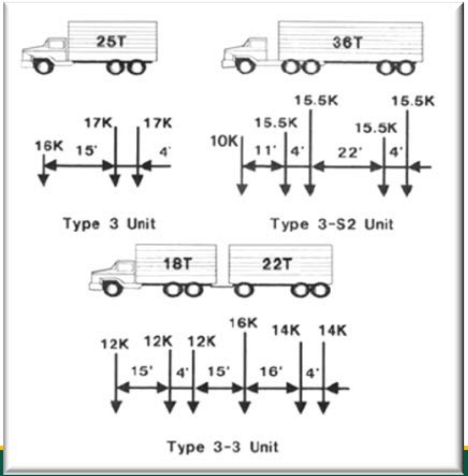


FIGURE 2: HS20 TRUCK



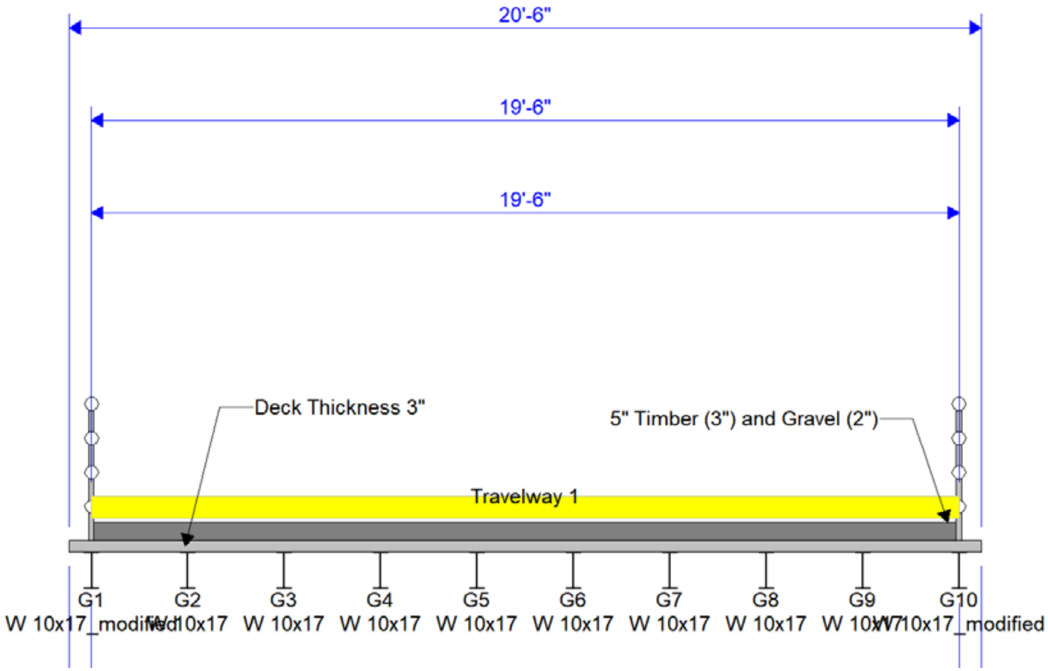
NDDOT Load Rating Manual

- Manual updated to comply with:
  - 23 CFR 650 Subpart C
  - AASHTO Manual for Bridge Evaluation MBE
  - ND State Load Limits
- Updates Include:
  - Single vs multilane loaded
  - Checking Exterior Beams
  - Checking for Shear on P/S Beams
  - Checking for all AASHTO and State Legal Loads

Example Bridge 02-122-36.0

- Barnes County
- 10 Steel Girders
- Timber Deck
- 2 inches Gravel Overburden
- Travelway 19.5’.
- Bridge Length 22’

NDDOT Load Rating Manual



Example Bridge 02-122-36.0

- Controlling Member= G2
- Moment Capacity @ Mid Span G2 = 40.5 Kips
- Dead Load Moment @ Mid Span G2 = 6.84 Kips
- HS20 LL Moment @ Mid Span G2 = 57.2 Kips
- SU4 LL Moment @ Mid Span G2 = 58.82 Kips
- Load Factors = 1.3

Example Load Rating Summary Sheet 02-122-36.0

NORTH DAKOTA DEPARTMENT OF TRANSPORTATION
BRIDGE LOAD RATING SUMMARY

EXISTING BRIDGE DATA

Bridge ID	02-122-36.0	Year Built	1920	Yr Recon:	N/A
Bridge Location (NBI Item 009)	1 WEST 2 NORTH KATHRYN	Design Loading	0 - Other or Unknown		
Material Main (Item 043A)	3 - Steel	Length of Bridge	24	ft	
Design Main (Item 043B)	2 - Stringer/Multi-beam or girder	Number of Spans	1		

BRIDGE CONDITION DATA

Superstructure Rating Item 059 (Culvert Rating Item 062)	6
Condition Factor	1.00

SOFTWARE

AASHTOWare BrR version 6.8.4.3001

BRIDGE DEAD LOAD DATA

Depth of Fill (Buried Structures)	N/A	
Utility/Additional Load	N/A	
Overlay Type	Gravel	
Overlay Depth	2	in
Overlay Depth Measured	Yes	

SPECIFICATIONS

AASHTO Manual for Bridge Evaluation, Third Edition, 2018 with 2019 Interim Revisions

NDDOT Load Rating Manual

LIVE LOAD DATA

AADTT (one-way)	N/A
Emergency Vehicle Route[1]	No

Example Load Rating Summary Sheet 02-122-36.0

			LRFR RATINGS							LFR/ASD/ENGR JUDGEMENT RATINGS					
Level	Vehicle	GVW (Tons)	Rating Factor	Rating Tons	Posting Tons[2]	Limit State	Mode	Member[3]	Span	Rating Factor	Rating Tons	Posting Tons[4]	Mode	Member	Span
Design	HL-93 (INV)	36													
	HL-93 (OPR)	36													
	HS-20 (INV)	36								0.26	9.1		Flexure	G2	1
	HS-20 (OPR)	36								0.43	15.3	15	Flexure	G2	1
Legal[5]	Type 3	25								0.49	12.2	12	Flexure	G2	1
	Type 3-3	40								0.59	23.7	23	Flexure	G2	1
	Type 3S2	36								0.54	19.2	19	Flexure	G2	1
	NRL	40								0.37	14.6	14	Flexure	G2	1
	SU4	27								0.41	11.1	11	Flexure	G2	1
	SU5	31								0.39	12.0	12	Flexure	G2	1
	SU6	35								0.37	12.6	12	Flexure	G2	1
	SU7	39								0.37	14.1	14	Flexure	G2	1
	~~EV2~~	~~29~~		-	-						-	-			
	~~EV3~~	~~43~~		-	-						-	-			
	ND 1	53													
Permit[5,6]	ND 2	59													
					Controlling Posting	11									
					~~Emergency Vehicle Posting~~	~~N/A[8]~~									

Remarks:

[1] Within 1 mile of the interstate
[2] Safe posting load based determined according to MBE equation 6A.8.3-1
[3] Identify the girder using the format G1, G2, etc.
[4] Safe posting tons using LFD method are equal to the Operating Rating
[5] Rated for operating level for LFR/ASD
[6] Rated for unlimited crossings for LRFR
[7] RF≥1.0, No Posting Required
[8] No Posting required (Non EV route)

Engineer Seal

Load Rating Performed By/Firm:	Charles J. Kieffer III / Stantec	
Initials/Date	CJK	3/3/2021
Load Rating Checked By/Firm:	Robert Sisto P. E. / Stantec	
Initials/Date	RFS	3/4/2021

Other Potential Causes for Changes to Load Posting Tonnage

- AASHTO Legal Vehicles (SU4)
- Exterior Girder
- Lateral Support
- Cover
- Bridge Designed with outdated design load (e.g. H15, H20)
- Design Details not Previously Checked (e.g. Gusset Plates, Pin & Hanger Assemblies)

Lateral Support

- No Lateral Support

- Example Lateral Support Retrofit

Additional Details to Consider

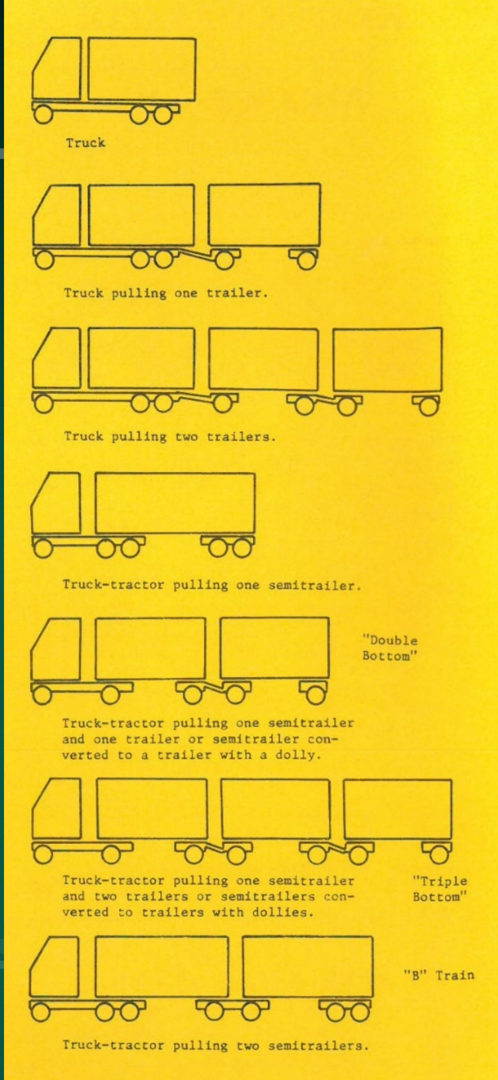
- Cover for Box Culverts
  - For some designs more cover can produce a better load rating especially for fills less than 2ft.
- Pier Reinforcement for P/S Concrete Bridges

Load Rating Intervals

- Initial Load Rating
  - During the Design & Construction phase
- Re-load Rating
  - Changes in Dead Load Conditions
  - Deterioration in Structural Elements
  - Changes in Live Load
  - Damage

Wrap-Up

- Additional Resources
  - AASHTO Manual for Bridge Evaluation
  - NDDOT Load Rating Manual


Truck
Truck pulling one trailer.
Truck pulling two trailers.
Truck-tractor pulling one semitrailer.
"Double Bottom"
Truck-tractor pulling one semitrailer and one trailer or semitrailer converted to a trailer with a dolly.
"Triple Bottom"
Truck-tractor pulling one semitrailer and two trailers or semitrailers converted to trailers with dollies.
"B" Train
Truck-tractor pulling two semitrailers.

Unit Weights

Water = 62.4 #/cubic foot

Gasoline = 42
Ice = 56

Wood = 25 - 50
Gravel= 120
Asphalt/Concrete = 150
Aluminum = 168
Steel = 490

Moment and Shear

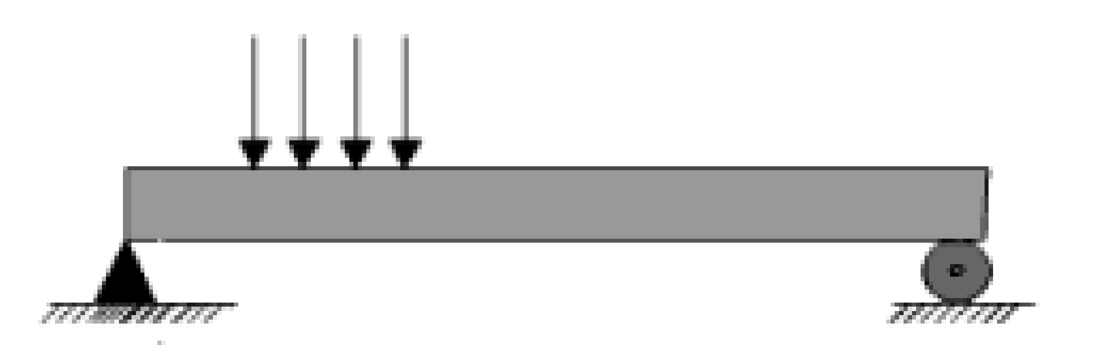
Forces in a beam as a load crosses a bridge

Tension and Compression

Material properties and forces

Span length – forces in the beam

Load Rating of Bridges



Dead Load

Gravel
Asphalt
Combination


Overburden

Dynamic Impact Loads

What is it?

Smooth ride solution

Fracture Critical Bridges

NDSU

Key Terms and Topics

Dead Loads

Live Loads

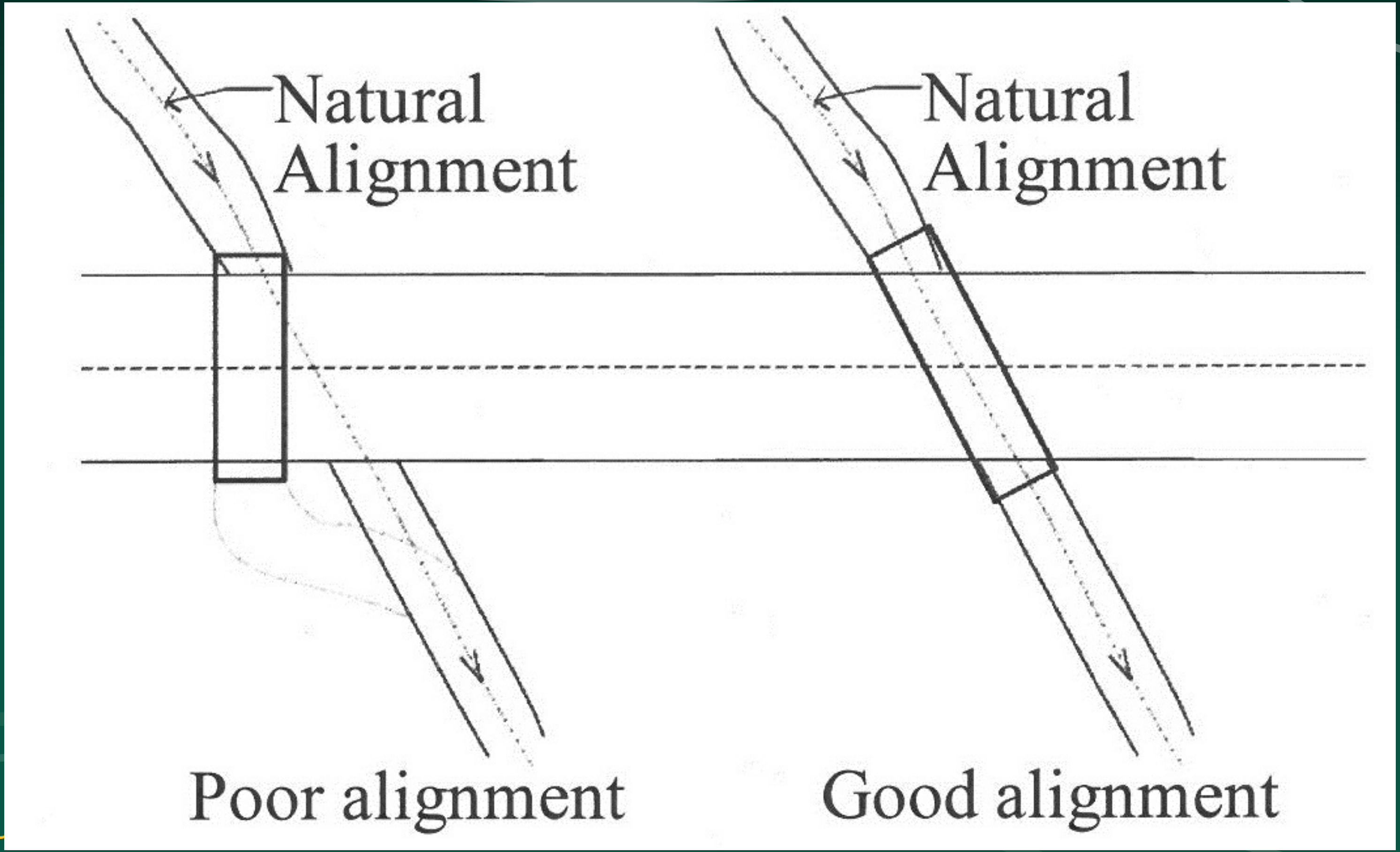
Fracture Critical

Bridge Inspections

Inspection Tool List

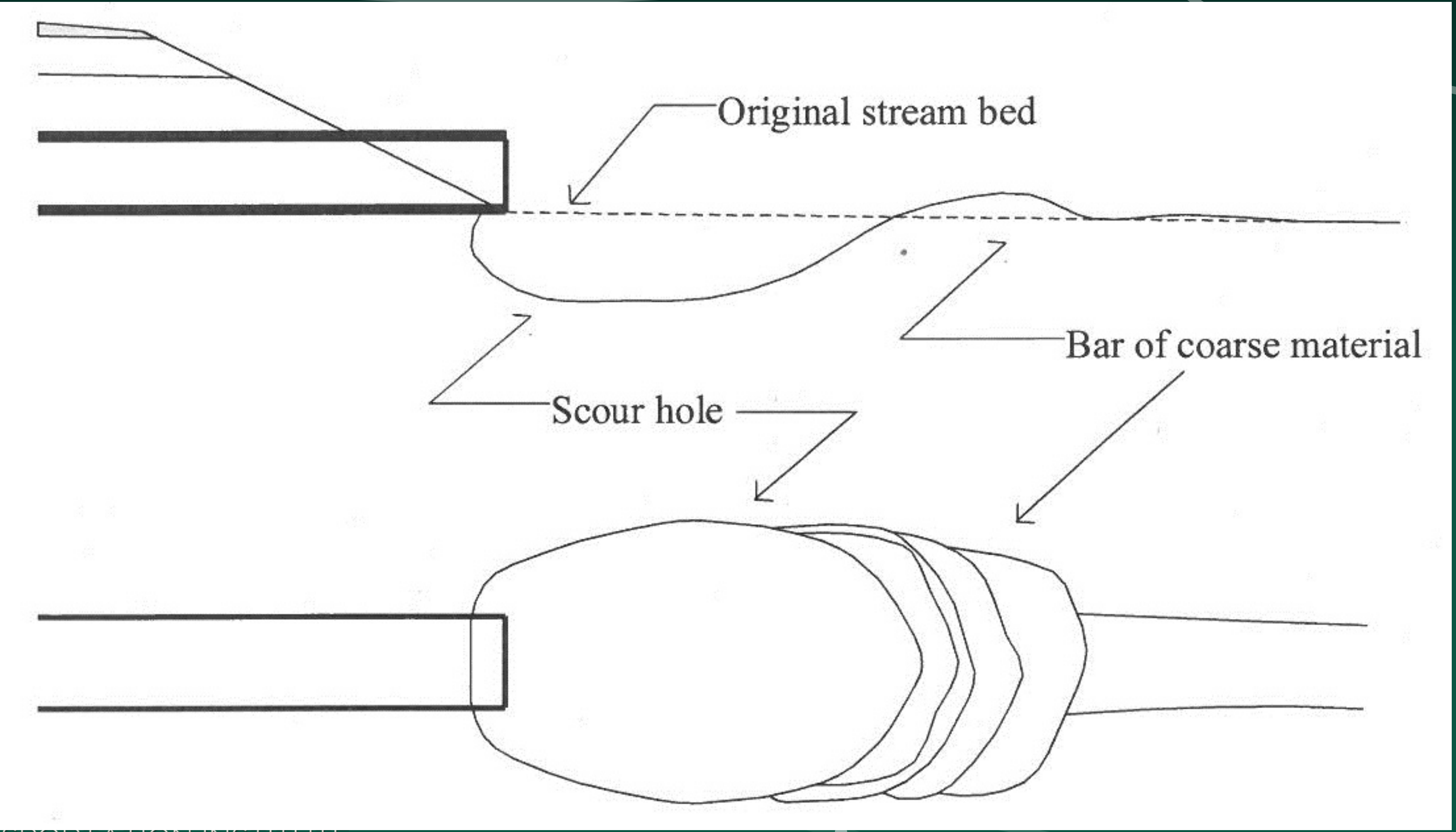
100 ft tape
Tape measure
4’ level
Plumb bob
Range pole
Ladder
Magnifying glass
Flashlight
Binoculars

Hammer
First Aid Kit
Scraper
Shovel
Inspection forms
Camera
Paint
Lumber crayon

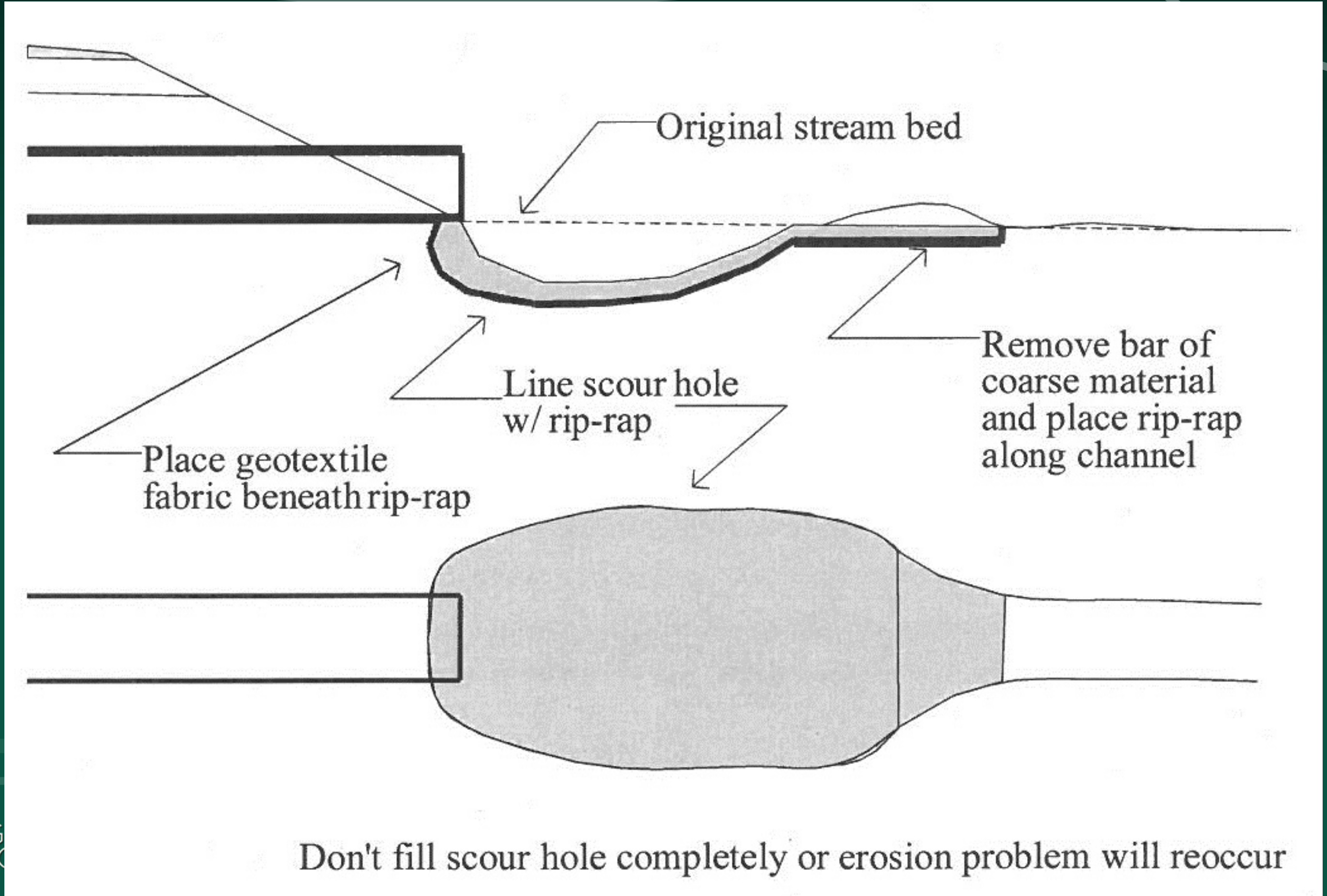

Natural
Alignment
Natural
Alignment
Poor alignment
Good alignment

NDSU

Outlet Scour



Outlet Scour Treatment



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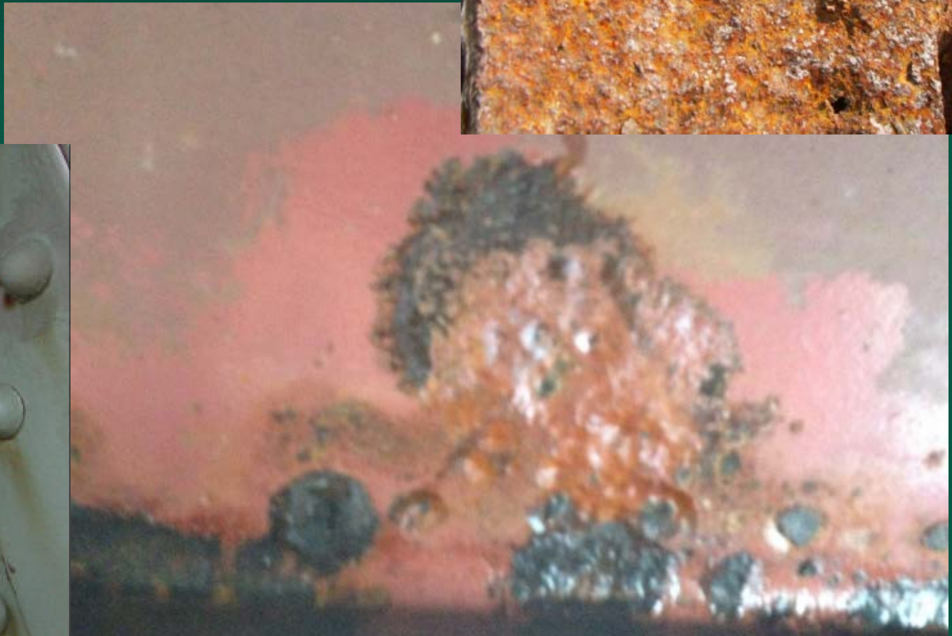
Concrete Decks and Overlays

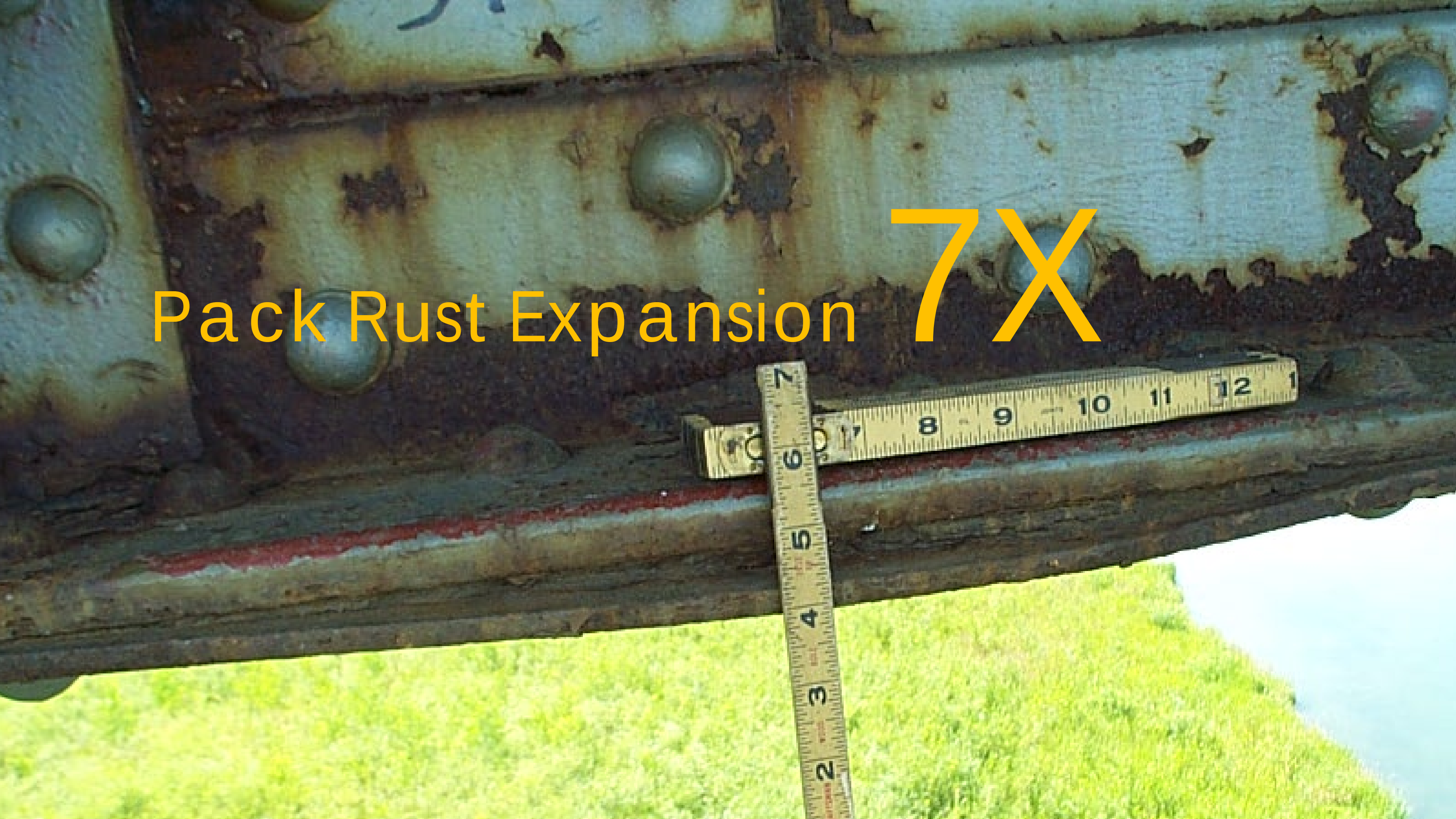
Deck Overlays Cause Problems


Bonding Issues
Trapping Salts

Steel and Weathering Steel

Pack Rust
Oxidation
Corrosion




Pack Rust Expansion 7X

Identify Joints

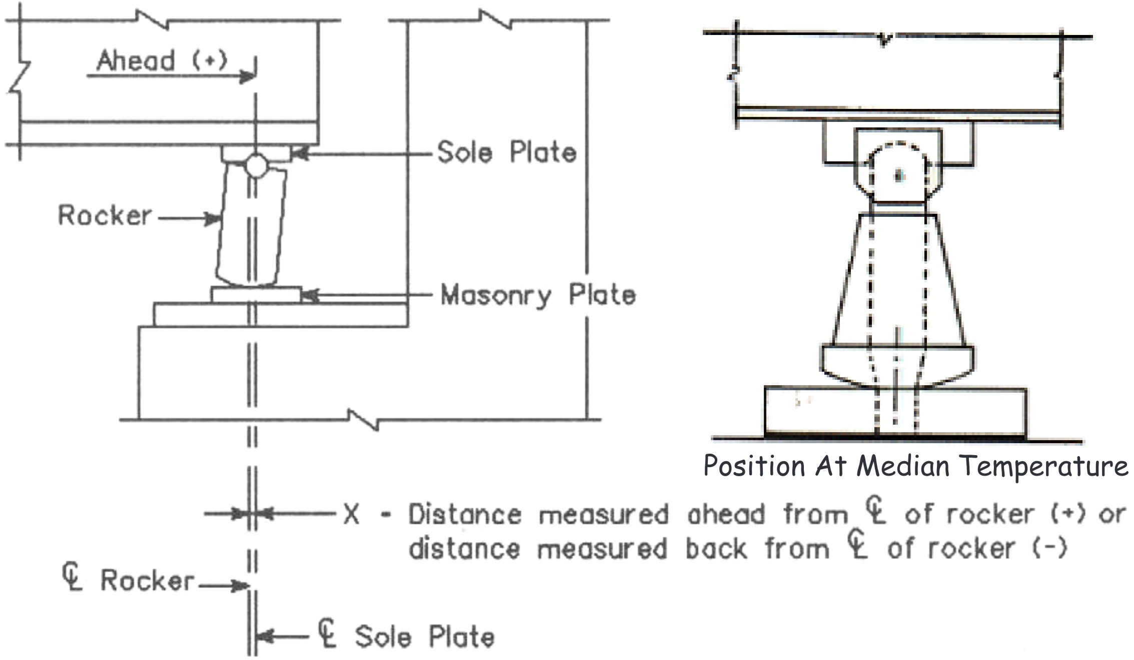
Finger Joints


2010

Piling

Bearings

Position is Important




6.6.2001

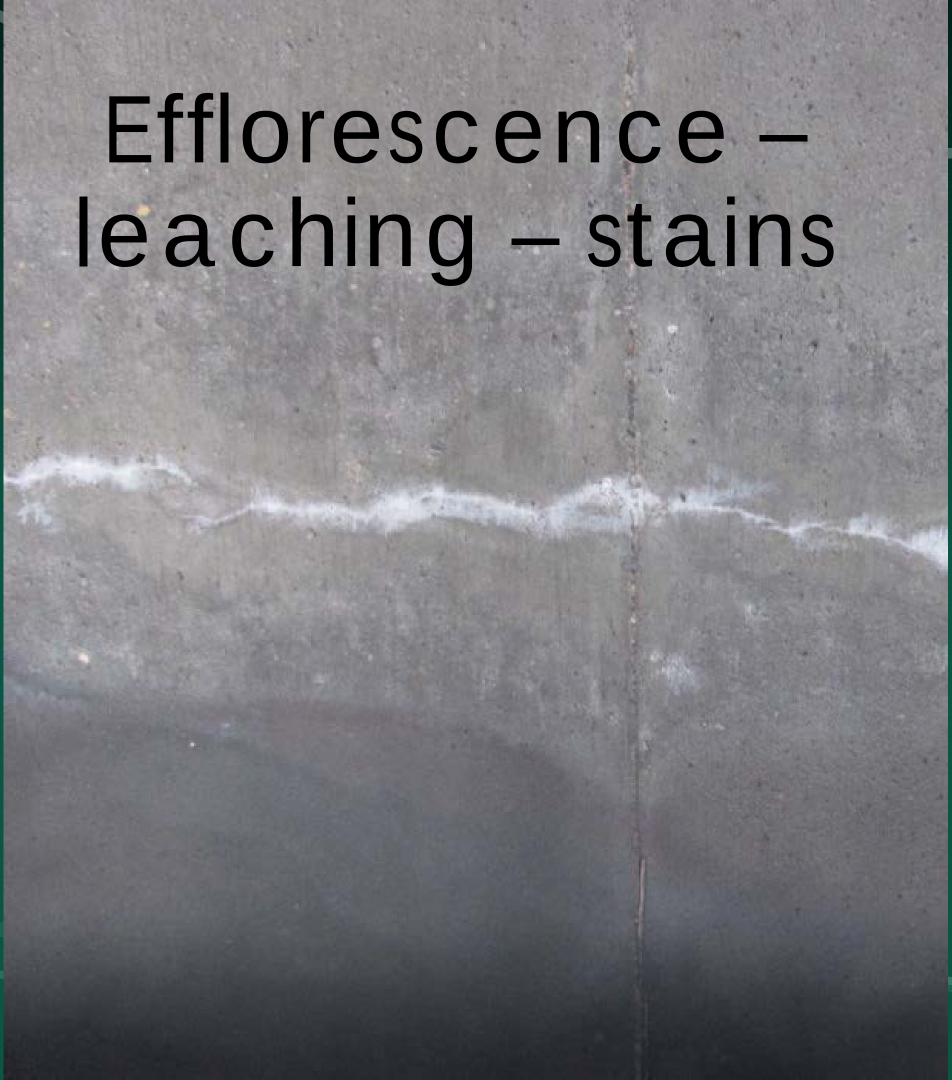
Timber

Decay

Cracks

Look for damage and gaps

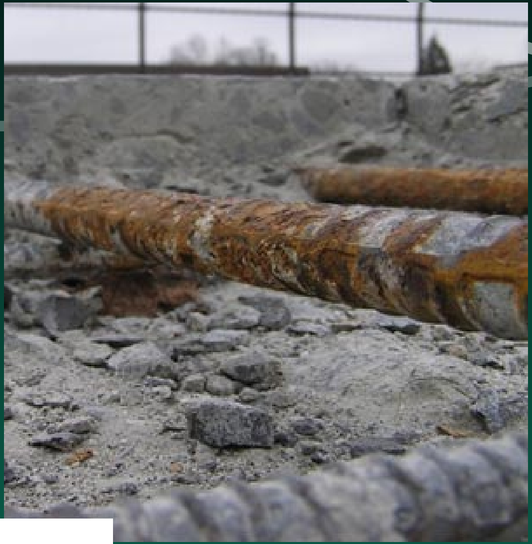
Efflorescence – leaching – stains

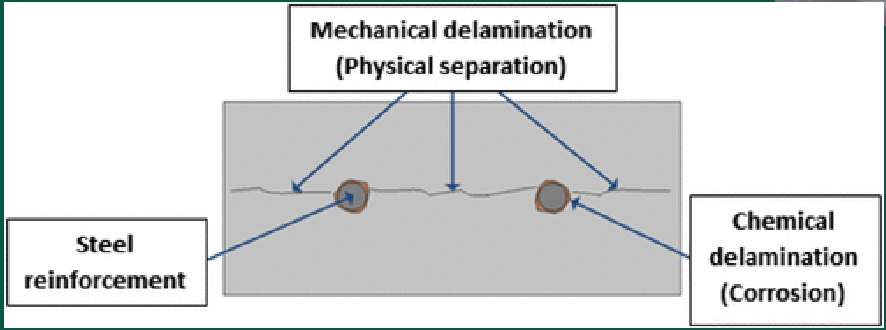


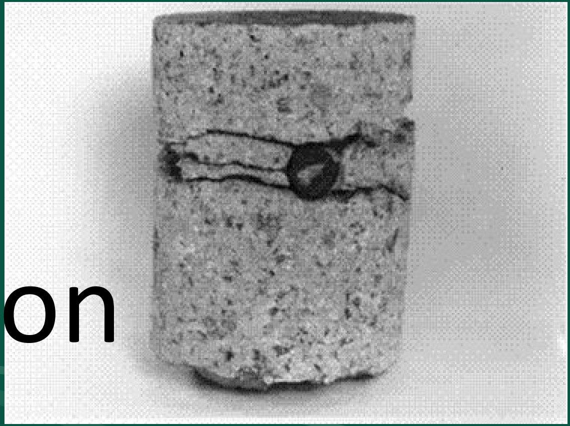
Alkali–Silica Reactivity (ASR)

ASR


ACPA
www.acpa.org







Concrete Delamination

Chaining & Delam Tool

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Utilities

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- CenterPoint Energy 10" Natural

Key Terms and Topics

Bridge Length – Major and Minor

Structurally Deficient

Functionally Obsolete

Sufficiency Rating

SI&A Sheet

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Sims Road bridge to be preserved

Historical society adopts bridge for $1

JACK DURA
Bismarck Tribune

Saving a century-old, Sims-area bridge was a simple decision for Joel Johnson.

"I guess when you think about it, once they're gone, they're gone," said the lifelong Sims-area rancher and president of the Almont Historical Society.

Johnson

The society in July paid $1 to adopt the Warren pony truss bridge built in 1916 on Sims Road over Sims Creek. The bridge's age and narrow width led Morton County to plan its replacement with a double-barrel box culvert to be built beginning next May.

"It's not a bridge we can widen because of the design, so it has to be replaced," County Engineer John Saiki said.

Construction next year could last two months, weather permitting. Federal money and a 20% county match will fund the $436,000 cost, Saiki said. The historical society will provide a foundation on which to set the old bridge near the Sims Scandinavian Lutheran Church, which dates to 1884, according to Johnson.

"We decided it would probably be a good thing to save and have it just over in our historical area at the Sims church," he said.

Morton County has about 260 bridges, 84 of which are in need of repairs or replacement by 2036, according to a 2016 study by the Upper Great Plains Transportation Institute. Only North Dakota's Red River Valley counties have more bridges than Morton County, Saiki said.

A bridge adoption is uncommon but not unheard of in Morton County. Almont's Heritage Park contains another local truss bridge adopted years ago. That bridge is popular for garden club functions and as a scene for family photos.

Johnson noted the similarity of the Sims Road bridge adoption to efforts to preserve the historic BNSF rail bridge completed in 1883 over the Missouri River at Bismarck. BNSF seeks to build a new crossing; the Friends of the Rail Bridge group hopes to the preserve the current structure.

But that bridge is on a vastly different scale, involving the U.S. Coast Guard, which has permitting authority for a new bridge, and an ongoing, required consultation review on the historic property.

Still, the goals are the same.

"It's a preservation issue involving something that is meaningful to the people that are fighting to either save it in place or save it in a new location," said Amy Sakariassen, North Dakota adviser for the National Trust for Historic Preservation. "The goal is preservation of something that has value and meaning, and that's the similarity."

The Trust in May named the rail bridge one of "America's 11 Most Endangered Historic Places."

Johnson said the Sims Road bridge is the last one he knows of around his neck of the woods. He grew up in Sims, which once was a thriving town along the railroad but now is all but a ghost town.

"It was just a real boomtown," Johnson said.

Reach Jack Dura at 701-250-8225 or jack.dura@bismarcktribune.com.

JACK DURA, TRIBUNE

Morton County will replace the Sims Road bridge, seen here in March 2019, with a double-barrel box culvert in 2020. A local historical society has adopted the bridge, to be preserved near the historic Sims Scandinavian Lutheran Church.


94
252
1 MILE

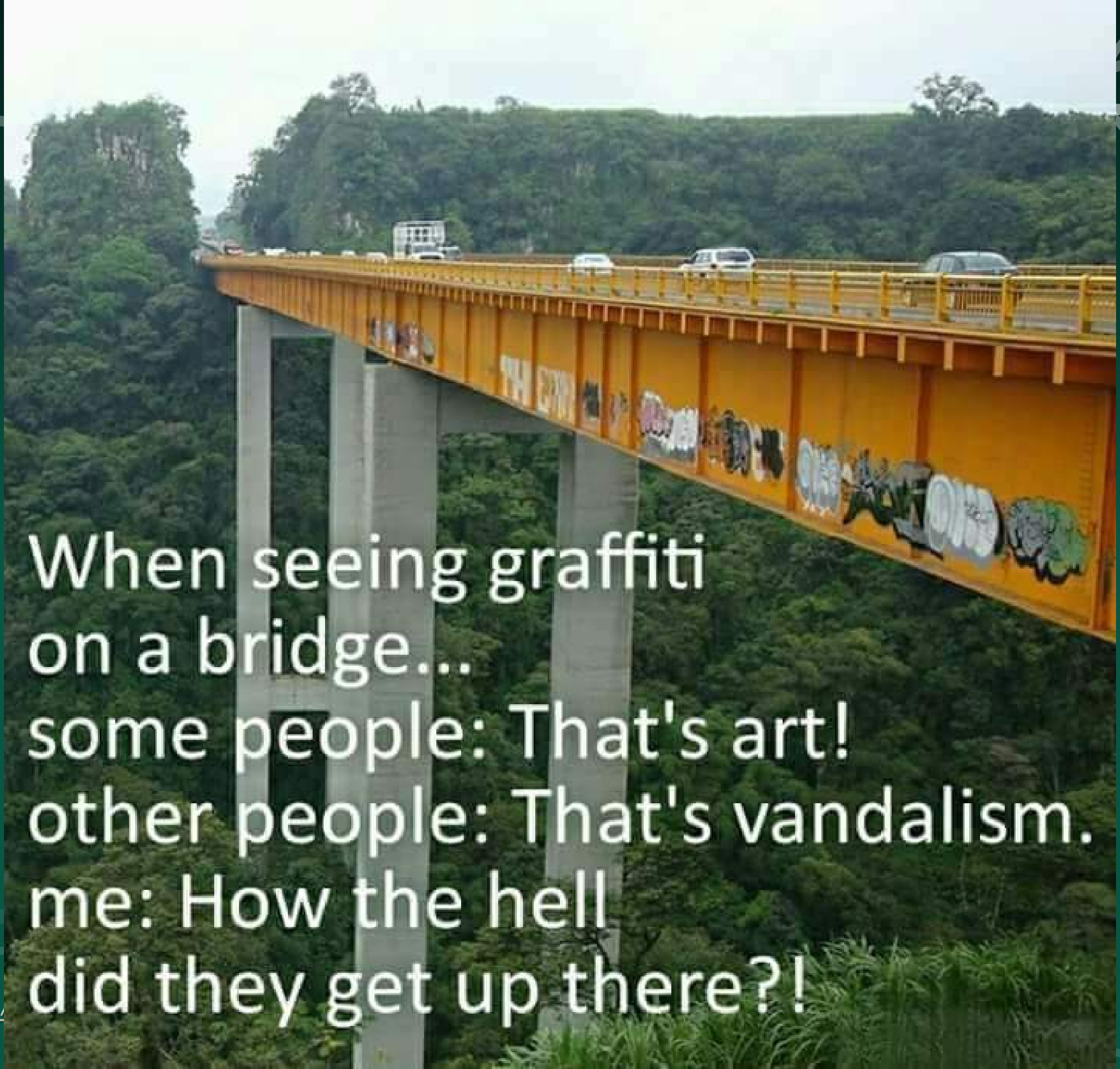
David Buchmoyer
You guys that are not from farm country, and never hauler from the field to the mills, the " running over " low ton bridges happens all the time! And i would bet, there is nothing marking this bridge as a " national land mark!
Just saying!

1d Like Reply 172

View 92 more replies

Roger Oesch David Buchmoyer what does a sig...

Jonathan Scheich
So you're weighing out in your mind as whether to cross this bridge or not does the inconvenience of turning around out weigh (no pun intended) the probability of losing everything



NDSU UPPER GREA
TRANSPORT

NDSU UPPER GREAT PLAINS TRANSPORTATION INSTITUTE

Failures to Flood Plans

Bismarck Memorial Bridge Demo

Frost Heaves

Frost Damage in Pavement: Causes and Cures (You Tube video)

https://www.youtube.com/watch?v=7gjtFaCxVRU


Press Esc to exit full screen
FROST DAMAGE
IN PAVEMENT:
Causes and Cures


08/02/2011

NDS

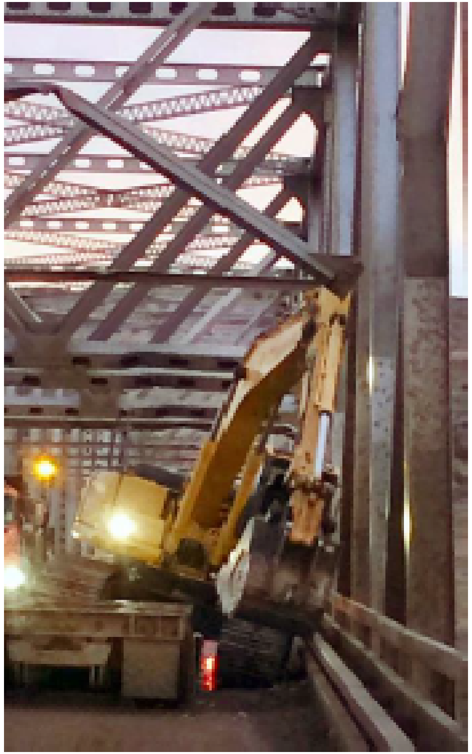
Oil Patch bridge not the only one taking a beating

By Kathleen J. Bryan, Forum News Service on Dec 7, 2014 at 11:25 p.m.

WATFORD CITY, N.D. – Mauricio Gomez drove a truck more than 1,500 miles from Houston hauling pipe to North Dakota's Oil Patch only to find the bridge on a main traffic route closed, creating a detour that added another 100 miles to his trip.

A load being hauled by another driver had struck the overhead framing on the Long X Bridge on U.S. Highway 85 south of Watford City, forcing it to close.

The Nov. 22 accident was not the first time an oversized load had damaged the 55-year-old bridge,



The most recent hit on the Long X Bridge near Watford City came Nov. 22 when an excavator on a trailer hit the bridge's overhead framing. Special to The Forum

NDSU


WEIGHT
LIMIT
3
TONS

NDSU

A wooden walking bridge over the Sheyenne River in Lisbon, N.D., is a twisted mess Thursday, Sept. 25, 2008, after it collapsed Wednesday, injuring five construction workers who were taking a break on the bridge. Authorities said two of the men were treated and released and three others were taken to Fargo hospitals. No names or conditions were immediately available. (AP Photo/The Forum, Dave Wallis)


The Bismarck Tribune

Bismarck Tribune SPORT SHOW

Look inside for information on the Sport Show!

Rewriting legislation

Senate Bill 2344 would change language of Measure 5 DAKOTA, B1

SUNNY 15 • 6 FORECAST, B6 | FRIDAY, FEBRUARY 3, 2017 | bismarckt

TOM STROMME PHOTOS, TRIBUNE

ruck with an oversize load struck the underside of a bridge over Interstate 94 near mile marker 179 on Wednesday, leaving extensive damage to the derside of the overpass near McKenzie. The bridge, closed indefinitely until repairs can be made, carried local traffic on 275th Street Northeast in rural rleigh County.

Truck crashes into bridge

ND

NDSU

NDIRF

NORTH DAKOTA INSURANCE RESERVE FUND

McHenry County 2014

Fire Damage

Fire – above and below

DAVID GOLDMAN, ASSOCIATED PRE

Atlanta firefighter Latoyia Bailey jumps over a highway divider Friday while working the scene where a section of ar overpass collapsed from a large fire on Interstate 85 in Atlanta.

Highway collapse could snarl traffic for months

Atlanta's dreadful rush hour to get even worse through heart of city

KATE BRUMBACK and BILL BARROW
Associated Press

ATLANTA — Atlanta's dreadful rush-hour traffic could be extra nasty for months to come after a raging fire underneath Interstate 85 collapsed an elevated portion of the highway and shut down the heavily traveled route through the heart of the city.

Traffic was bumper to bumper on nearby streets as drivers were forced to take a detour Friday, the morning after the blaze caused the concrete to crumble.

The collapse took place a few miles north of downtown, and the effects could fall most heavily on commuters from Atlanta's densely populated northern suburbs. They will have to find other routes to work or ride mass transit.

Connie Bailey-Blake, of Dacula, 37 miles northeast of Atlanta, waited for a MARTA commuter train to reach her job downtown. She typically drives, often by way of the interstate.

"I'm supposed to be at work at 9 a.m. and it's 9:15 a.m.," Bailey-Blake said. "The first few days are going to be difficult. This will be my new life."

Amelia Ford picked a new route to work by car and said it took her 45 minutes to travel 3 miles from her Atlanta home to the nearest open on-ramp to the interstate.

Georgia Transportation Commissioner Russell McMurry said 350 feet of highway will need to be replaced in both directions on I-8 which carries about 400,000 cars day through the city and is one of th South's most important north-sout routes.

He said repairs will take month but declined to be more specific.

The collapse effectively "puts cork in the bottle," Georgia Stat Patrol Commissioner Mark Mc Donough said.

The fire broke out Thursday after noon in an area used to store state owned construction materials an equipment, sending flames an smoke high into the air. Fire author ities said they had not determine how the blaze started.

McMurry said his departmen stored coils of plastic conduit use in fiber optic networks beneath th span but insisted they were noncombustible.

APRIL 1, 2017 – BISMARCK TRIBUNE

Courtesy of Morton County Sheriffs Office

Posted: Wed 7:57 AM, Dec 21, 2016

MORTON CO., N.D. (KFYR) Nearly two months after it was damaged and closed to traffic, Gov. Doug Burgum announced that the North Dakota Department of Transportation will inspect damage to the Backwater Bridge in southern Morton County.

Parts of Highway 1806 and the bridge have been closed since Oct. 27 when protesters blocked it with burning vehicles.

North Dakota DOT and law enforcement agencies have said the bridge is unsafe for travel.

The DOT says results of the tests are expected 30 days after they are completed.


WELCOME
TO
Minnesota
'97 4 18

NDSU

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

North Dakota Local Technical Assistance Program
@ndltap

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- Photos
- Videos
- Posts
- Community

Promote

Manage Promotions

North Dakota Local Technical Assistance Program shared a link.
Published by Shared via AddThis [?] · April 4 ·

Bridges Destroyed in Bottineau County Flooding

Flooding from melting snow has filled ditches and farm fields along the Canadian border in North Dakota.And in Bottineau County, it's caused some expensive...

MYNDNOW.COM


BRIDGE OUT
TOP STORY
Bottineau County Flooding


TOP STORY


TOP STORY


TOP STORY
Rich Gimbel
BOTTINEAU COUNTY ROAD SUPERINTENDENT

NDS

Duluth, MN

Lessons Learned

- We should have had a more formal post-flood bridge inspection process to ensure all issues were documented and addressed at locations requiring longer term follow-up due to high water. There were a couple of structures that sustained damage not assessed and fixed until the subsequent routine safety inspection.
- We ran out of traffic control devices. We don't think we should necessarily have on hand what a large emergency event requires, but that determination and acquisition is something that still needs to be done.

Stark County Bridge Replacement

INFORUM

Bridge in rural N.D. collapses under weight of truck

By Forum News Service Today at 6:28 a.m.

64

FOREST RIVER, N.D. - A semi driver is lucky to be safe after a bridge caved while crossing it.

A woman who lives nearby the crash site, Holly Beaton, says it happened around 10 a.m. Thursday, Oct. 19 near Forest River.

The truck appears to have been hauling grain when the bridge gave out, causing the cab of the truck to be caught in the air.

Beaton says the driver made it out safely, and the sheriff's office told her the truck will be stuck in the bridge for a few days while they


WEIGHT LIMIT
4 TONS PER AXLE
11 TONS GROSS


FERGUSON


ND

Flood Plan of Action

When to check

What bridges to check

When to close

Who to Inform

Actions to Save Bridge

Flow Rate of Water – Velocity Checks

Bridge - 5 feet per second

Culvert – 10 feet per second

(USFS uses 7 fps in the Badlands)

Walk = 3 mph = 4.5 feet per second

Jog = 5 mph = 7 feet per second

Run = 10 mph = 15 feet per second

Key Terms and Topics

Who can close a bridge?

Flood Action Plan

Deck Dead Load


VISION ZERO
Zero fatalities. Zero excuses.
Don’t Text and Drive
Safety reminder brought to you by your friends at NDLTAP and the NDDOT.

Bridge Preservation

What is Bridge Preservation?

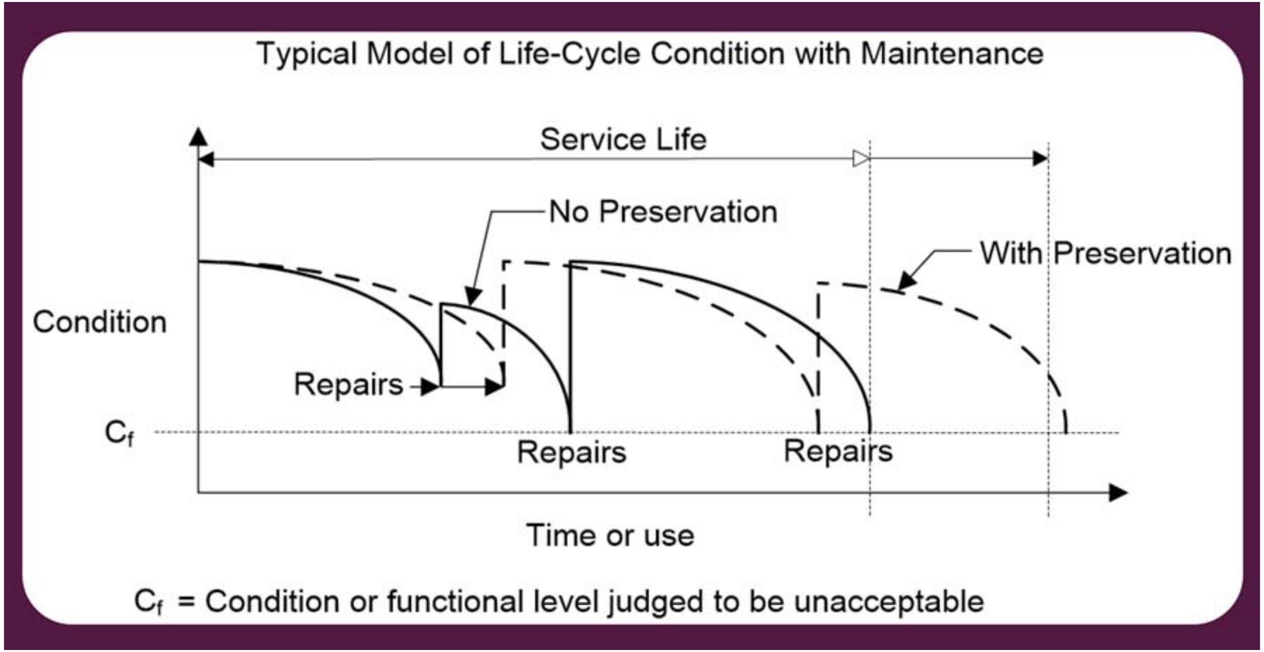
AASHTO defines **Bridge Preservation [as] "actions or strategies that prevent, delay or reduce deterioration of bridges or bridge elements, restore the function of existing bridges, keep bridges in good condition and extend their life."**

Source: AASHTO Board of Directors, Policy Resolution PR-3-11, October 17, 2011.

Bridge Cost Estimates

New bridge - $250/sf
Deck replacement - $75/sf
Treat deck with silane - $0.25/sf
Crack seal deck - $0.10/sf

Example of Life Cycle Cost Chart



Life Cycle Costs => Bridge Preservation

Construction Costs

Maintenance Costs

Salvage Value

Scheduled Maintenance

– Sweeping & Washing Decks
– Cleaning joints
– Cleaning drains
– Crack sealing decks
– Cleaning & lubricating bearings

Bridge Maintenance checklist		
No.	**Description**	**Frequency**
1	Debris Removal	As Needed
2	Mechanical Sweeping	Spring and as needed
3	Cleaning of Abutment & Pier Tops	Annually
4	Cleaning of Elastomeric Expansion Joints (4 each)	Spring and as needed
5	Cleaning and Repair of Drainage system (68 Ea.)	Spring, Fall and as needed
6	Cleaning & Washing of Bridge (includes Washing of beams, walkways etc)	Annually
7	Cleaning and Lubrication of Bearings	Annually after No. 4&6
8	Patching of Sidewalks	Annually
9	Repair of Sidewalk Barrier	Annually
10	Patching and crack repair in Jersey Barriers	As Needed
11	Crack Sealing in Pavement & Curblines	Annually
12	Maintenance of Electrical Systems	As Needed
13	Repair of Wearing Surface/Overlays	Every 3-5 years
15	Painting of Steel (Full Bridge)	Every 30 years
14	Spot Painting 1	8 yrs. after No. 10
15	Spot Painting 2 (Painting of Salt Splash Zone and at bearings)	16 yrs. after No. 10
17	Spot Painting 3	24 yrs. after No. 10


Risk Management
assess
control
identify
review

See no Evil

NDSU UPPER GRE
TRANSPOR

Sand and debris holding water on deck

Keep It Clean!


Bobcat

Deck Crack Sealing

-Helps prevent water infiltration

-Reduces rebar corrosion

- Pro-active Preventative Maintenance

Deck Surface Treatment (Silane)

Box Beam Weep Hole

Cracked Beam – plugged weep hole

Bearing Maintenance

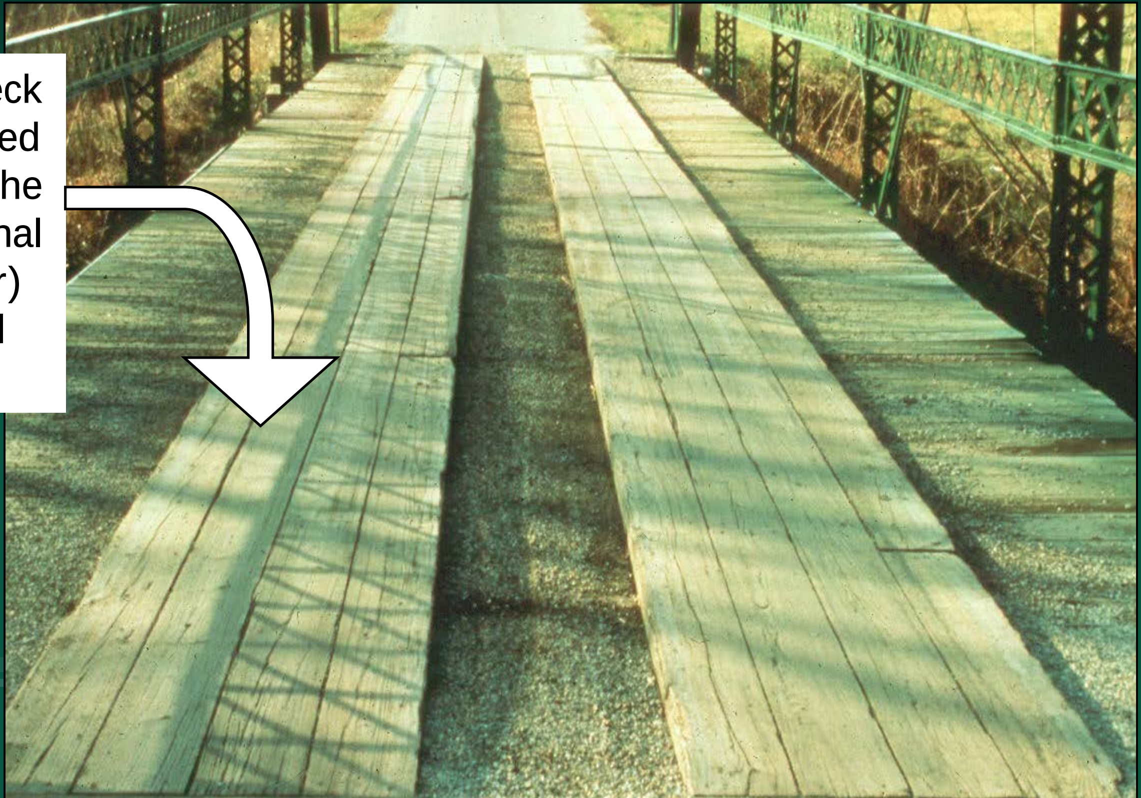
Drains

Standing water on the bridge will cause damage. Drains need to function properly

Debris must be removed around drains for the deck to drain properly

Timber Deck Maintenance

Undersized or worn deck planks may be protected or strengthened with the addition of a longitudinal runner (steel or timber) placed over the wheel tracks



Erosion Issues

Key Terms and Topics

Crack Sealing

Life Cycle

Bridge Preservation


Pluskwik Photography

Solutions

Alternatives

Load Restrictions
Temporary Bridges
Single Lane Bridges
Bridge/Road Closure
Use of Low-Water Crossings
Structural Repairs
Reusing Structural Members
ABC and Modular Units
GRS- IBS Abutments
Buried Bridges

Prior to ALL Bridge Work

Low Water Crossings

NDSU UPPER GREAT PLAINS TRANSPORTATION INSTITUTE

Trends

Accelerated Bridge Construction Using Steel Sheet Piles

PHOTO: COURTESY OF SKYLINE STEEL

In the United States, the use of steel sheet pile in accelerated bridge construction (ABC) dates back more than 15 years. The use of sheet piles in civil engineering and public works has become a popular alternative to traditional methods.

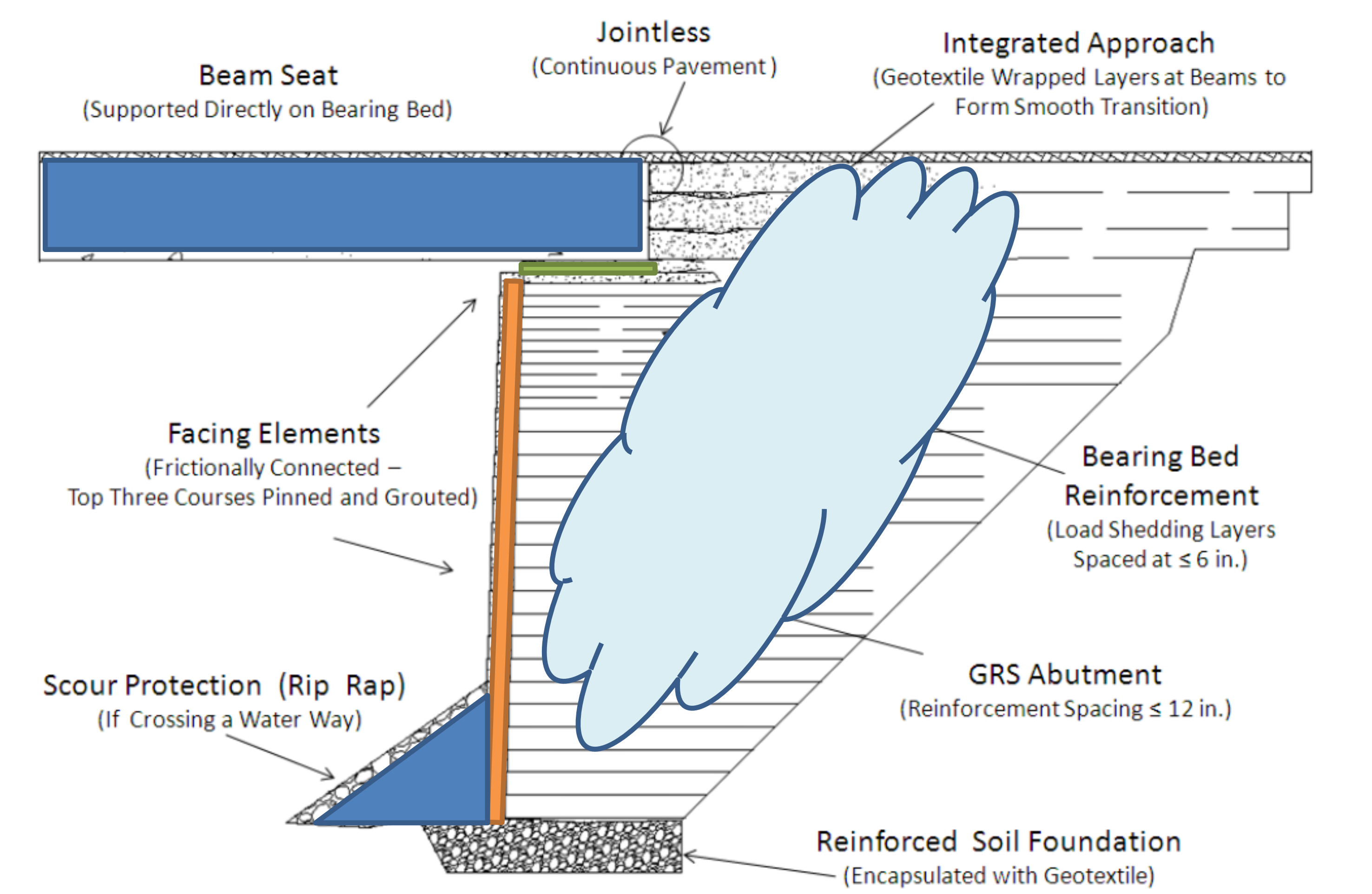
Due to innovations in the manufacturing of steel and improvements of steel grades and composition, along with the enhanced availability of corrosion protection methods, steel sheet piles such as

This is an example of an accelerate
bridge construction utilizing perma
steel sheet piles supplied by Skyline

Geosynthetic Reinforced Soil-Integrated Bridge System

The Geosynthetic Reinforced Soil–Integrated Bridge System (GRS–IBS) is an innovation to help reduce bridge construction time and cost. GRS-IBS projects can be built in weeks instead of months, due to the ease of construction and the use of readily available materials and equipment. Reduced construction schedule translates into less exposure around work zones improving safety.

GRS - IBS



Typical Section of a GRS/IBS Bridge Abutment
"ABC—Experience in Design, Fabrication, and Erection of PBES"

Geosynthetic Reinforced Soil Integrated Bridge System

GRS-IBS

Why Consider the GRS IBS?

Lower costs

Accelerated bridge construction

Smooth transition eliminating the “bridge bump”

FIBERGLASS REINFORCED POLYMER (FRP) DECK PANELS

Description: These panels are much like the partial- and full-depth precast deck panels previously discussed. However, they are constructed from fiberglass reinforced polymer rather than concrete. The polymer is reinforced with fiber or some other material of equal strength to reinforce the panels in one or more directions along the span of the bridge.

18" x 30" x 16' Pre-engineered SuperSil® abutment system ready to be filled with concrete.

(ABC-Accelerated Bridge Construction) & Modular Units

Vibratory Piling Driver

NDS

Railroad car bridge - temporary

DEVELOPMENT OF LOAD RATING PROCEDURES FOR RAILROAD FLATCARS FOR USE AS HIGHWAY BRIDGES BASED ON EXPERIMENTAL AND NUMERICAL STUDIES

PHASE III FINAL REPORT-

Prepared for
The Indiana Local Technical Assistance Program (LTAP)

NDS


Railroad Flatcar
Bridges

Types of Cars

Pulp Cars

Military

89’ Flatcars, Cost $19,000 (?) Delivered

89’ Flatcar cut to 68’, Cost $16,667 Delivered

Total Costs range between $65,000 and $95,000

NDS

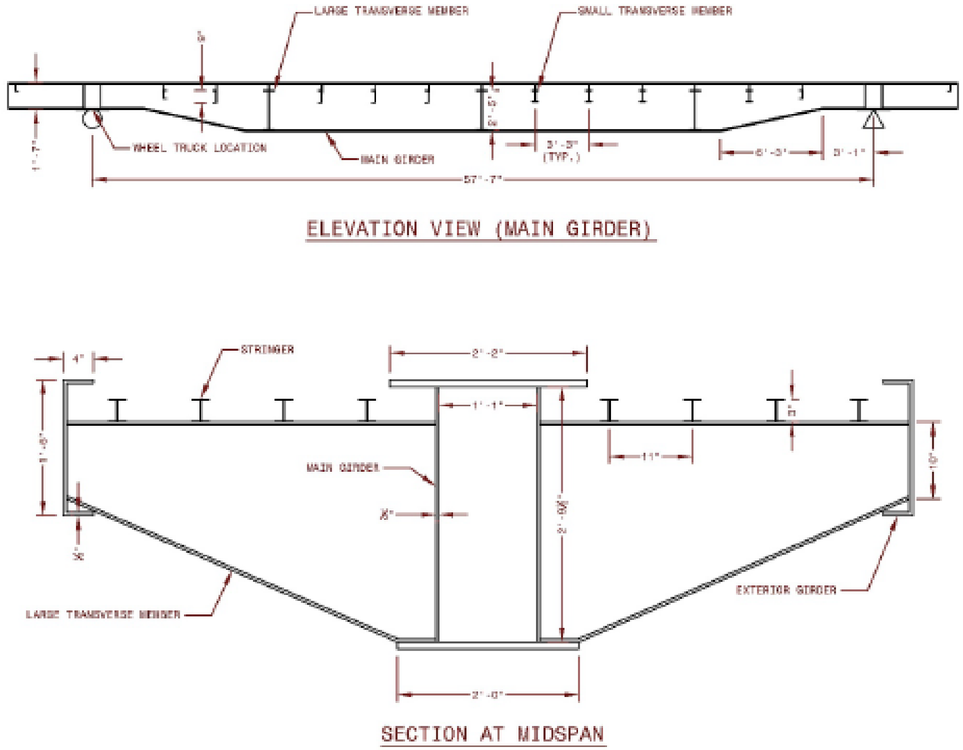


Figure 1 – Section Cut Drawing of RRFC Bridge

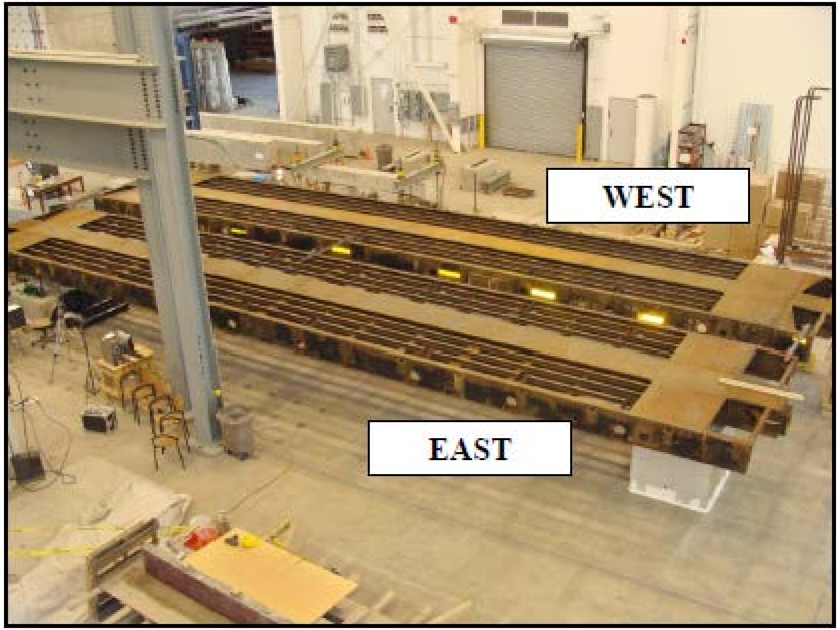


Figure 3 – Placement of RRFCs in laboratory

Flatcars NOT Boxcars

NDS

https://www.youtube.com/watch?v=GEw2YxIfljg


GhostsofNorthDakota.com
WEIGHT LIMIT
3 TONS PER AXLE
7 TONS GROSS

Barnes County – Timber Box Culvert

Richland County Bridge


WEIGHT
LIMIT
3
TONS


97TH ST SE
CO RD 81
CO RD 81
176TH AV SE
97TH ST SE

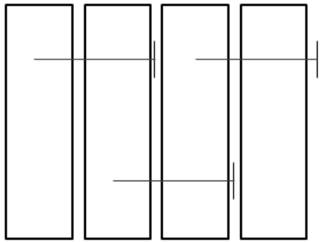
Stark County Bridge Replacement


Bridge # 46-120-04.0
Direction: Up
Far North Deck Patch (2 in Deck)
02/15/05


21-141-19.0 3-7-07
DECK REPAIRED WITH CUT
EDGES PICT # 28

Post-tension Wood Deck - Michigan

- Over time nails back out and timbers spread

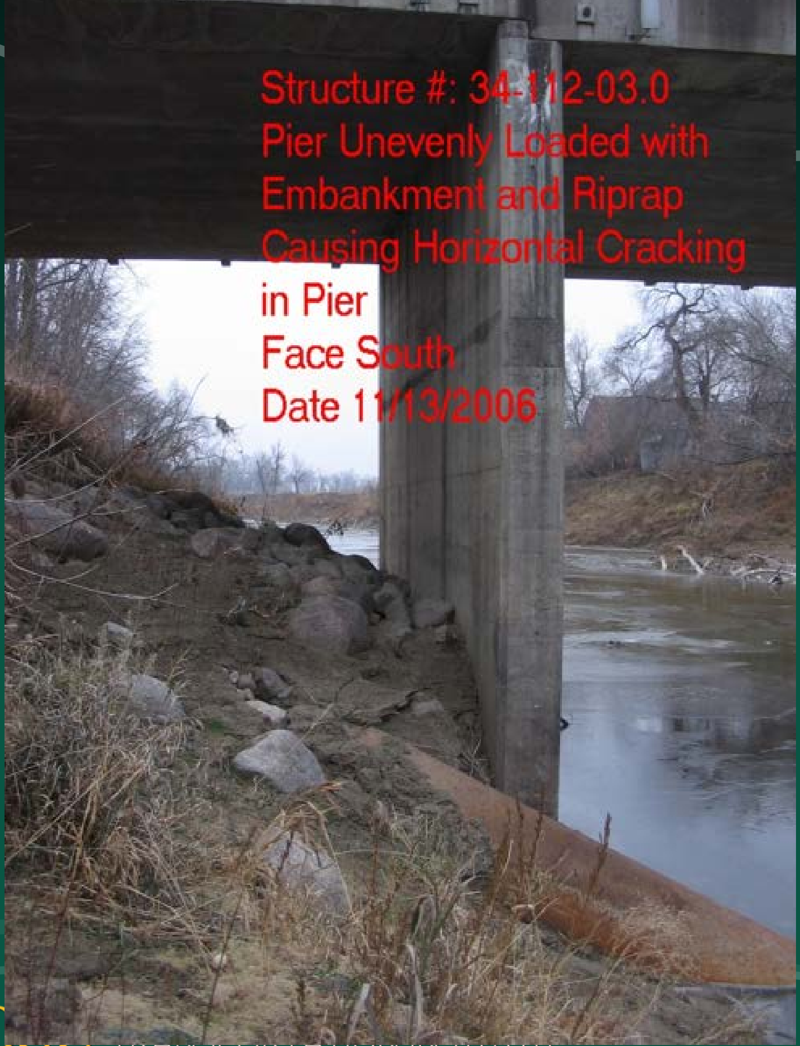


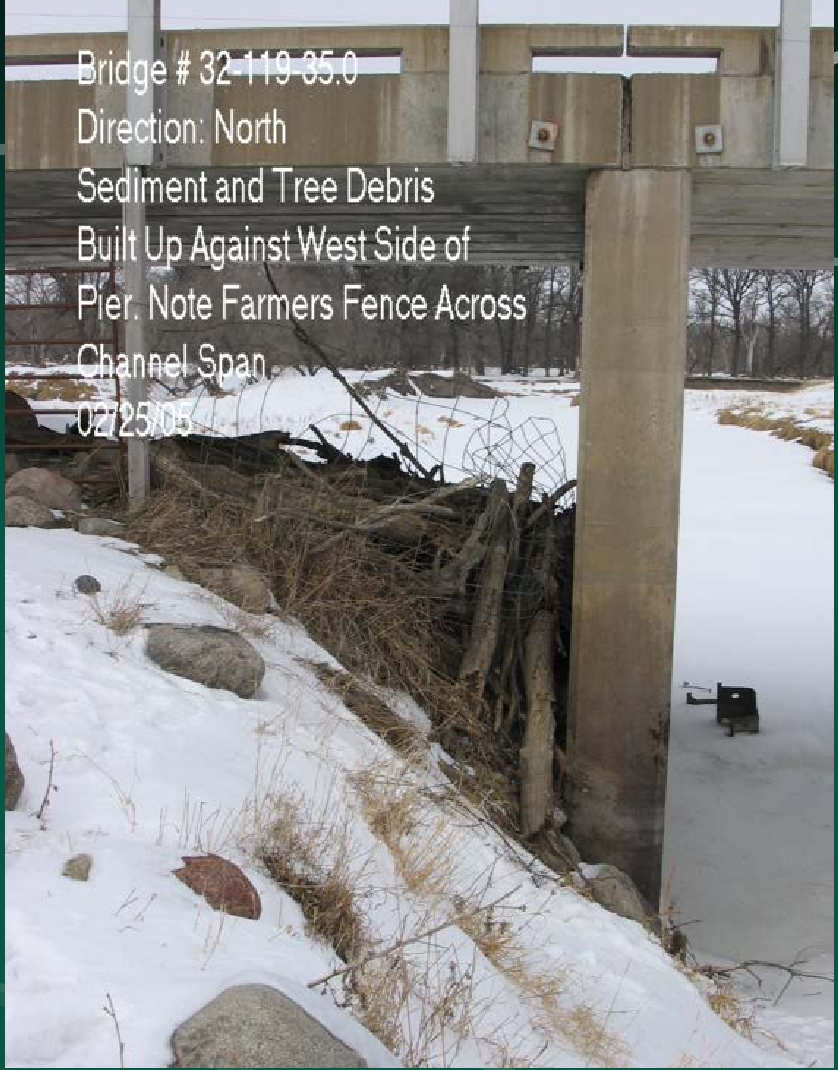
Spread Laminates

Load Test

	West Fascia	4' West	8' West	Centerline	8' East	4' East	East Fascia
Baseline	34 1/4	33 5/8	32 3/4	32 1/8	31 5/8	31 1/4	30 5/8
Test 1	34 1/8	33 5/8	32 3/4	32 1/8	31 1/2	31	30 1/2
Test 2	34 1/8	33 5/8	32 1/2	31 7/8	31 3/8	31 1/4	30 5/8
Test 3	34	33 3/8	32 1/2	32 1/8	31 1/2	31 3/8	30 5/8

¼" Max Deflection (Greater than 50% Reduction)


Structure #: 34-112-03.0
Pier Unevenly Loaded with
Embankment and Riprap
Causing Horizontal Cracking
in Pier
Face South
Date 11/13/2006


Bridge # 32-119-35.0
Direction: North
Sediment and Tree Debris
Built Up Against West Side of
Pier. Note Farmers Fence Across
Channel Span
02/25/05

Debris accumulation may cause lateral pressure and scour.

Water


NAND

NDSU UPPER TRANS

Plates welded to rusted pile

Beam Seat Failure

NDSU


Pitcairn Creek
9-2-03
N Abmt
S Bnd

Shot Crete

Power Team
Power Team
Power Team
Power Team
Power Team
Power Team
Power Team
Power Team
FUEL
BRUSHLESS

Abutment Repair

Pedestal Repair

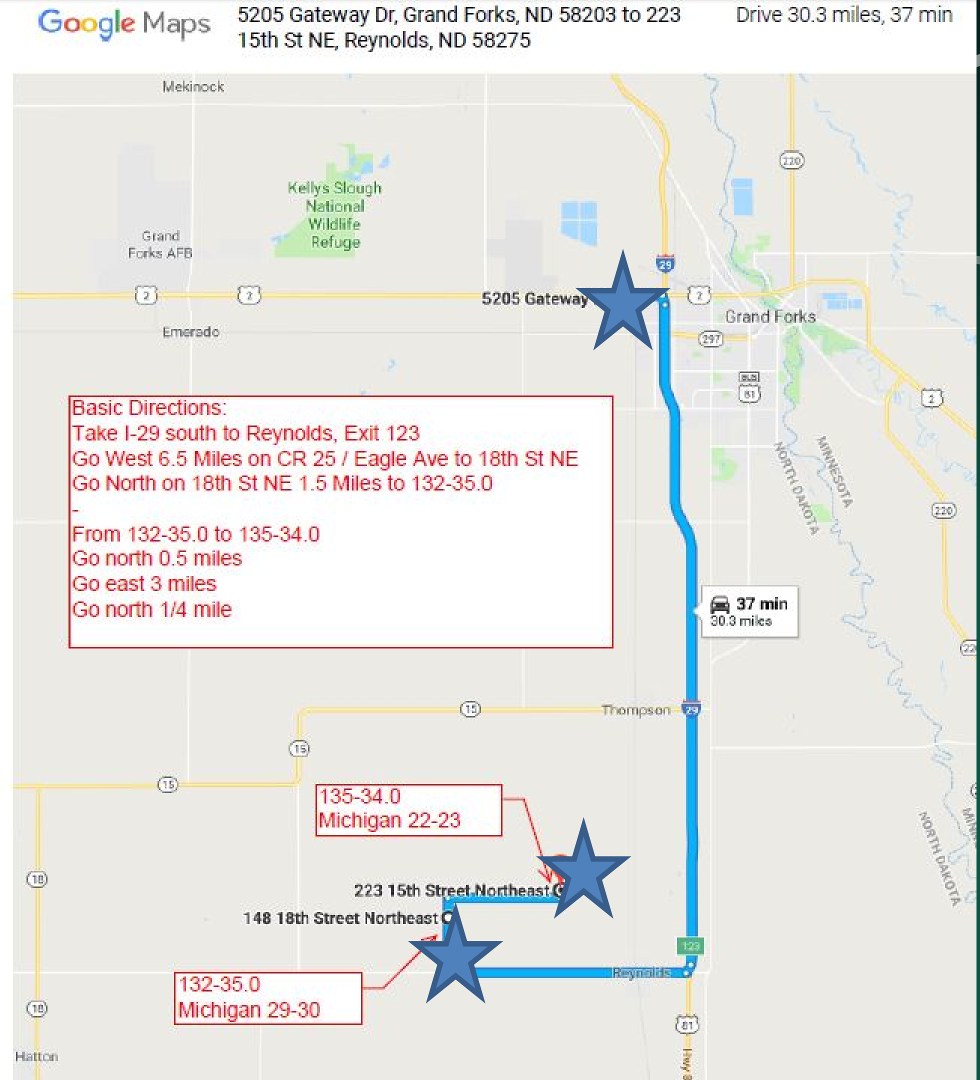
NDSU

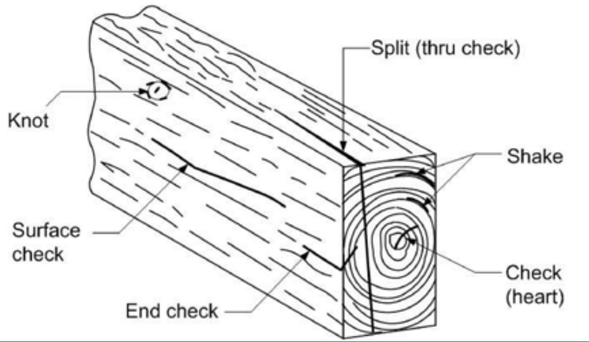
NDSU

NDSU

NDSU UPPER GREAT PLAINS TRANSPORTATION INSTITUTE

Grand Forks Field Inspections





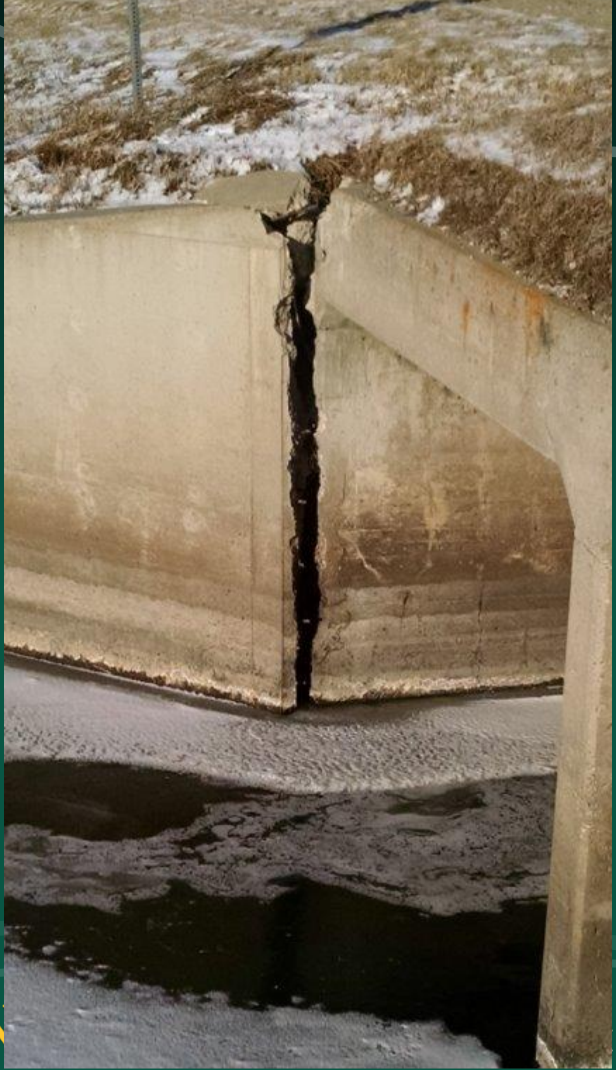
Grand Forks County Tips

Rip Rap

Sign

Treat timber ends

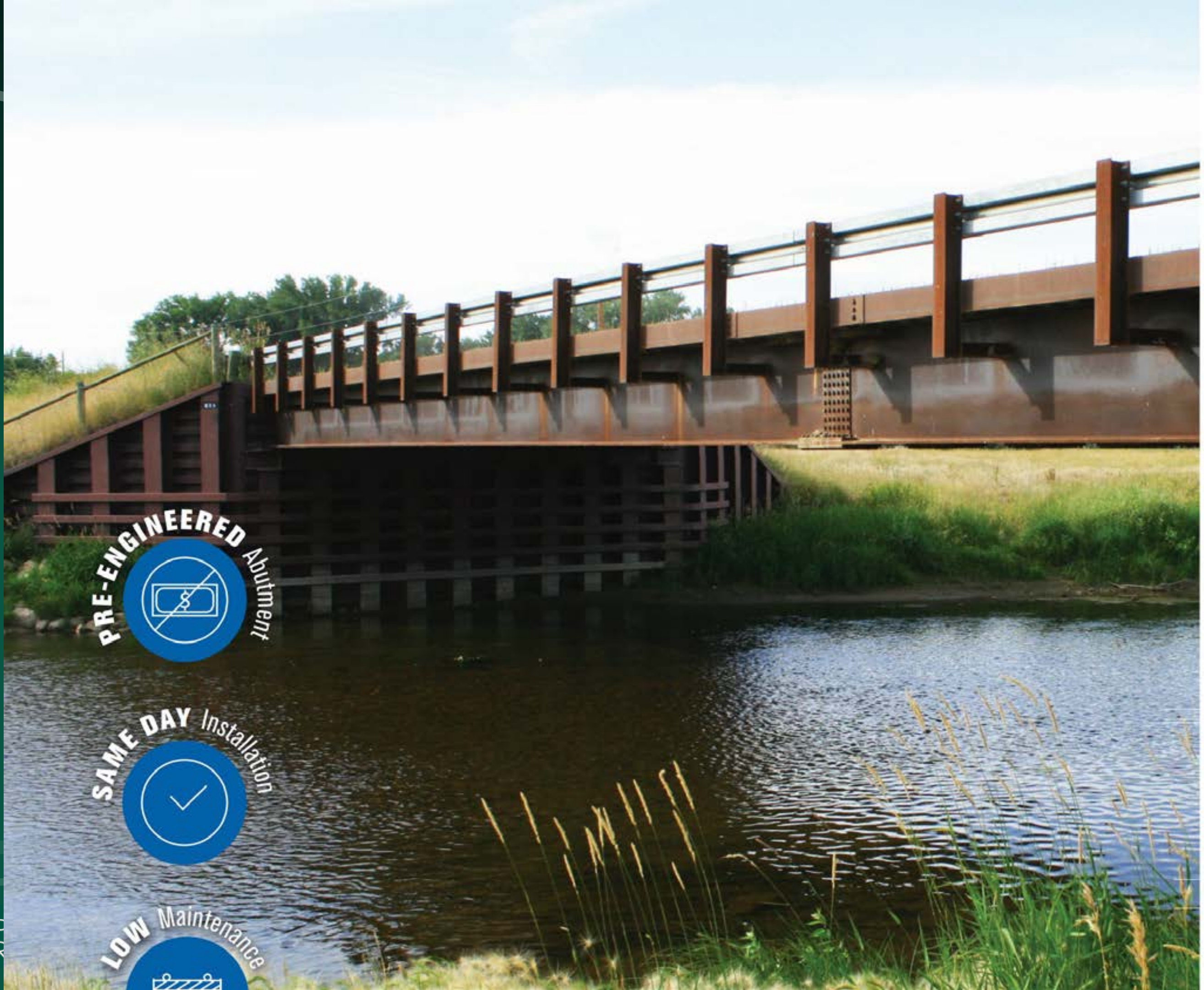
Keep wooden deck timbers tight





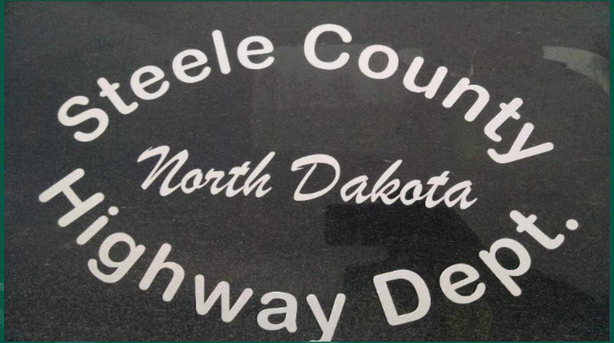

ND


Glue Laminated Beams


PRE-ENGINEERED Abutment
SAME DAY Installation
LOW Maintenance

NDSU UP
TR

Steele County – Reed Olen




BRIDGE
CLOSED

NDSU


B1
CAT


BRIDGE
CLOSED

NDSU UPPER GREAT PLAINS TRANSPORTATION INSTITUTE

NDSU UPPER GREAT PLAINS TRANSPORTATION INSTITUTE

Bridge 201class for ND LTAP

Kelly Bengtson
Bridge and Pavement Engineer
Phone: (701)231-5361
Email: kelly.bengtson@ndsu.edu

Bridge Preservation - https://www.fhwa.dot.gov/bridge/preservation/guide/guide.pdf

FHWA – 2018 guide

Bridge Preservation Guide

Maintaining a Resilient Infrastructure to Preserve Mobility

Spring 2018

Tendency to build it and forget it

- Rural Counties have limited budgets
- Most often money is used for roads
- New bridges need maintenance too, especially if salt is being used on them in winter months.

A different way to look at it:

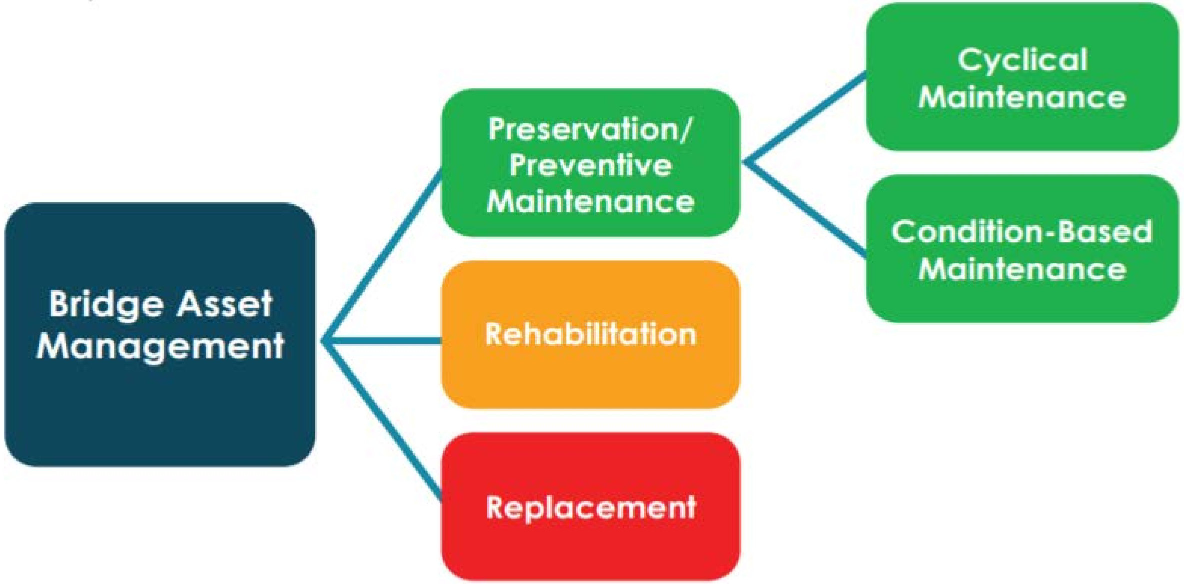


Figure 2. Bridge action categories.

Bridges in ND >20’ from the NBI

County = 3,043

State = 1,134

City = 80

Bureau of Reclamation = 18

US Fish & Wildlife = 12

Other = 42 (private, RR, COE, BIA, Parks)

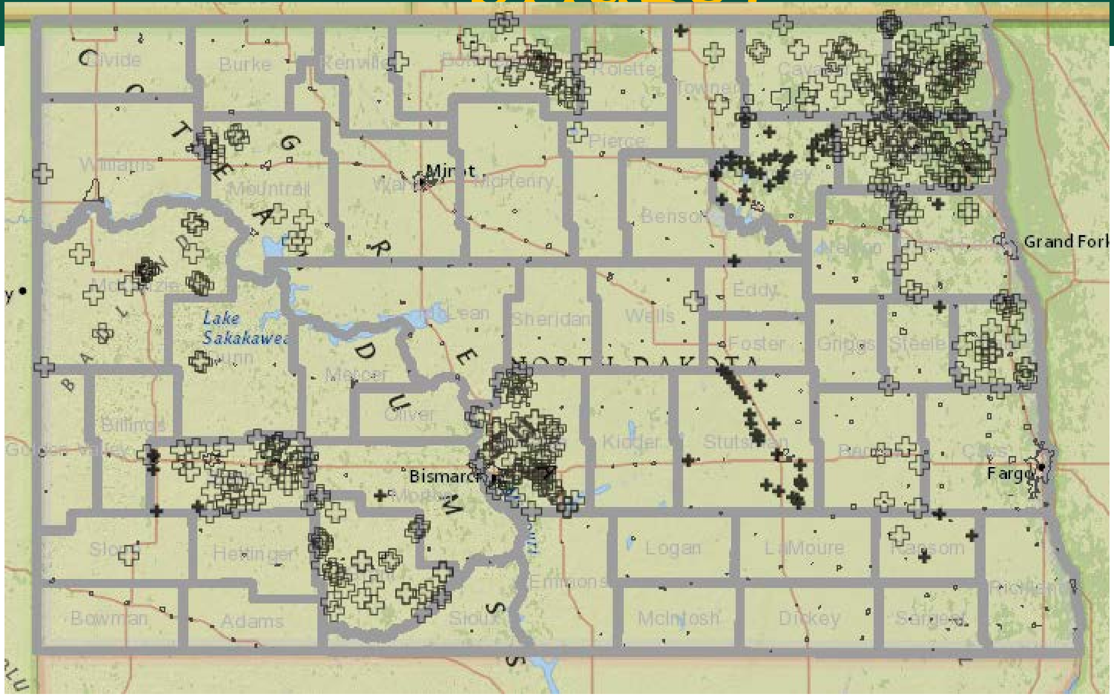
Grand total of 4,329 bridges

What if we add in Minor Structures 4’ to 20’

- Lets say this triples the total
- 12,987 !!!
- State does inspect 580 structures that are <20’ but has many more.

Wow, that's a lot!

County Bridges in GRIT(black + is an NBI bridge)



ND DOT Bridge acronyms

ABBREVIATIONS

The following is a list of abbreviations used in all Chapters of the Bridge Management Manual:

AASHTO	American Association of State Highway and Transportation Officials
ADT	Average Daily Traffic
BrM	AASHTOWare Bridge Management Software
CFR	Code of Federal Regulations
FC	Fracture Critical
FCM	Fracture Critical Member
FHWA	Federal Highway Administration
GPR	Ground Penetrating Radar
GPS	Global Positioning System
LRFD	Load Resistance Factor Design
MBE	AASHTO Manual for Bridge Evaluation
MT	Magnetic Particle Testing
MUTCD	Manual of Uniform Traffic Control Devices
NBI	National Bridge Inventory
NBIS	National Bridge Inspection Standards
NCHRP	National Cooperative Highway Research Program
NDDOT	North Dakota Department of Transportation
NDE	Non-destructive Evaluation
NDT	Non-destructive Testing
NHI	National Highway Institute
NHS	National Highway System
PCA	Plan of Corrective Action
POA	Plan of Action
PPE	Personal Protection Equipment
PT	Liquid Penetrant Testing
SI&A	Structure Inventory and Appraisal
UW	Underwater

Bridge Acronyms

- NBI – National Bridge Inventory
- NBIS- National Bridge Inspection Stds.
- PCA – Plan of Corrective Action
- FCM – Fracture Critical Member
- NDT – Non Destructive Testing

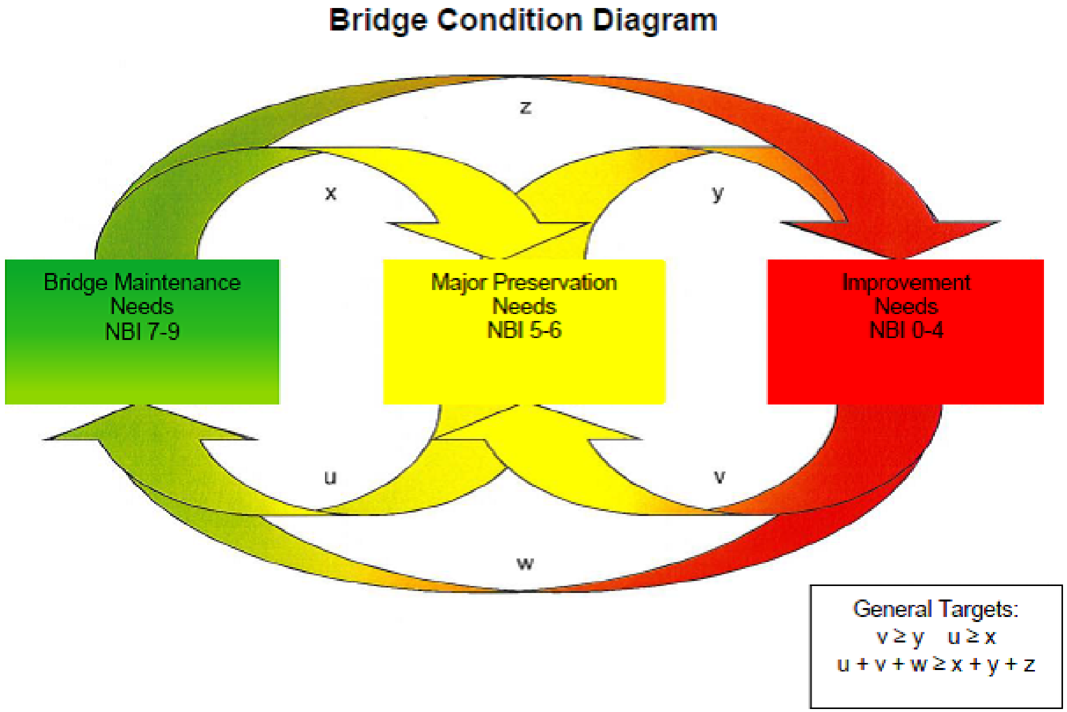
Routine Maintenance

These are examples of routine maintenance activities not eligible for Federal funds:
Trash, Litter, and Dead Animal Removal
Snow Removal/Application of Salt/Deicing Chemicals
Graffiti Removal
Hazardous Material Removal
Asphalt Patch with No Membrane on Concrete Deck
Accident Damage to Bridge and Its Appurtenances
Storm Damage

Four levels of Br. Maintenance based on cost groupings

- Preservation: <30% the cost of a new bridge
- Improvement: 30 to 60% of the cost of new bridge
- Rehabilitation: 60 to 70%
- Replacement: if work to be done is >70%

When to perform bridge work



Cyclical Maintenance: monthly, annual, base period of time

Cyclical Maintenance Activity	Bridge Component
Clean/Wash Bridge	Deck and/or Super/Substructure
Clean and Flush Drains	Deck
Clean Joints	Deck
Deck/Parapet/Rail Sealing and Crack Sealing	Deck
Seal Concrete	Super/Substructure

Condition Based Maintenance

Examples of Condition-Based Maintenance Activity	Bridge Component
Drains, Repair/Replace	Deck
Joint Seal Replacement	Deck
Joint Repair/Replace/Elimination	Deck
Electrochemical Extraction (ECE)/Cathodic Protection (CP)	Deck
Concrete Deck Repair (see halo effect below) in Conjunction with Overlays, CP Systems or ECE Treatment	Deck
Deck Overlays (thin polymer epoxy, asphalt with waterproof membrane, rigid overlays)	Deck
Repair/Replace Approach Slabs	Approach
Seal/Patch/Repair Superstructure Concrete	Superstructure
Protective Coat Concrete/Steel Elements	Superstructure
Spot/Zone/Full Painting Steel Elements	Superstructure
Steel Member Repair	Superstructure
Fatigue Crack Mitigation (pin-and-hanger replacement, retrofit fracture critical members)	Superstructure
Bearing Restoration (cleaning, lubrication, resetting, replacement)	Superstructure
Movable Bridge Machinery Cleaning/Lubrication/Repair	Superstructure
Patch/Repair Substructure Concrete	Substructure/Culvert
Protective Coat/Concrete/Steel Substructure	Substructure/Culvert
ECE/CP	Substructure/Culvert
Spot/Zone/Full Painting Steel Substructure	Substructure
Pile Preservation (jackets/wraps/CP)	Substructure
Channel Cleaning / Debris Removal	Channel
Scour Countermeasure (installation/repair)	Channel

Get rid of the old, bring in the new!

Concrete cracks or leaky joints lead to rebar issues

Obsolete precast channel beam

What is eligible for Fed. Funds?

Action	Activities	Eligible for Federal Funds	Reference
Maintenance	Routine Maintenance	No	Table 1
Preservation/Preventive Maintenance	Cyclical Maintenance	Yes	Table 2
	Condition-Based Maintenance	Yes	Table 3
Rehabilitation	-	Yes	-
Replacement	-	Yes	-

New Bridges are great!

Single slab span designs

Winter Bridge Construction

Precast Concrete Beam Design

Culverts spanning > 20’

Salt can be damaging

Section loss due to corrosion

Pictures

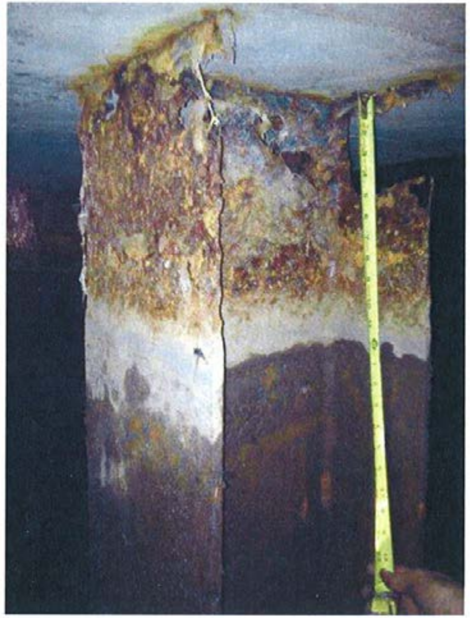
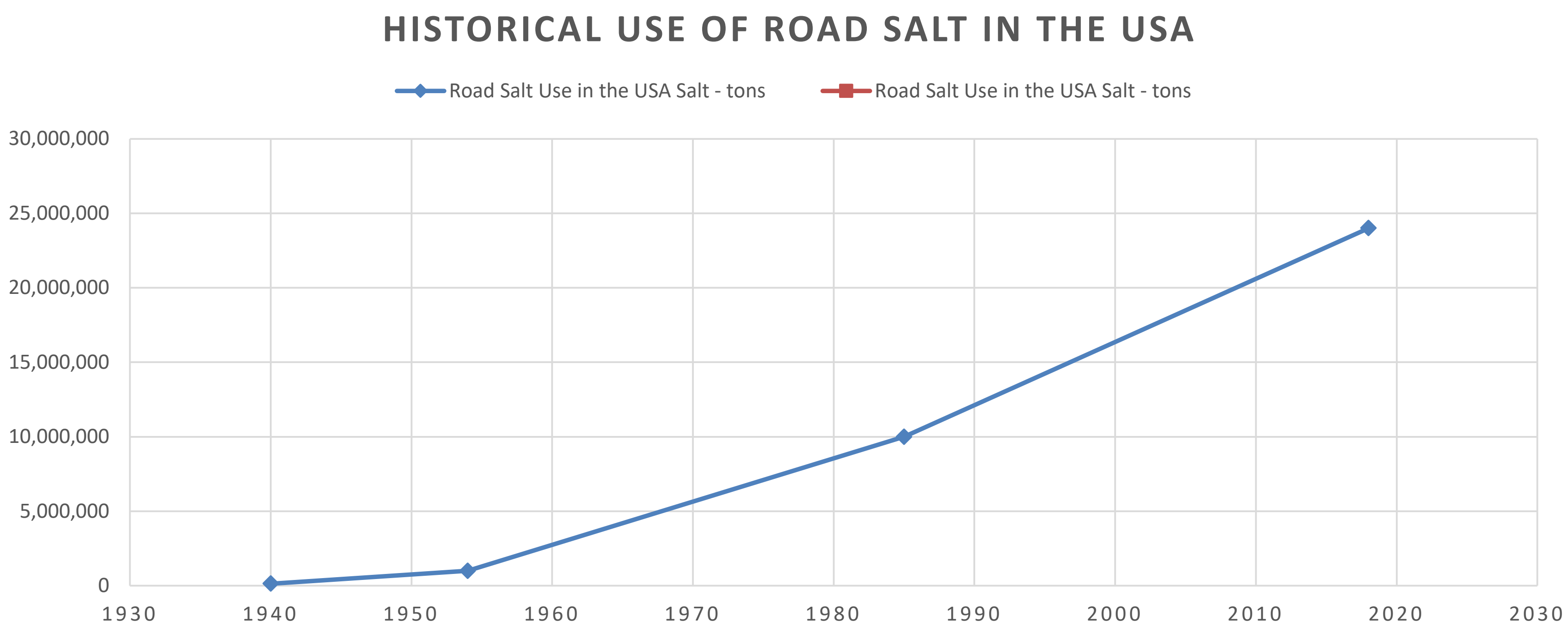


Photo 18 - 2013 11 13 pier 32 SB (pic 2)

Salt usage in the USA (USA Today News, 12/'19)



Salt damages sub structure

Salt damages pier caps

I-35W failed gusset plate

Salt - Reduced bridge strength

- Oregon DOT finds some bridges have a 40% loss of strength even with high visual ratings.
- Salt costs car owners $3B annual in repair
- Drinking water is seeing higher salt levels
- High tech is working to reduce salt on plow trucks by more than 40%.

Innovative Bridge Committee

- United Soybean Transportation Coalition
- 3 primary panel engineers
- 10 advisory panel engineers
- Innovative Bridge Designs/Replacement
- Innovative Bridge repair/rehabilitation

Top 10 Bridge Replacement Concepts

- Rail Flat Car Bridges (load ratings and railings)
- Vibratory H-Piling Drivers
- Buried Soil Structures
- GRS-IBS (Fabric Abutments)
- Press Brake Tub Girders
- Pre-stressed Deck Panels
- Inverted T Beam
- Prefabricated Steel Decks and Superstructures**
- All Steel Piers
- Galvanized H-Piling
- Galvanized Steel Beams

Press Brake formed Tub Girder Design in Iowa &

Top 10 Bridge Repair Ideas

- Piling Encasement
- Concrete Pier Piling Repairs
- Epoxy Deck Injections
- Deck Patching
- Thin Polymer Concrete Overlays
- Penetrating Concrete Sealers
- Spot Cleaning Painting Steel Beams
- Driving Piling Through Decks
- Deck Overlays with Type O Concrete and Plasticizers
- Concrete Overlay on Adjacent Box Beams

Innovative Bridge Repairs

Bridge Repair Innovations

- Piling Encasements: https://intrans.iastate.edu/app/uploads/2018/09/pile_assessment_tool_t2.pdf
- Concrete Pier Piling Repairs: https://www.goodreads.com/book/show/50213190-underwater-bridge-repair-rehabilitation-and-countermeasures---marine-c
- Driving Piling Through Decks: https://www.fhwa.dot.gov/engineering/geotech/pubs/hif17044.pdf
- Micro-Piling/Screw-Piling (some excitement, but some concern regarding its widespread application in rural areas): http://publications.iowa.gov/31052/1/TR-718_Final%20Report_Evaluation%20of%20Alternative%20Abutment%20Piling%20for%20Low-Volume%20Road%20Bridges.pdf
- Soil Nails (some concern due to cost, but it may be the only option in certain circumstances): https://trid.trb.org/view/474787
- Epoxy Deck Injections: https://intrans.iastate.edu/app/uploads/2019/02/bridge_deck_epoxy_injection_process_w_cvr.pdf
- Deck Overlays with Type O Concrete and Plasticizers: https://www.fhwa.dot.gov/publications/research/infrastructure/bridge/17097/17097.pdf
- Deck Patching: https://docs.lib.purdue.edu/cgi/viewcontent.cgi?article=3106&context=jtrp
- Thin Polymer Concrete Overlays: https://wisconsindot.gov/documents2/research/12-06-2nd-final-report.pdf
- Penetrating Concrete Sealers: https://docs.lib.purdue.edu/jtrp/1628/
- Spot Cleaning Painting Steel Beams: https://www.nap.edu/read/25089/chapter/5
- Concrete Overlay on Adjacent Box Beams: https://www.fhwa.dot.gov/publications/research/infrastructure/structures/bridge/17093/001.cfm

Concrete Deck Sealing

- https://docs.lib.purdue.edu/jtrp/1628/
- If a bridge deck is expected to be exposed to deicing salts, any cracks should be sealed, as well as the full deck surface. Sealing should be completed as soon as possible in the life of the bridge to prevent as much chloride intrusion as possible.

1600 day long study @ Purdue

- Sikadur 55 SLV and Dural 335, low-viscosity epoxies, were shown to be effective in reducing corrosion in cracked concrete by as much as 80 to 100%.

Application of Epoxy Deck Seal

Fick's Law of Diffusion

$$C(x,t) = C_i + (C_s - C_i)\,erf\left(1 - \frac{x}{2\sqrt{tD_{app}}}\right), \qquad (1)$$

where $C(x, t)$ – chloride amount in concrete depth x (concrete surface, if $x = 0$ mm) and time t, mass balance – %; C_i – initial chloride concentration in concrete, mass balance – %; C_s – surface chloride concentration, mass balance – %; x depth in concrete cover, mm; erf – function: $erf(z) = \frac{2}{\sqrt{\pi}}\int_0^z e^{-y^2}dy$; t – concrete structure age, years; D_{app} – apparent diffusion coefficient, mm^2/year.

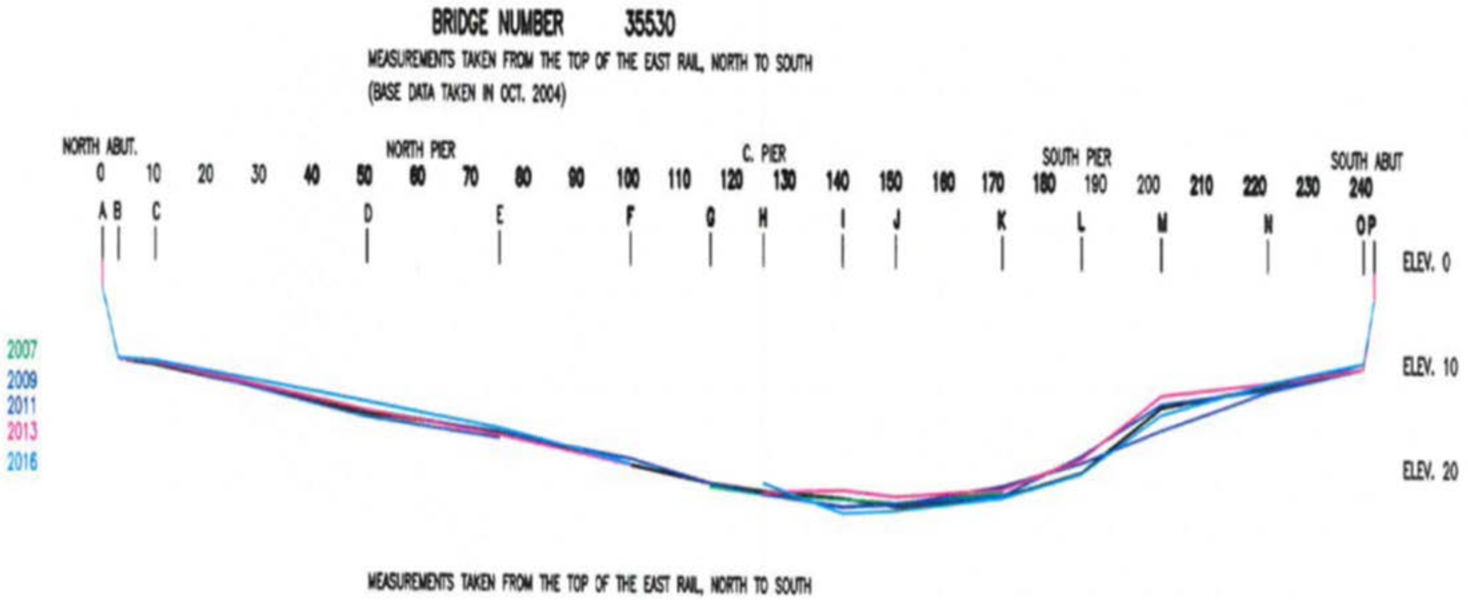
Reapplication of deck sealers

- Simulation of traffic wear on uncracked concrete with applied deck sealer revealed that the likelihood of corrosion increases as the depth of sealer penetration is abraded (wore off) over time. Therefore, reapplication of deck sealers over time is warranted.

Debris from flooding

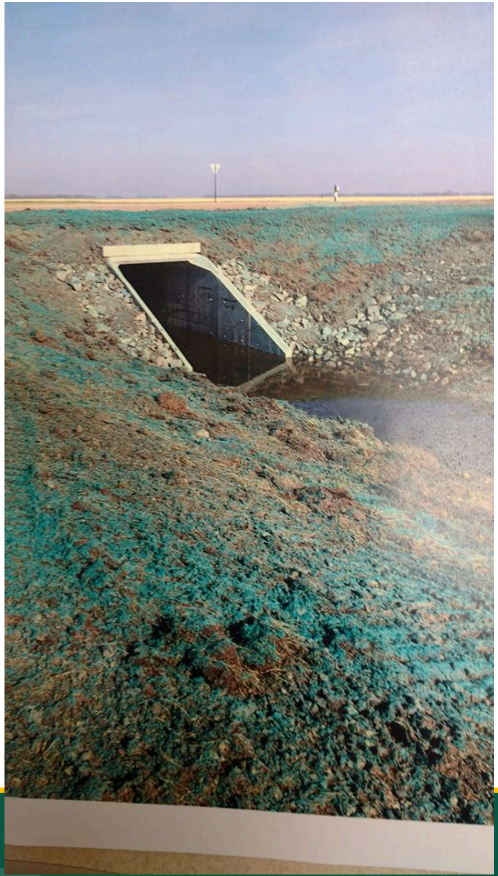
Photo 3 - 10-31-16 Large pile of debris hung up on center pier

Monitor Scour



Is this debris from this year or last year?

Is this 20' wide?



Everyone wears a vest!

Abutment Protection

Bridge rehab, new deck

New Timber Deck, no approach work needed

Double boxes are common today

Timber Bridges

Failing Stringers

Take advantage of low flows

Ice Breakers

Are you washing your bridges?

We all want to avoid this:

Not a race but you do want to finish

FHWA Bridge Preservation

- https://www.youtube.com/watch?v=20UIiHH4dr0

Recognize your bridge people

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NDSU TRANSPORTATION INSTITUTE

Wheeler

NDLTAP – Bridge 201

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Wheeler


Minneapolis, MN
Erickson Engineering
Engineered Products Sales
Whitewood, SD
Timber Fabrication
and Treating
Shakopee, MN
Steel Fabrication
Landscape Supply
Waverly, KS
Roof & Floor Truss
Fabrication

Engineered Products

Salt Storage Buildings

Steel Recreation Bridges

Timber Vehicle Bridge (Panel-Lam)

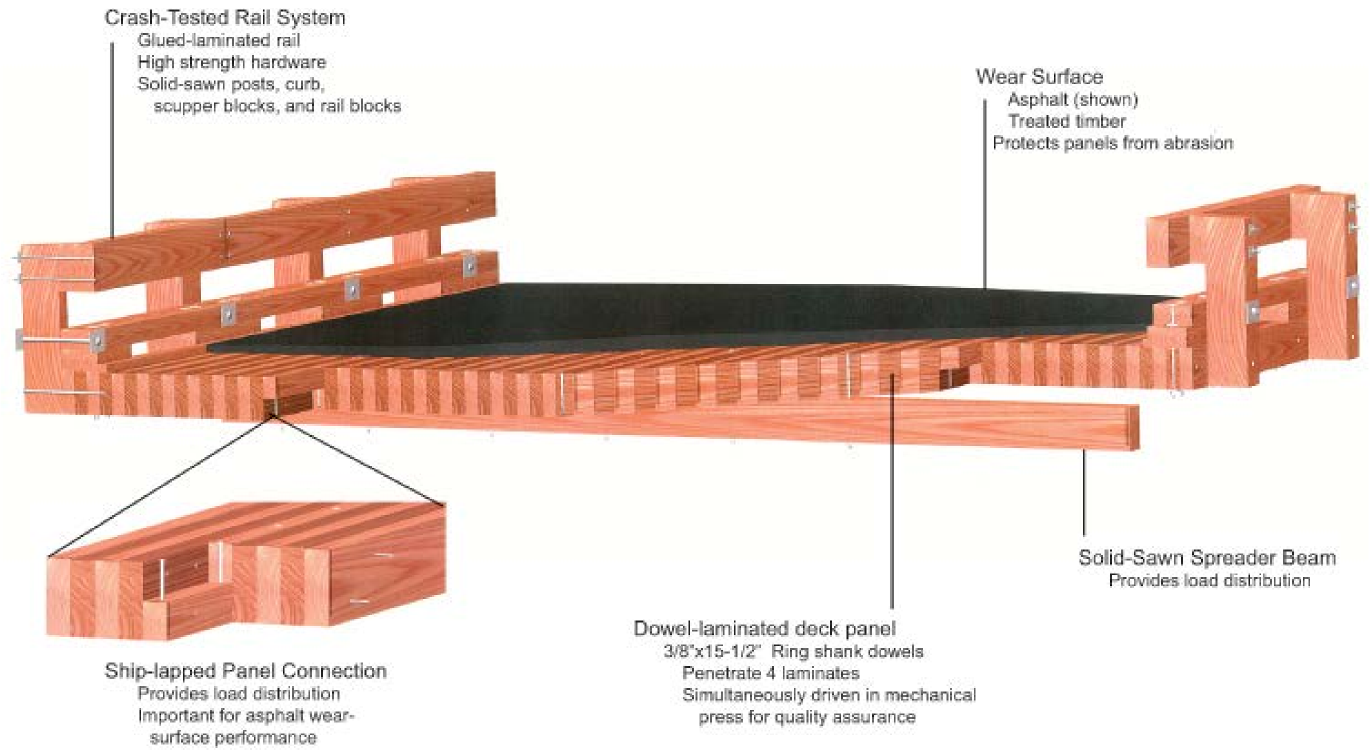
Timber Recreation Bridges

Panel-Lam Bridge Kits

Overview

- Panel-Lam System
- New Construction
- Repair/Renovation
- Owner or Contractor Built

Longitudinal Timber Deck Panels



Pre-manufactured Kits

- Shop Fabricated
- Shipped as Components
- Complete Material Package
- No Formwork

Proven System

QNAP®

COPPER NAPHTHENATE

- ➢Durable Treatment 70+ Year Design Life
- ➢Standard Details
- ➢Standard Equipment
- ➢No Specialty Labor

Proven System

LRRB
LOCAL ROAD RESEARCH BOARD

TECHNICAL SUMMARY

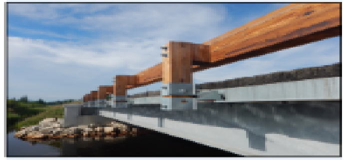
Questions?
Contact research.dot@state.mn.us.

Technical Liaison:
Dave Conkel, MnDOT
Dave.Conkel@state.mn.us

Principal Investigators:
Brian Brashaw and James Wacker,
USDA Forest Service

Donald Fosnacht,
University of Minnesota Duluth

LRRB PROJECT COST:
$212,883



A St. Louis County composite timber and steel bridge features wooden railings.

2020-16TS
Published July 2020

Timber-Based Bridges Offer a Cost-Effective, Durable Alternative

Timber-based bridges can be built at costs similar to other kinds of bridges and can perform well for 70 years or more. These bridges also offer green benefits and can be built much faster than steel or concrete structures.

What Was the Need?

MnDOT and the Local Road Research Board (LRRB) have been supporting timber bridge owners with research on inspection and repair since the early 2000s, including acquired tools for inspectors.

Advocates of timber bridges credit advances in design, preservation, maintenance and inspection that should dispel misconceptions about the cost, durability and structural strength of contemporary timber bridges.

Yet from 2000 through 2019, Minnesota local agencies built 4,335 concrete-based bridges, 26 steel-based bridges and 26 timber-based bridges. While timber bridges are traditionally believed to perform satisfactorily for 50 years or more, few local road agencies in Minnesota have extensive experience with timber in new bridge construction. Common misperceptions about timber bridges include that they can be expensive to construct, less durable than other types of bridges and cannot carry heavy truckloads.

As Minnesota's local road agencies grapple with the challenges of renewing an aging bridge infrastructure with limited resources, LRRB needs to provide these agencies with design and construction guidance on alternatives to bridges made with concrete and steel such as timber.

What Was Our Goal?

The LRRB sought to help local agencies understand how timber bridges can be built cost-effectively. Investigators needed to examine the literature and Minnesota practice, develop new superstructure design aids that meet national bridge design standards and compile case studies presenting timber-based bridge options to Minnesota bridge builders and owners.

What Did We Do?

To identify design needs, researchers reviewed current literature on timber bridges and building products, interviewed Minnesota manufacturers of timber bridge elements, and surveyed county engineers in Minnesota and Iowa about their perceptions of timber-based bridges.

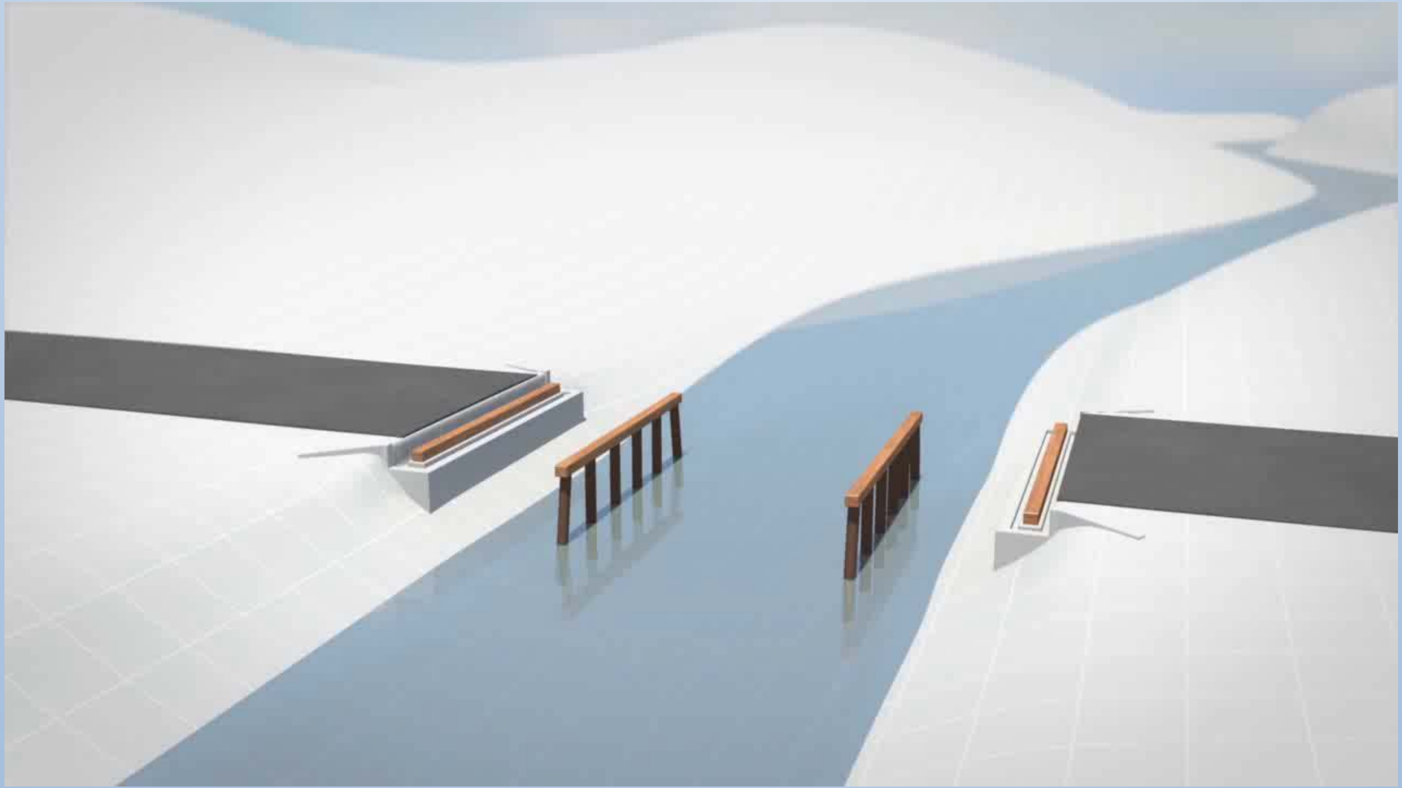
In 2017 St. Louis County built a bridge west of Babbitt with steel girders and a glue-laminated timber deck. In 2019 Hennepin County erected a bridge with a longitudinal spike-laminated timber deck in Dayton. Researchers worked with each county during

SINGLE SPAN

MULTIPLE SPAN

Foundations

Installation



Wood County, WI - Young Road

SPECIFICATIONS:

GRADING
ALL DOUGLAS FIR-LARCH TO BE GRADED PER WCLIB STANDARD GRADING RULES.

MATERIALS & TREATMENT
TIMBER PRESERVATIVE TREATMENT SHALL BE IN ACCORDANCE WITH CURRENT STATE AND/OR AASHTO SPECIFICATIONS. ALL TIMBER SHALL BE COPPER NAPHTHENATE TREATED UNLESS NOTED OTHERWISE.

DECK TO BE 12" DOUGLAS FIR-LARCH, NO.2. S1S.

BRIDGE RAILPOST TO BE DOUGLAS FIR-LARCH, DENSE SELECT STRUCTURAL.

GLU-LAM RAIL TO BE DOUGLAS FIR, COMB. SYMBOL 24F-V8, DF/DF.

ABUTMENT & PIER CAPS TO BE DOUGLAS FIR-LARCH, NO.1.

CURBS & SCUPPERS TO BE DOUGLAS FIR - LARCH, NO.1.

BALANCE OF TIMBER TO BE DOUGLAS FIR - LARCH, IN ACCORDANCE WITH DESIGN REQUIREMENTS.

ALL TIMBER IS ROUGH UNLESS OTHERWISE NOTED.

MISCELLANEOUS
ALL TIMBER TO BE CUT TO EXACT LENGTH, DRESSED TO SIZE REQUIRED AND ALL PRACTICAL FRAMING TO BE DONE PRIOR TO TREATMENT.

ALL DECK PLANKS SHALL BE PREDRILLED PRIOR TO TREATMENT.

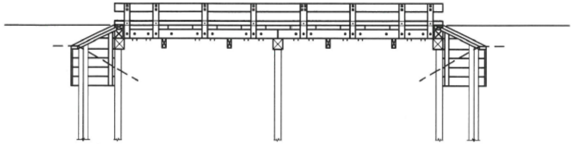
ALL PLANK FOR DECK PANELS SHALL BE PRECISION END TRIMMED TO LENGTH WITH 1/4" UNDERLENGTH & NO OVERLENGTH TOLERANCE PERMITTED.

DECK PANELS SHALL BE ASSEMBLED WITH 3/8" DIAMETER RING SHANK DOWELS. ALL DOWELS ARE TO BE SIMULTANEOUSLY DRIVEN WITH EQUAL FORCE USING A MECHANICAL PRESS THE FULL LENGTH OF THE DECK, ENSURING ALL HEADS ARE FLUSH WITH THE SURFACE OF THE TIMBER PLANK. MULTIPLE IMPACT TOOLS ARE NOT TO BE USED TO SET DOWELS BECAUSE OF POTENTIAL FOR WOOD FIBER RUPTURE.

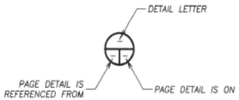
DECK PANELS WILL BE DELIVERED TO JOBSITE AFTER BEING FULLY ASSEMBLED AT FABRICATION PLANT.

ALL HARDWARE TO MEET ASTM A307-97 GALVANIZED TO A153. ALL HIGH STRENGTH HARDWARE TO MEET ASTM A325 OR A449 GALVANIZED TO A153. ALL STRUCTURAL STEEL TO MEET ASTM A36, GALVANIZED TO A123.

WOOD COUNTY, WISCONSIN
YOUNG ROAD OVER ELM CREEK
DOUBLE SPAN PANEL-LAM BRIDGE



BRIDGE ELEVATION



CALLOUT LEGEND

DO NOT SCALE DRAWINGS

INSTALLATION NOTE:
HIGH-STRENGTH (A449) DOME HEAD BOLTS (3/4" X 26") DO NOT HAVE FINS UNDER THE HEAD AT THE SHANK, AND ARE TO BE USED AT THE CURB TO DECK LOCATION.

PLAN SHEET INDEX	
SHEET	DESCRIPTION
1	COVER SHEET & SPECIFICATIONS
2	GENERAL BRIDGE PLAN & ELEVATION
3	ABUTMENT PLAN & ELEVATION/SECTION/DETAILS
4	PIER PLAN & ELEVATION/DETAILS
5	SECTIONS THRU DECK
6	RAILPOST SECTION & DETAILS

BRIDGE SPAN RATINGS		
BRIDGE IS DESIGNED TO AASHTO HL-93 LOADING		
RATINGS BASED ON FLEXURE		
LOAD	US TONS	
INVENTORY	48.3	
OPERATING	62.6	

REVISION	DESCRIPTION	DATE	INITIALS
1			
2			
3			

CONSTRUCTION NOTES:

TIMBER DECK PANELS ARE MARKED IN THE SHOP FOR USE IN FIELD PLACEMENT OF THE PANELS ON THE CAPS, e.g. A1, B1, C1 FOR SPAN 1, A2, B2, C2 FOR SPAN 2.

DOWEL LAMINATED DECK: PANEL "A" IS PLACED FIRST IN ITS FINAL POSITION ON THE CAPS. NEXT DRILL THE 11/16" DIA. HOLES THRU PANEL INTO CAP IN EACH END OF PANEL AT THE LOCATIONS SHOWN AND FASTEN THE 3/4" DIA. DM. HD. DR. SPKS. NEXT PLACE PANEL "C" SO THAT ITS UPPER SPLICE BLOCK IS DIRECTLY OVER THE LOWER SPLICE BLOCK ON PANEL "A" AND DRAW TIGHT TOGETHER. THEN DRILL THE 9/16" DIA. HOLES THRU LOWER SPLICE BLOCK AND DRIVE THE 5/8" DM. HD. DR. SPIKES IN LOCATIONS SHOWN. THEN DRILL HOLES THRU PANEL INTO CAP AND FASTEN THE 3/4" DM. HD. DR. SPKS. THEREAFTER, SUCCESSIVELY PLACE PANELS "C" AND "B" IN THE SAME MANNER, ENSURING ALL PANELS ARE DRAWN TIGHT TOGETHER BEFORE ANY FASTENING OCCURS.

STEEL BANDING ON PANELS IS TO BE REMOVED AFTER PANELS HAVE BEEN PLACED IN THEIR FINAL POSITION ON THE CAPS.

ALL HOLES DRILLED IN THE FIELD WHERE SPIKES ARE USED ARE TO BE 1/16" SMALLER THAN SPIKE SIZE.

ALL HOLES DRILLED FOR BOLTS ARE TO BE 1/16" LARGER THAN BOLT SIZE.

HOLES DRILLED FOR 3/4" LAG BOLTS ARE TO BE 9/16" IN DIAMETER FOR THE THREADED PORTION OF THE BOLT AND 13/16" FOR THE SHANK.

ANY NUT OR MACHINE BOLT HEAD IN DIRECT CONTACT WITH TIMBER TO HAVE ONE PLATE WASHER BETWEEN NUT & TIMBER, OR BOLT HEAD & TIMBER.

ANY NUT OR MACHINE BOLT HEAD IN DIRECT CONTACT WITH STEEL TO HAVE ONE CUT WASHER BETWEEN NUT & STEEL, OR BOLT HEAD & STEEL.

SET THREADS ON ALL BOLTS AT NUT WITH A CENTER PUNCH AFTER TIGHTENING.

ABUTMENTS TO BE BACKFILLED WITH A CLEAN GRANULAR FILL.

ALL TIMBER CUT OR DRILLED IN THE FIELD SHALL BE TREATED WITH AN APPROVED PRESERVATIVE.

CONSTRUCTION REQUIREMENTS SHALL CONFORM TO STATE SPECIFICATIONS.

ALTHOUGH ALL PRACTICAL PRE-FRAMING WILL BE DONE PRIOR TO TREATING, SOME CUTTING & DRILLING WILL BE REQUIRED IN THE FIELD.

8/10/15

ENGINEER'S SIGNATURE AND SEAL ARE TO ASSUME DESIGN RESPONSIBILITY FOR THE TIMBER BRIDGE AS SUPPLIED & DRAWN BY WHEELER LUMBER, LLC, INDEPENDENT OF ITS FINAL POSITION. THIS DESIGN RESPONSIBILITY IS LIMITED TO THE TIMBER BRIDGE AND DOES NOT INCLUDE ANY DESIGN RESPONSIBILITY PERTAINING TO, BUT NOT LIMITED TO, ROADWAY GEOMETRICS, BRIDGE POSITIONING, HYDRAULIC DESIGN, SCOUR ANALYSIS, PERMITTING PROCEDURES, ERECTION, UTILITY FACILITIES, SOIL CONDITIONS, SUBSURFACE PILE DESIGN (INCLUDING PILE LENGTHS), ETC.

COVER SHEET & SPECIFICATIONS

20'/20' (40' TOTAL) TREATED TIMBER SPANS
32'-1" CLEAR ROADWAY
YOUNG ROAD OVER ELM CREEK
WOOD COUNTY, WISCONSIN
PL-1 RAIL SYSTEM

Wheeler Lumber, LLC
9330 JAMES AVE. S.
BLOOMINGTON, MN 55431

DATE: 7/6/15		TRACKING NO. T18380	SHEET NO.
DWN: LAF	CHK: WEH	ORDER NO. 711-13752	1 OF 6

Removal of Old Structure

Pile Driving

H-Pile Cut Off

Pile Caps Placed

Pile Stays Behind Backing Plank

Filter Fabric

Rip-Rap Placed

Deck Panels Installed

Crash-Tested Railing Installed

Asphalt Overlay

Wood County, WI - Young Road

Juneau County, WI - CTH M

Sealed Bridge Plans

SPECIFICATIONS:

GRADING

ALL DOUGLAS FIR–LARCH TO BE GRADED PER WCLIB STANDARD GRADING RULES.

MATERIALS & TREATMENT

TIMBER PRESERVATIVE TREATMENT SHALL BE IN ACCORDANCE WITH CURRENT STATE AND/OR AASHTO SPECIFICATIONS. ALL TIMBER SHALL BE COPPER NAPHTHENATE TREATED UNLESS NOTED OTHERWISE.

ALL PILING IS TO BE IN ACCORDANCE WITH CURRENT STATE SPECIFICATIONS.

DECK TO BE 12" DOUGLAS FIR–LARCH, NO.1. S1S.

BRIDGE RAILPOST TO BE DOUGLAS FIR–LARCH, DENSE SELECT STRUCTURAL.

GLU–LAM RAIL TO BE DOUGLAS FIR, COMB. SYMBOL 24F–V8, DF/DF.

ABUTMENT & SPREADER BEAMS TO BE DOUGLAS FIR–LARCH, NO.1.

CURBS & SCUPPERS TO BE DOUGLAS FIR – LARCH, NO.1.

BALANCE OF TIMBER TO BE DOUGLAS FIR – LARCH, IN ACCORDANCE WITH DESIGN REQUIREMENTS.

ALL TIMBER IS ROUGH UNLESS OTHERWISE NOTED.

MISCELLANEOUS

ALL TIMBER TO BE CUT TO EXACT LENGTH, DRESSED TO SIZE REQUIRED AND ALL PRACTICAL FRAMING TO BE DONE PRIOR TO TREATMENT.

ALL DECK PLANKS SHALL BE PREDRILLED PRIOR TO TREATMENT.

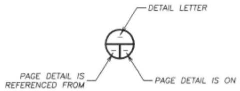
ALL PLANK FOR DECK PANELS SHALL BE PRECISION END TRIMMED TO LENGTH WITH 1/4" UNDERLENGTH & NO OVERLENGTH TOLERANCE PERMITTED.

DECK PANELS SHALL BE ASSEMBLED WITH 3/8" DIAMETER RING SHANK DOWELS. ALL DOWELS ARE TO BE SIMULTANEOUSLY DRIVEN WITH EQUAL FORCE USING A MECHANICAL PRESS THE FULL LENGTH OF THE DECK, ENSURING ALL HEADS ARE FLUSH WITH THE SURFACE OF THE TIMBER PLANK. MULTIPLE IMPACT TOOLS ARE NOT TO BE USED TO SET DOWELS BECAUSE OF POTENTIAL FOR WOOD FIBER RUPTURE.

DECK PANELS WILL BE DELIVERED TO JOBSITE AFTER BEING FULLY ASSEMBLED AT FABRICATION PLANT.

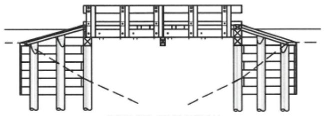
ALL HARDWARE TO MEET ASTM A307–97 GALVANIZED TO A153. ALL HIGH STRENGTH HARDWARE TO MEET ASTM A325 OR A449 GALVANIZED TO A153. ALL STRUCTURAL STEEL TO MEET ASTM A36, GALVANIZED TO A123. 3/4" GALVANIZED CABLE TO BE ASTM A741–98.

JUNEAU COUNTY, WISCONSIN
COUNTY HIGHWAY "M" BRIDGE
SINGLE SPAN PANEL–LAM BRIDGE



CALLOUT LEGEND

DO NOT SCALE DRAWINGS



BRIDGE ELEVATION

PLAN SHEET INDEX	
SHEET	DESCRIPTION
1	COVER SHEET & SPECIFICATIONS
2	GENERAL BRIDGE PLAN & ELEVATION
3	ABUTMENT PLAN & ELEVATION
4	SECTIONS
5	SECTION THRU RAILPOST/MISC. DETAILS

BRIDGE SPAN RATINGS

BRIDGE IS DESIGNED TO AASHTO HS–20 LOADING

RATINGS BASED ON FLEXURE

LOAD	SPAN	
INVENTORY	HS–26.4	
OPERATING	HS–36.7	

REVISION	DESCRIPTION	DATE	INITIALS
1	WING LENGTH CHANGE	7/15	LAF
2			
3			

CONSTRUCTION NOTES:

TIMBER DECK PANELS ARE MARKED IN THE SHOP FOR USE IN FIELD PLACEMENT OF THE PANELS ON THE CAPS, e.g. A1, B1, C1 FOR SPAN 1.

DOWEL LAMINATED DECK: PANEL "A" IS PLACED FIRST IN ITS FINAL POSITION ON THE CAPS. NEXT DRILL THE 11/16" DIA. HOLES THRU PANEL INTO CAP IN EACH END OF PANEL AT THE LOCATIONS SHOWN AND FASTEN THE 3/4" DIA. DM. HD. DR. SPKS. NEXT PLACE PANEL "C" SO THAT ITS UPPER SPLICE BLOCK IS DIRECTLY OVER THE LOWER SPLICE BLOCK ON PANEL "A" AND DRAW TIGHT TOGETHER. THEN DRILL THE 9/16" DIA. HOLES THRU LOWER SPLICE BLOCK AND DRIVE THE 5/8" DM. HD. DR. SPIKES IN LOCATIONS SHOWN. THEN DRILL HOLES THRU PANEL INTO CAP AND FASTEN THE 3/4" DM. HD. DR. SPKS. THEREAFTER, SUCCESSIVELY PLACE PANELS "C" AND "B" IN THE SAME MANNER, ENSURING ALL PANELS ARE DRAWN TIGHT TOGETHER BEFORE ANY FASTENING OCCURS.

STEEL BANDING ON PANELS IS TO BE REMOVED AFTER PANELS HAVE BEEN PLACED IN THEIR FINAL POSITION ON THE CAPS.

ALL HOLES DRILLED IN THE FIELD WHERE SPIKES ARE USED ARE TO BE 1/16" SMALLER THAN SPIKE SIZE.

ALL HOLES DRILLED FOR BOLTS ARE TO BE 1/16" LARGER THAN BOLT SIZE.

HOLES DRILLED FOR 3/4" LAG BOLTS ARE TO BE 9/16" IN DIAMETER FOR THE THREADED PORTION OF THE BOLT AND 13/16" FOR THE SHANK.

ANY NUT OR MACHINE BOLT HEAD IN DIRECT CONTACT WITH TIMBER TO HAVE ONE PLATE WASHER BETWEEN NUT & TIMBER, OR BOLT HEAD & TIMBER.

ANY NUT OR MACHINE BOLT HEAD IN DIRECT CONTACT WITH STEEL TO HAVE ONE CUT WASHER BETWEEN NUT & STEEL, OR BOLT HEAD & STEEL.

SET THREADS ON ALL BOLTS AT NUT WITH A CENTER PUNCH AFTER TIGHTENING.

ABUTMENTS TO BE BACKFILLED WITH A CLEAN GRANULAR FILL.

ALL TIMBER CUT OR DRILLED IN THE FIELD SHALL BE TREATED WITH AN APPROVED PRESERVATIVE.

CONSTRUCTION REQUIREMENTS SHALL CONFORM TO STATE SPECIFICATIONS.

ENGINEER'S SIGNATURE AND SEAL ARE TO ASSUME DESIGN RESPONSIBILITY FOR THE TIMBER BRIDGE AS SUPPLIED & DRAWN BY WHEELER LUMBER, LLC, INDEPENDENT OF ITS FINAL POSITION. THIS DESIGN RESPONSIBILITY IS LIMITED TO THE TIMBER BRIDGE AND DOES NOT INCLUDE ANY DESIGN RESPONSIBILITY PERTAINING TO, BUT NOT LIMITED TO, ROADWAY GEOMETRICS, BRIDGE POSITIONING, HYDRAULIC DESIGN, SCOUR ANALYSIS, PERMITTING PROCEDURES, ERECTION, UTILITY FACILITIES, SOIL CONDITIONS, SUBSURFACE PILE DESIGN (INCLUDING PILE LENGTHS), ETC.

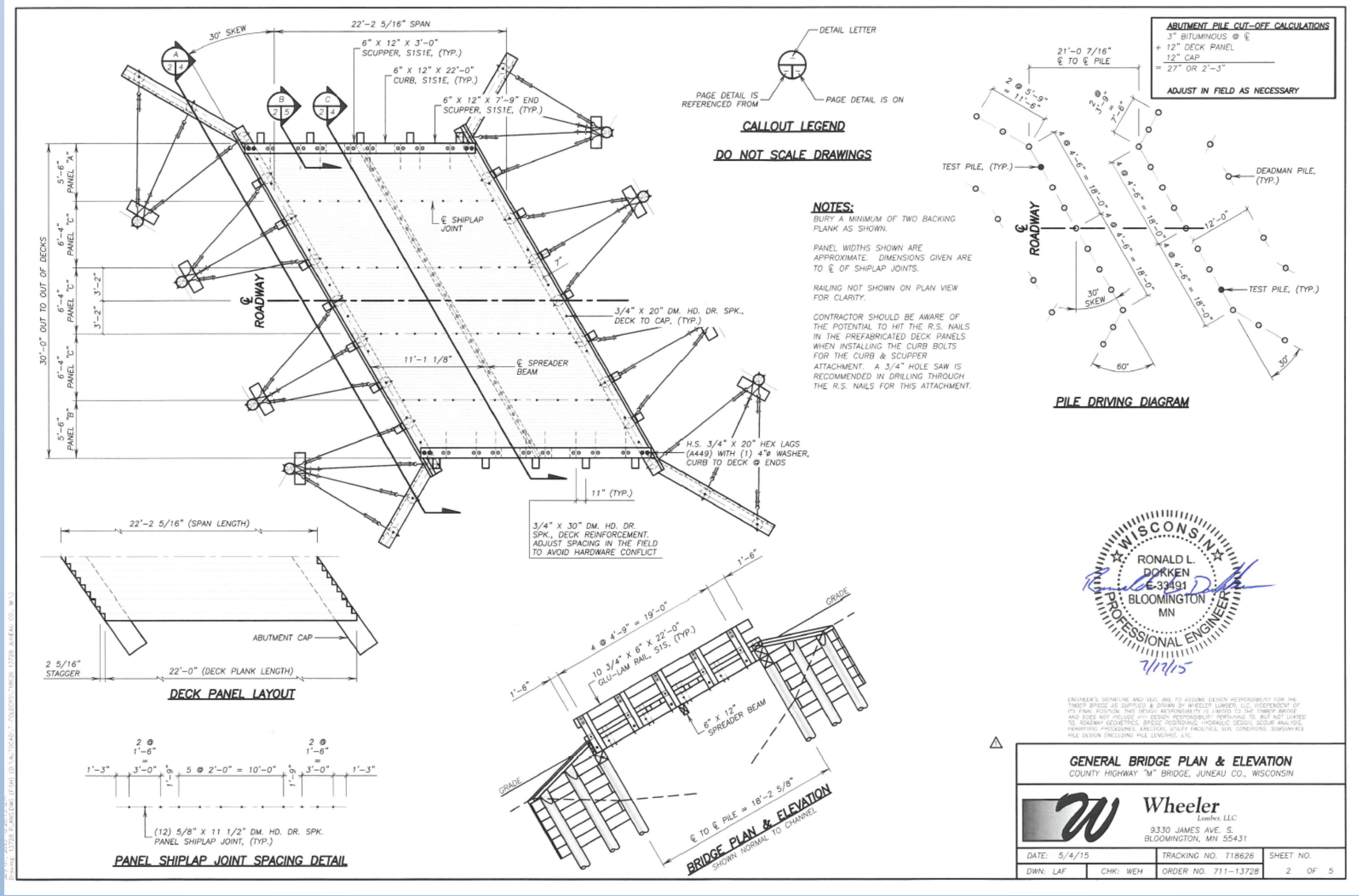
COVER SHEET & SPECIFICATIONS

22'–0" TREATED TIMBER SPAN
28'–1" CLEAR ROADWAY
COUNTY HIGHWAY "M" BRIDGE
JUNEAU COUNTY, WISCONSIN
PL–1 RAIL SYSTEM/30° R.H.F. SKEW

Wheeler Lumber, LLC
9330 JAMES AVE. S.
BLOOMINGTON, MN 55431

DATE: 5/4/15		TRACKING NO. T18626	SHEET NO.
DWN: LAF	CHK: WEH	ORDER NO. 711–13728	1 OF 5

Skewed Abutments



Juneau County, WI - CTH M

Huston Twp – GRS Abutment

GRS Abutment – FHWA Design Guide

Bridge Seat - Concrete Sill w/ Timber Sleeper

Deck Panel Installation

Panel on Timber Sleeper

- Panel spiked to sleeper
- Panel handled once
- Rail posts & curbs attached prior to setting

Final Grading

- Approach fill placed directly against superstructure
- No allowance for thermal expansion required

Dane County, WI – CTH Z

Existing Concrete Abutments

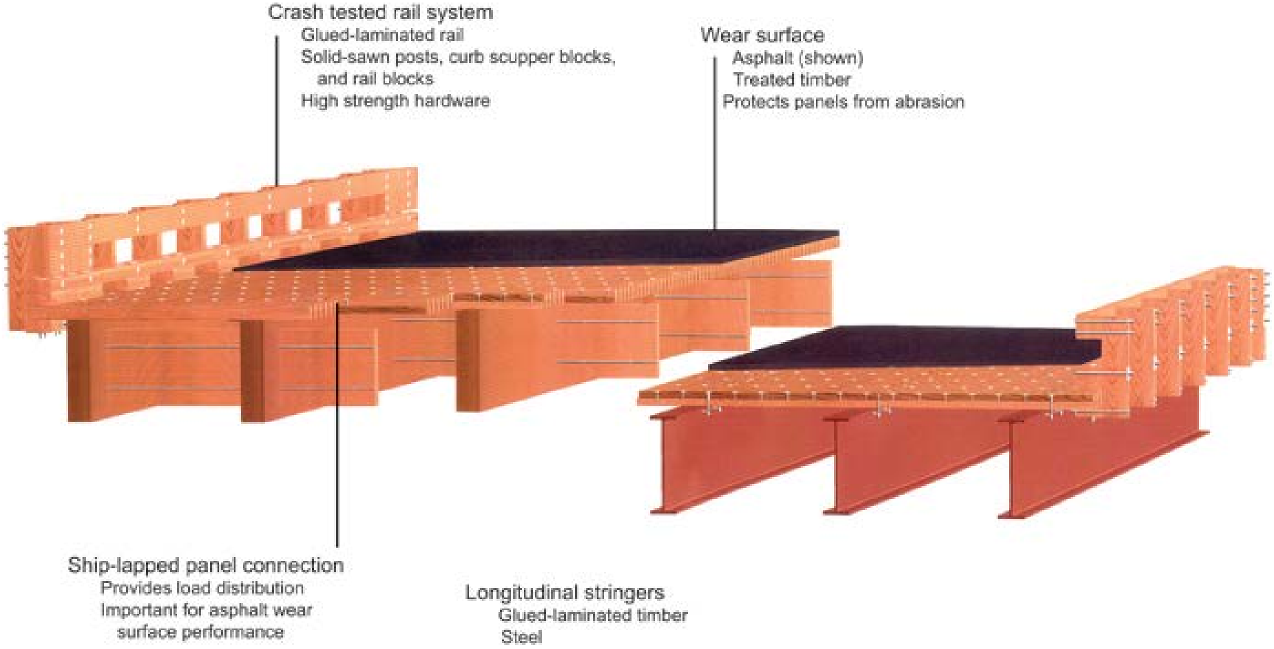
Five Panels – Set in 1 Day

Dodge County, MN

Deck Replaced in 5 Days

Divide County, ND

Stringer Vehicle Bridges



Glulam Stringer

Steel Stringer

Steel Stringer w/ Timber Abutments

Steel Stringer Deck Attachment

Truss Bridge Deck Replacement

SPECIFICATIONS:

GRADING
ALL DOUGLAS FIR–LARCH TO BE GRADED PER WCLIB STANDARD GRADING RULES.

MATERIALS & TREATMENT
TIMBER PRESERVATIVE TREATMENT SHALL BE IN ACCORDANCE WITH CURRENT STATE AND/OR AASHTO SPECIFICATIONS. ALL TIMBER SHALL BE COPPER NAPHTHENATE TREATED UNLESS NOTED OTHERWISE.

DECK TO BE 6" DOUGLAS FIR–LARCH, NO.1, S1S1E (5 1/2"), SMOOTH TOP

BALANCE OF TIMBER TO BE DOUGLAS FIR – LARCH, COPPER NAPHTHENATE TREATED IN ACCORDANCE WITH DESIGN REQUIREMENTS.

MISCELLANEOUS
ALL TIMBER IS ROUGH UNLESS OTHERWISE NOTED.

ALL TIMBER TO BE CUT TO EXACT LENGTH, DRESSED TO SIZE REQUIRED AND ALL PRACTICAL FRAMING TO BE DONE PRIOR TO TREATMENT.

ALL DECK PLANKS SHALL BE PREDRILLED PRIOR TO TREATMENT.

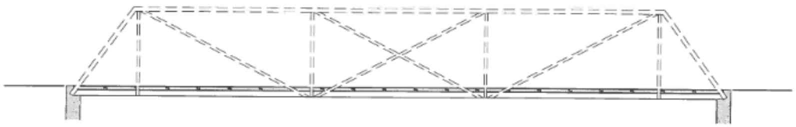
ALL PLANK FOR DECK PANELS SHALL BE PRECISION END TRIMMED TO LENGTH WITH 1/4" UNDERLENGTH & NO OVERLENGTH TOLERANCE PERMITTED.

DECK PANELS SHALL BE ASSEMBLED WITH 3/8" DIAMETER RING SHANK DOWELS. ALL DOWELS ARE TO BE SIMULTANEOUSLY DRIVEN WITH EQUAL FORCE USING A MECHANICAL PRESS THE FULL LENGTH OF THE DECK, ENSURING ALL HEADS ARE FLUSH WITH THE SURFACE OF THE TIMBER PLANK. MULTIPLE IMPACT TOOLS ARE NOT TO BE USED TO SET DOWELS BECAUSE OF POTENTIAL FOR WOOD FIBER RUPTURE.

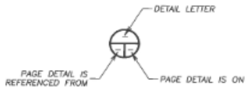
DECK PANELS WILL BE DELIVERED TO JOBSITE AFTER BEING FULLY ASSEMBLED AT FABRICATION PLANT.

ALL HARDWARE TO MEET ASTM A307–97 GALVANIZED TO A153. ALL HIGH STRENGTH HARDWARE TO MEET ASTM A325 OR A449 GALVANIZED TO A153. ALL STRUCTURAL STEEL TO MEET ASTM A36, GALVANIZED TO A123.

EMMONS COUNTY, NORTH DAKOTA
EMMONS TRUSS BRIDGE
TIMBER TRANSVERSE VEHICLE DECK



SUPERSTRUCTURE ELEVATION



CALLOUT LEGEND

DO NOT SCALE DRAWINGS

PLAN SHEET INDEX

SHEET	DESCRIPTION
1	COVER SHEET & SPECIFICATIONS
2	GENERAL SUPERSTRUCTURE PLAN & ELEVATION
3	SECTION THRU & DETAILS

DECK DESIGN DATA

TIMBER TRANSVERSE DECK IS DESIGNED TO AASHTO HL–93 VEHICLE LOAD & 90 LB. PEDESTRIAN LOAD

REVISION	DESCRIPTION	DATE	INITIALS
1			
2			
3			

CONSTRUCTION NOTES:

STEEL BEAM SPANS: PANEL "A" IS PLACED IN ITS FINAL POSITION ON THE BEAMS. NEXT DRILL 13/16"ø HOLES THRU THE PANEL AND FASTEN DECK TO BEAMS WITH 3/4"ø DM. HD. BOLTS & HCP–15 BRIDGE TIE ANCHORS, NEXT PLACE THE NEXT PANEL "C" SO THAT ITS UPPER SPLICE BLOCK IS DIRECTLY OVER THE LOWER SPLICE BLOCK ON THE PREVIOUS PANEL "A" AND DRAW TIGHT TOGETHER. THEN DRILL THE 9/16" DIA. HOLES THRU LOWER SPLICE BLOCK AND DRIVE THE 5/8" DM. HD. DR. SPIKES FOR THE SHIPLAP JOINTS AT LOCATIONS SHOWN. AGAIN, DRILL 13/16"ø HOLES THRU THE PANELS AND INSTALL THE 3/4"ø DM. HD. BOLTS & HCP–15 BRIDGE TIE ANCHORS. THEREAFTER, SUCCESSIVELY PLACE THE REMAINING PANEL "C'S" & "B" FOR THE STEEL BEAM CONNECTIONS IN THE SAME MANNER, ENSURING ALL PANELS ARE DRAWN TIGHT TOGETHER BEFORE ANY FASTENING OCCURS.

STEEL BANDING ON PANELS IS TO BE REMOVED AFTER PANELS HAVE BEEN PLACED IN THEIR FINAL POSITION ON THE BEAMS.

ALL HOLES DRILLED IN FIELD WHERE SPIKES ARE USED ARE TO BE 1/16" SMALLER THAN SPIKE SIZE.

HOLES DRILLED FOR BOLTS ARE TO BE 1/16" LARGER THAN BOLT SIZE.

HOLES DRILLED FOR 3/4" LAG BOLTS ARE TO BE 9/16" IN DIAMETER FOR THE THREADED PORTION OF THE BOLT AND 13/16" FOR THE SHANK.

ANY NUT OR MACHINE BOLT HEAD IN DIRECT CONTACT WITH TIMBER TO HAVE ONE PLATE WASHER BETWEEN NUT & TIMBER, OR BOLT HEAD & TIMBER.

ANY NUT OR MACHINE BOLT HEAD IN DIRECT CONTACT WITH STEEL TO HAVE ONE CUT WASHER BETWEEN NUT & STEEL, OR BOLT HEAD & STEEL.

ANY HEX LAG IN DIRECT CONTACT WITH TIMBER TO HAVE ONE CUT WASHER BETWEEN HEAD & TIMBER.

SET THREADS ON ALL BOLTS AT NUT WITH A CENTER PUNCH AFTER TIGHTENING.

ALL DIMENSIONS SHALL BE FIELD VERIFIED PRIOR TO FABRICATING MATERIALS.

ALL TIMBER CUT OR DRILLED IN THE FIELD SHALL BE TREATED WITH AN APPROVED PRESERVATIVE.

CONSTRUCTION REQUIREMENTS SHALL CONFORM TO STATE SPECIFICATIONS UNLESS OTHERWISE NOTED

ALTHOUGH ALL PRACTICAL PRE-FRAMING WILL BE DONE PRIOR TO TREATING, SOME CUTTING & DRILLING WILL BE REQUIRED IN THE FIELD.

REGISTERED PROFESSIONAL ENGINEER
DALE A. DRAVES
PE 4122
DATE 1-27-2020
NORTH DAKOTA

ENGINEER'S SIGNATURE AND SEAL ARE TO ASSUME DESIGN RESPONSIBILITY FOR THE TIMBER SUPERSTRUCTURE AS SUPPLIED & DRAWN BY WHEELER LUMBER, LLC. INDEPENDENT OF ITS FINAL POSITION. THIS DESIGN RESPONSIBILITY IS LIMITED TO THE TIMBER SUPERSTRUCTURE AND DOES NOT INCLUDE ANY DESIGN RESPONSIBILITY PERTAINING TO, BUT NOT LIMITED TO, ROADWAY GEOMETRICS, BRIDGE POSITIONING, HYDRAULIC DESIGN, SCOUR ANALYSIS, PERMITTING PROCEDURES, UTILITY FACILITIES, ERECTION, SOIL CONDITIONS, EXISTING SUBSTRUCTURE, ETC.

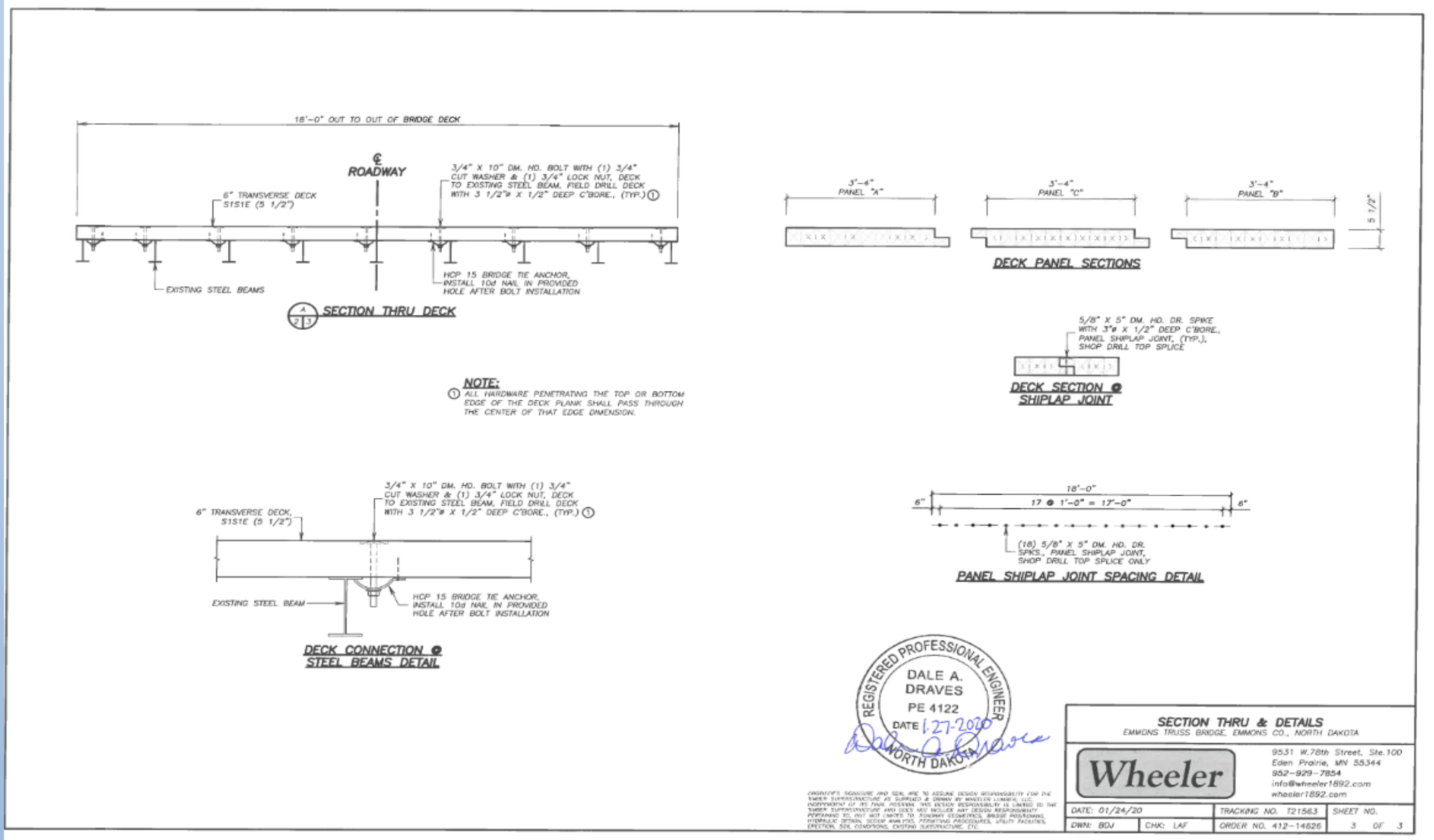
COVER SHEET & SPECIFICATIONS

77'–0" TREATED TIMBER SPAN
18'–0" OUT TO OUT OF DECKS
EMMONS TRUSS BRIDGE
EMMONS COUNTY, NORTH DAKOTA

Wheeler
9531 W.78th Street, Ste.100
Eden Prairie, MN 55344
952–929–7854
info@wheeler1892.com
wheeler1892.com

DATE: 01/24/20		TRACKING NO. T21563	SHEET NO.
DWN: BDJ	CHK: LAF	ORDER NO. 412–14626	1 OF 3

Detailed Repair Plans



Deck Replacement

Chip/Seal Wear Surface

Velva, ND

Timber Railing on Concrete

Shoulders Added

RECREATION BRIDGES

TIMBER STRINGER

Horse Thief Lake - Black Hills, SD

TIMBER PANEL-LAM

Michelson Trail - Black Hills, SD

TIMBER PRATT TRUSS

Custer State Park - Black Hills, SD

TIMBER TRUSSED ARCH

Old Fort King Trail -Tampa, FL

TIMBER COVERED BRIDGES

Lakes at Red Rock - Leesburg, VA

RAILROAD RETRO-FIT

Michelson Trail - Black Hills, SD

PLATFORMS

Bridal Veil Falls - Black Hills, SD

PRATT

WARREN

Hendricks Park – Beloit, WI

BOWSTRING

Luce Line Trail - Plymouth, MN

MODIFIED BOW

Gateway Trail – Stillwater, MN

Thank You!

Matt Gregg - Sales Engineer
612.249.0851
mgregg@wheeler1892.com

Deck Replacement

NDSU UPPER GREAT PLAINS TRANSPORTATION INSTITUTE

Bridge Substructure Repair

Bridge 201 Presentation

June 22/24, 2021

Wes Dickhut, PE

GSI

GeoStabilization International®

CONSIDER REPAIR OR REHABILITATION OF SUBSTRUCTURE

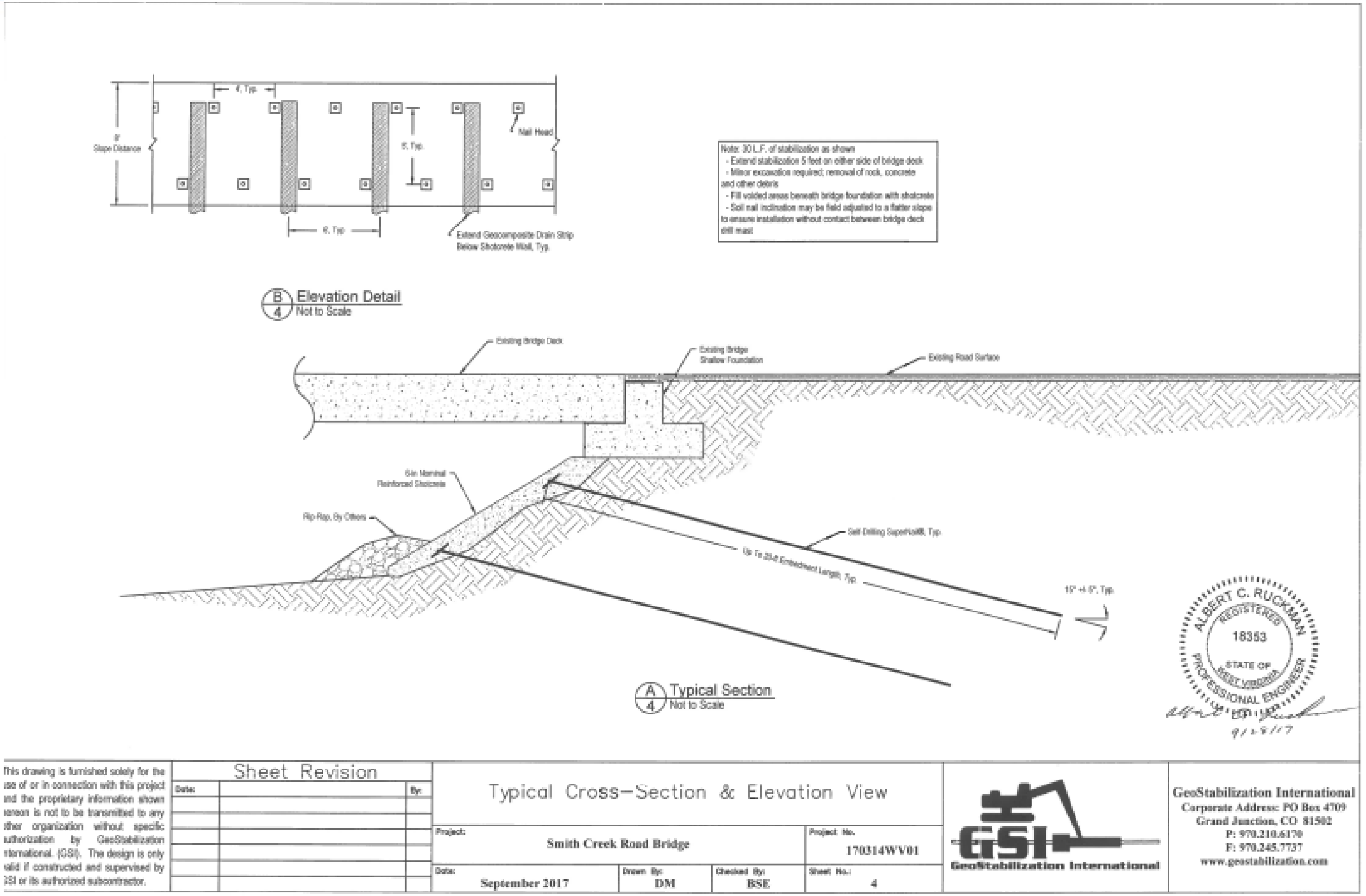
- ✓ **If a substructure unit is deficient, total bridge replacement may <u>not</u> be the only option**
  - What is the Remaining Service Life of the remainder of the bridge?
  - Can it be modeled in a **global stability analysis**?
    - What is the capacity of in-house or maintenance forces to participate in the repair?
  - What is the budget for a repair, a rehabilitation, preservation, or a replacement?
  - Can a new wingwall of abutment be built?
  - Is creating a **new load path** viable?
  - Does the superstructure need to be temporarily supported and is that viable?

Smith Creek Road Bridge – Repair of abutment undermining

Smith Creek Road Bridge – Repair of abutment undermining

Smith Creek Road Bridge – Repair of abutment undermining

Smith Creek Road Bridge – Repair of abutment undermining



Smith Creek Road Bridge – Repair of abutment undermining

KY 110 Bridge over Rough River

KY 110 Bridge over Rough River

KY 110 Bridge over Rough River

KY 110 Bridge over Rough River

Rocky Fork Road Bridge – Wingwall Stabilization

Rocky Fork Road Bridge – Wingwall Stabilization

Rocky Fork Road Bridge – Wingwall Stabilization

Vanderbilt Road Bridge – WingWall Stabilization

Vanderbilt Road Bridge – WingWall Stabilization

Vanderbilt Road Bridge – WingWall Stabilization

Cow Creek Road Bridge Reconstruction, Putnam Co., WV

Cow Creek Road Bridge Reconstruction, Putnam Co., WV

Cow Creek Road Bridge Reconstruction, Putnam Co., WV

Cow Creek Road Bridge Reconstruction, Putnam Co., WV

Cow Creek Road Bridge Reconstruction, Putnam Co., WV

Cow Creek Road Bridge Reconstruction, Putnam Co., WV

Cow Creek Road Bridge Reconstruction, Putnam Co., WV

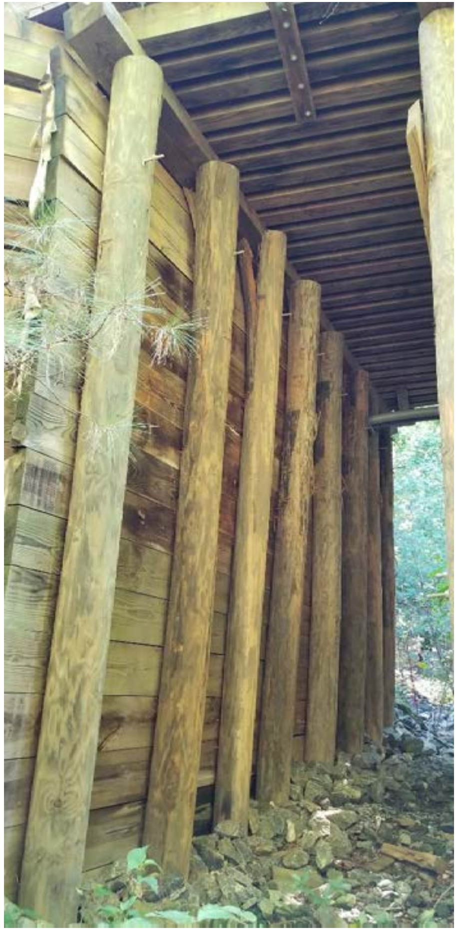
SR 129 over Raccoon Cr, Ripley Co., Indiana – Wingwall Reconstr.

SR 129 over Raccoon Cr, Ripley Co., Indiana – Wingwall Reconstr.

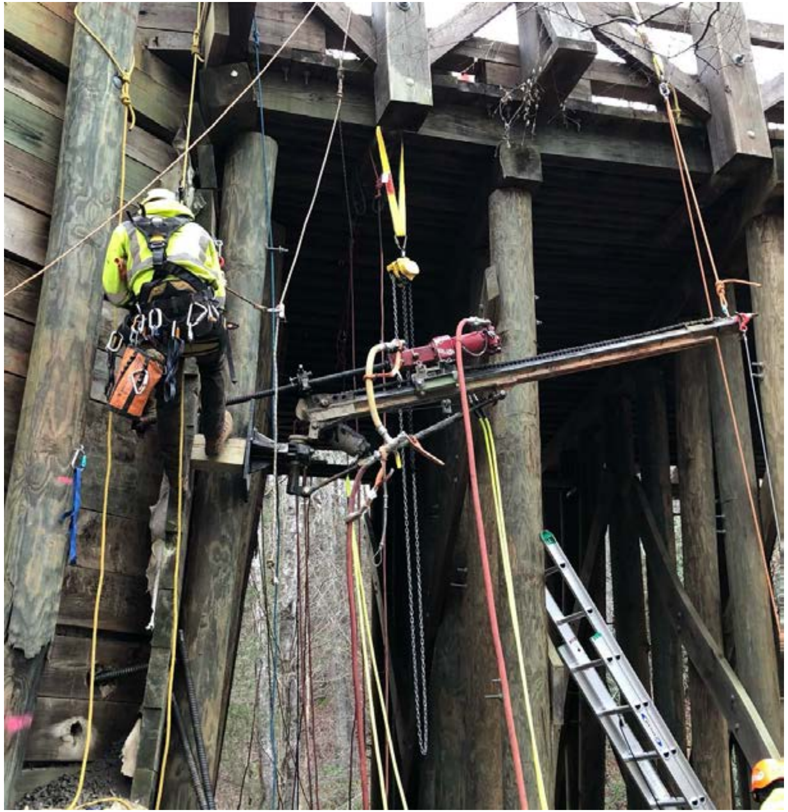
SR 129 over Raccoon Cr, Ripley Co., Indiana – Wingwall Reconstr.

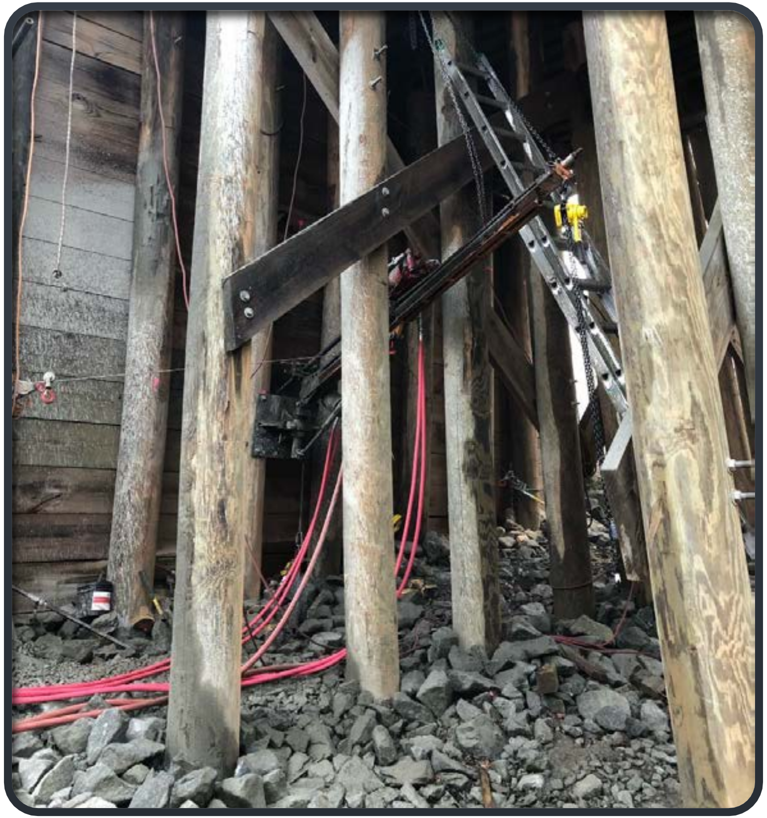
Private Bridge, NC – Timber Abutment

Private Bridge, NC – Timber Abutment



Private Bridge, NC – Timber Abutment





Private Bridge, NC – Timber Abutment

I-96 over Deer Creek, Michigan – Culvert Distress

I-96 over Deer Creek, Michigan – Culvert Distress

Railroad Bridge – North Dakota

Railroad Bridge – North Dakota

Railroad Bridge – North Dakota

THANK YOU

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Project Development Engineer
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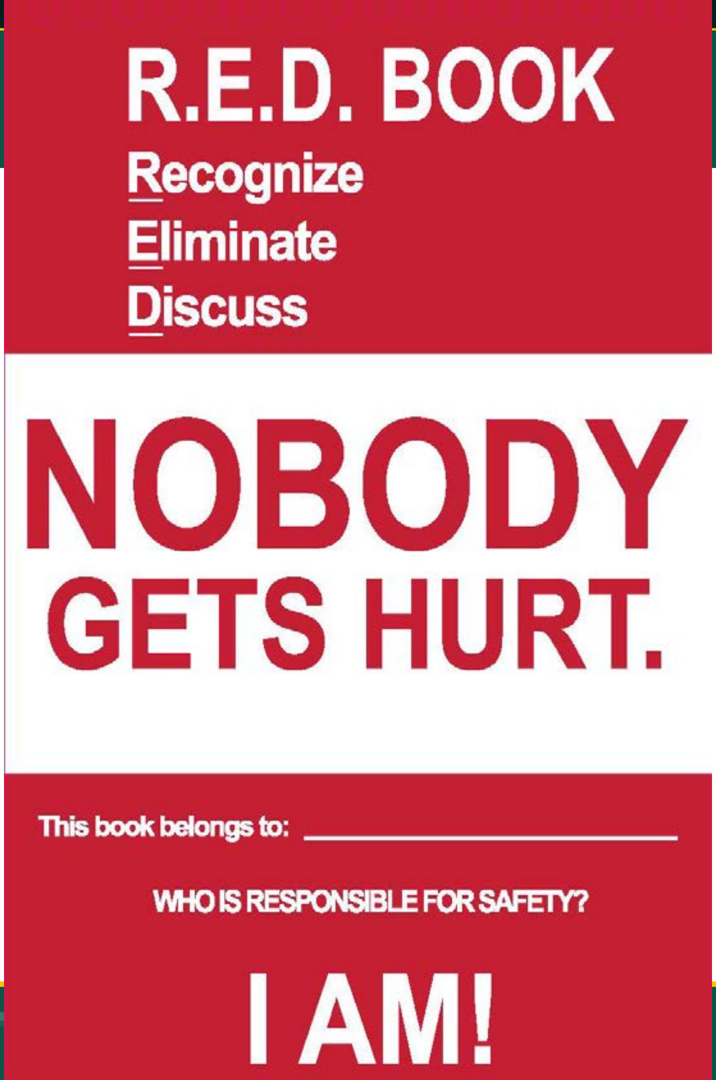
OVERSIZE LOAD


R.E.D. BOOK
Recognize
Eliminate
Discuss
NOBODY
GETS HURT.
This book belongs to: ____________________
WHO IS RESPONSIBLE FOR SAFETY?
I AM!


Think Safe
Act Safe
Be Safe


MEN
NOBLE
R.E.D. BOOK
Recognize
Eliminate
Discuss
NOBODY
GETS HURT.


SEE
SOMETHING
SAY
SOMETHING
HELP IMPROVE
ROAD SAFETY

VISION
ZERO

Zero fatalities. Zero excuses.

INSTRUCTIONS FOR POSTING WEIGHT LIMITS
ON
COUNTY BRIDGES

Priority I — Post all unposted bridges as soon as possible (data from last inventory provided).

Priority II — Update signs as conditions or re-rating change present weight limits.

NOTE: All bridges should be posted using one of the following sign types. Either the inventory ton or the operating ton is the maximum posting to be used. The choice of which one is left up to your discretion at each bridge site.

A. The new rating is in the HS format (e.g. the first digit is a 2). If the last two digits are less than 36 and more than 21, then post by using sign R12-1.

Examples: Where range is above 21 or less than 36

WEIGHT LIMIT 22 TONS	WEIGHT LIMIT 22 TONS	WEIGHT LIMIT 22 TONS	WEIGHT LIMIT 22 TONS

(all are R12-1 24"x30")

B. The new rating is in the HS format (e.g. the first digit is a 2). If the last two digits are 21 or less, then post by using sign R21-4.

Examples: Where range is 21 or less

WEIGHT LIMIT 2 TONS PER AXLE 5 TONS GROSS	WEIGHT LIMIT 5 TONS PER AXLE 12 TONS GROSS	WEIGHT LIMIT 9 TONS PER AXLE 21 TONS GROSS
[0.444X5=2 (max/axle)]	[0.444X12=5 (max/axle)]	[0.444x21=9 (max/axle)]

(All are R12-4 36"x24")

https://www.facebook.com/ndltap/videos/3
372964148000

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FULLER RANCH
FIRE EXTINGUISHER INSIDE

Williams County Action Plan 2016

Major Structures

– Provide an evaluation/interpretation based on NDDOT FHWA/NBIS and field visit for each major structure

Minor Bridges

– Perform a full FHWA/NBIS inspection and provide an evaluation/interpretation for each minor bridge

Scour and Channel Profile

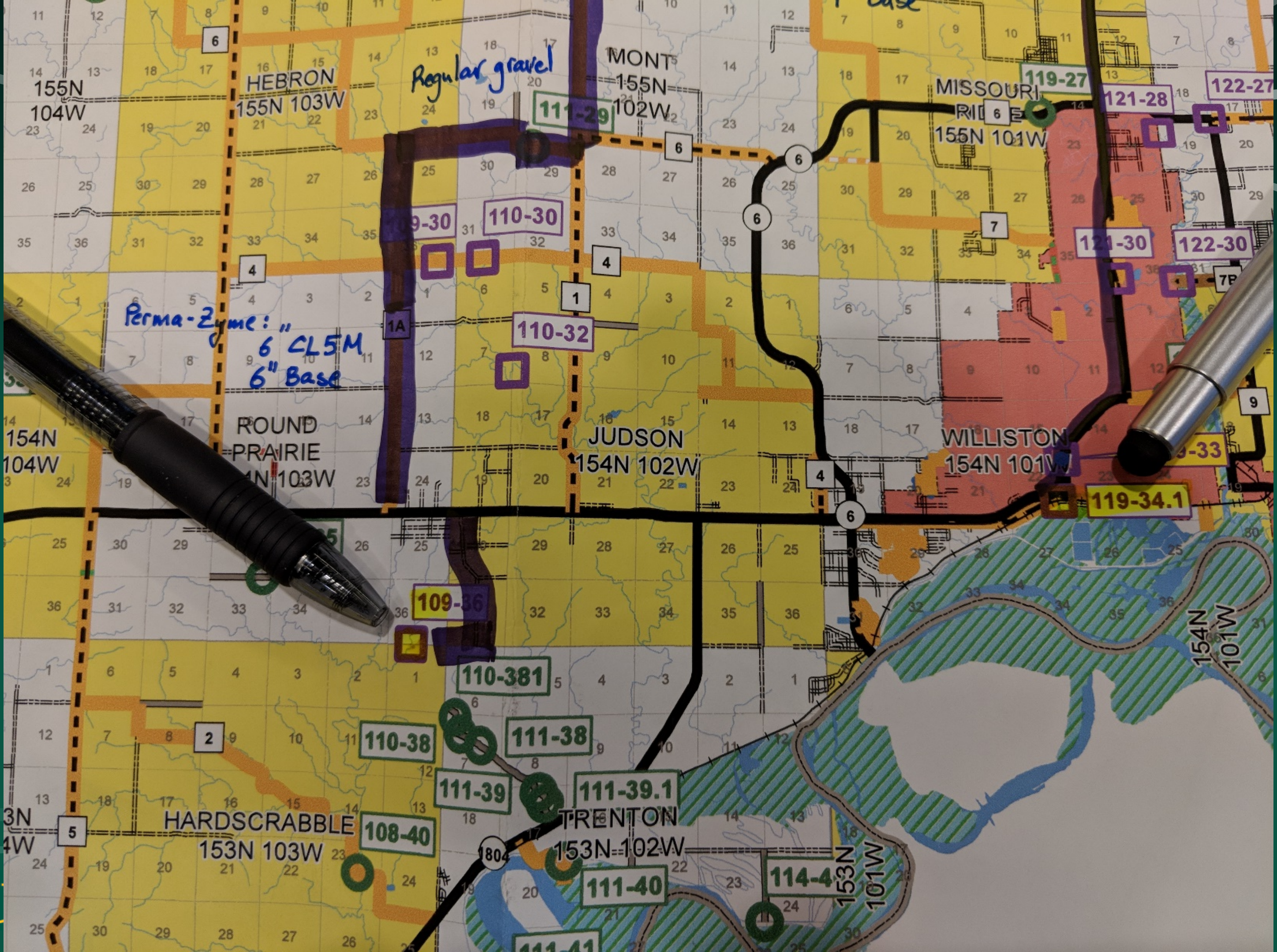
– Perform a scour and channel profile evaluation, completing NDDOT Form SFN 50344) for all major and minor bridges crossing water

Culvert Evaluation

– Perform a full evaluation on select minor culverts with significant concerns and prepare a report with findings, recommendations, and costs estimates

GIS Database


EXIT
Code Alert 3 Inspections
FORSGREN
EXIT


Regular gravel
Perma-Zyme: 6" CL5M 6" Base
HEBRON 155N 103W
MONT 155N 102W
MISSOURI RIDGE 155N 101W
155N 104W
ROUND PRAIRIE
JUDSON 154N 102W
WILLISTON 154N 101W
154N 104W
HARDSCRABBLE 153N 103W
TRENTON 153N 102W
153N 101W
154N 101W
111-29
110-30
110-32
109-36
110-381
110-38
111-38
111-39
111-39.1
108-40
111-40
119-27
121-28
122-27
121-30
122-30
119-34.1

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WEIGHT
LIMIT
5 TON
10,000 LBS MAX
OASIS
PETROLEUM
LIGHT TRUCK
TRAFFIC ONLY

NDSU


08.11.2014

ND

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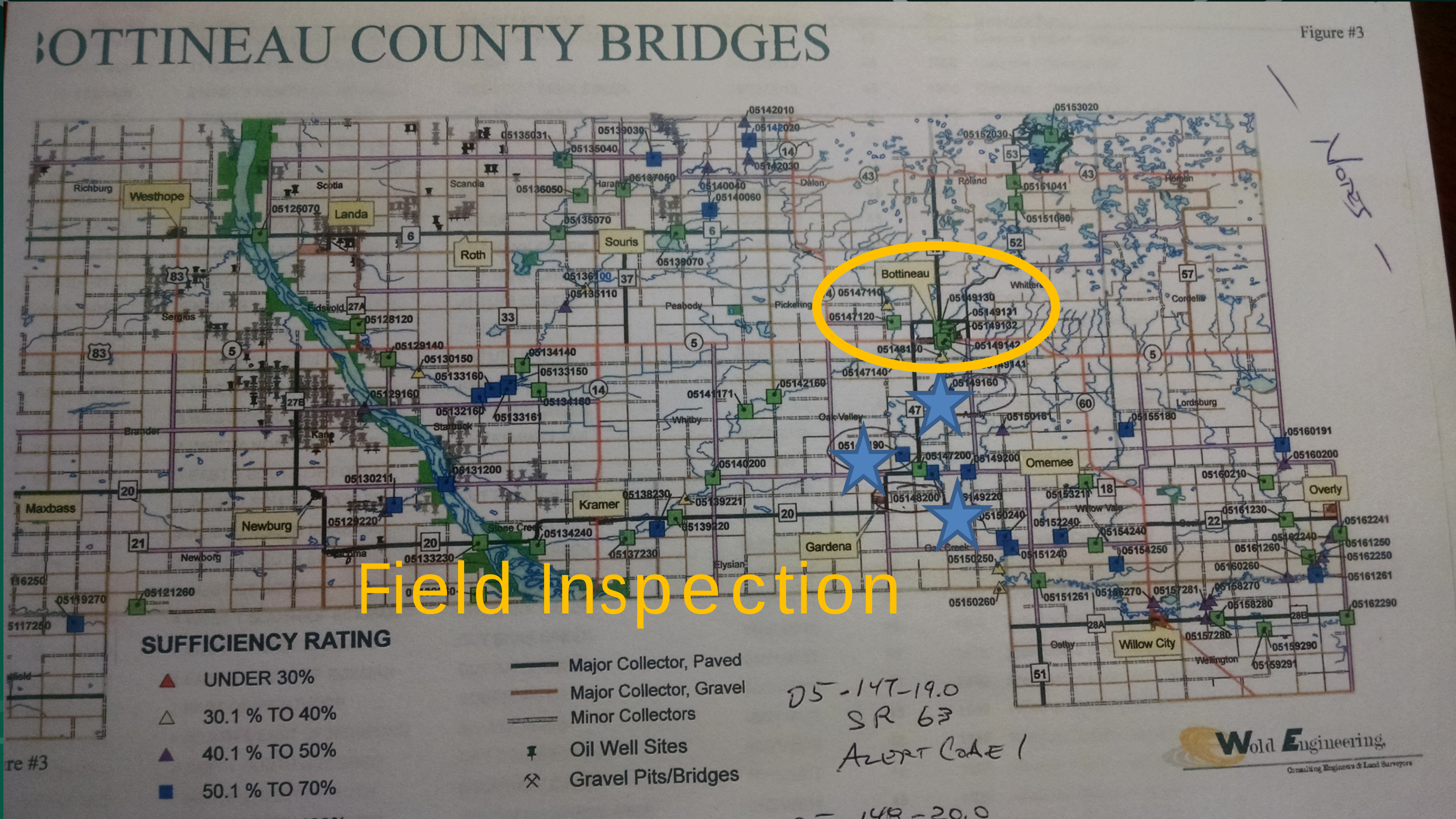
Next up:
Bridge Inspections



BOTTINEAU COUNTY BRIDGES
Figure #3
Field Inspection
Bottineau
Westhope
Landa
Roth
Souris
Maxbass
Newburg
Kramer
Gardena
Omemee
Overly
Willow City
Richburg
Scotia
Scandia
Roland
Dalen
Peabody
Pickering
Cordelia
Lordsburg
Oak Valley
Whitby
Brander
Kane
Eidsvold
Sergius
Starbuck
Stone Creek
Elysian
Willow Vale
Oak Creek
Wellington
Newborg
Antler
Souris River
SUFFICIENCY RATING
UNDER 30%
30.1 % TO 40%
40.1 % TO 50%
50.1 % TO 70%
Major Collector, Paved
Major Collector, Gravel
Minor Collectors
Oil Well Sites
Gravel Pits/Bridges
05-147-19.0
SR 63
ALERT CODE 1
Notes
Wold Engineering
Consulting Engineers & Land Surveyors



RAM
DEAD
91 St SE

Field Inspection – What did we find?

Resource List

NDDOT Design Manual – Chapter 5

NDDOT Local Government Manual

NDDOT Bridge Inspection Team

ND Township Officers Manual

State Stream Standards

North Dakota's Local Roadway Inventory

FHWA, AASHTO Joint Technical Committee on Pavements and, TRB Committee AFD10, Pavement Management Systems

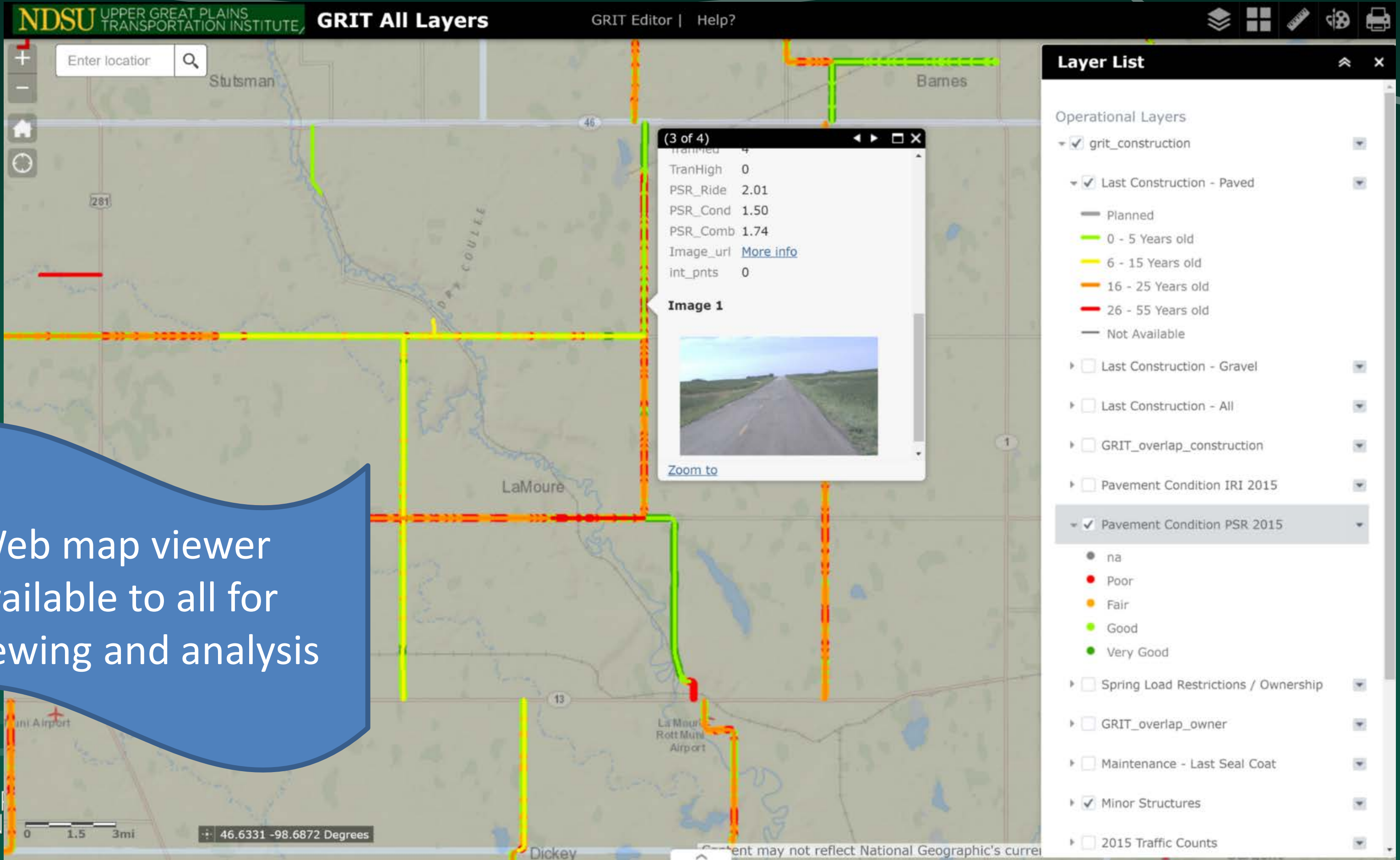
Pavement Management Quarterly Webinars

January 19, 2017

Brad Wentz, PE and Dale Heglund, PE/PLS
Upper Great Plains Transportation Institute

NDSU UPPER GREAT PLAINS TRANSPORTATION INSTITUTE

GRIT – Geographic Roadway Information Tool



Web map viewer available to all for reviewing and analysis

TRANSPORTATION LEARNING NETWORK

A partnership with MDT·NDDOT·SDDOT·WYDOT
and the Mountain-Plains Consortium Universities

Safety Inspection of In-Service Bridges - Pre-Season Tips and Advice

Presented by:

Drew Garceau, P.E., CWI, Steven Miller, P.E. &
Terry Browne, PE, CSP

COLLINS ENGINEERS INC

Our partners:

MOUNTAIN-PLAINS CONSORTIUM · MONTANA MDT DEPARTMENT OF TRANSPORTATION · NORTH Dakota | Transportation Be Legendary. · South Dakota DOT Connecting South Dakota and the Nation · WYOMING TRANSPORTATION DEPARTMENT · NDSU · UPPER GREAT PLAINS TRANSPORTATION INSTITUTE TRANSPORTATION LEARNING NETWORK

NDLTAP Resource Page

Ndltap.org
Your one stop shop for local road info

Tap into NDDOT and NDLTAP
We Want to Help!

Presentation Partners

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For North Dakota. For Local Government. For You.
www.ndirf.com

U.S. Department of Transportation
Federal Highway Administration

NORTH Dakota | Transportation
Be Legendary.™

Wheeler

TrueNorth Steel®

GSI
GeoStabilization International®
Geohazard Mitigation Experts

Better roads save lives

Together, we can do great things. Please tap into the NDLTAP and NDDOT teams. We look forward to expanding a partnership that elevates the knowledge of all those that touch our transportation network and helps all of our friends and family return home safely every day.

Respectfully,

Dale C. Heglund, NDLTAP Program Director

701-318-6893 – dale.heglund@ndsu.edu

www.ndltap.org

Information for this class was provided in part by the NDDOT, UGPTI, NDLTAP, MDOT, MnDOT and TRB.
With contributions from Nancy Huether, NDDOT, Nick West, Grand Forks County, and Andrew Wrucke, West Fargo.

Bridge 201

Devils Lake – June 22, 2021
Watford City – June 24, 2021

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Reed Oien – Steele County
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Kelly Bengtson – UGPTI/NDLTAP

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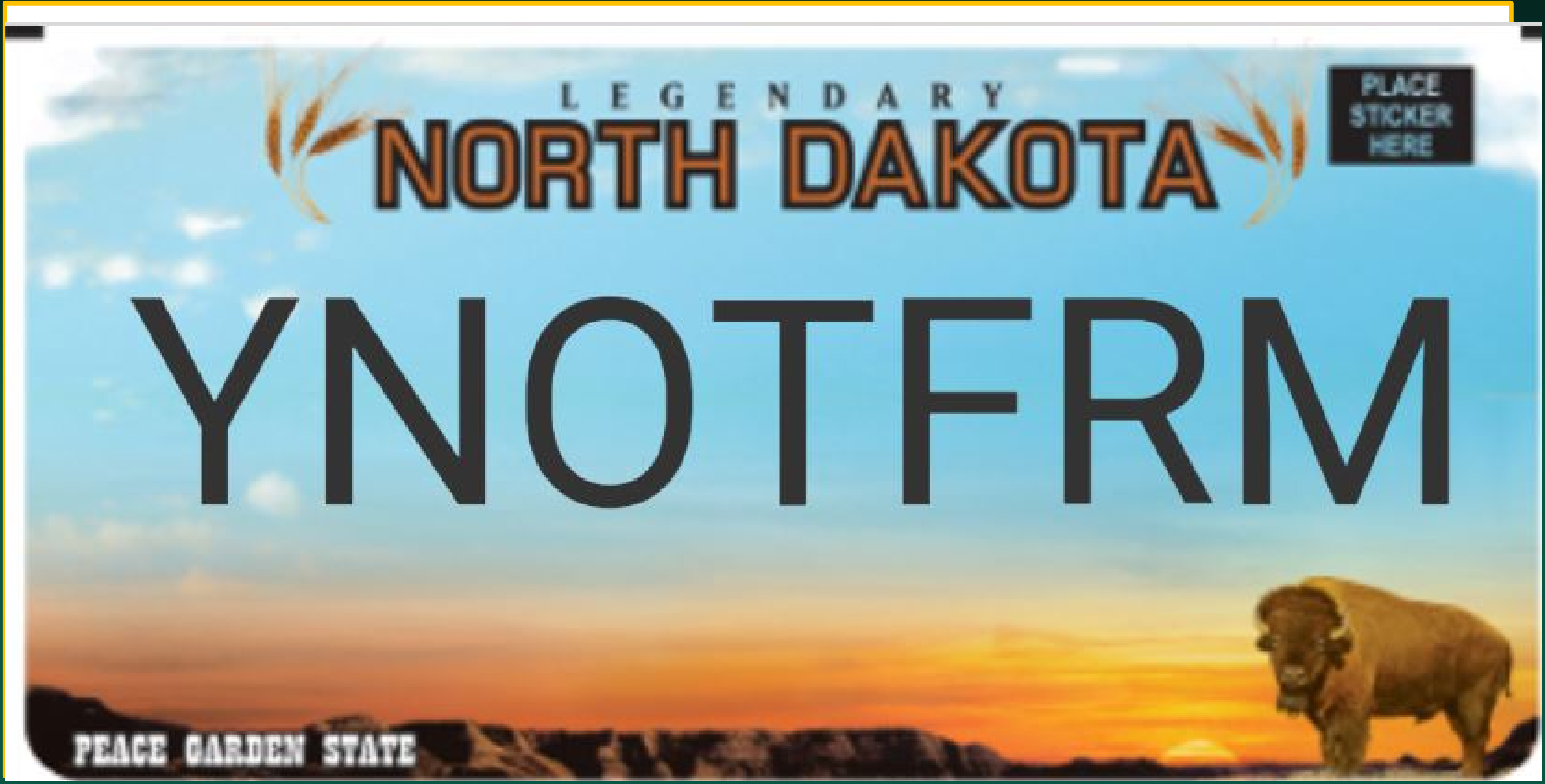
NORTH DAKOTA LOCAL TECHNICAL ASSISTANCE PROGRAM

NDSU TRANSPORTATION INSTITUTE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NORTH DAKOTA
PLACE STICKER HERE
YNOTFRM
PEACE GARDEN STATE


WELCOME TO
NORTH
Dakota
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