NDIRF

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

Bridge 101

Grand Forks, June 6, 2018
Williston, June 13, 2018

Gary L. Doerr, PE
Bridge Management Team Leader, NDDOT

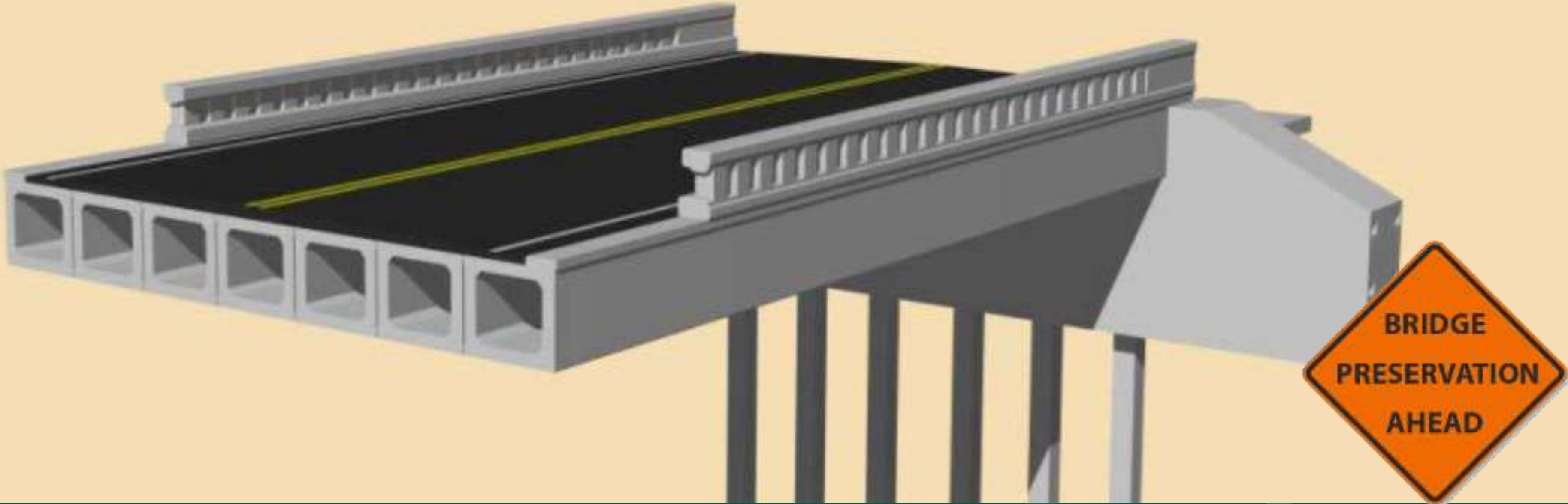
Bryon Fuchs, PE
Local Government, NDDOT

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

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

NDDOT
North Dakota Department of Transportation

What is a Bridge?



Bridges are . . .

- A Valuable and Critical Asset
  - Major Rehabilitation or Replacement is Costly
  - Detour Routes are often Long
- The Link that Connects the Roadways in our Transportation System

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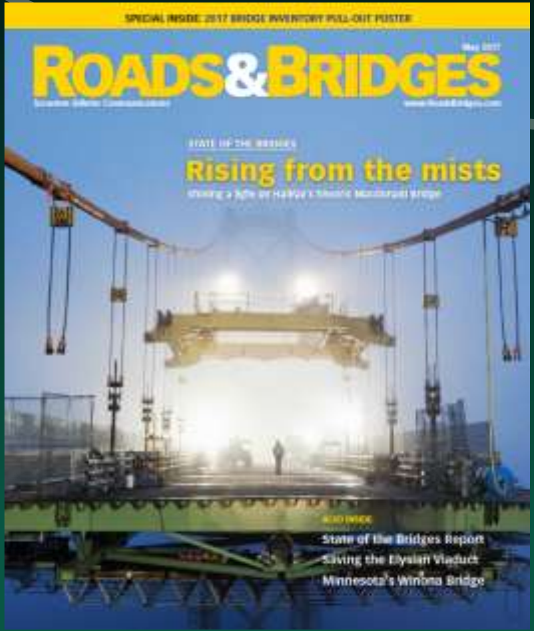
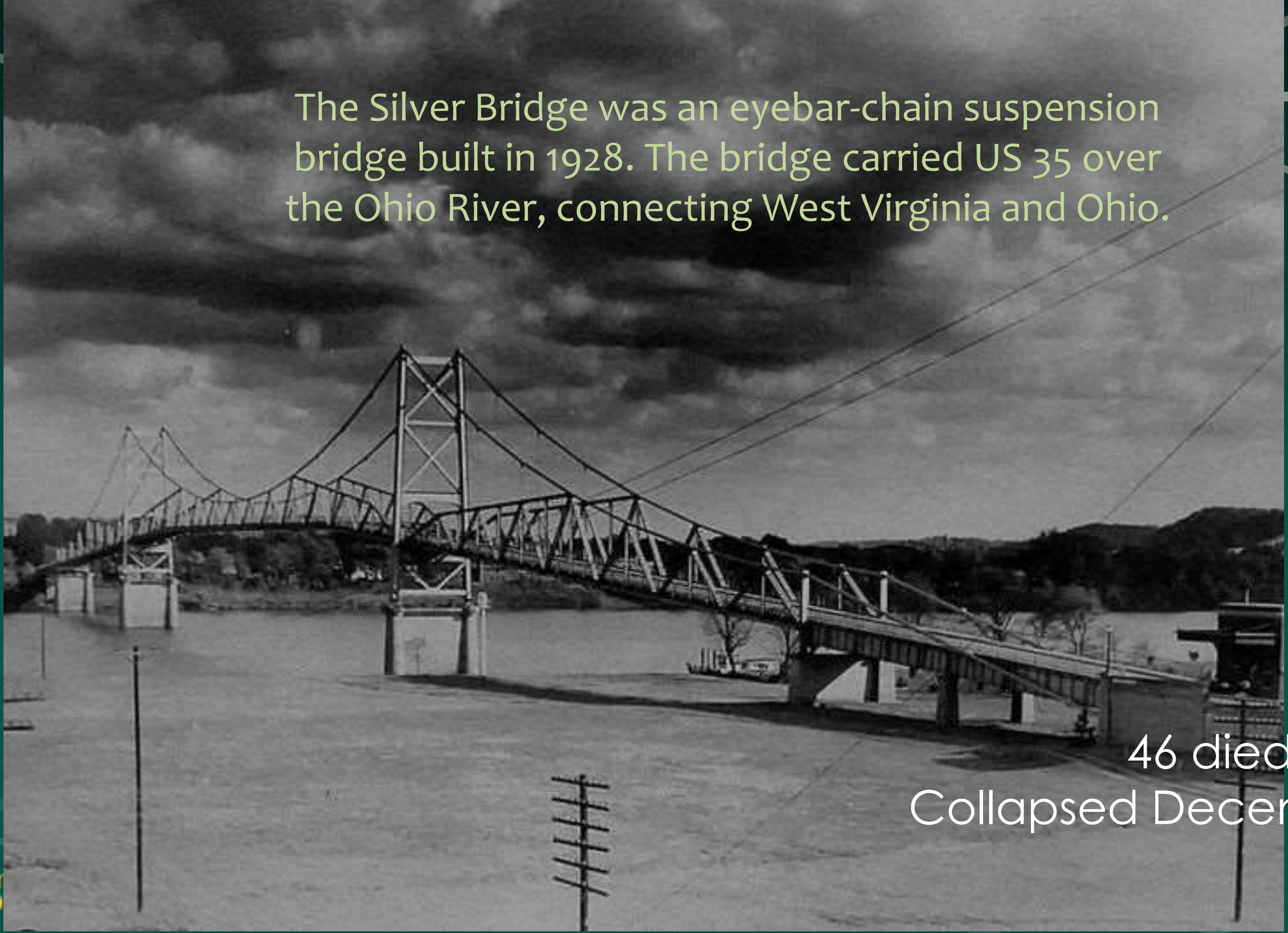


9% of Nation's 614,400 Bridges are Structurally Deficient (NBI, 2016)
(75% of those deficient bridges are on Rural Roads)



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

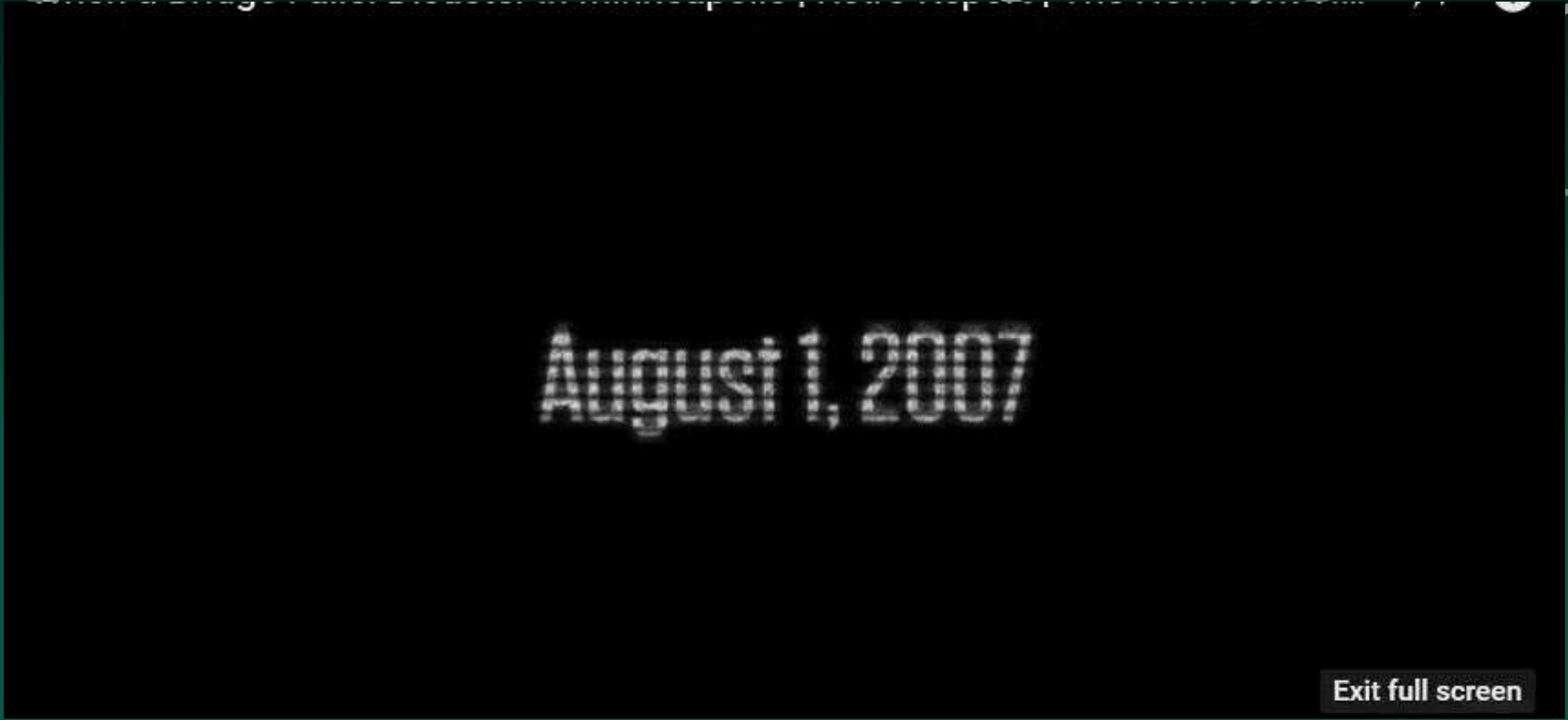
Collapsed December 1967

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

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

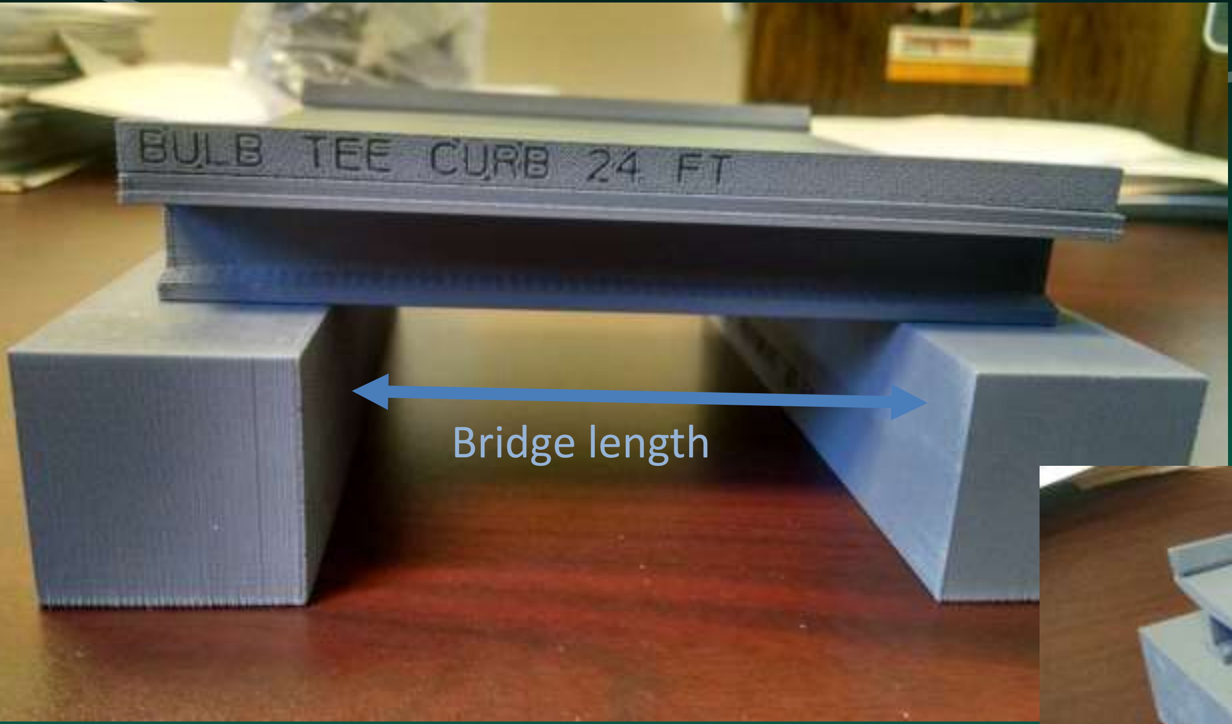
- 1968 – National bridge inspection (NBI) program initiated (requiring regular and periodic inspections)
- 1971 – National bridge inspection standards (NBIS) adopted (prescribe how, with what frequency, and by whom bridge inspections must be completed)
- 1987 – Schoharie Creek collapse (scour)
- 2007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

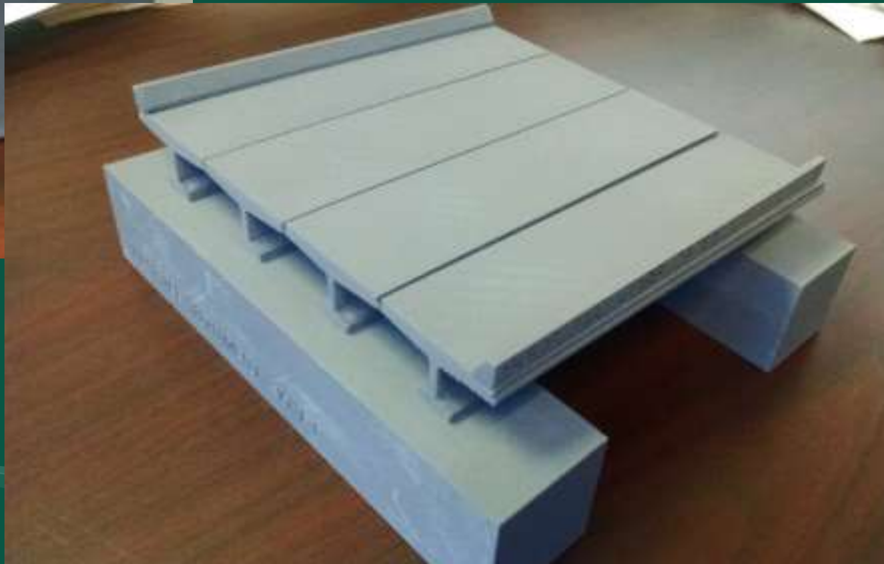
1985 – Adopted 20'+ major structures and dropped minor structure inspections

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

Bridges in North Dakota

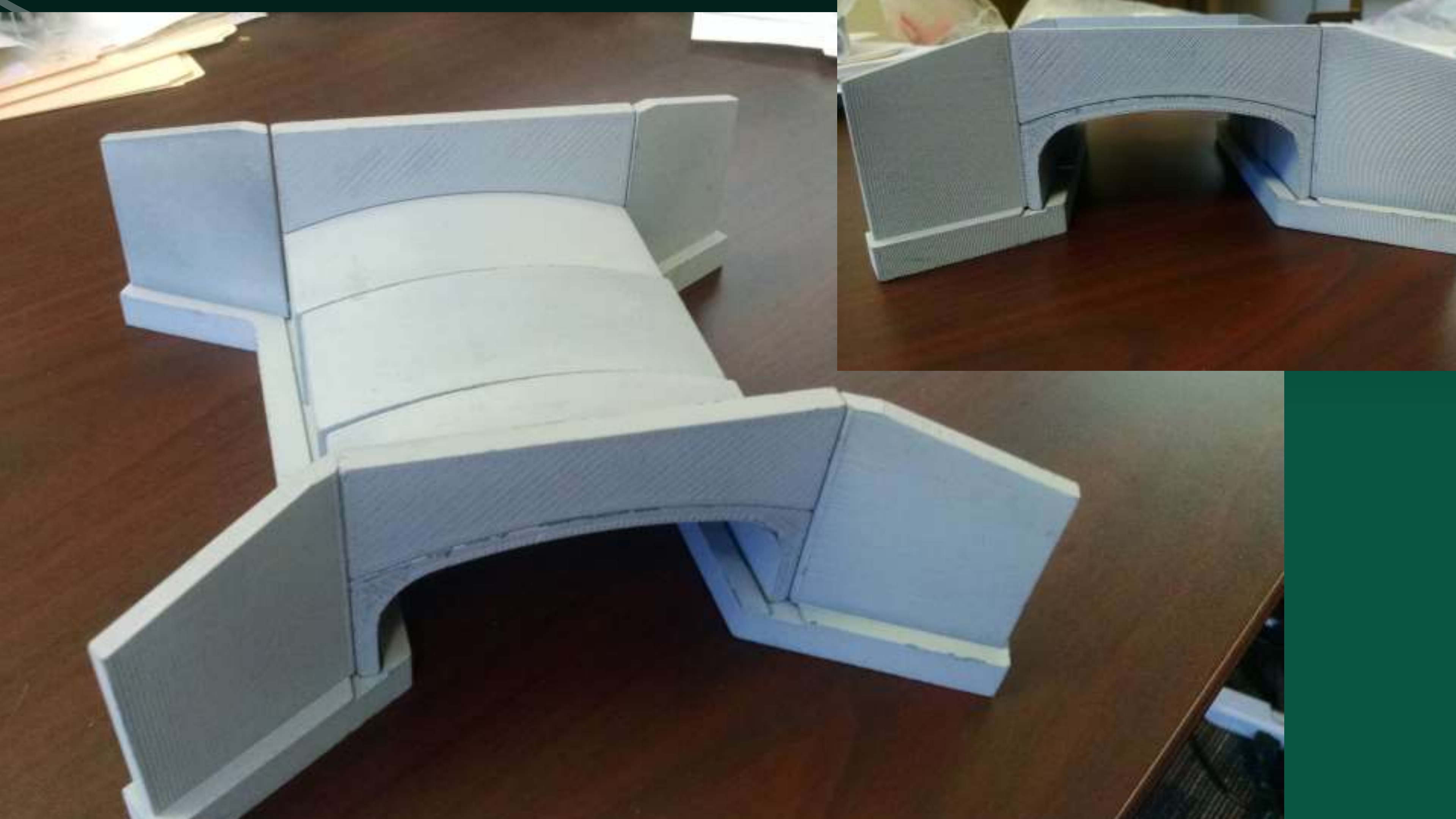
NDDOT	1,365 >=20’
City/County	3,287 >=20’
Total	4,652





NDSU UPPER GREAT PLAINS TRANSPORTATION INSTITUTE

Buried Bridges




20’ minimum
< 1/2 dia

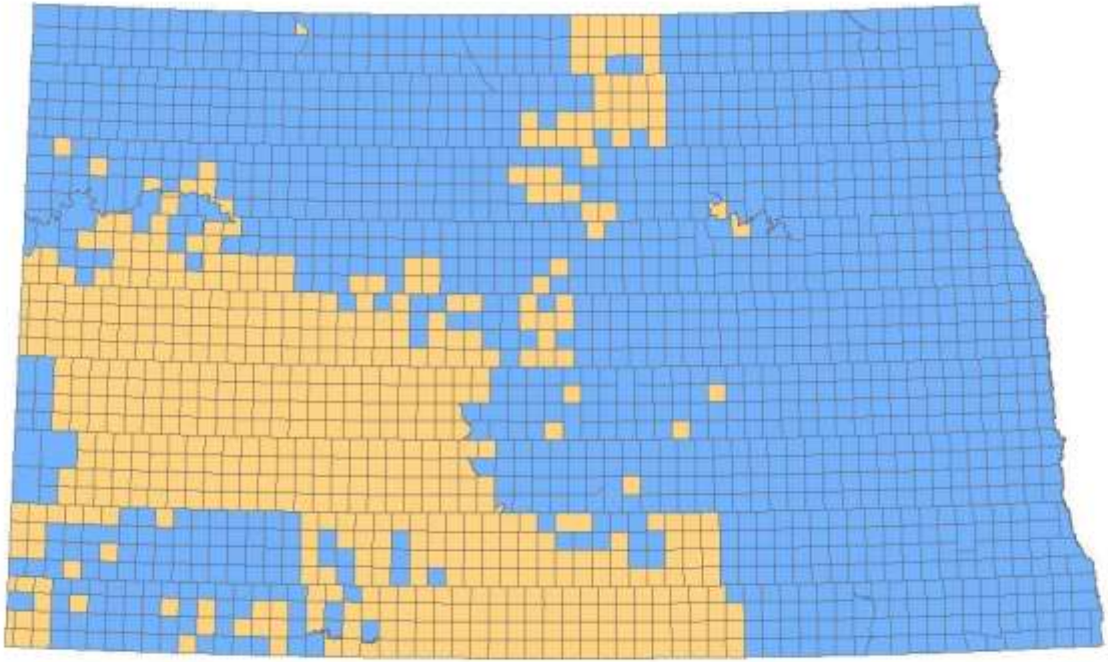
Minor Structures

Less than 20’ in length

Local Practices

Who has bridge responsibility?

Organized Townships



July 29, 2017 - Bis. Trib.

Funding remains obstacle for bridges

JOHN HAGEMAN
Forum News Service

County transportation officials say funding remains the biggest obstacle to maintaining North Dakota's bridges 10 years after a busy Minneapolis bridge plunged into the Mississippi River.

Tuesday, Aug. 1, will mark a decade since the Interstate 35W bridge colla pron the r

Fi bridg tural enth cord the A tatio sota of st

"S nece safe

But the nearly 56,000 American bridges in that category show "state and local transportation departments haven't been provided the resources to keep pace with the nation's bridge needs," ARTBA Chief Economist Alison Premo Black said earlier this year.

A Federal Highway Administration spokesman said they now use a three-tier standard instead of the structurally deficient measure. Un-

West said.

"Our funding has been very stagnant, and of course construction costs have risen," he said. "So we're doing less and less than what we were doing 10, 20 years ago."

West said they rely largely on local property taxes and state g revenues to fund bridge pr They got a "one-time shot arm" with the recent boom i revenues — the county doub its normal bridge b r thanks to state oil r tate budgets have sinc ed.

ve had bridges with to decades. And it seem one and another one list," West said. "One r, if you want these ve need money."

dent Donald Trum l an ambitious infrastr m, but the New York d this week that those efforts alled behind other priorities, such as the federal budget and immigration.

But state officials are confident in the condition of North Dakota's bridges. Every public bridge in the state is inspected at least every two years, said Jon Ketterling, the bridge

mediate funding challenges, "that could change in the next 10 years."

Incoming North Dakota DOT Director Tom Sorel was tapped to lead the Minnesota DOT just months after the I-35W bridge collapse. In an interview this week, he said bridge safety will be a priority in his new job.

"Having gone through the bridge

said Frank project engineer at the Cass County Highway Department. "The next couple of years could be a little tighter."

> Fifteen percent of the 4,400 bridges in North Dakota are "structurally deficient," which is seventh-highest in the country, according to a February report from the American Road and Transportation Builders Association. Minne-

> Of the 1,135 bridges on the state highway system, only 23 are structurally deficient, down from 32 in 2007, Ketterling said. That means the vast majority of the deficient bridges are on the urban and county systems, and most county bridges are on "low-volume roads," DOT

Bridge Cost Estimates

New bridge - $200/sf

Deck replacement - $75/sf

Treat deck with silane - $0.25/sf

Crack seal deck - $0.10/sf

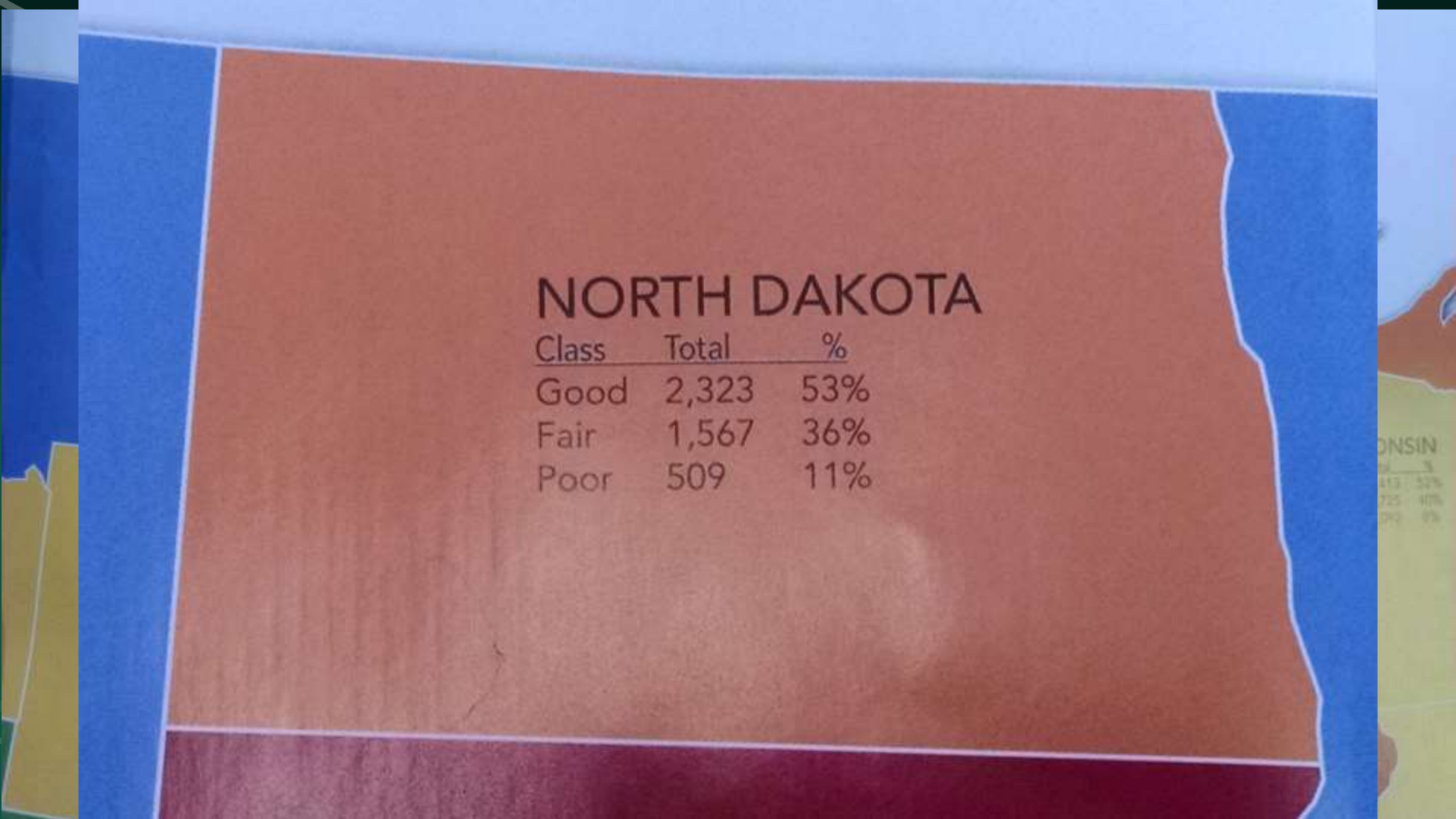
Williams County Bridge Value

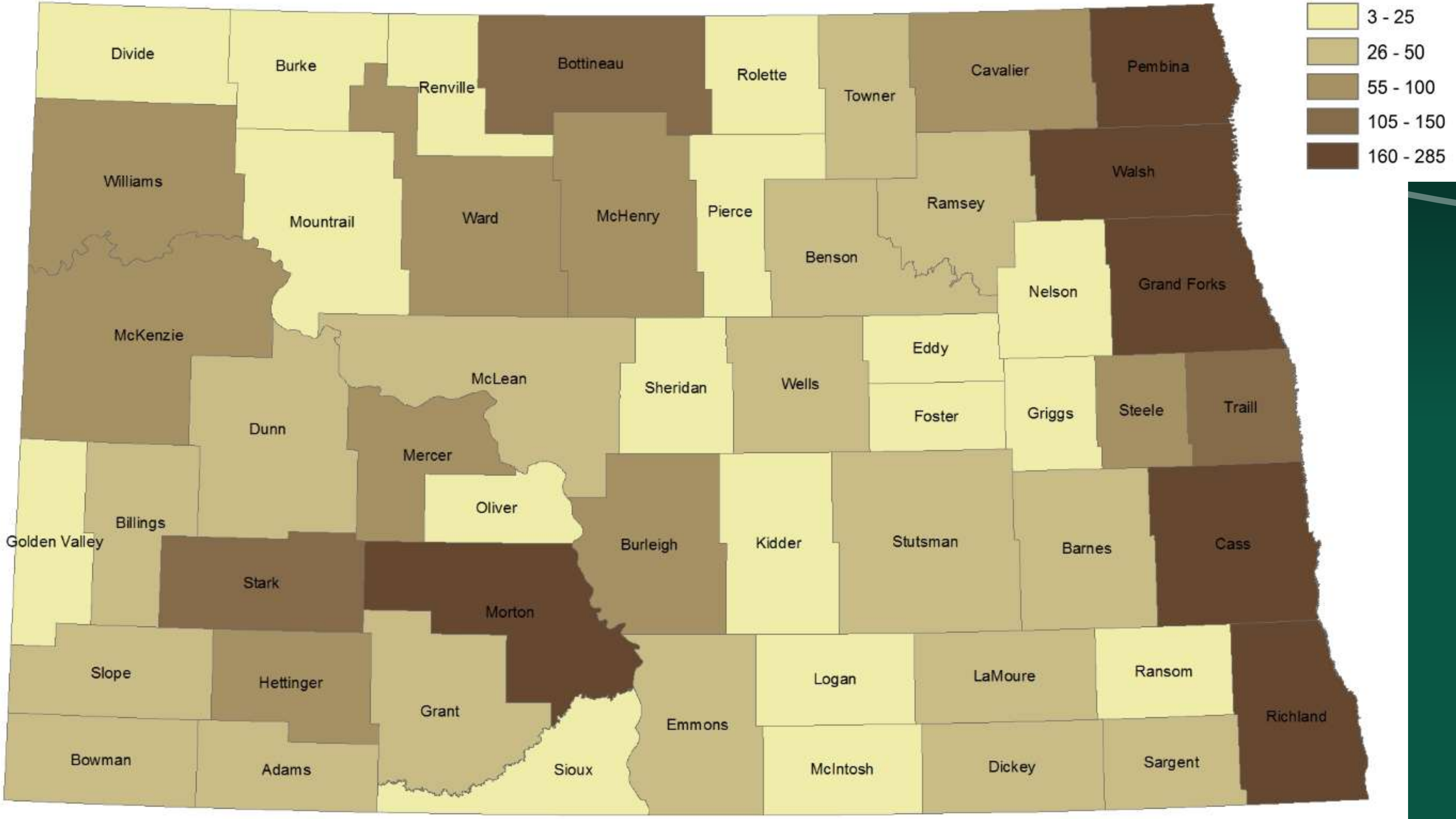
67 Bridges - $35 Million

Grand Forks County Bridge Value

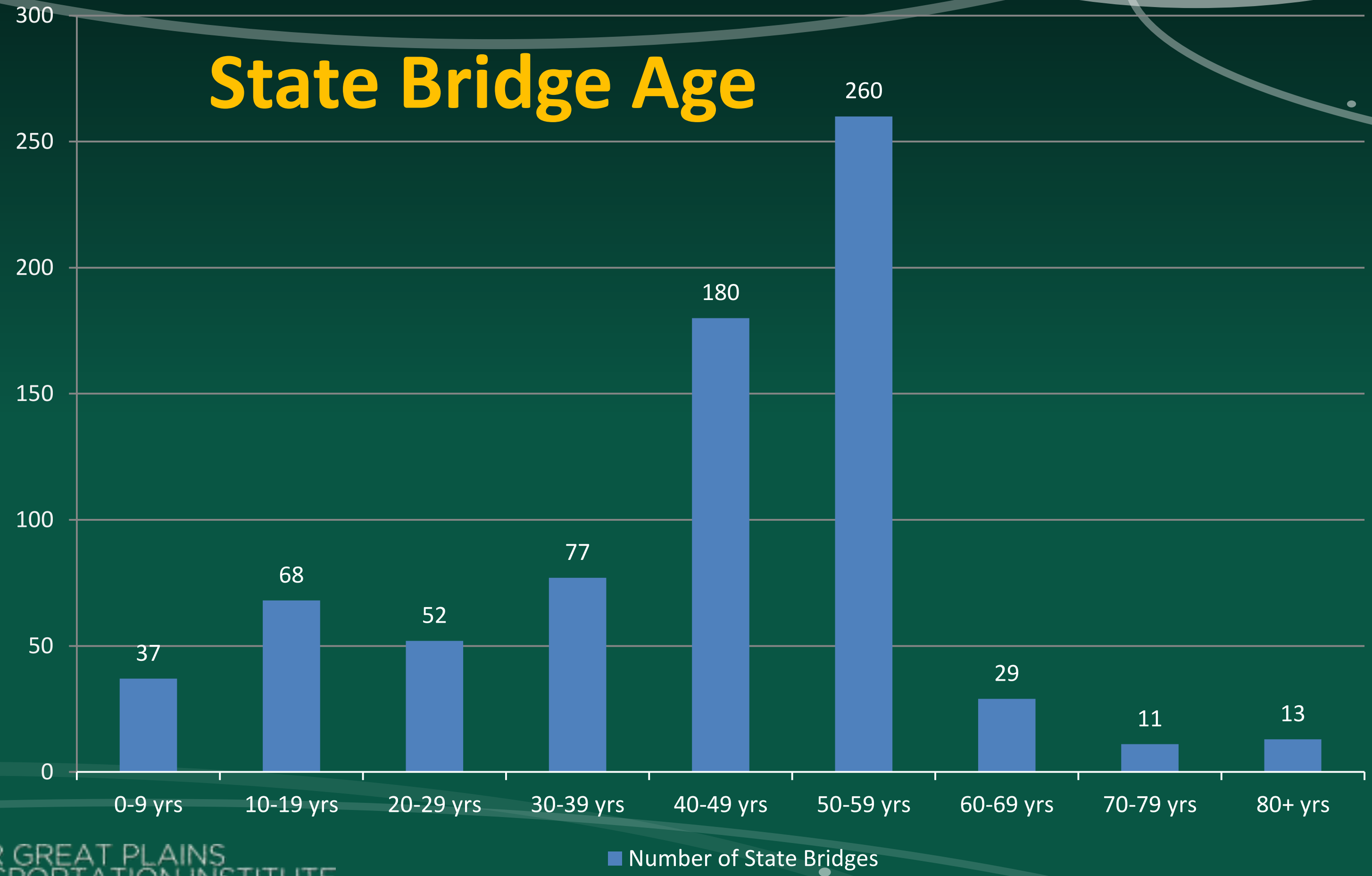
285 Bridges - $169 Million

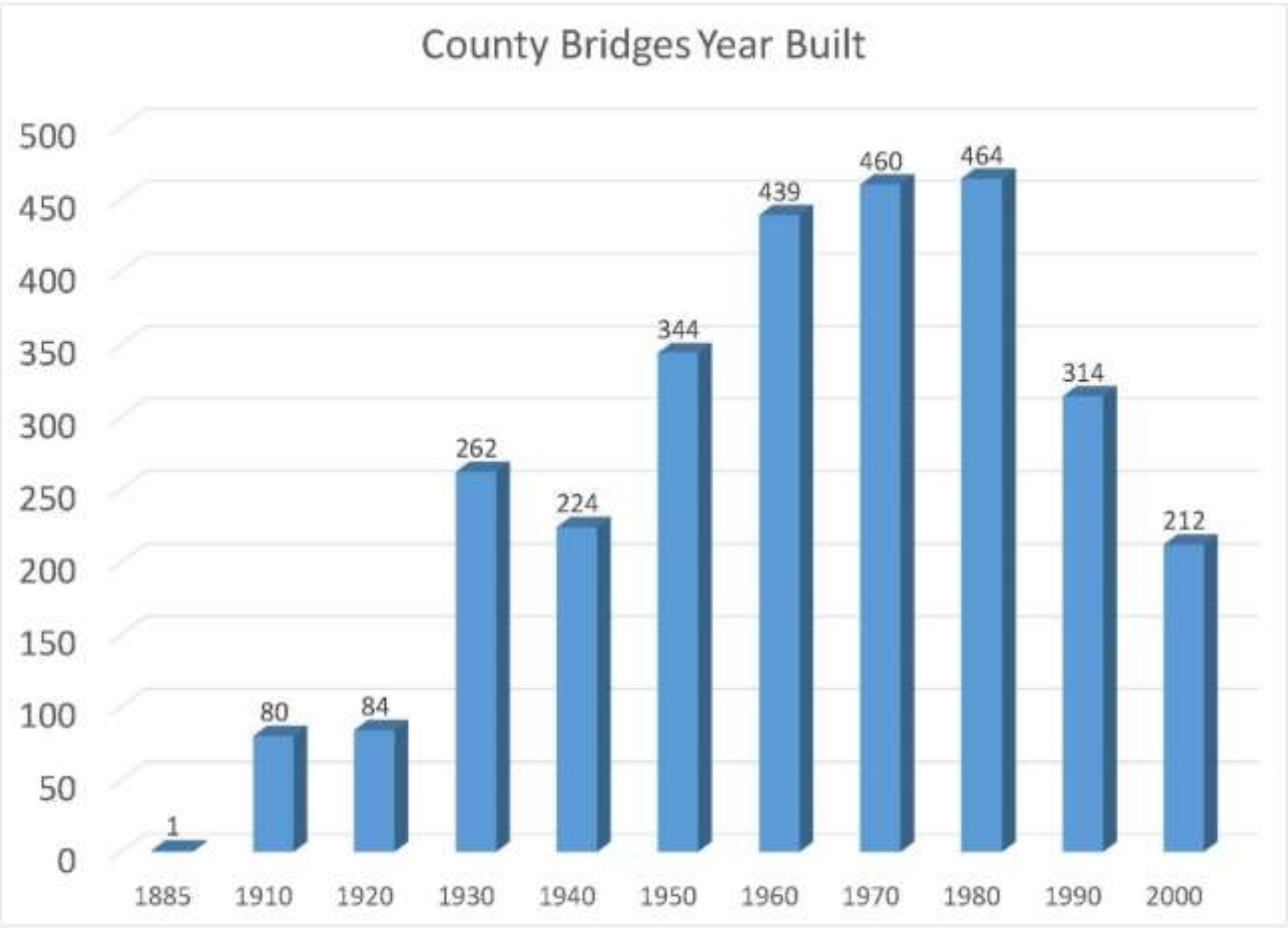

ROADS&BRIDGES
2017 BRIDGE INVENTORY
A State-by-State Look at Current National Bridge Conditions
AZZ METAL COATINGS
% of Total Bridges in St
Classified as Poor
1-3%
4-7%
8-10%
11-13%
14% and abov

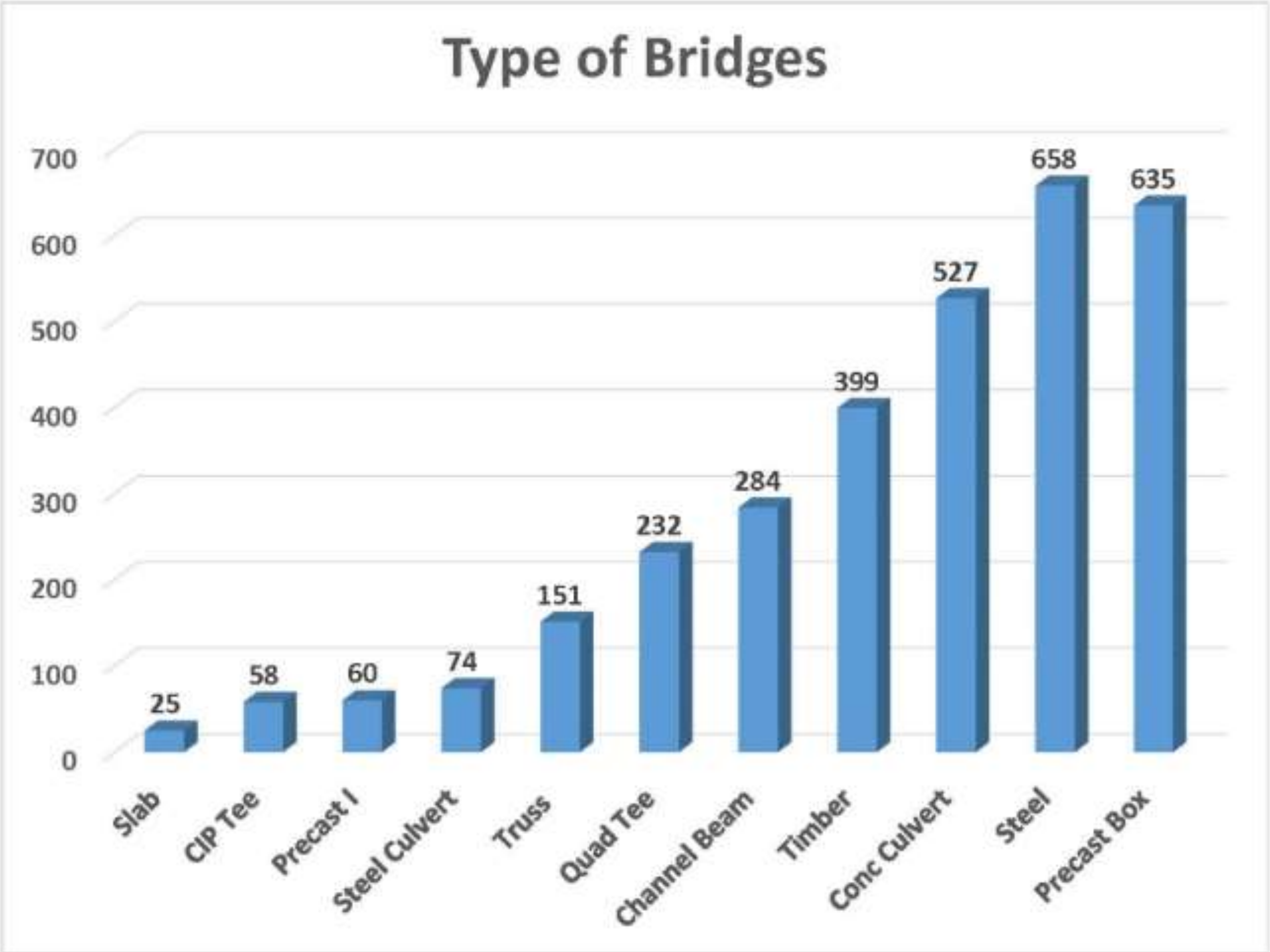

NORTH DAKOTA
Class Total %
Good 2,323 53%
Fair 1,567 36%
Poor 509 11%


3 - 25
26 - 50
55 - 100
105 - 150
160 - 285
Divide
Burke
Renville
Bottineau
Rolette
Towner
Cavalier
Pembina
Williams
Mountrail
Ward
McHenry
Pierce
Ramsey
Walsh
Benson
Nelson
Grand Forks
McKenzie
McLean
Sheridan
Wells
Eddy
Foster
Griggs
Steele
Traill
Dunn
Mercer
Oliver
Burleigh
Kidder
Stutsman
Barnes
Cass
Golden Valley
Billings
Stark
Morton
Slope
Hettinger
Grant
Emmons
Logan
LaMoure
Ransom
Richland
Bowman
Adams
Sioux
McIntosh
Dickey
Sargent

State Bridge Age

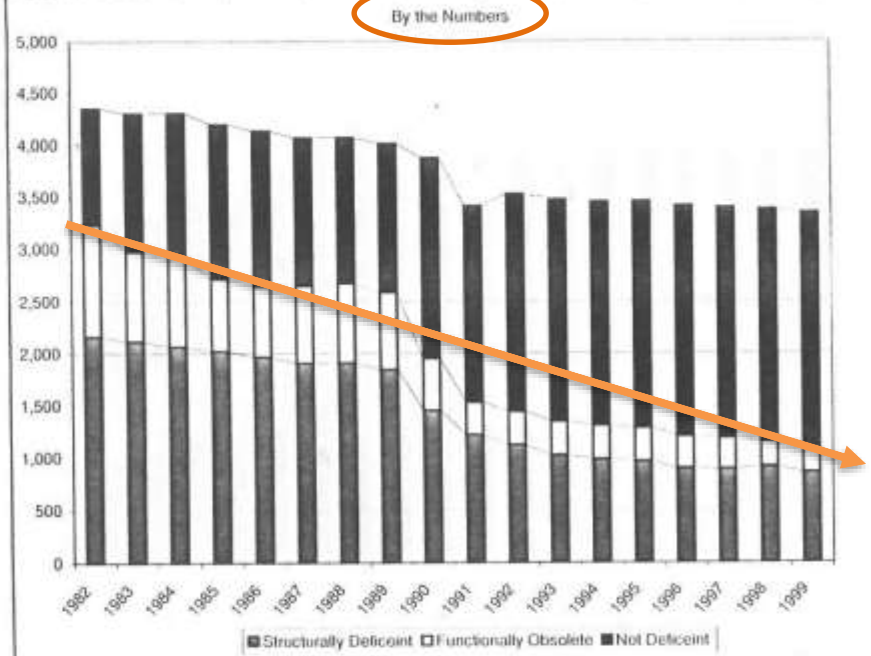


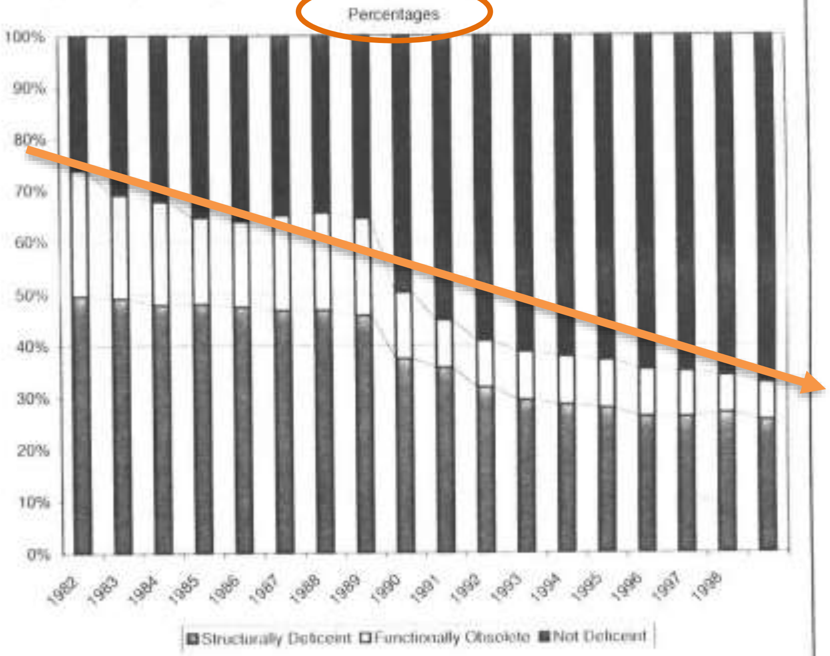

County Bridges Year Built
500
450
400
350
300
250
200
150
100
50
0
1
80
84
262
224
344
439
460
464
314
212
1885
1910
1920
1930
1940
1950
1960
1970
1980
1990
2000


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

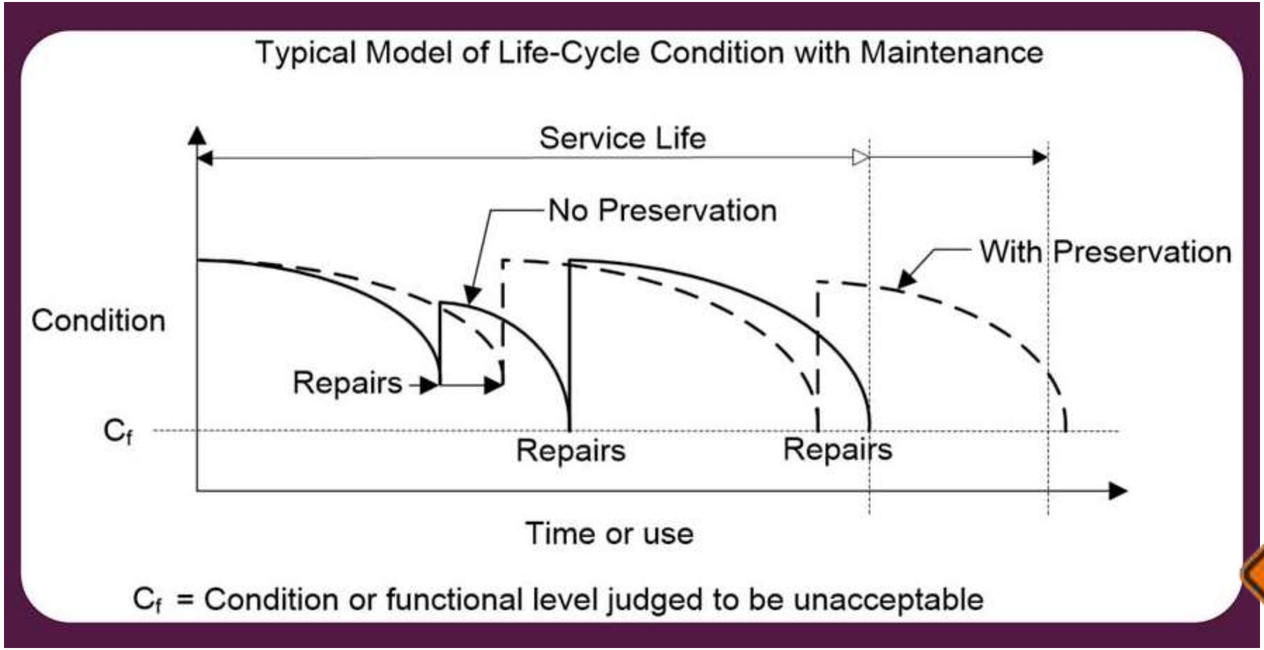
NBI Condition History of All County Bridges in ND Since 1982

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%

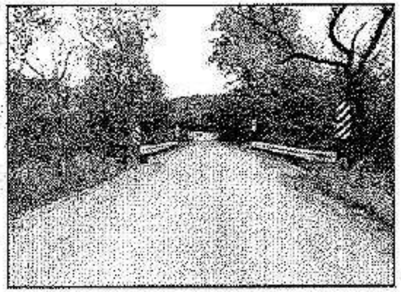


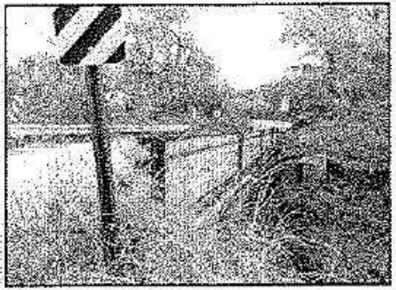


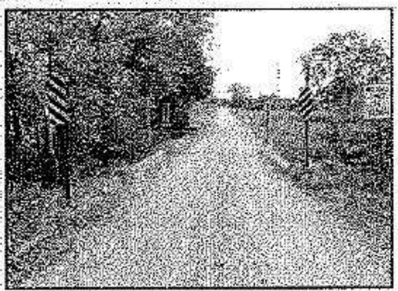
Example of Life Cycle Cost Chart




BRIDGE OUT
USE ALTERNATE
ROUTE







Kansas
Department of Transportation

ECONOMIC IMPACT OF CLOSING LOW-VOLUME RURAL BRIDGES

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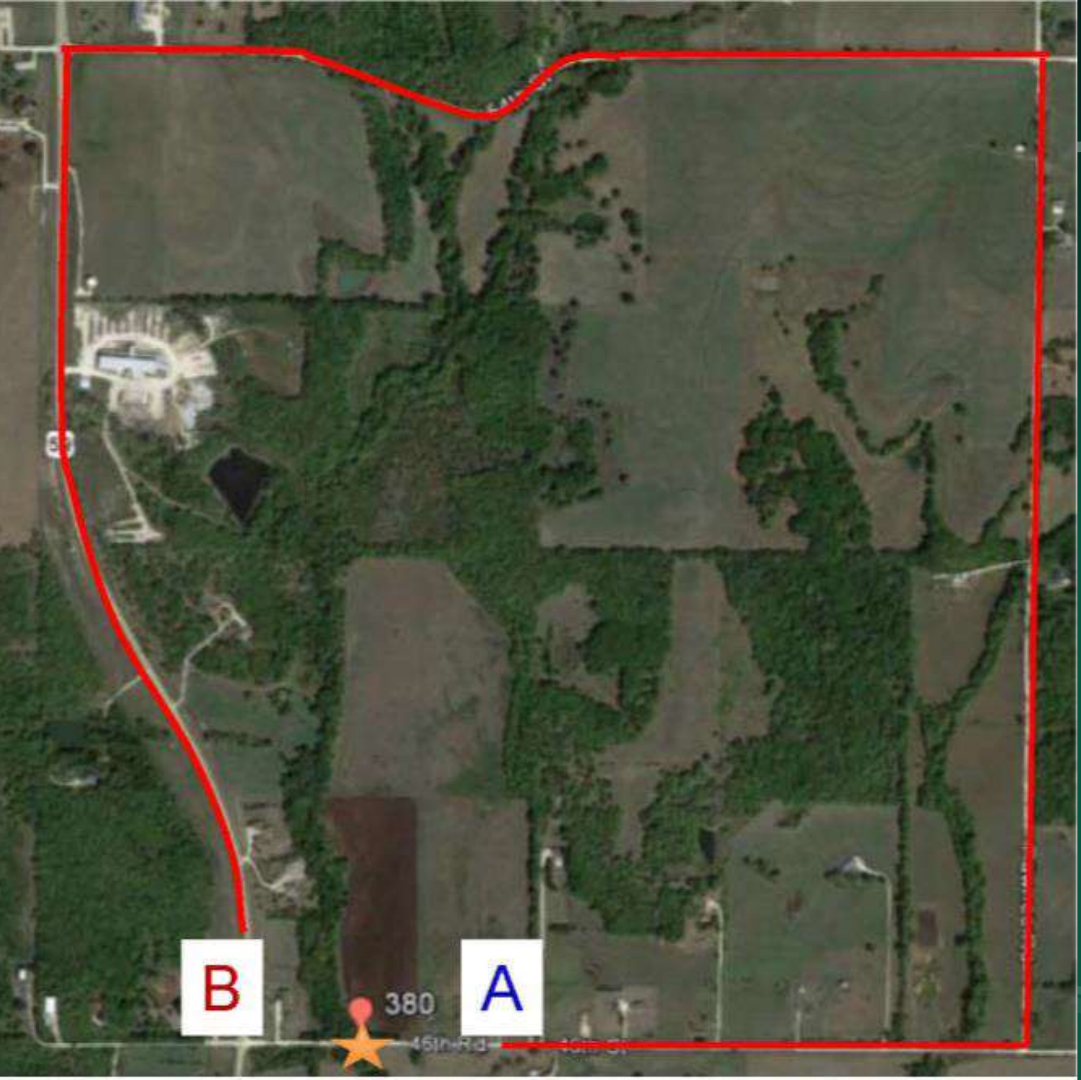
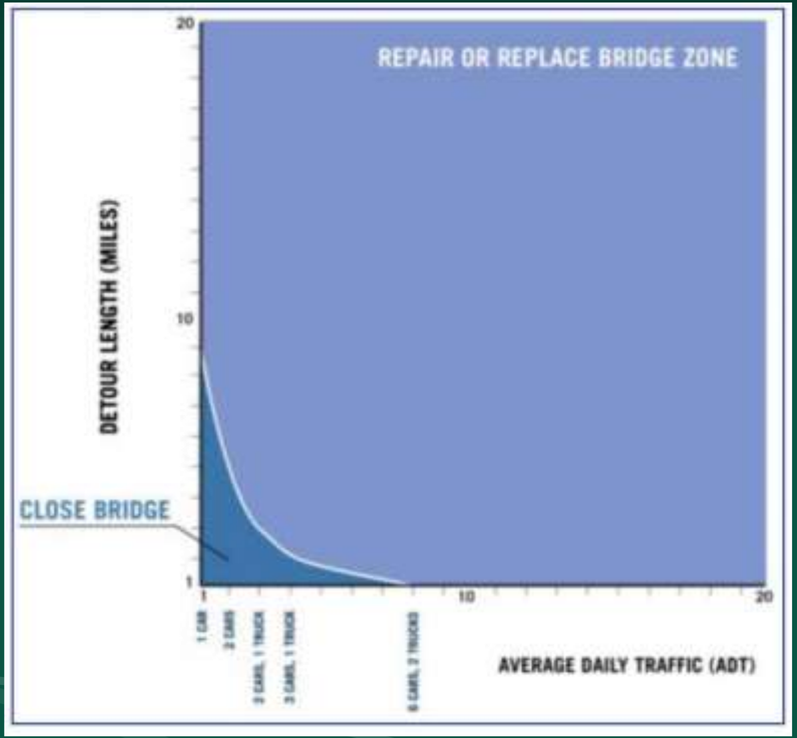
Kansas Research



Detour Length – Closures




Little Missouri
Scenic River
GhostsofNorthDakota.com

Key Terms and Topics

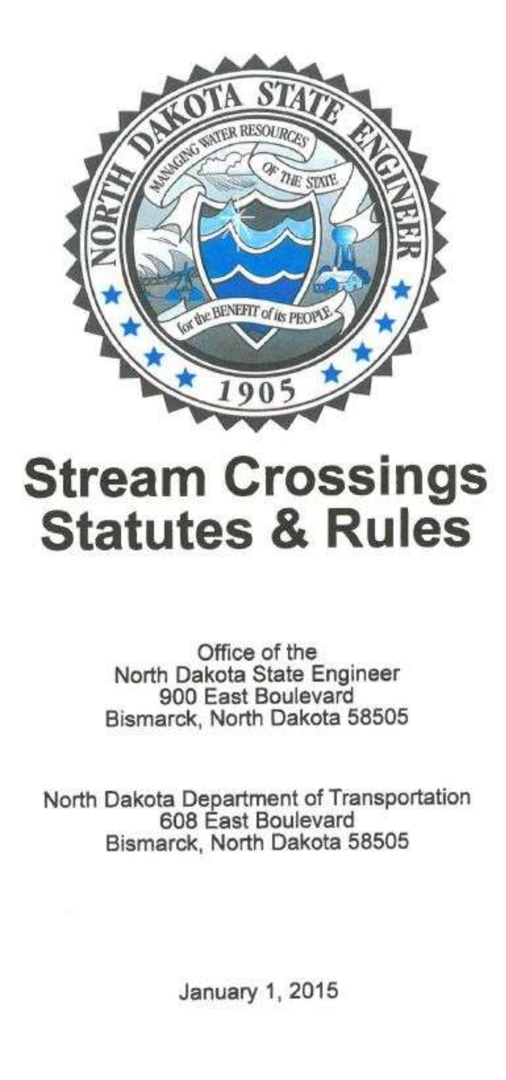
Bridge – Major Structure

Minor Structure

Design Life

Stream Rules

North Dakota's Laws



Stream Crossings Statutes & Rules

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

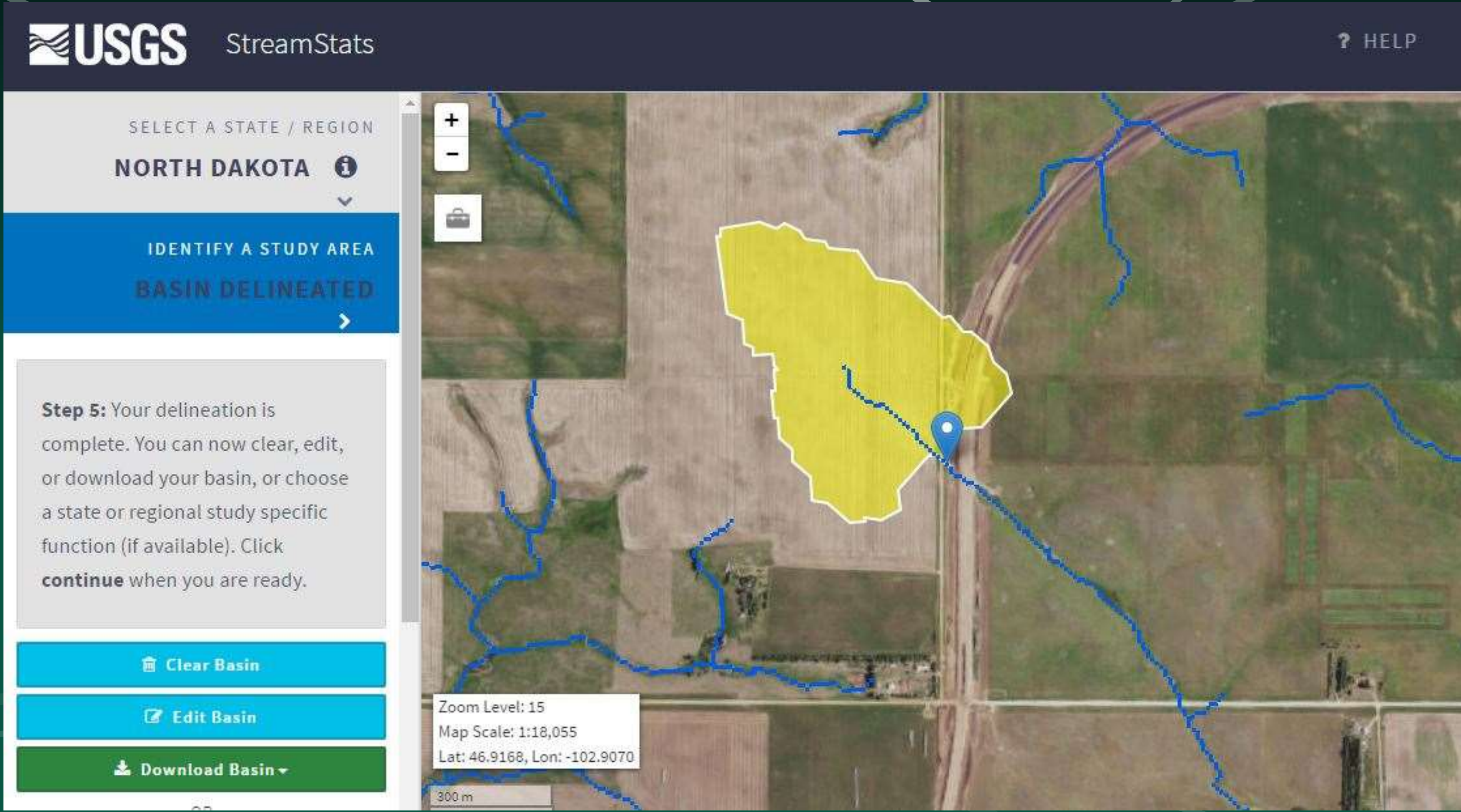
North Dakota Department of Transportation
608 East Boulevard
Bismarck, North Dakota 58505

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]		


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

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

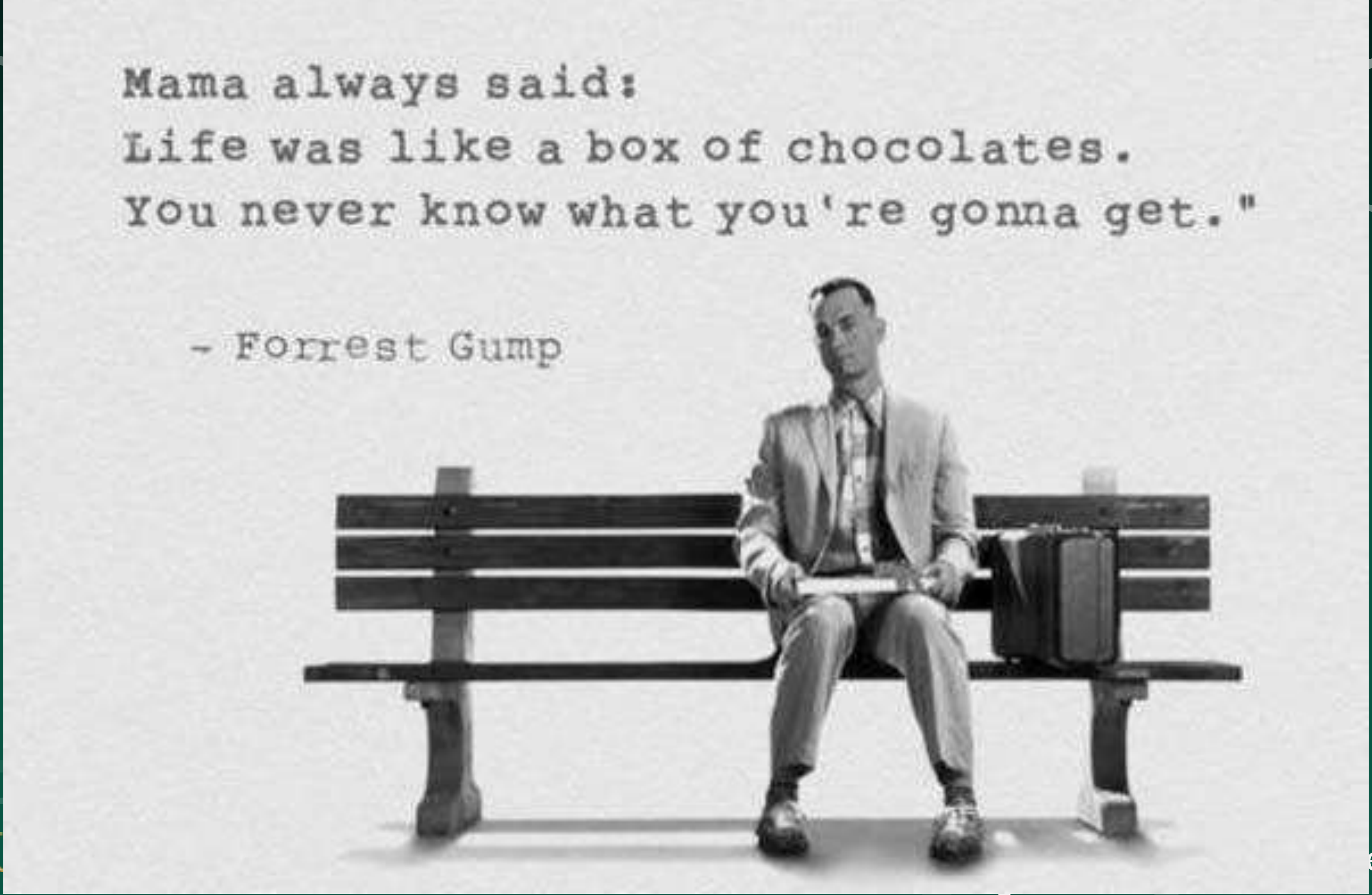
Gambling – the odds are always in your favor

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

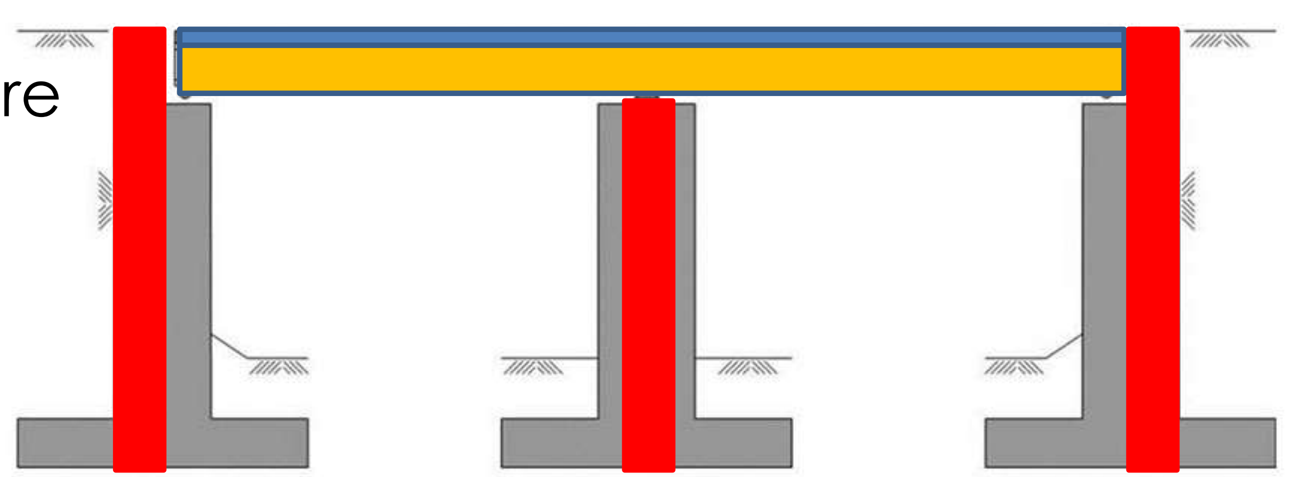
2012 Storm
Duluth, Minnesota
8" Rainfall


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

Bridge Parts

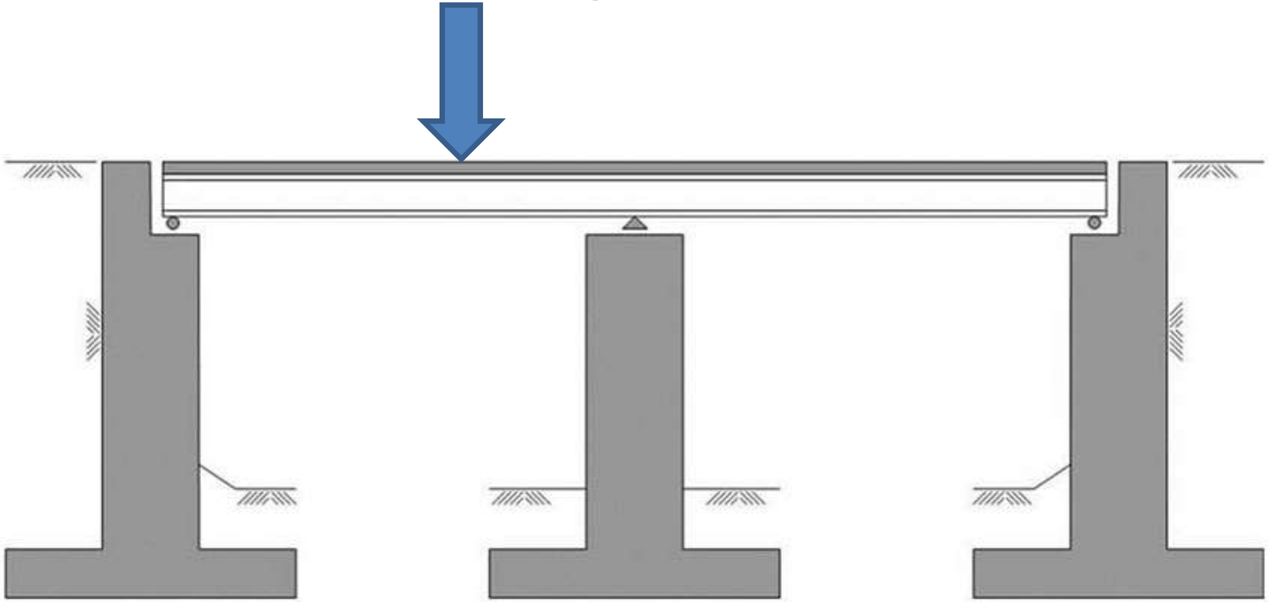
Bridge Components and Terms

- Three Major Bridge Components
  - Deck
  - Superstructure
  - Substructure



Deck

- Portion of the bridge that you drive on



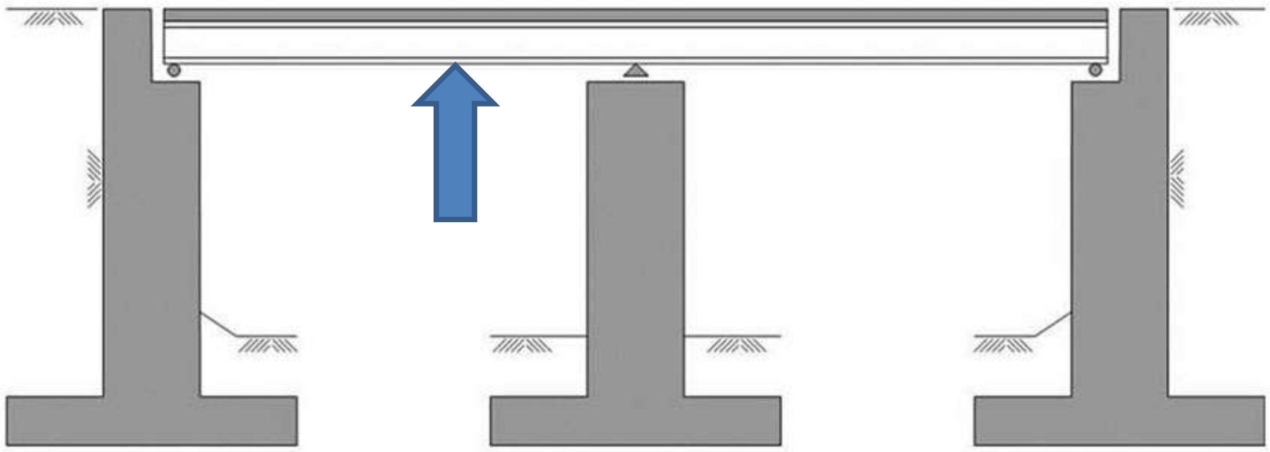
Wooden Deck

Beams as a deck

NDSU UPPER GR
TRANSPO

Superstructure

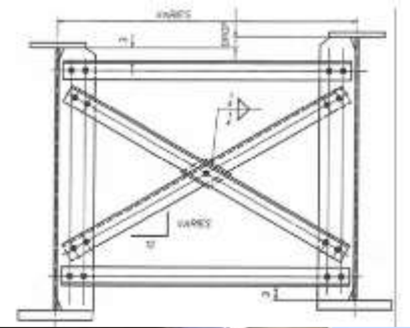
- Portion of the bridge that lies directly below and supports the deck
  – Beams, girders, truss, arch




Top Flange
Web
Steel Beams
(Girders – Stringers)
Bottom Flange

NDSU

Diaphragms, Cross Bracing and Supports

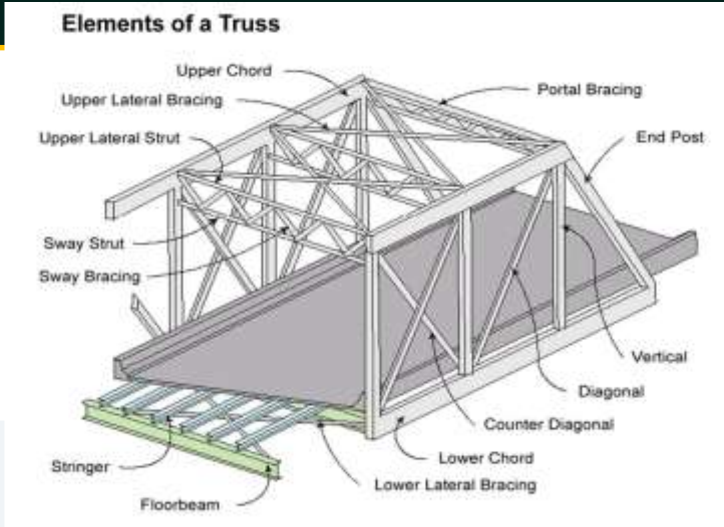



Diaphragms


Splice Plate

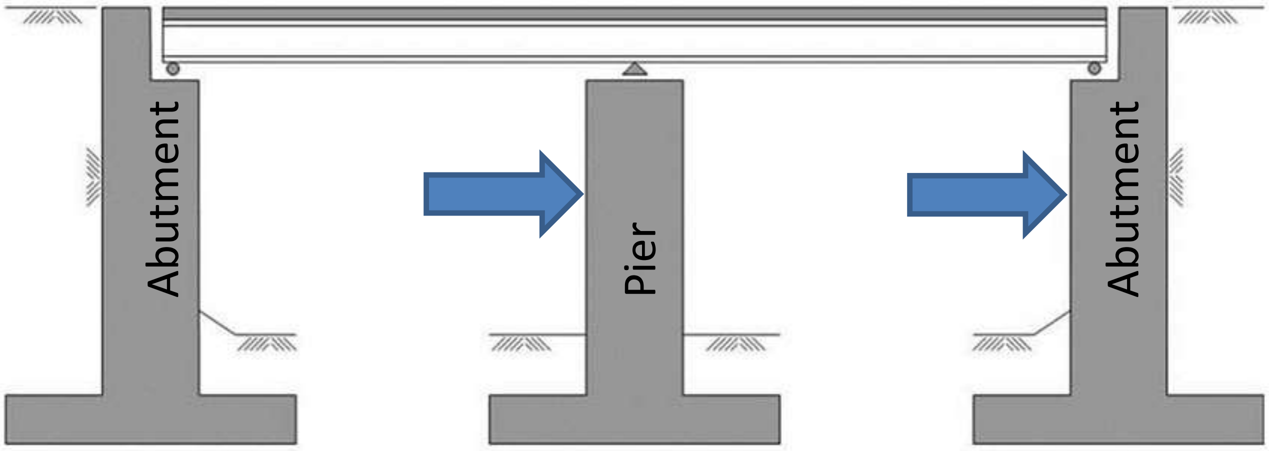

Gusset Plate

Truss Bridge Superstructure Elements



Substructure

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




Abutment

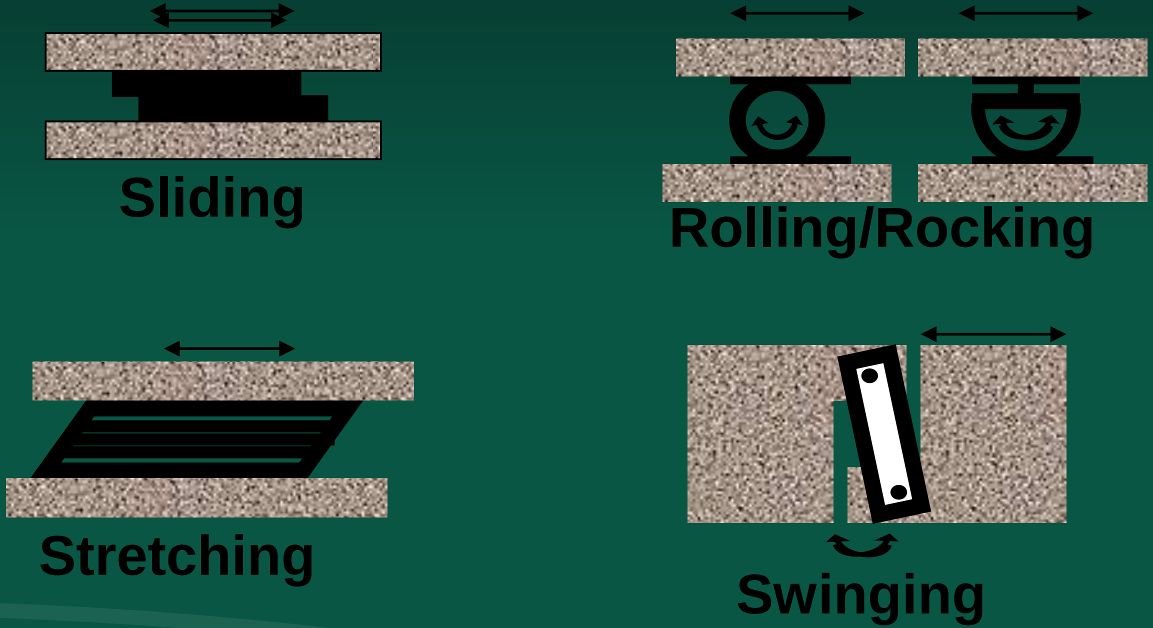
NDS


Steel Pile Foundations

Bearings

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

Bearings




Ice Nose


Wing Wall

Foundations Piling

Metal Railing

Approach Slabs

Key Terms and Topics

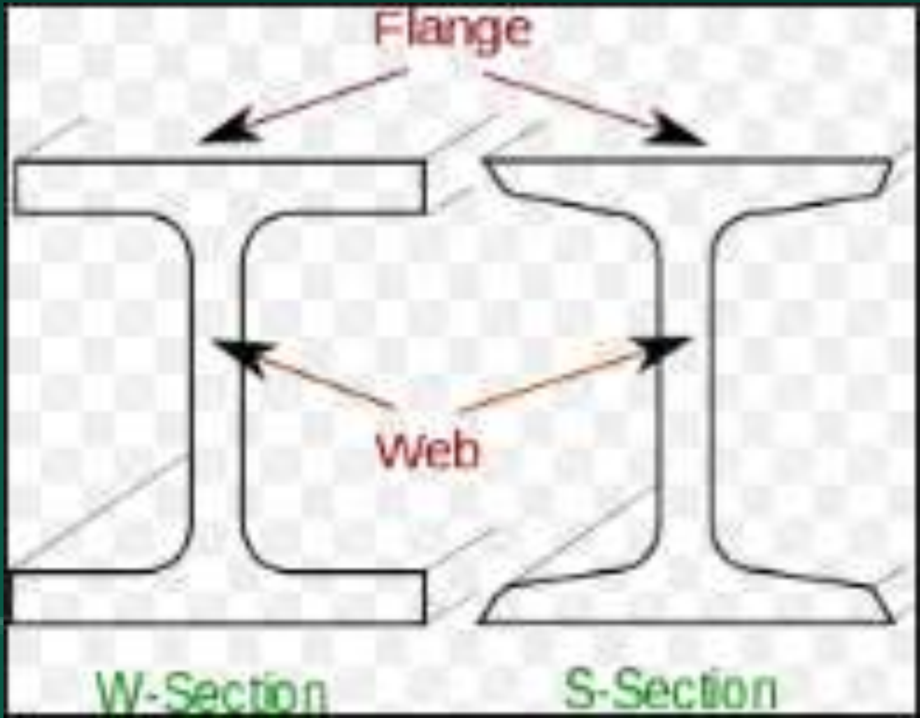
Deck
Superstructure
Substructure
Foundation


smile.

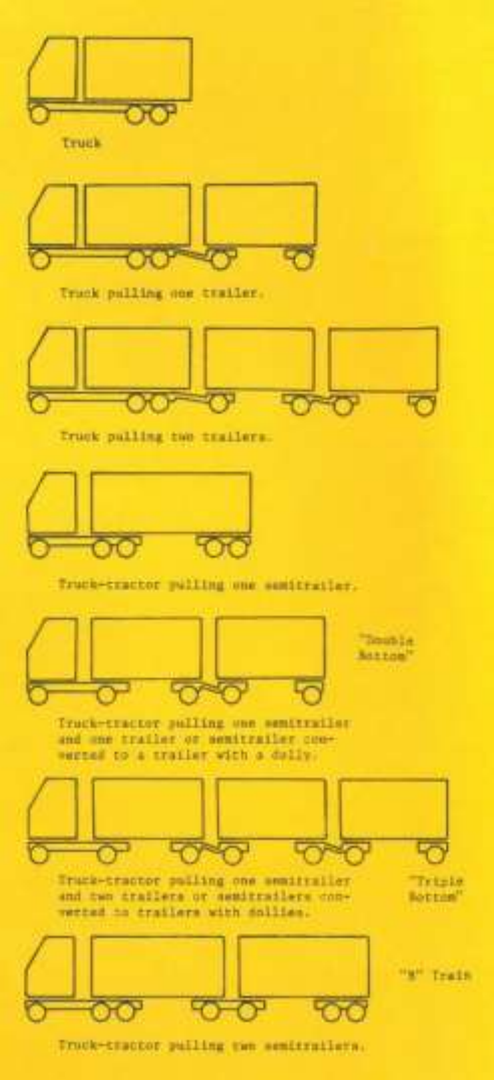
Beam Shapes

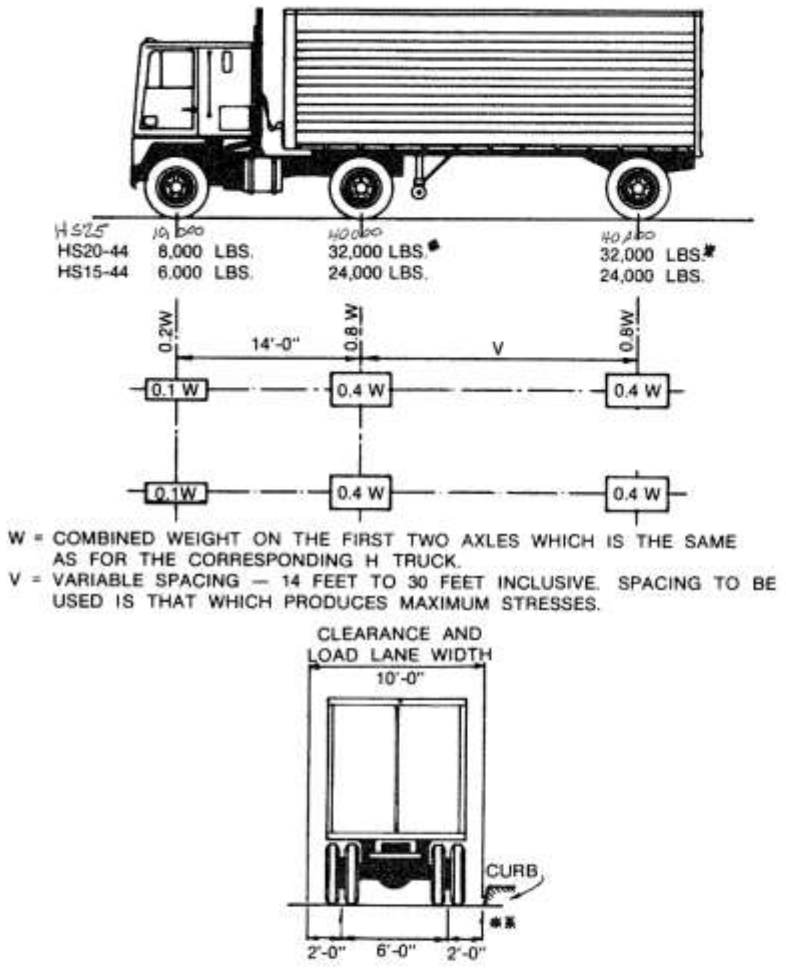
NI

W or H – S or I Shaped



Bridge Loadings


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


HS25
10,000
40,000
40,000
HS20-44 8,000 LBS. 32,000 LBS.* 32,000 LBS.*
HS15-44 6,000 LBS. 24,000 LBS. 24,000 LBS.
0.2W
0.8 W
0.8W
14'-0"
V
0.1 W
0.4 W
0.4 W
0.1W
0.4 W
0.4 W
W = COMBINED WEIGHT ON THE FIRST TWO AXLES WHICH IS THE SAME AS FOR THE CORRESPONDING H TRUCK.
V = VARIABLE SPACING — 14 FEET TO 30 FEET INCLUSIVE. SPACING TO BE USED IS THAT WHICH PRODUCES MAXIMUM STRESSES.
CLEARANCE AND LOAD LANE WIDTH
10'-0"
CURB
**
2'-0"
6'-0"
2'-0"

Overload Permits

Process Review

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

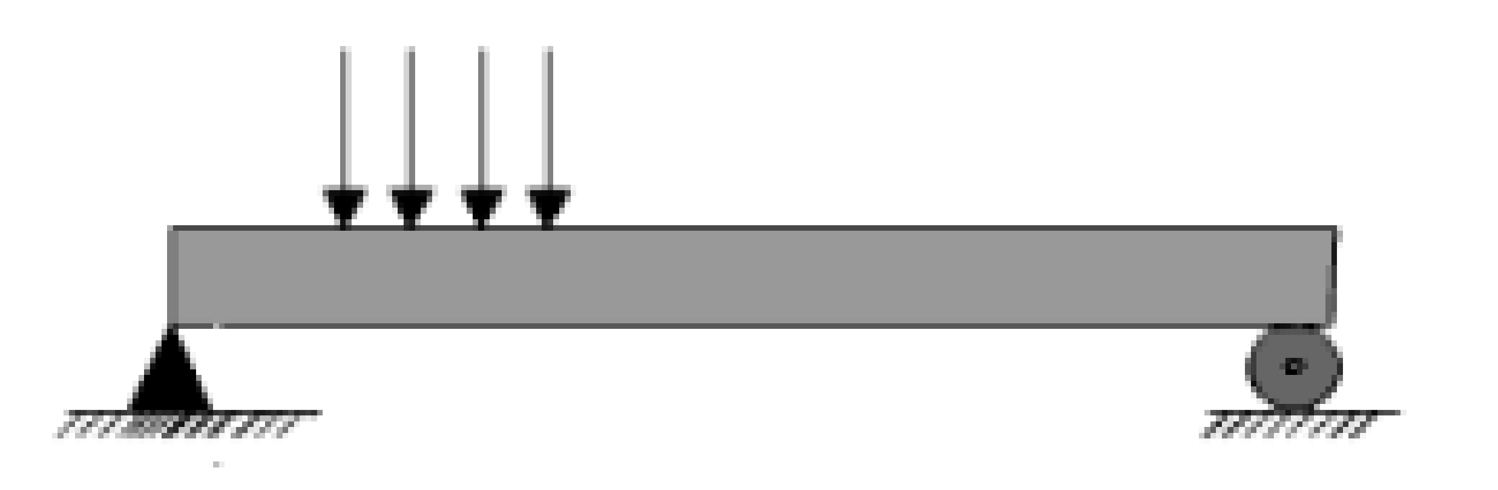
Forces in a beam as a load crosses a bridge

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?

Is faster better?

Smooth ride solution

Fracture Critical Bridges

NDSU


Underwater Inspections
When Are They Needed?

Key Terms and Topics

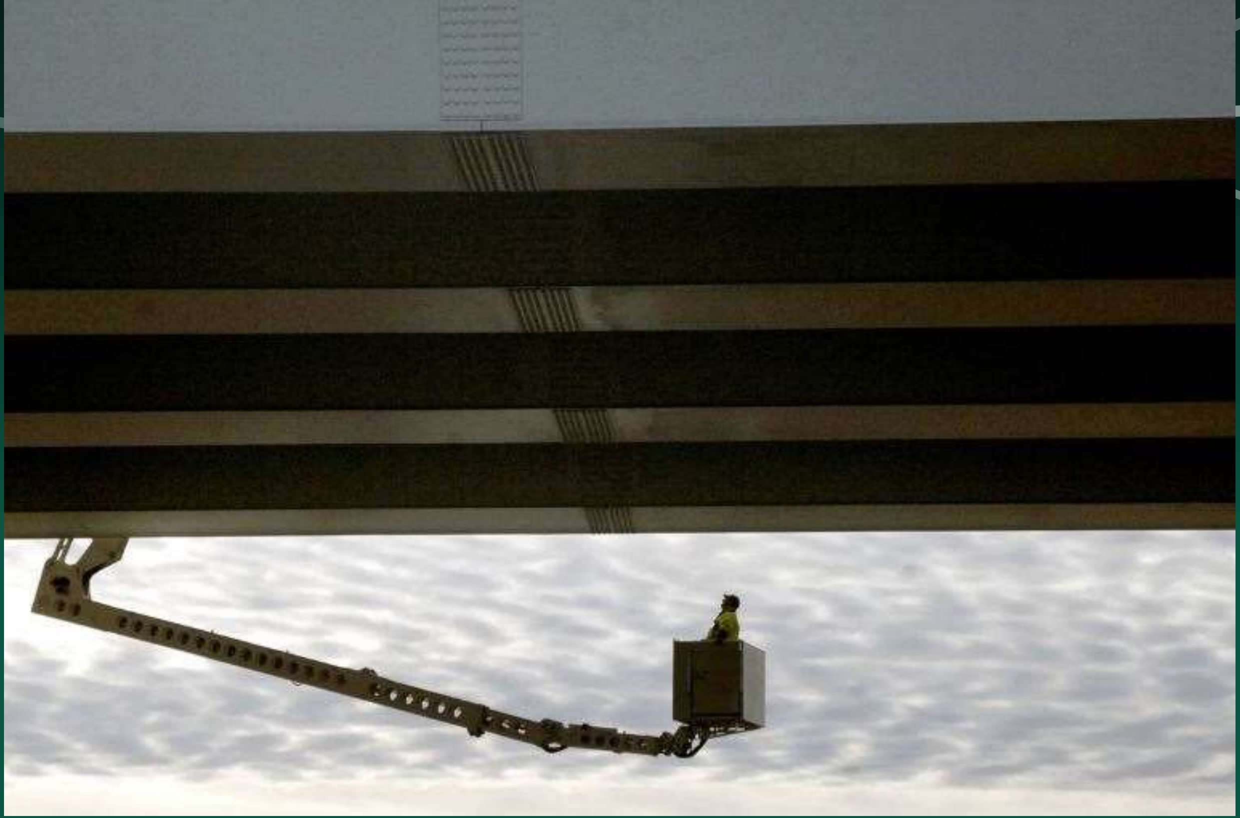
Dead Loads

Live Loads

Fracture Critical

Bridge Posting – Operating and Inventory

Bridge Inspections



Jake Mertz, with the North Dakota Department of Transportation, maneuvers an aerial lift to reach under the Liberty Memorial Bridge during a routine structure inspection in Bismarck on Monday. The bridge, dedicated on Veteran's Day in 2008, replaced the original 1920 bridge spanning the Missouri River between Bismarck and Mandan. The inspectors look for cracks in the piers, corrosion and light bulb replacement. Burleigh County has 2,985 structures receiving inspections from the department on a two-year rotation. November 28, 2017 Bismarck Tribune

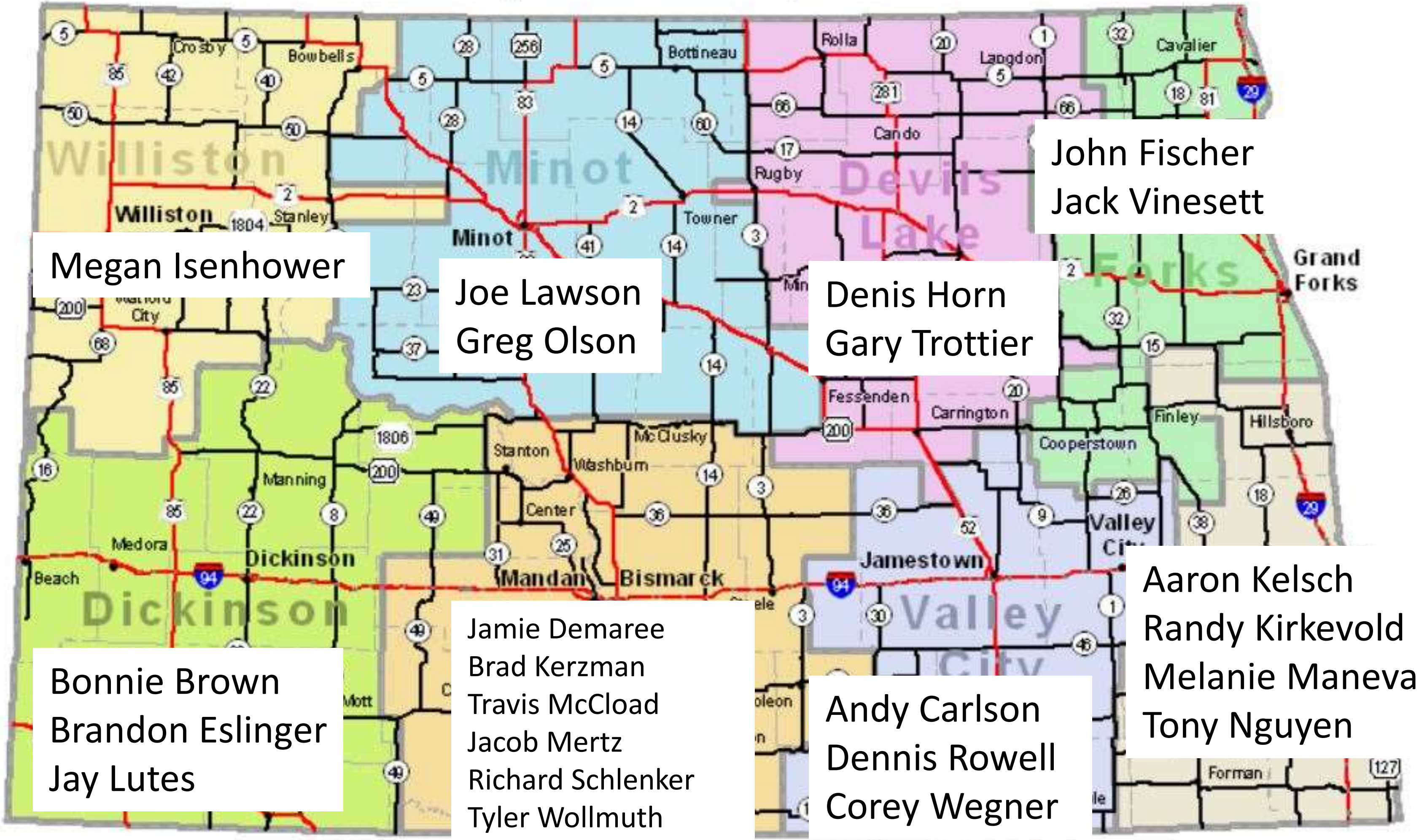
NDDOT/FHWA Inspections

- Federally mandated
- Includes both NDDOT and City/County bridges
- Normal frequency - 2 years
- Special frequency – 4 years (box culverts)

Who are you going to call???

First Name	Last Name	District	Experience	Certified By	Date Certified	Remarks	Team Leader
BONNIE	BROWN	Dickinson District	15	TE	01-Apr-02	2 WK NHI C[illegible] CT '98	TRUE
ANDY	CARLSON	Valley City District	5	TE	01-Apr-17	2 WK [illegible] 2011	TRUE
JAMIE	DEMAREE	Bismarck District	12	TE	09-Jun-09	2 W[illegible]	TRUE
GARY	DOERR	Main Office	12	PE	22-Mar-02	2 [illegible]	TRUE
BRANDON	ELSINGER	Dickinson District	9	TE	29-Oct-0[illegible]	[illegible]	TRUE
JOHN	FISCHER	Grand Forks District	24	TE	31-Ma[illegible]	[illegible]	TRUE
GARY	HEISLER	Fargo District	14	TE	14-[illegible]	[illegible] '92	TRUE
DENIS	HORN	Devils Lake District	8	TE	0[illegible]	[illegible] '98	TRUE
MEGAN	ISENHOWER	Williston District	4	PE	[illegible]	[illegible]	TRUE
AARON	KELSCH	Fargo District	11	TE	[illegible]	[illegible]	[illegible]RUE
BRAD	KERZMAN	Bismarck District	12	TE	[illegible]	[illegible]	[illegible]UE
RANDY	KIRKEVOLD	Fargo District	33	TE	[illegible]	[illegible]	[illegible]
SCOTT	LARSON	Retired May 2017	15	TE	[illegible]	[illegible]	[illegible]
JOE	LAWSON	Minot District	7	TE	[illegible]	[illegible]	[illegible]
JAY	LUTES	Dickinson District	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
MELANIE	MANEVAL	Fargo District	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
TRAVIS	MCCLOUD	Bismarck District	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
JACOB	MERTZ	Bismarck District	[illegible]	[illegible]	[illegible]17	2[illegible]	[illegible]
TONY	NGUYEN	Fargo District	[illegible]	TE	09[illegible]	[illegible]	[illegible]E
GREG	OLSON	Minot District	17	TE	[illegible]	[illegible]	[illegible]E
DENNIS	ROWELL	Valley City District	23	TE	[illegible]	[illegible]	[illegible]UE
RICHARD	SCHLENKER	Bismarck District	29	TE	[illegible]	[illegible]HI C[illegible]	[illegible]RUE
GARY	TROTTIER	Devils Lake District	15	TE	[illegible]	[illegible]K NHI [illegible]	TRUE
JACK	VINESETT	Grand Forks District	13	TE	[illegible]	[illegible]	TRUE
DIANA	WEBER	Dept of Transportation	8	TE	30[illegible]	[illegible]	TRUE
COREY	WEGNER	Valley City District	6	TE	01-Ap[illegible]	[illegible]	TRUE
RAYMOND	WERRE	Main Office	7	TE	21-Oct-1[illegible]	[illegible]	TRUE
TYLER	WOLLMUTH	Bismarck District	4	PE	20-Feb-14	2 [illegible]	TRUE

North Dakota Department of Transportation Districts



Megan Isenhower

Joe Lawson
Greg Olson

Denis Horn
Gary Trottier

John Fischer
Jack Vinesett

Bonnie Brown
Brandon Eslinger
Jay Lutes

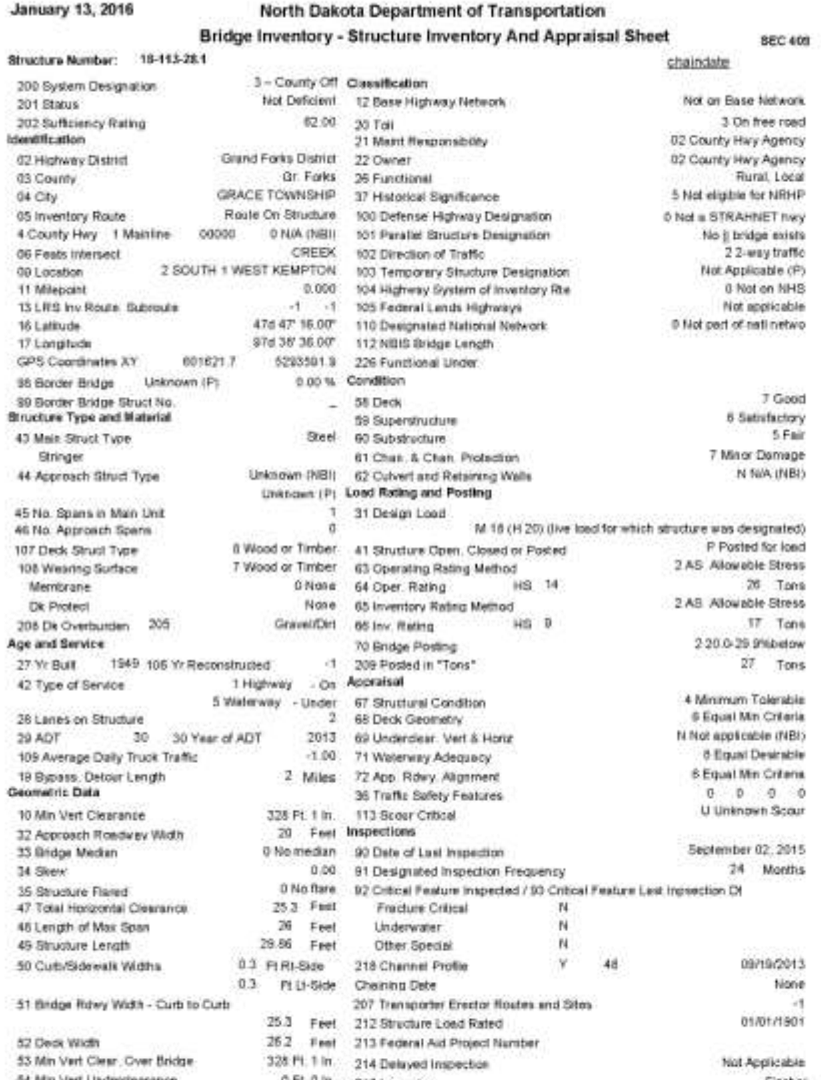
Jamie Demaree
Brad Kerzman
Travis McCload
Jacob Mertz
Richard Schlenker
Tyler Wollmuth

Andy Carlson
Dennis Rowell
Corey Wegner

Aaron Kelsch
Randy Kirkevold
Melanie Maneval
Tony Nguyen

Structural Inventory and Appraisal Sheet

SI&A Sheet


January 13, 2016

North Dakota Department of Transportation

Bridge Inventory - Structure Inventory And Appraisal Sheet

SEC 409

Structure Number: 18-113-28.1

chaindate

200 System Designation	3 – County Off	**Classification**	
201 Status	Not Deficient	12 Base Highway Network	Not on Base Network
202 Sufficiency Rating	82.00	20 Toll	3 On free road
Identification		21 Maint Responsibility	02 County Hwy Agency
02 Highway District	Grand Forks District	22 Owner	02 County Hwy Agency
03 County	Gr. Forks	26 Functional	Rural, Local
04 City	GRACE TOWNSHIP	37 Historical Significance	5 Not eligible for NRHP
05 Inventory Route	Route On Structure	100 Defense Highway Designation	0 Not a STRAHNET hwy
4 County Hwy 1 Mainline 00000	0 N/A (NBI)	101 Parallel Structure Designation	No ‖ bridge exists
06 Feats Intersect	CREEK	102 Direction of Traffic	2 2-way traffic
09 Location	2 SOUTH 1 WEST KEMPTON	103 Temporary Structure Designation	Not Applicable (P)
11 Milepoint	0.000	104 Highway System of Inventory Rte	0 Not on NHS
13 LRS Inv Route, Subroute	-1 -1	105 Federal Lands Highways	Not applicable
16 Latitude	47d 47' 16.00"	110 Designated National Network	0 Not part of natl netwo
17 Longitude	97d 38' 38.00"	112 NBIS Bridge Length	
GPS Coordinates XY 601621.7	5293501.3	226 Functional Under	
98 Border Bridge Unknown (P)	0.00 %	**Condition**	
99 Border Bridge Struct No.	_	58 Deck	7 Good
Structure Type and Material		59 Superstructure	6 Satisfactory
43 Main Struct Type	Steel	60 Substructure	5 Fair
Stringer		61 Chan. & Chan. Protection	7 Minor Damage
44 Approach Struct Type	Unknown (NBI)	62 Culvert and Retaining Walls	N N/A (NBI)
	Unknown (P)	**Load Rating and Posting**	
45 No. Spans in Main Unit	1	31 Design Load	
46 No. Approach Spans	0		M 18 (H 20) (live load for which structure was designated)
107 Deck Struct Type	8 Wood or Timber	41 Structure Open, Closed or Posted	P Posted for load
108 Wearing Surface	7 Wood or Timber	63 Operating Rating Method	2 AS Allowable Stress
Membrane	0 None	64 Oper. Rating HS 14	26 Tons
Dk Protect	None	65 Inventory Rating Method	2 AS Allowable Stress
208 Dk Overburden 205	Gravel/Dirt	66 Inv. Rating HS 9	17 Tons
Age and Service		70 Bridge Posting	2 20.0-29.9%below
27 Yr Built 1949 106 Yr Reconstructed	-1	209 Posted in "Tons"	27 Tons
42 Type of Service 1 Highway	- On	**Appraisal**	
5 Waterway	- Under	67 Structural Condition	4 Minimum Tolerable
28 Lanes on Structure	2	68 Deck Geometry	6 Equal Min Criteria
29 ADT 30 30 Year of ADT	2013	69 Underclear. Vert & Horiz	N Not applicable (NBI)
109 Average Daily Truck Traffic	-1.00	71 Waterway Adequacy	8 Equal Desirable
19 Bypass, Detour Length	2 Miles	72 App. Rdwy. Alignment	6 Equal Min Criteria
Geometric Data		36 Traffic Safety Features	0 0 0 0
10 Min Vert Clearance	328 Ft. 1 In.	113 Scour Critical	U Unknown Scour
32 Approach Roadway Width	20 Feet	**Inspections**	
33 Bridge Median	0 No median	90 Date of Last Inspection	September 02, 2015
34 Skew	0.00	91 Designated Inspection Frequency	24 Months
35 Structure Flared	0 No flare	92 Critical Feature Inspected / 93 Critical Feature Last Inspection Dt	
47 Total Horizontal Clearance	25.3 Feet	Fracture Critical N	
48 Length of Max Span	26 Feet	Underwater N	
49 Structure Length	29.86 Feet	Other Special N	
50 Curb/Sidewalk Widths	0.3 Ft Rt-Side	218 Channel Profile Y 48	09/19/2013
	0.3 Ft Lt-Side	Cleaning Date	None
51 Bridge Rdwy Width - Curb to Curb		207 Transporter Erector Routes and Sites	-1
	25.3 Feet	212 Structure Load Rated	01/01/1901
52 Deck Width	26.2 Feet	213 Federal Aid Project Number	
53 Min Vert Clear, Over Bridge	328 Ft. 1 In.	214 Delayed Inspection	Not Applicable

March 09, 2017

North Dakota Department of Transportation

Bridge Inventory - Structure Inventory And Appraisal Sheet

SEC 409

Structure Number: **05-147-19.0**

200 System Designation	3 – County Off
201 Status	Not Deficient
202 Sufficiency Rating	63.30

Identification

02 Highway District			Minot District
03 County			Bottineau
04 City			OAK VALLEY TOWNSHIP
05 Inventory Route			Route On Structure
4 County Hwy	1 Mainline	00000	0 N/A (NBI)
06 Feats Intersect			DRAINAGE DITCH
09 Location			2 NORTH 1 EAST OF GARDENA
11 Milepoint			0.000
13 LRS Inv Route. Subroute		-1	-1
16 Latitude			48d 44' 02.00"
17 Longitude			100d 28' 53.00"
GPS Coordinates XY		391084.1	5398918.9
98 Border Bridge	Unknown (P)		0.00 %
99 Border Bridge Struct No.			_

Structure Type and Material

Classification

12 Base Highway Network	Not on Base Network
20 Toll	3 On free road
21 Maint Responsibility	02 County Hwy Agency
22 Owner	02 County Hwy Agency
26 Functional	Rural, Local
37 Historical Significance	3 Possibly eligible for
100 Defense Highway Designation	0 Not a STRAHNET hwy
101 Parallel Structure Designation	No || bridge exists
102 Direction of Traffic	2 2-way traffic
103 Temporary Structure Designation	Not Applicable (P)
104 Highway System of Inventory Rte	0 Not on NHS
105 Federal Lands Highways	Not applicable
110 Designated National Network	0 Not part of natl netwo
112 NBIS Bridge Length	Yes

Condition

58 Deck	7 Good
59 Superstructure	6 Satisfactory
60 Substructure	6 Satisfactory

Structure Type and Material		Condition (cont.)	
43 Main Struct Type	Wood or Timber	60 Substructure	6 Satisfactory
Stringer		61 Chan. & Chan. Protection	7 Minor Damage
44 Approach Struct Type	Unknown (NBI) Unknown (P)	62 Culvert and Retaining Walls	N N/A (NBI)
45 No. Spans in Main Unit	2	**Load Rating and Posting**	
46 No. Approach Spans	0	31 Design Load	Unknown
107 Deck Struct Type	8 Wood or Timber	41 Structure Open, Closed or Posted	P Posted for load
108 Wearing Surface	8 Gravel	63 Operating Rating Method	2 AS Allowable Stress
Membrane	0 None	64 Oper. Rating HS 11	19 Tons
Dk Protect	None	65 Inventory Rating Method	2 AS Allowable Stress
208 Dk Overburden 205	Gravel/Dirt	66 Inv. Rating HS 7	13 Tons
Age and Service		70 Bridge Posting	0 >39.9% below
27 Yr Built 1935	106 Yr Reconstructed -1	209 Posted in "Tons"	10 Tons
42 Type of Service	1 Highway - On 5 Waterway - Under	**Appraisal**	
28 Lanes on Structure	2	67 Structural Condition	4 Minimum Tolerable
29 ADT 25	30 Year of ADT 2016	68 Deck Geometry	5 Above Tolerable
109 Average Daily Truck Traffic	-1.00	69 Underclear. Vert & Horiz	N Not applicable (NBI)
19 Bypass, Detour Length	2 Miles	71 Waterway Adequacy	6 Equal Minimum
		72 App. Rdwy. Alignment	7 Above Min Criteria
		36 Traffic Safety Features	0 0 0 0

Geometric Data

10 Min Vert Clearance	99 Ft. 12 In.
32 Approach Roadway Width	16 Ft.
33 Bridge Median	0 No median
34 Skew	0.00
35 Structure Flared	0 No flare
47 Total Horizontal Clearance	23.0 Ft.
48 Length of Max Span	13 Ft.
49 Structure Length	29.86 Ft.
50 Curb/Sidewalk Widths	0.7 Ft Rt-Side
	0.7 Ft Lt-Side
51 Bridge Rdwy Width - Curb to Curb	23.0 Ft.
52 Deck Width	24.3 Ft.
53 Min Vert Clear. Over Bridge	99 Ft. 12 In.
54 Min Vert Underclearance	0 Ft. 0 In.
	N Feature not hwy or RR
55 Min Lateral UnderClear. - Rt	99.9 Ft.
	N Feature not hwy or RR
56 Min Lateral UnderClear. - Lt	0.0 Ft.
210 Culvert / 211 Description	

113 Scour Critical	U Unknown Scour

Inspections

90 Date of Last Inspection			October 11, 2016
91 Designated Inspection Frequency			24 Months
92 Critical Feature Inspected / 93 Critical Feature Last Inpsection Dt			
Fracture Critical	N		
Underwater	N		
Other Special	N		
218 Channel Profile	Y	48	08/16/2013
Chaining Date			None
207 Transporter Erector Routes and Sites			-1
212 Structure Load Rated			01/01/1901
213 Federal Aid Project Number			
214 Delayed Inspection			Not Applicable
216 Inspector			Olson, Lawson

Navigation Data

38 Navigation Control	Permit Not Required
39 Navigation Vertical Clearance	0 Ft.
40 Navigation Horizontal Clearance	0 Ft.
111 Pier or Abutment Protection	Unknown (NBI)
116 Minimum Navigation Vertical Clearance	-1 Ft.

Element Rating

Item or Defect	Condition States			
	1	2	3	4
	Good	Fair	Poor	Severe

Item or Defect	Condition States			
	1	2	3	4
	Good	Fair	Poor	Severe

March 09, 2017

North Dakota Department of Transportation

Bridge Inventory - Structure Inventory And Appraisal Sheet

SEC 409

Structure Number: 05-147-19.0

Element / Env. / Description	Units	Total Qty	1 %	1-Qty St	2 %	2-Qty St	3 %	3-Qty St	4 %	4-Qty St
111/1:Timber Open Girder	ft	689	0	0	98	676	2	13	0	0
1150/1:Check/Shake	each	676	0	0	100	676	0	0	0	0
1160/1:Crack (Timber)	each	13	0	0	0	0	100	13	0	0
206/1:Timber Column	each	18	0	0	100	18	0	0	0	0
1150/1:Check/Shake	each	18	0	0	100	18	0	0	0	0
216/1:Timber Abutment	ft	49	0	0	100	49	0	0	0	0
1150/1:Check/Shake	each	49	0	0	100	49	0	0	0	0
235/1:Timber Pier Cap	ft	72	0	0	100	72	0	0	0	0
1150/1:Check/Shake	each	72	0	0	100	72	0	0	0	0

NDSU UPPER TRANS

31/1:Timber Deck	sq.ft	689	0	0	100	689	0	0	0	0
332/1:Timb Bridge Railing	ft	59	0	0	49	29	0	0	51	30
1150/1:Check/Shake	each	29	0	0	100	29	0	0	0	0
7000/1:Damage	each	30	0	0	0	0	0	0	100	30
8401/1:Wings	each	4	75	3	25	1	0	0	0	0

Remarks: TIMBER CURBS HAVE MINOR TO MODERATE DAMAGE. TOPS OF WINGS HAVE MINOR SNOW PLOW DAMAGE. PLANK AT GIRDER ENDS HAS SLIPPED DOWN, ALLOWING SOIL TO BUILD UP ON ABUTMENT CAPS. ALL STRUCTURAL MEMBERS ARE WEATHER CHECKED. SILT BAR BUILDING UP IN WEST SPAN. GIRDER 17 FROM NORTH HAS LONGITUDINAL CRACK. GIRDER 13 HAS DEEP WEATHER CHECK. EAST ABUTMENT CAP HAS DEEP WEATHER CHECK ON ITS VERTICAL FACE. Pier 2 has minor damage at both ends from debris. West abutment bottom horizontal plank is cracked 3'-4', north end. Small void behind west abutment south end where ties to wing. NO END MARKERS.

Alert Code 1: Small sink holes at west end of bridge behind abutment in wheel paths.

Inspection Terms

- The **SUFFICIENCY RATING** of a bridge is a single number from 0 (low) to 100 (high) taking into account, bridge condition, geometry, traffic, and how well the waterway passes underneath the bridge. Sufficiency rating is used to determine funding eligibility. A low sufficiency rating does not necessarily mean the bridge is unsafe or in need or immediate repair.

- A **FRACTURE CRITICAL MEMBER** is a steel member in tension that does not have enough additional, structural members to sufficiently redistribute load in the bridge if one member loses capacity, thus resulting in a portion of or entire bridge collapse.

- **FATIGUE** is a material response that describes the tendency of a material to break when subjected to repeated loading.

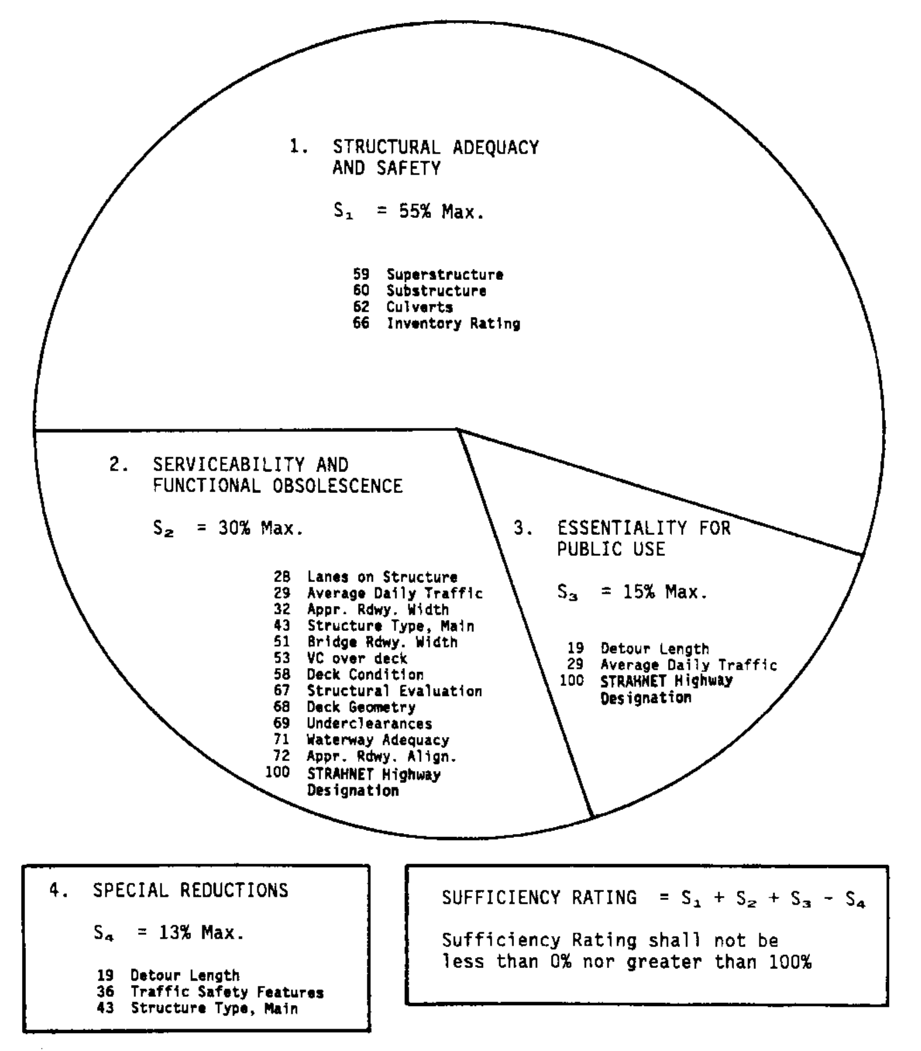
Inspection Terms

- Bridges are considered **STRUCTURALLY DEFICIENT** if significant load-carrying elements are found to be in poor or worse condition due to deterioration and/or damage, or the adequacy of the waterway opening provided is determined to be extremely insufficient. The fact that a bridge is structurally deficient does not immediate imply that it is likely to collapse or that it is unsafe.

- Bridges are considered **FUNCTIONALLY OBSOLETE** when the geometry of the roadway no longer meets today's minimum design standards for width or vertical clearance for that roadway classifications, or the adequacy of the waterway opening provided is determined to be insufficient. The fact that a bridge is functionally obsolete does not imply that it is unsafe.

NDS

Sufficiency Rating



Drone Inspection Video

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

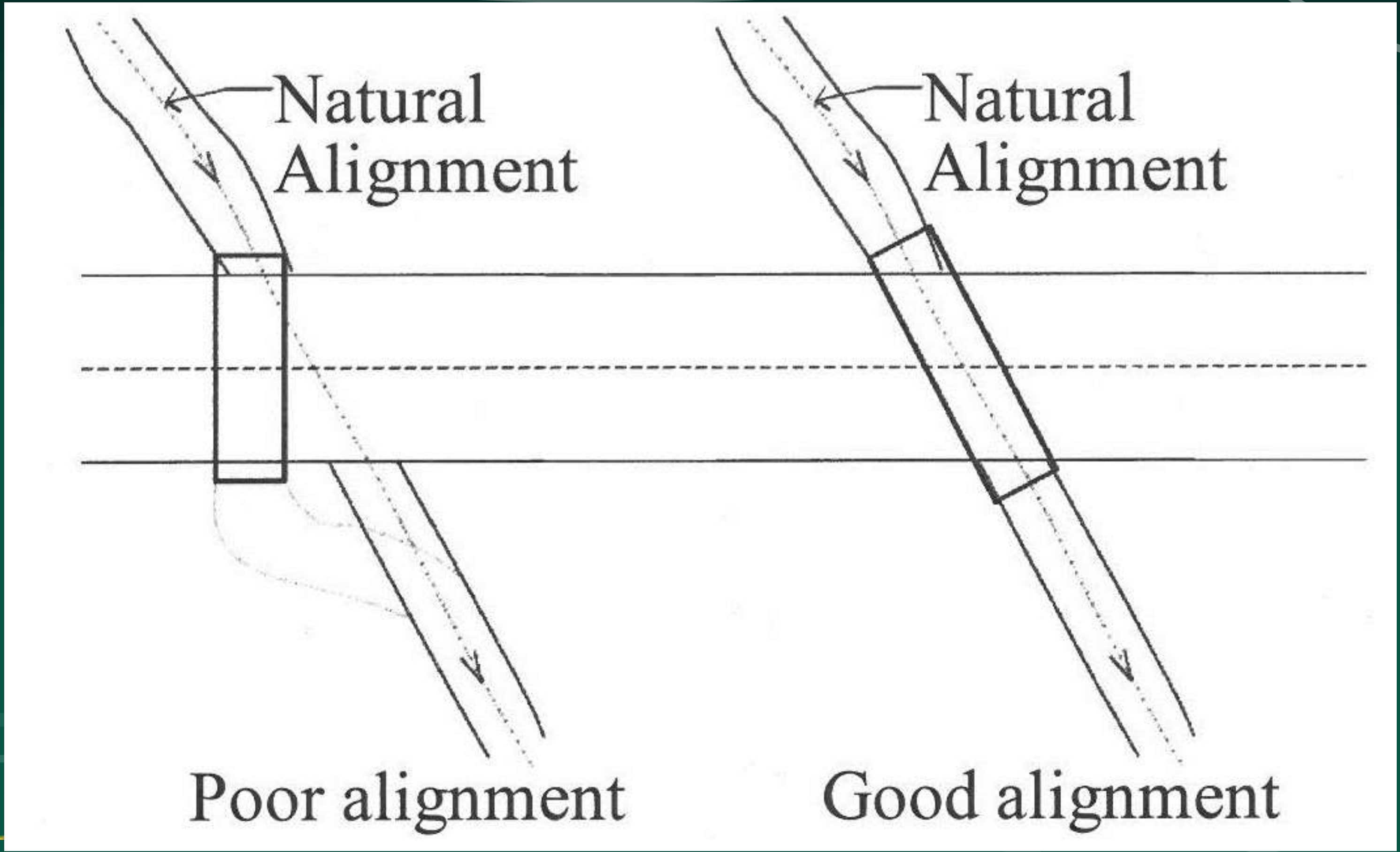


Underwater Inspections

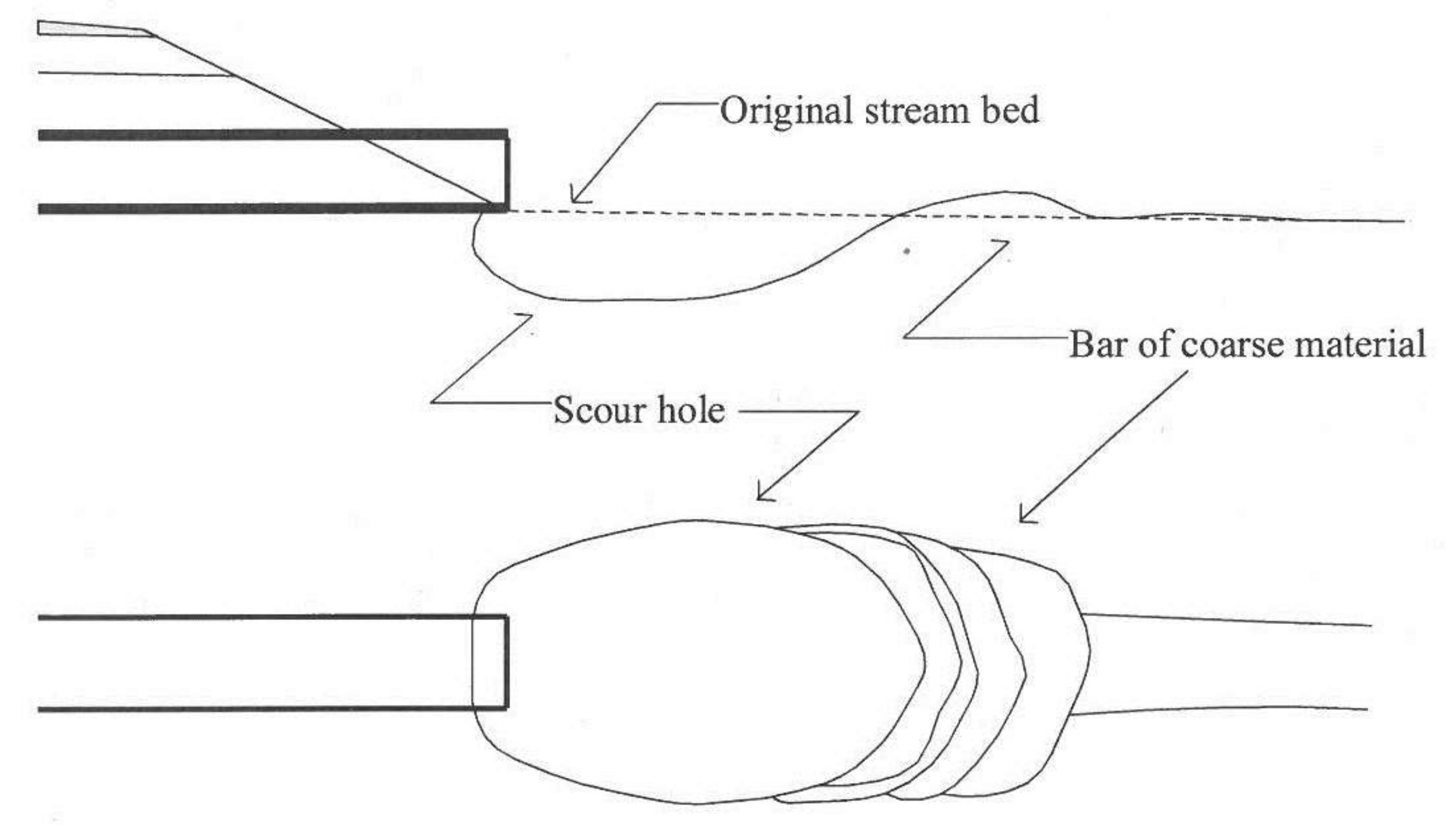
Inspection Tool List

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

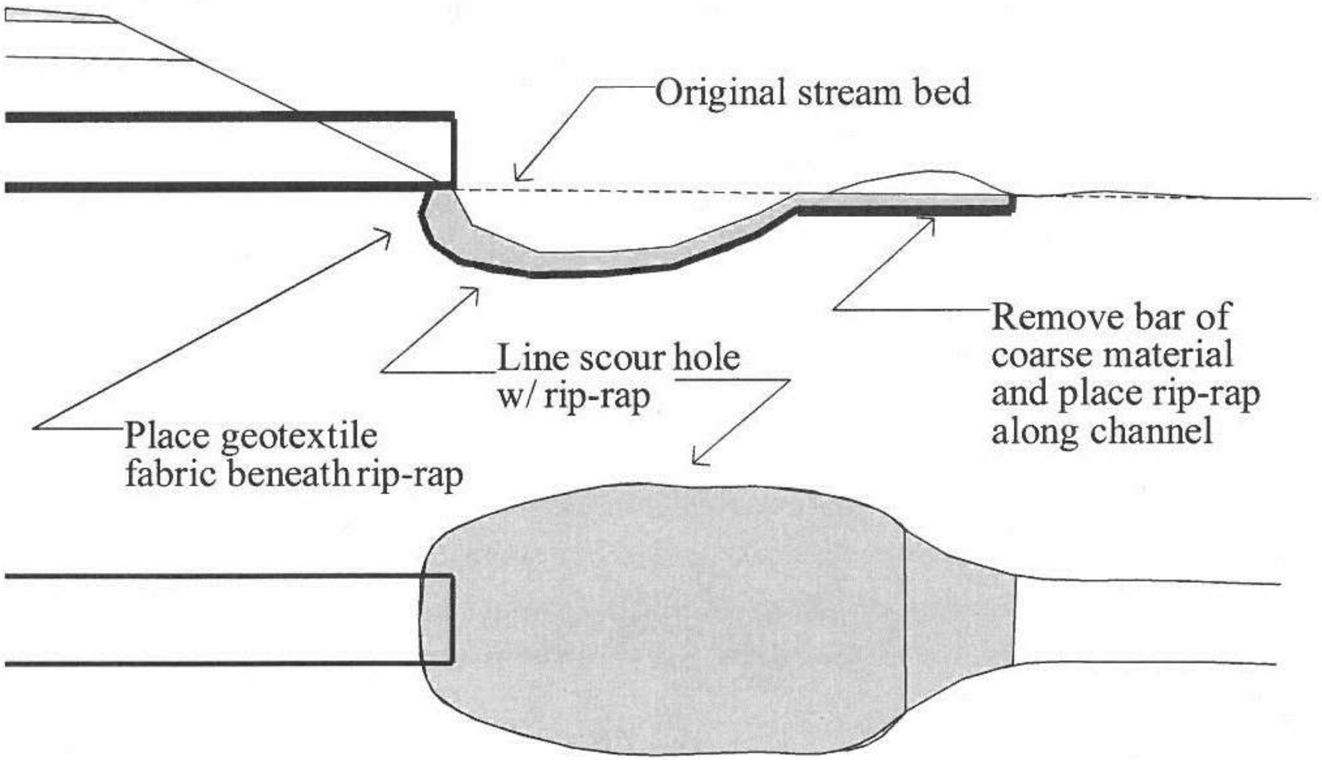
Hammer
First Aid Kit
Scraper
Shovel
Inspection forms
Camera
Paint
Lumber crayon


Natural
Alignment
Natural
Alignment
Poor alignment
Good alignment

Outlet Scour



Outlet Scour Treatment



Don't fill scour hole completely or erosion problem will reoccur

NDSU UPPER GREAT PLAINS TRANSPORTATION INSTITUTE

Bridge Photos – Photography 101

1. Roadway across Bridge

2. Side Elevation View

3. Underside View

NDSU UPPER GREAT PLAINS TRANSPORTATION INSTITUTE

Concrete Deck Overlays

Deck Overlays Cause Problems


Bonding Issues
Trapping Salts

Identify Joints

Finger Joints

NDSU

Timber

Decay

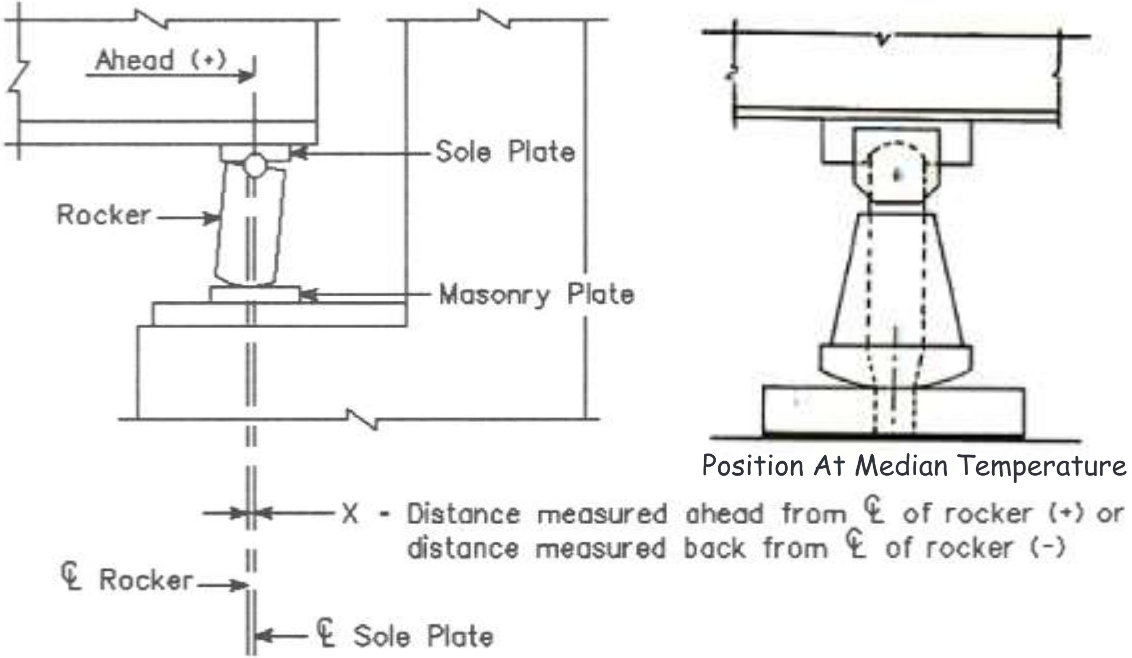
Cracks

Look for damage and gaps



Bearings

Position is Important

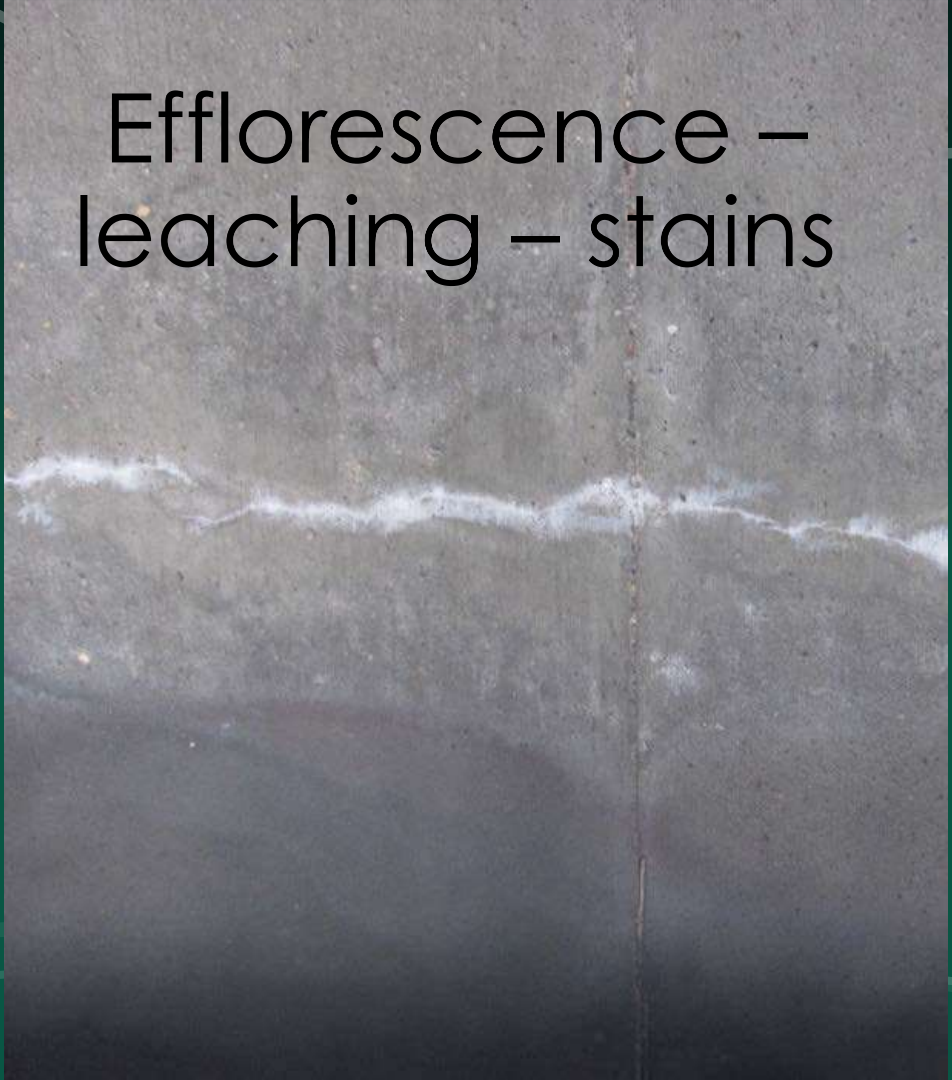



6.6.2001

Piling


ACPA

Efflorescence – leaching – stains



Alkali–Silica Reactivity (ASR)

ASR

Steel and Weathering Steel

Pack Rust
Oxidation
Corrosion

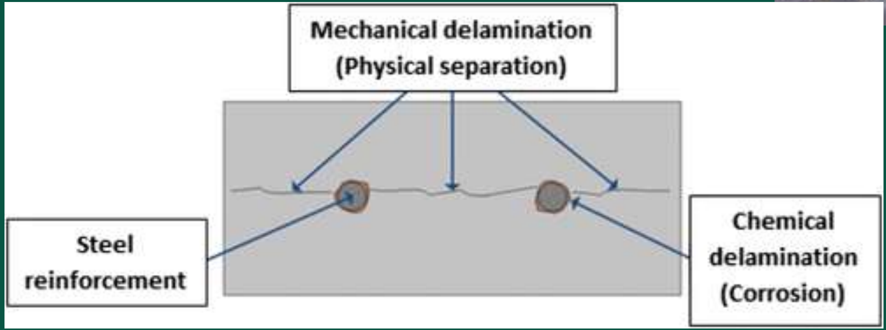


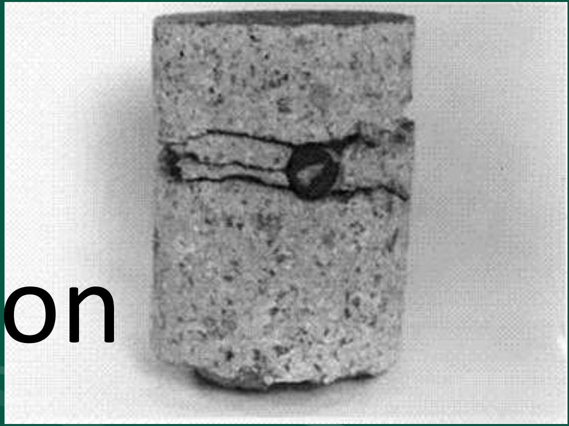


Pack Rust Expansion 7X



2010





Concrete Delamination

Chaining & Delam Tool

Utilities

- CenterPoint Energy 10" Natural

Key Terms and Topics

Bridge Length – Major and Minor

Structurally Deficient

Functionally Obsolete

Sufficiency Rating

SI&A Sheet

Inspections - Part #2 and Reporting Procedures

Paperwork

- Load Posting Requirement
- Alert Code 3 notification
- Scour & Channel Profiles Due
- Bridge Location Maps

TO: Bottineau County

FROM: Paul Benning, Local Government

DATE: March 31, 2017

SUBJECT: Bridge Requiring Load Limit Posting

Bridge Number: 05-157-28.0
Location: 2E OF WILLOW CITY

According to the latest bridge inspection and inventory data on record with the Bridge Division, bridge number 05-157-28.0 lacks proper Load Limit Signs. FHWA Regulations require that any bridge with an operating rating of less than legal loads must be posted for a Load Limit that does not exceed the Operating Rating. The legal load in North Dakota is an HS20 truck which weighs 36 tons. Since bridge number 05-157-28.0 is less than 36 tons, it must have Load Limit Signs.

Bridge number 05-157-28.0 has an Operating Rating of 17.0 Gross Tons and an Inventory Rating of 10.0 Gross Tons. It is your option to post the bridge at any tonnage you want as long as it is equal to or less than the maximum operating tonnage. Two types of signs (shown on attachment) are recommended in order to provide drivers with a more consistent messages statewide. Please complete the following after you have posted this bridge.

Bridge number 05-157-28.0 is posted at ________________ Tons

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

Date Bridge was posted: ________________

TO: Bottineau County
FROM: Paul Benning, Local Government
DATE: March 31, 2017
SUBJECT: Bridge Requiring Load Limit Posting
Bridge Number: 05-157-28.0
Location: 2E OF WILLOW CITY

Other Remarks: ________________

Work Done By Whom: ________________

If you have any questions, please call me at 328-4334. Pleas
Appreciated) to:

Local Government
ND Department of
608 East Boulevard
Bismarck, North D

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")

Alert Codes

FHWA requires that there is a follow-up procedure for bridges that have been identified with the alert code 3 status (immediate attention required). To comply with the FHWA requirement, NDDOT is requesting each owner of a bridge with an alert code 3 to use this report format to identify action taken to address the alert code 3 condition. This should be done by July 15, 2017. The following is the alert code remarks section from the Structure Inventory and Appraisal sheet for the subject bridge that requires attention:

TO: Dickey County

FROM: Paul Benning, Local Government

DATE: March 31, 2017

SUBJECT: Follow-up on Bridges with Alert Code 3 - IMMEDIATE ATTENTION

Bridge Number: 11-123-08.0

Location: 3 EAST 1 NORTH MONANGO

FHWA requires that there is a follow-up procedure for bridges that have been identified with the alert code 3 status (immediate attention required). To comply with the FHWA requirement, NDDOT is requesting each owner of a bridge with an alert code 3 to use this report format to identify action taken to address the alert code 3 condition. This should be done by July 15, 2017. The following is the alert code remarks section from the Structure Inventory and Appraisal sheet for the subject bridge that requires attention:

Remarks: NBI Remarks: Spalling thru-out structure. Exposed steel on east curb. West railing bent. Poor stream alignment. Road posted for 30 mph. Exposed rebar throughout structure exposed rebar west curb north end. .

Alert Code 3: 1/2016 - South diaphragm has a longitudinal crack.

Below describes what work or (repairs or other action) was done by the county to alleviate the cause of the alert code 3. Also describe any other work that you've done on this bridge that would affect the condition ratings or the load ratings.

____

____

____

____

____

____

Work Done By Whom: ____________________ On Date: ____________

If you have any questions, please call me at 328-4334. Please return this form by July 15, 2017 (Earlier Response Appreciated) to:

Local Government Division
ND Department of Transportation
608 East Boulevard Ave.
Bismarck, North Dakota 58505-0700

Scour Surveys

Turned over to the Counties in 1995 – WHY??

Required every 4 years

Bottineau County

Bridge Inventory - Scour and Channel Profile

SEC 409

Structure Number	Location	Feature Intersected	Channel Profile Last Inspected	Channel Profile Frequency	Year Built	Structure Type
05-101-14.0	12 NORTH 4 WEST LANSFORD	WEST CUT BANK CREEK	08/23/2013	48	1945	Wood or Timber - Stringer
05-101-15.0	11 NORTH 5 WEST LANSFORD	CREEK	08/26/2013	48	1955	Concrete - Channel Bm
05-102-14.0	2 EAST 3 NORTH OF MOHALL	WEST CUT BANK CREEK	08/23/2013	48	1970	Concrete - Channel Bm
05-103-12.0	8 SOUTH 8 WEST ANTLER	CUT BANK CREEK	08/23/2013	48	1969	Prestressed conc - Adjacent Box Bm
05-103-15.0	3 EAST 2 NORTH OF MOHALL	CUT BANK CREEK	08/23/2013	48	1965	Concrete - Channel Bm
05-104-12.0	14 NORTH 1 WEST LANSFORD	CUT BANK CREEK	08/26/2013	48	1948	Wood or Timber - Stringer
05-105-14.0	12 NORTH 1 WEST LANSFORD	CUT BANK CREEK	08/23/2013	48	1970	Concrete - Channel Bm
05-107-08.0	6 SOUTH 3 WEST OF ANTLER	CREEK	08/23/2013	48	1935	Wood or Timber - Stringer
05-108-20.0	6 NORTH 3 EAST LANSFORD	CUT BANK CREEK	06/23/2014	48	1949	Wood or Timber - Stringer
05-108-21.0	8 WEST OF MAXBASS	CUT BANK CREEK	08/20/2013	48	1948	Wood or Timber - Stringer
05-109-01.0	2 NORTH 1 WEST OF ANTLER	ANTLER CREEK	08/23/2013	48	1939	Wood or Timber - Stringer
05-109-12.0	9 SOUTH OF ANTLER	CREEK BED	08/23/2013	48	1950	Wood or Timber - Stringer

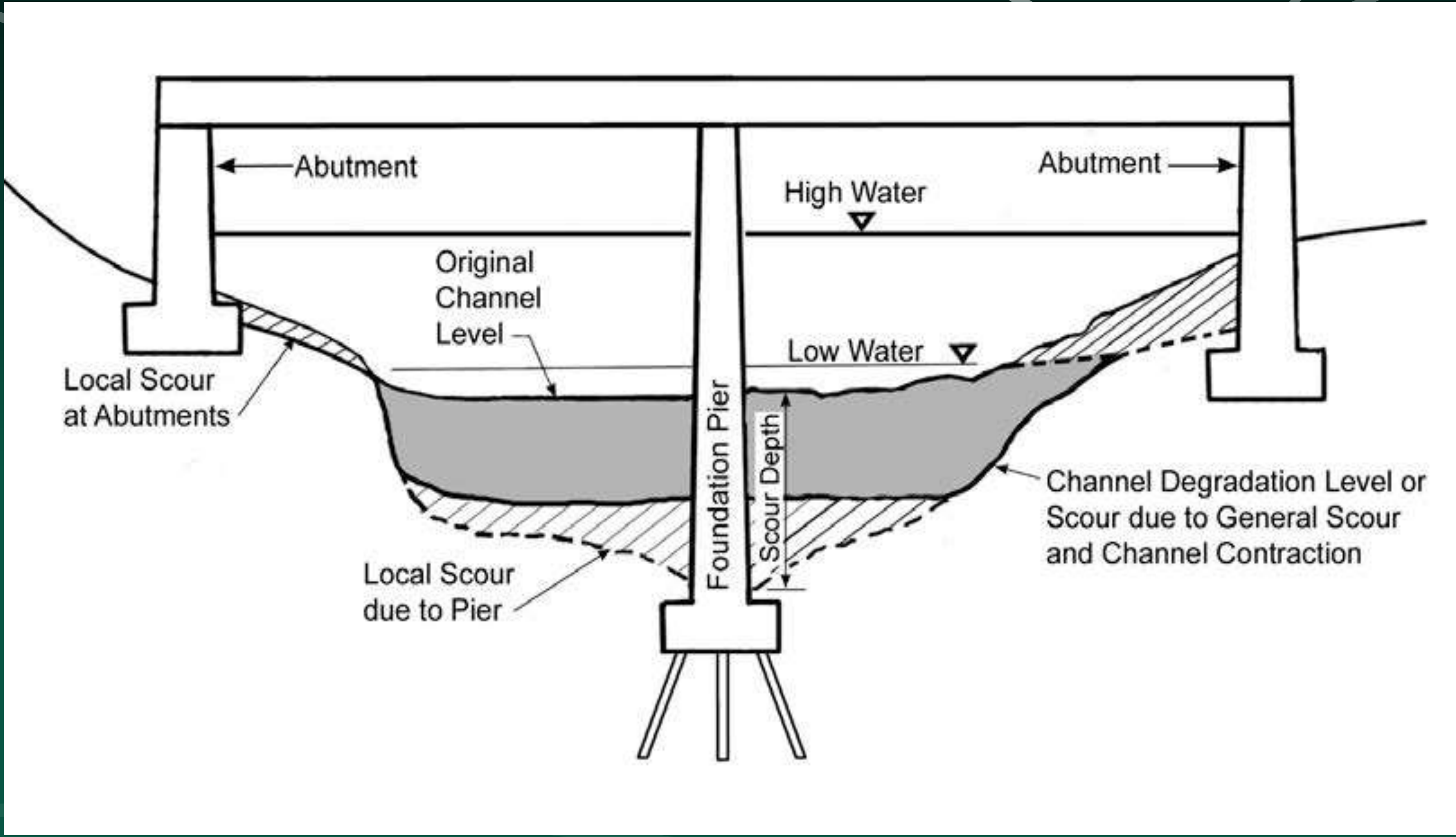
Dickey County

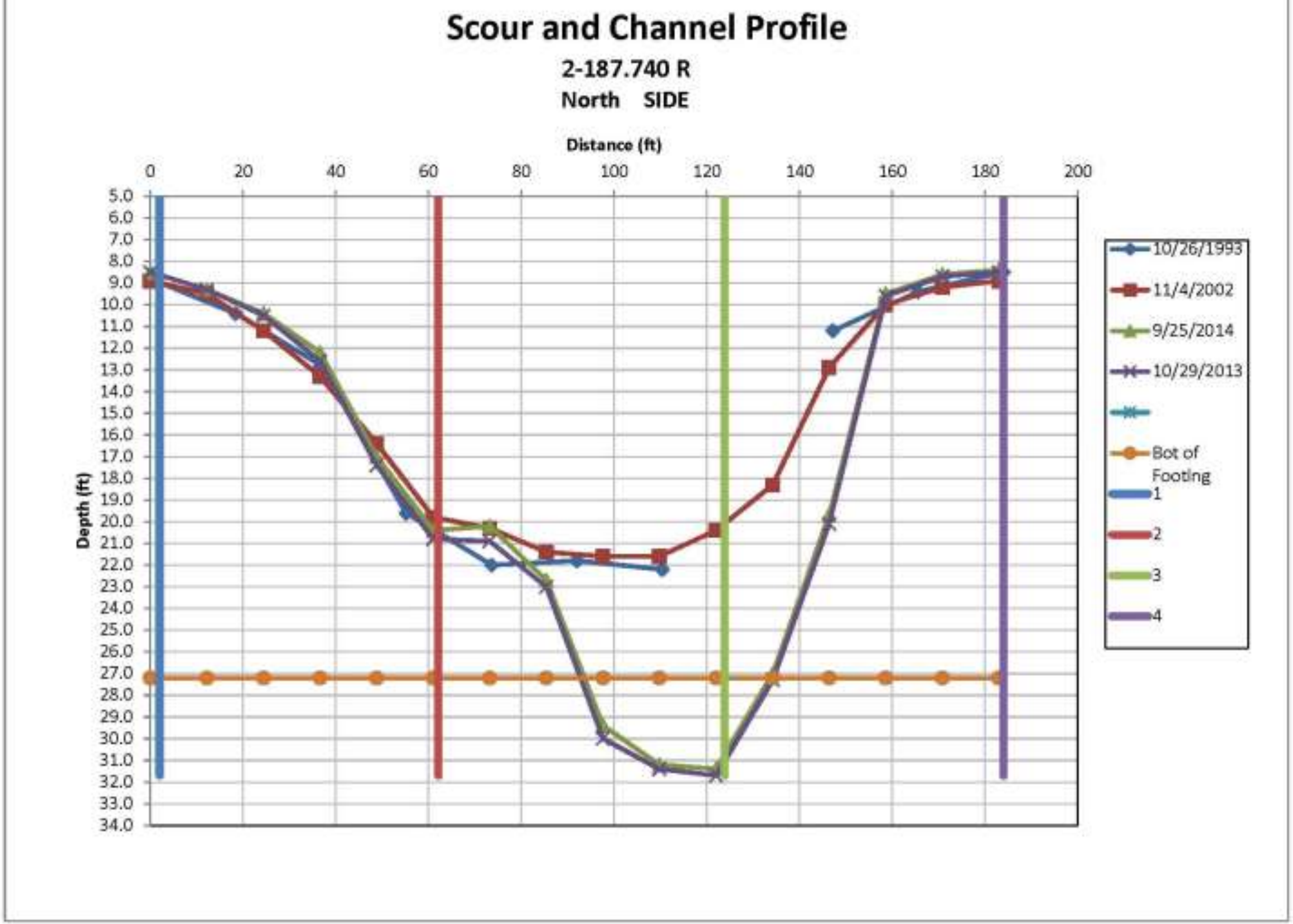
Bridge Inventory - Scour and Channel Profile

SEC 409

Structure Number	Location	Feature Intersected	Channel Profile Last Inspected	Channel Profile Frequency	Year Built	Structure Type
11-145-03.0	7 N 1 E OF OAKES	CREEK	06/12/2013		1976	Prestressed conc - Tee Bm

County Structures Due for Channel Profile: 1


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


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

NDSU

Bridge Inspection

County pays 19.07% match for NDDOT inspection = $45.20/structure

Box Culvert Inspection Cycle

January 13, 2016

North Dakota Department of Transportation

Bridge Inventory - Structure Inventory And Appraisal Sheet SEC 408

Structure Number: 18-113-28.1 chaindate

200 System Designation			3 – County Off
201 Status			Not Deficient
202 Sufficiency Rating			62.00
Identification			
02 Highway District			Grand Forks District
03 County			Gr. Forks
04 City			GRACE TOWNSHIP
05 Inventory Route			Route On Structure
4 County Hwy	1 Mainline	00000	0 N/A (NBI)
06 Feats Intersect			CREEK
09 Location			2 SOUTH 1 WEST KEMPTON
11 Milepoint			0.000
13 LRS Inv Route. Subroute		-1	-1
16 Latitude			47d 47' 16.00"
17 Longitude			97d 38' 36.00"
GPS Coordinates XY		601621.7	5293501.9
98 Border Bridge		Unknown (P)	0.00 %
99 Border Bridge Struct No.			_
Structure Type and Material			
43 Main Struct Type			Steel
Stringer			
44 Approach Struct Type			Unknown (NBI)
			Unknown (P)
45 No. Spans in Main Unit			1
46 No. Approach Spans			0
107 Deck Struct Type			8 Wood or Timber
108 Wearing Surface			7 Wood or Timber
Membrane			0 None
Dk Protect			None
208 Dk Overburden	205		Gravel/Dirt
Age and Service			
27 Yr Built	1949	106 Yr Reconstructed	-1
42 Type of Service		1 Highway	- On
		5 Waterway	- Under
28 Lanes on Structure			2
29 ADT	30	30 Year of ADT	2013
109 Average Daily Truck Traffic			-1.00
19 Bypass. Detour Length			2 Miles
Geometric Data			
10 Min Vert Clearance			328 Ft. 1 In.
32 Approach Roadway Width			20 Feet
33 Bridge Median			0 No median
34 Skew			0.00
35 Structure Flared			0 No flare
47 Total Horizontal Clearance			25.3 Feet
48 Length of Max Span			26 Feet
49 Structure Length			29.86 Feet
50 Curb/Sidewalk Widths		0.3	Ft Rt-Side
		0.3	Ft Lt-Side
51 Bridge Rdwy Width - Curb to Curb			25.3 Feet
52 Deck Width			26.2 Feet
53 Min Vert Clear. Over Bridge			328 Ft. 1 In.
54 Min Vert Underclearance			0 Ft. 0 In.
			N Feature not hwy or RR
55 Min Lateral UnderClear. - Rt			327.8 Feet
			N Feature not hwy or RR
56 Min Lateral UnderClear. - Lt			0.0 Feet
210 Culvert / 211 Description			

Classification			
12 Base Highway Network			Not on Base Network
20 Toll			3 On free road
21 Maint Responsibility			02 County Hwy Agency
22 Owner			02 County Hwy Agency
26 Functional			Rural, Local
37 Historical Significance			5 Not eligible for NRHP
100 Defense Highway Designation			0 Not a STRAHNET hwy
101 Parallel Structure Designation			No ‖ bridge exists
102 Direction of Traffic			2 2-way traffic
103 Temporary Structure Designation			Not Applicable (P)
104 Highway System of Inventory Rte			0 Not on NHS
105 Federal Lands Highways			Not applicable
110 Designated National Network			0 Not part of natl netwo
112 NBIS Bridge Length			
226 Functional Under			
Condition			
58 Deck			7 Good
59 Superstructure			6 Satisfactory
60 Substructure			5 Fair
61 Chan. & Chan. Protection			7 Minor Damage
62 Culvert and Retaining Walls			N N/A (NBI)
Load Rating and Posting			
31 Design Load			
			M 18 (H 20) (live load for which structure was designated)
41 Structure Open, Closed or Posted			P Posted for load
63 Operating Rating Method			2 AS Allowable Stress
64 Oper. Rating	HS	14	26 Tons
65 Inventory Rating Method			2 AS Allowable Stress
66 Inv. Rating	HS	9	17 Tons
70 Bridge Posting			2 20.0-29.9%below
209 Posted in "Tons"			27 Tons
Appraisal			
67 Structural Condition			4 Minimum Tolerable
68 Deck Geometry			6 Equal Min Criteria
69 Underclear. Vert & Horiz			N Not applicable (NBI)
71 Waterway Adequacy			8 Equal Desirable
72 App. Rdwy. Alignment			6 Equal Min Criteria
36 Traffic Safety Features			0 0 0 0
113 Scour Critical			U Unknown Scour
Inspections			
90 Date of Last Inspection			September 02, 2015
91 Designated Inspection Frequency			24 Months
92 Critical Feature Inspected / 93 Critical Feature Last Inspection Dt			
Fracture Critical	N		
Underwater	N		
Other Special	N		
218 Channel Profile	Y	48	09/19/2013
Chaining Date			None
207 Transporter Erector Routes and Sites			-1
212 Structure Load Rated			01/01/1901
213 Federal Aid Project Number			
214 Delayed Inspection			Not Applicable
216 Inspector			Fischer
Navigation Data			
38 Navigation Control			Permit Not Required
39 Navigation Vertical Clearance			0 Feet
40 Navigation Horizontal Clearance			0 Feet
111 Pier or Abutment Protection			Unknown (NBI)
116 Minimum Navigation Vertical Clearance			-1 Feet

Key Terms and Topics

Guardrail Requirements
Critter Crossings
New/Rehabilitated/Repaired Bridges
Historical Bridge

Guardrail Clear Zone

Table 1 CLEAR ZONE DISTANCE (in Feet from Edge of Driving Lane)[1]

DESIGN SPEED	DESIGN ADT***	FORESLOPE					BACKSLOPE				
		FLAT	1V: 6H	1V: 5H	1V: 4H	1V: 3H	1V: 3H	1V: 4H	1V: 5H	1V: 6H	FLAT
40 mph or less	Under 750	7-10	7-10	7-10	7-10	**	7-10	7-10	7-10	7-10	7-10
	750-1500	10	12	12	14	**	12-14	12-14	12-14	12-14	12-14
	1500-6000	12	14	14	16	**	14-16	14-16	14-16	14-16	14-16
	Over 6000	14	16	16	18	**	16-18	16-18	16-18	16-18	16-18
45-50 mph	Under 750	10	12	12	14	**	8-10	8	10	10	12
	750-1500	14	16	16	20	**	10-12	12	14	14	16
	1500-6000	16	18	20	26	**	12-14	14	16	16	18
	Over 6000	20	22	24	28	**	14-16	18	20	20	22
55 mph	Under 750	12	14	14	18	**	8-10	10-12	10-12	10-12	10-12
	750-1500	16	18	20	24	**	10-12	14	16	16	18
	1500-6000	20	22	24	30	**	14-16	16	18	20	22
	Over 6000	22	24	26	32*	**	16-18	20	22	22	24
	Under 750	16	18	20	24	**	10-12	12	14	14	16

NI

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

Increased Rail Height

- Improved capture
- Reduced rollover potential

Test No. MGSBR-1

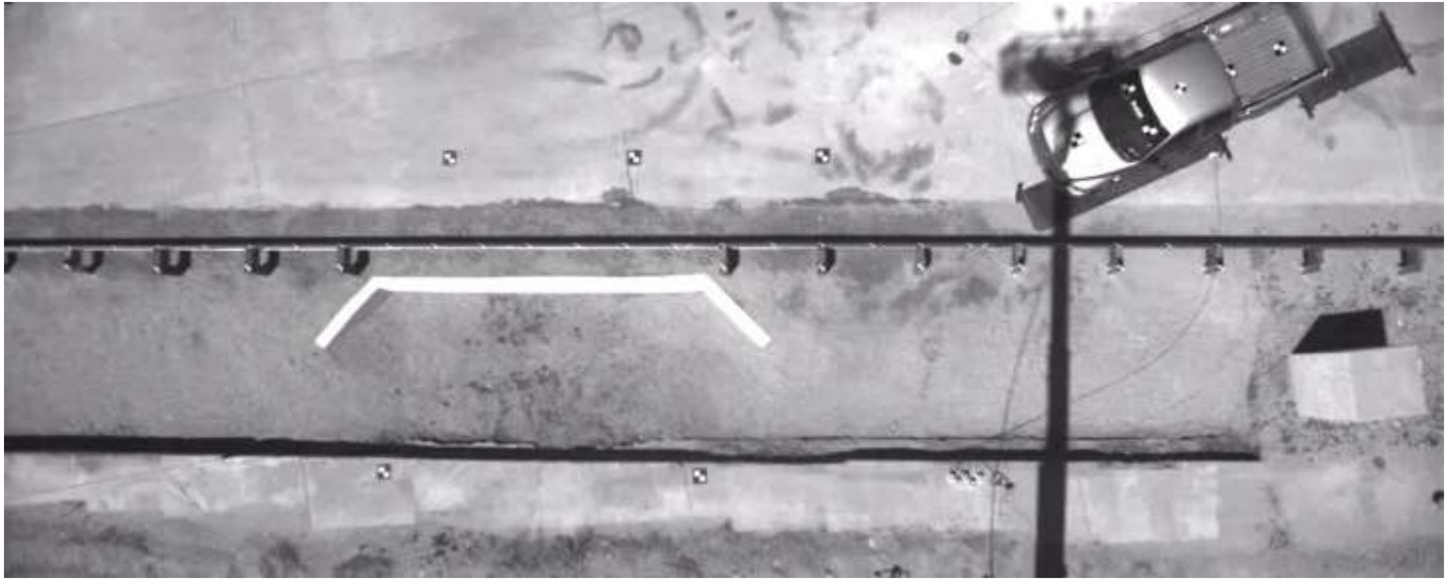
- MASH
  - 3-11
  - 2270P
- Impact conditions
  - 61.9 mph
  - 24.9 deg.
- Dynamic deflection
  - 48.9 in.

Test No. MGSBR-1




Test No. LSC-2

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



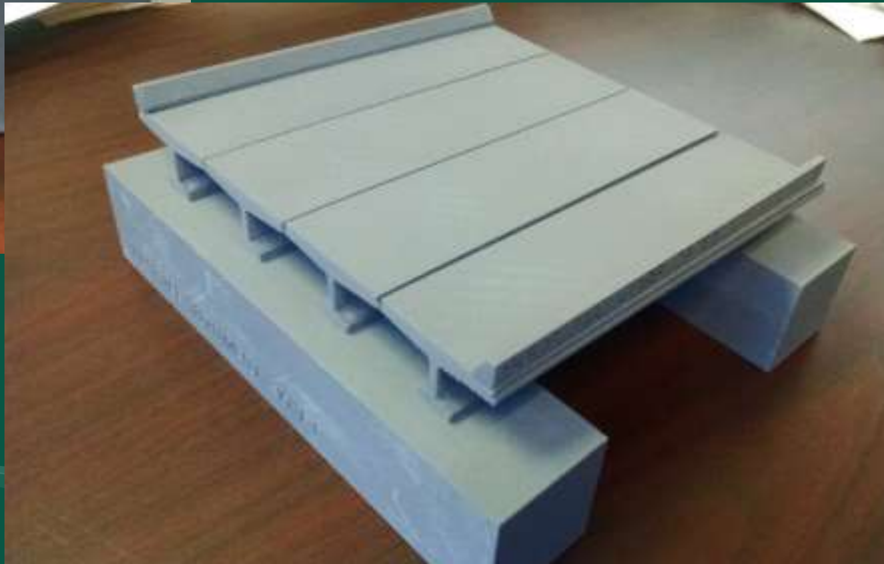
Critter Policies

Animal Crossings
We all have them

Moose Crossing


NUTTY NARROWS BRIDGE

New Bridge Process



Bridge Removal Process

NDSU UPPER GREAT PLAINS TRANSPORTATION INSTITUTE

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

Materials used (provide a description of the material properties, size, etc.)

Flood Plan of Action

When to check
What bridges to check
When to close
Who to Inform
Actions to Save Bridge

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

Historical Bridges

NDSU UPPER TRAN

Key Terms and Topics

Who can close a bridge?

Flood Action Plan

Clear Zones

Reporting for Closed, repaired or new bridges

Failures

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

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


08/02/2011

NDS

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)

NDSU UP TR

The Bismarck Tribune

THE ORIGINAL
Bismarck Tribune
SPORT SHOW
36th Annual
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 | bismarck

TOM STROMME PHOTOS, TRIBUNE

truck 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 Latovia Bailey jumps over a highway divider Friday while working the scene where a section of an 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 noncom bustible.

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

Stark County Bridge Replacement


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

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

64

NDSU UPPER TRAN


WEIGHT LIMIT
4 TONS PER AXLE
11 TONS GROSS


140M


AXLE
WEIGHT
LIMIT
3 TONS
PASSENGER
VEHICLES
ONLY


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."**

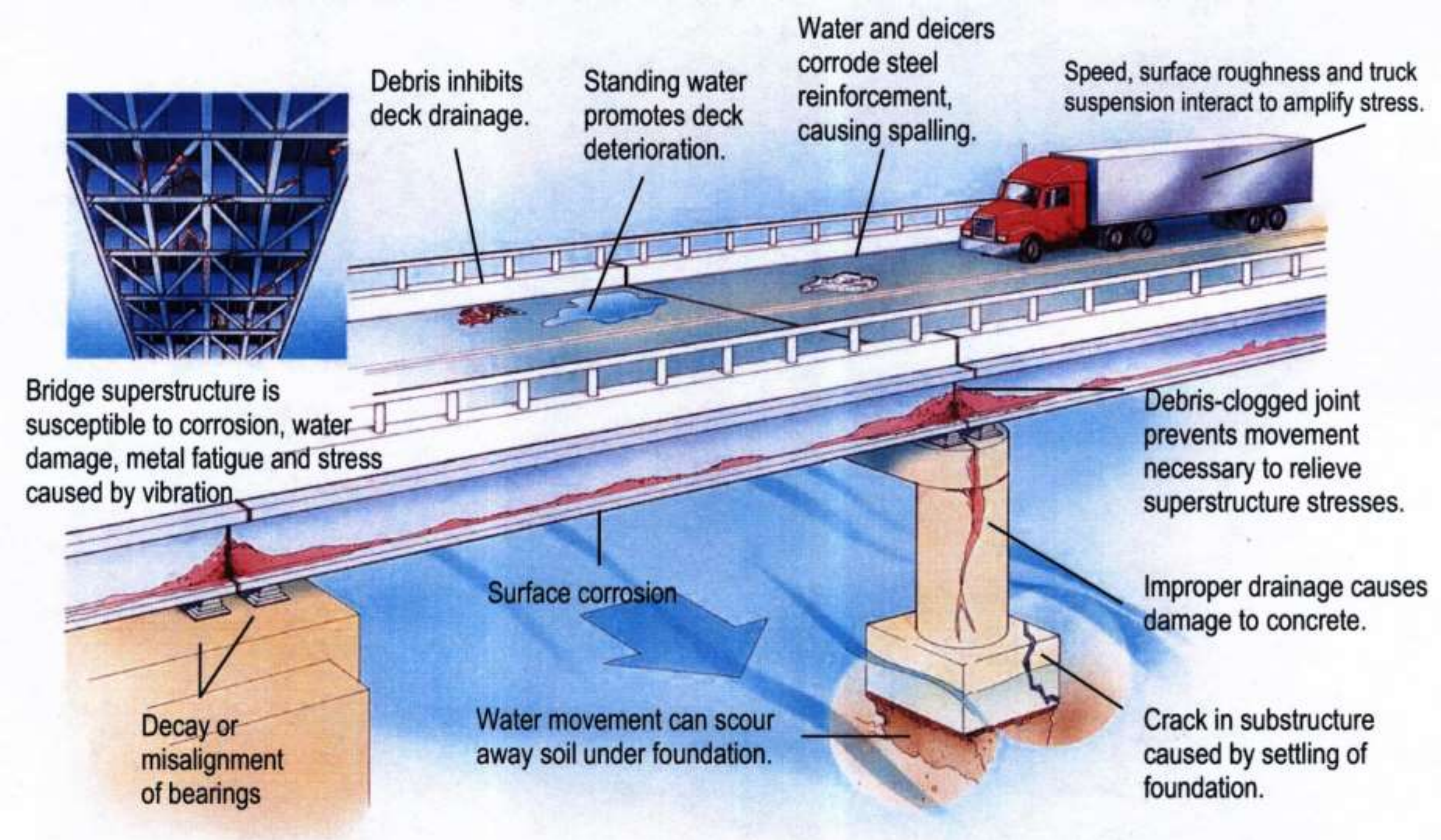
Source: AASHTO Board of Directors, Policy Resolution PR-3-11, October 17, 2011.

Life Cycle Costs => Bridge Preservation

Construction Costs

Maintenance Costs

Salvage Value



Debris inhibits deck drainage.
Standing water promotes deck deterioration.
Water and deicers corrode steel reinforcement, causing spalling.
Speed, surface roughness and truck suspension interact to amplify stress.
Bridge superstructure is susceptible to corrosion, water damage, metal fatigue and stress caused by vibration.
Debris-clogged joint prevents movement necessary to relieve superstructure stresses.
Surface corrosion
Improper drainage causes damage to concrete.
Decay or misalignment of bearings
Water movement can scour away soil under foundation.
Crack in substructure caused by settling of foundation.

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

Bridge Cost Estimates

New bridge - $200/sf

Deck replacement - $75/sf

Treat deck with silane - $0.25/sf

Crack seal deck - $0.10/sf


Risk Management
assess
control
review
identify

See no Evil

NDSU UPPER GRE
TRANSPOR

Williams County Asset Values

67 bridges =>$35 million

251 miles of paved road => $251 million

79 miles of AST => $59 million

497 miles of gravel road => $250 million
Sum = $595 million

Sand and debris holding water on deck

Keep It Clean!

Keep It Clean!

NDSU

Concrete Deck Maintenance

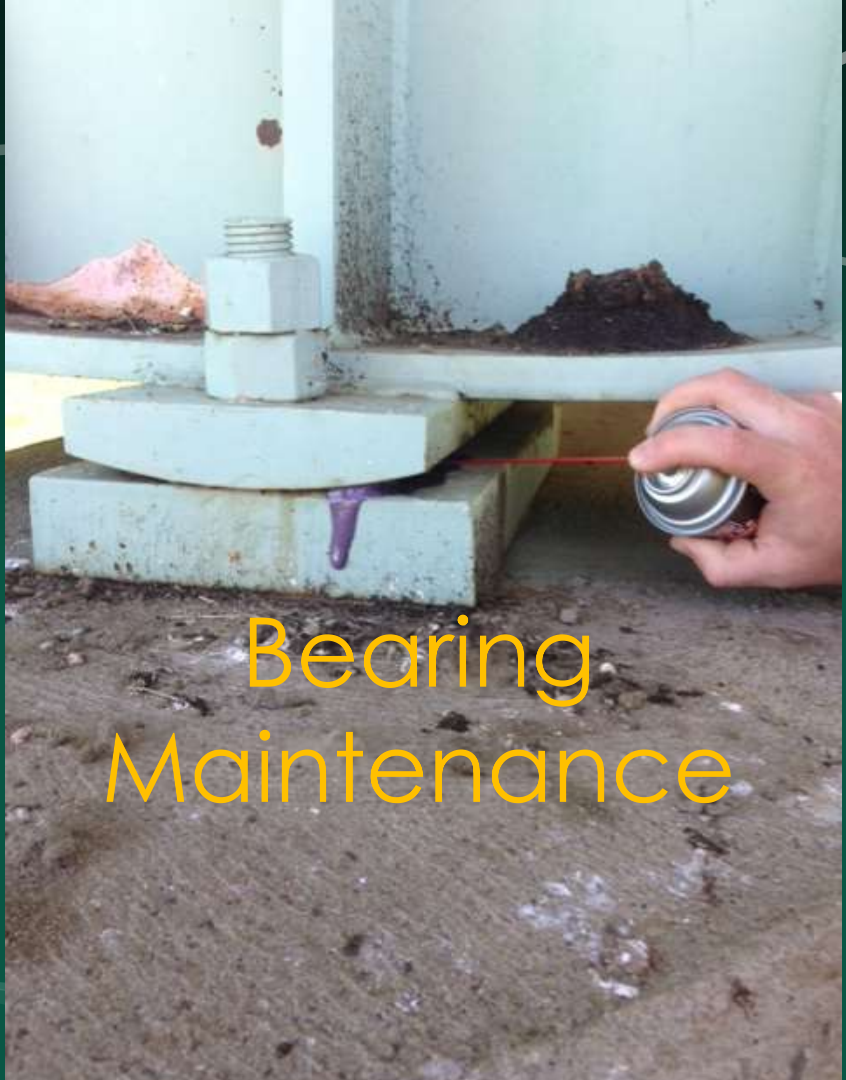
Deck Surface Treatment (Silane)

NDSU

Box Beam Weep Hole

Cracked Beam – plugged weep hole

NDSU UPPER TRANS



Bearing Maintenance

Timber Deck Maintenance

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


07/09/2012


07/09/2012

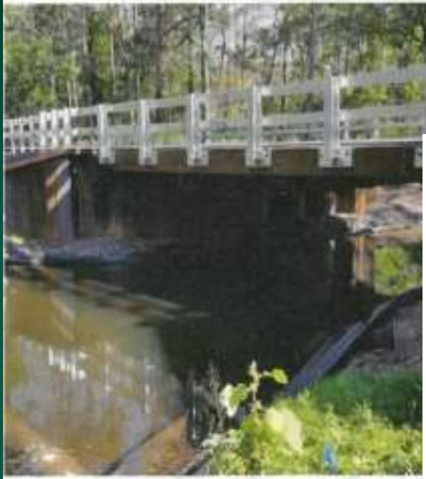
Trends

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

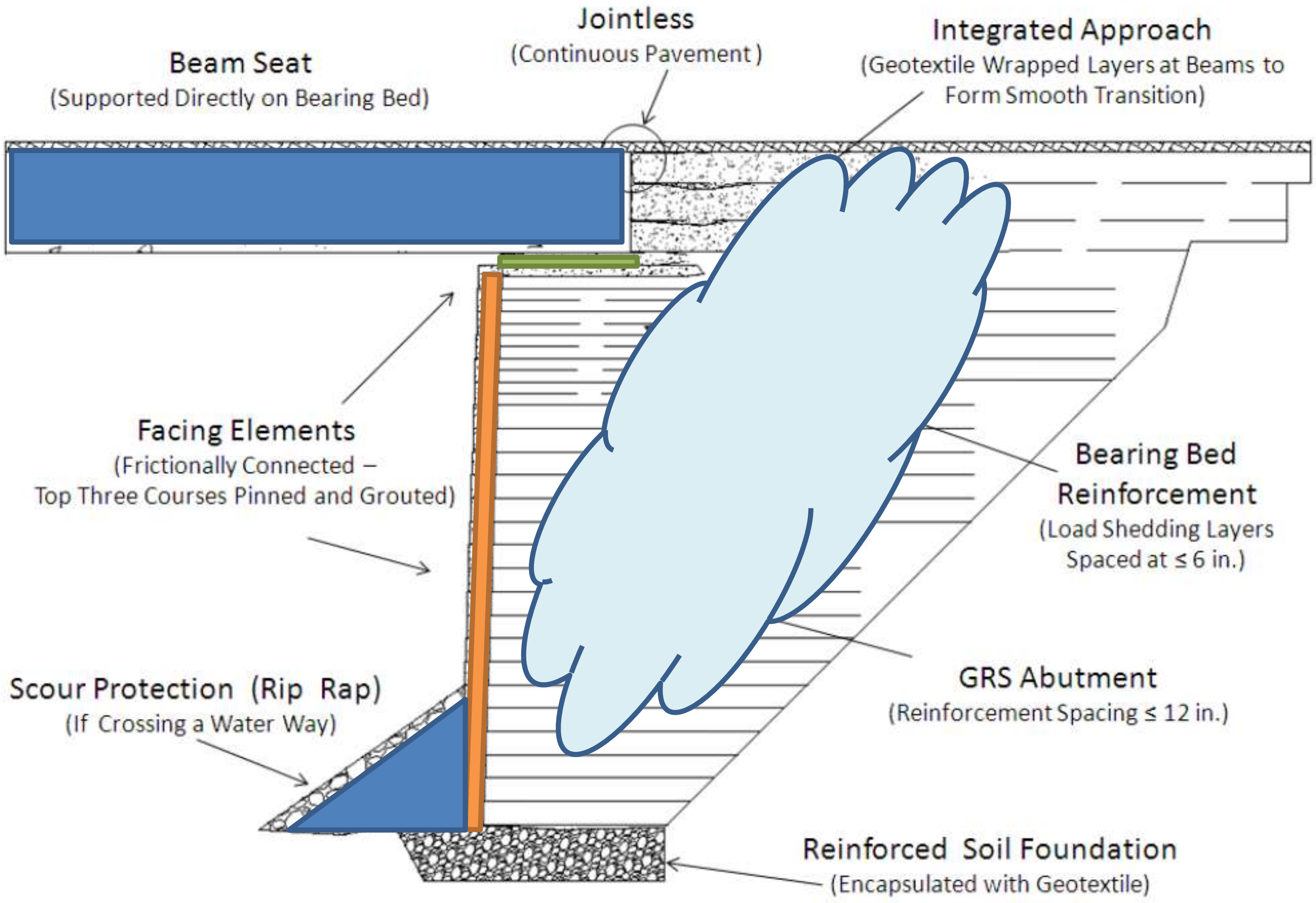


This is an example of an accelerate
bridge construction utilizing perma
steel sheet piles supplied by Skyline

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"

NDSU

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 SuperSill® abutment system ready to be filled with concrete.

(ABC-Accelerated Bridge Construction) & Modular Units

Vibratory Piling Driver

Railroad car bridge - temporary

BOWEN LABORATORY

LTAP
LOCAL TECHNICAL ASSISTANCE PROGRAM

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)

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

Flatcars NOT Boxcars


COONROD
P&H
OVERSIZE

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

NDSU


WEIGHT
LIMIT
3
TONS

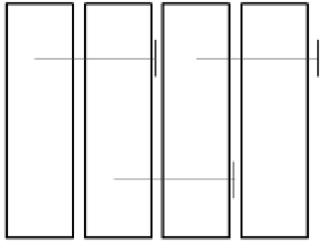
Stark County Bridge Replacement


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

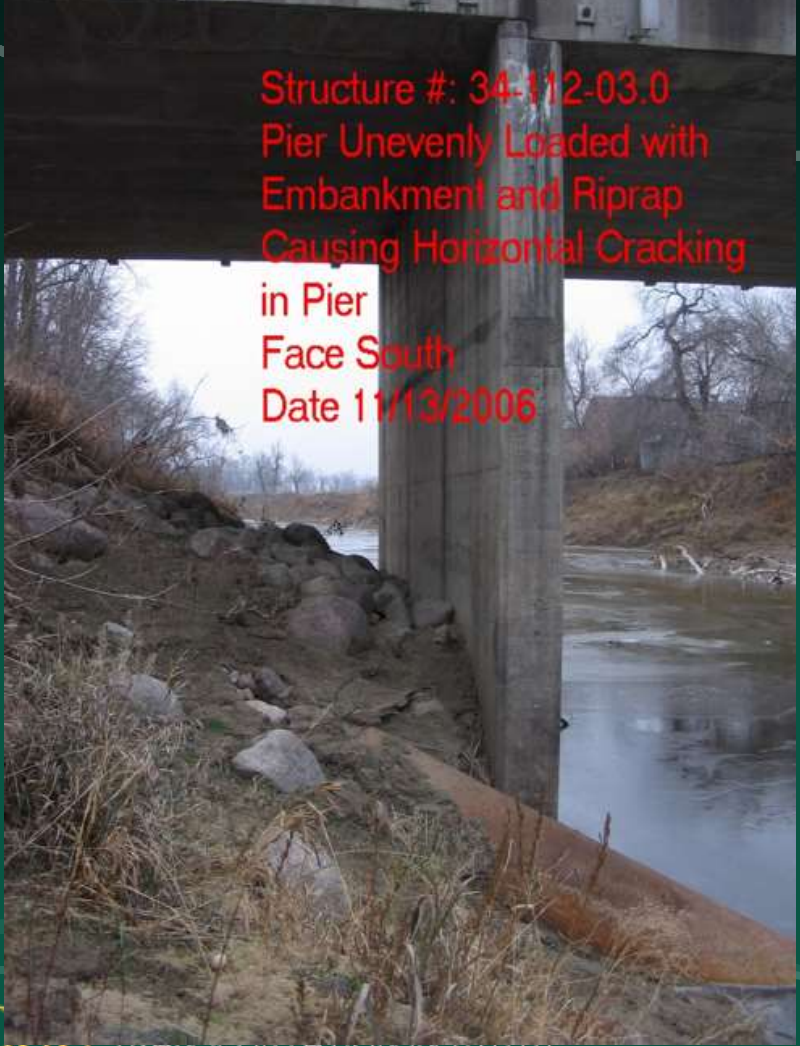


Spread Laminates

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


New steel pile.
rt-new
lt-slipped over
old wood pile
11.13.2006

Plates welded to rusted pile

Beam Seat Failure


09.26.2006 13:14


Pitcairn
9-2-03
N Abut

Shot Crete

Bridge 0024-000.320

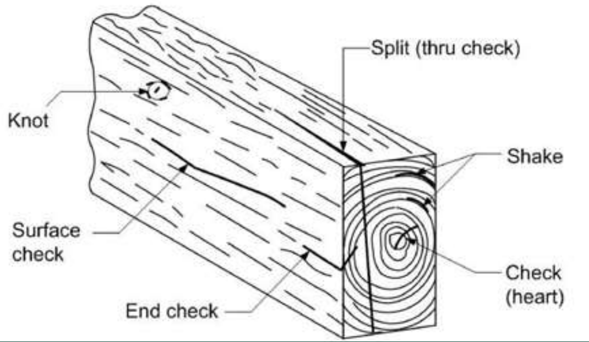
Pictures Taken February 2018

Abutment Repair

Pedestal Repair


200 LC
DEERE

NDSU



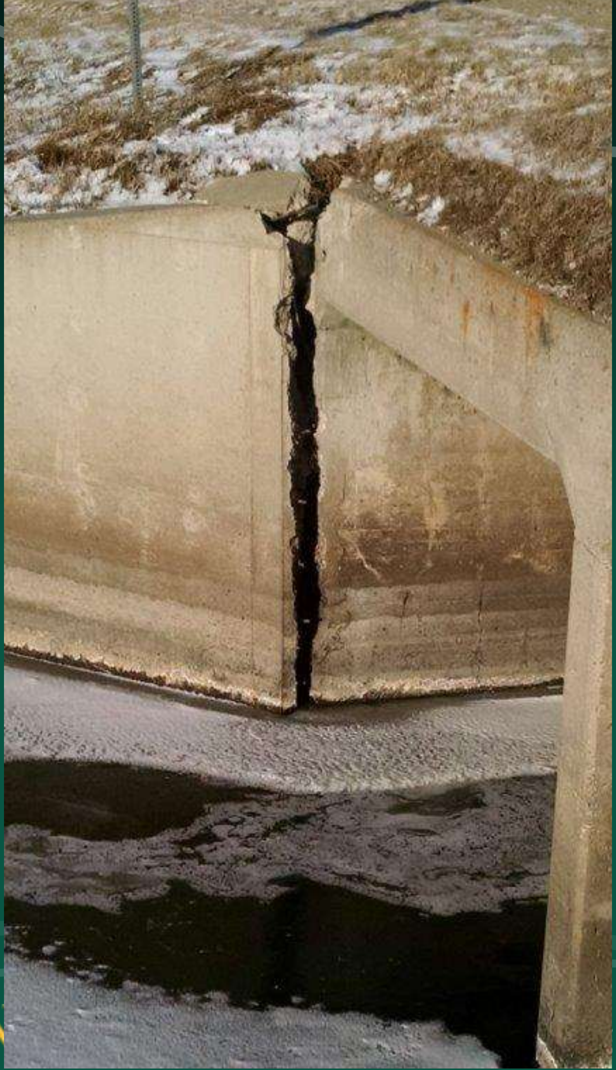
Grand Forks County Tips

Rip Rap

Sign

Treat timber ends

Keep wooden deck timbers tight





Glue Laminated Beams

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

Key Terms and Topics

Local Solution Examples

Preserve What We Have

Solve Small Problems

Truck Overweight Permit System

LoadPass

PERMITS

Next up:
Bridge Inspections


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

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Williams County Field Inspections

Resource List

NDDOT Design Manual – Chapter 5

NDDOT Local Government Manual

NDDOT Bridge Inspection Team

ND Township Officers Manual

State Stream Standards

NDLTAP Resource Page

Ndltap.org

Your one stop shop for local road info

Tap into NDDOT and NDLTAP
We Want to Help!

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

NDIRF

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

Bridge 101

Grand Forks, June 6, 2018
Williston, June 13, 2018

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NORTH DAKOTA LOCAL TECHNICAL ASSISTANCE PROGRAM

NDDOT
North Dakota Department of Transportation