



**NATIONAL
TRANSPORTATION
IN INDIAN COUNTRY
CONFERENCE**

**DULUTH, MINNESOTA
SEPTEMBER 17-20, 2018**

Bridge 101

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NDSU

UPPER GREAT PLAINS
TRANSPORTATION INSTITUTE
NORTH DAKOTA LOCAL TECHNICAL ASSISTANCE PROGRAM

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Info Hand-offs

What is a Bridge

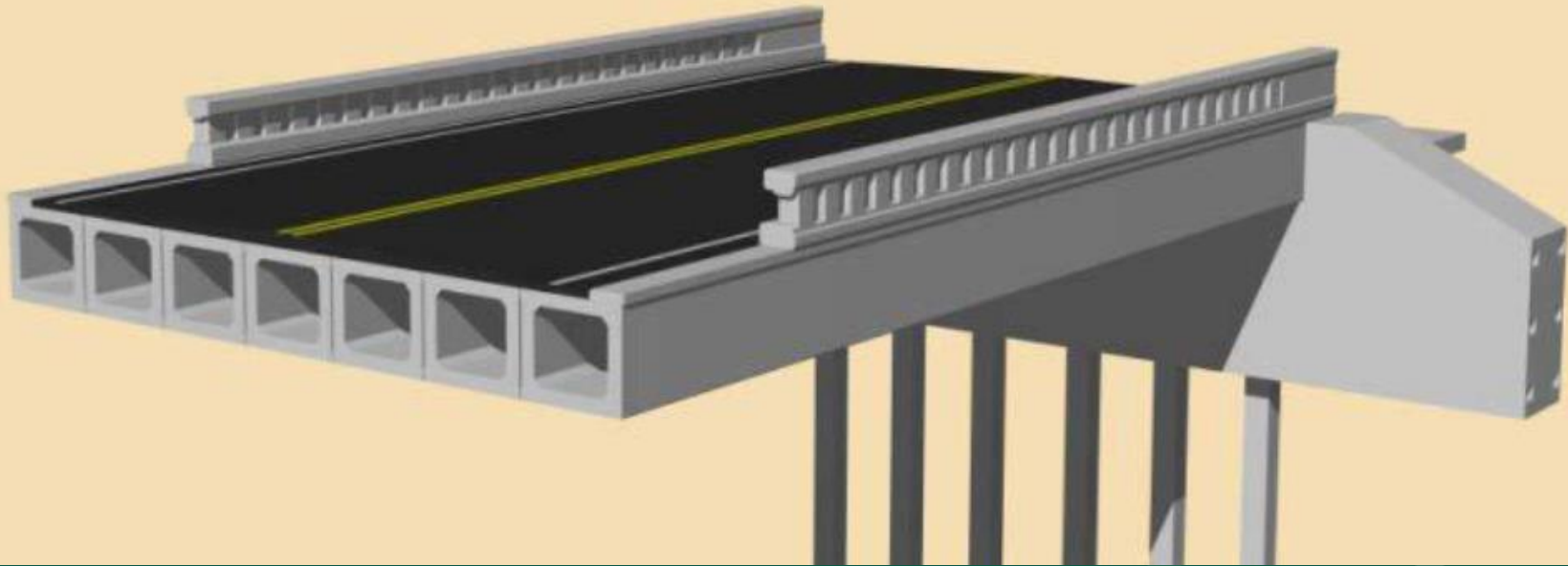
Bridge Parts

Bridge Inspections

Bridge Loadings

Solutions

What is a Bridge?



Bridges are . . .



Links in the roadway system





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.”



ROADS&BRIDGES

May 2017
Scranton Gillette Communications
www.RoadsBridges.com

STATE OF THE BRIDGES

Rising from the mists

Shining a light on Halifax's historic Macdonald Bridge

ALSO INSIDE:

State of the Bridges Report
Saving the Elysian Viaduct
Minnesota's Winona Bridge



2017
INFRASTRUCTURE
REPORT CARD
ASCE

Bridges

An orange clipboard icon with a white 'C+' grade written on it.

9.1% of bridges rated structurally deficient



**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-Ydl>



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



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

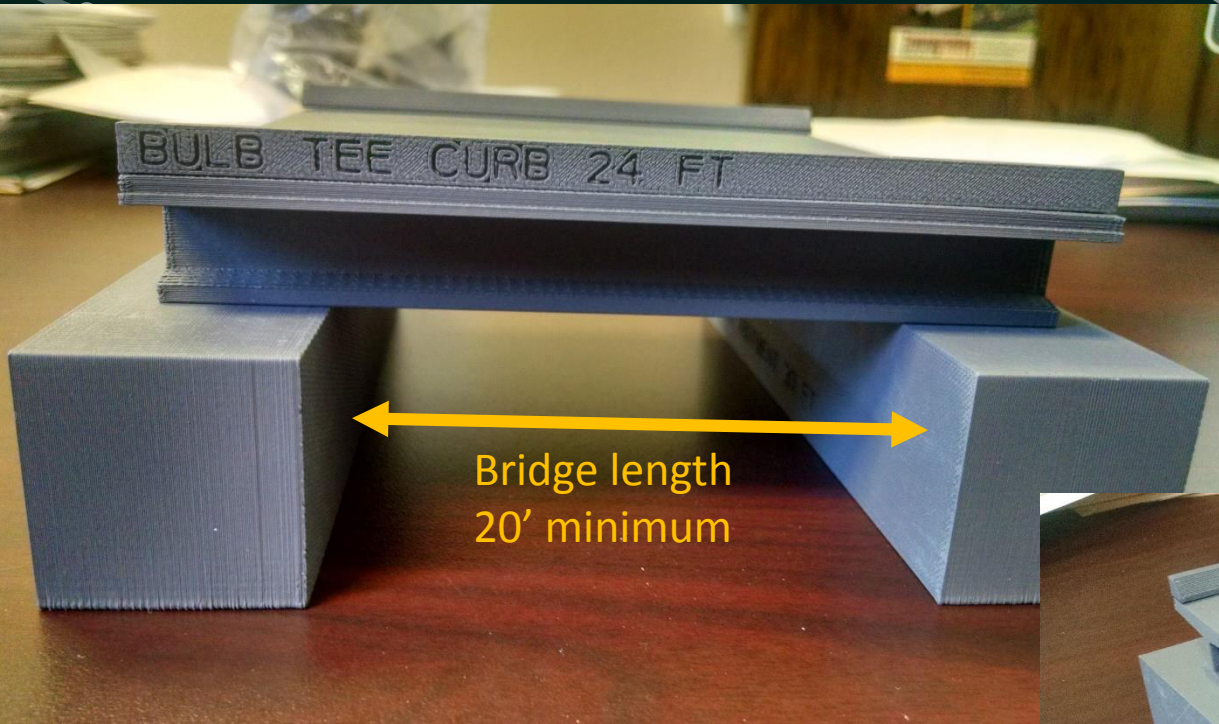


Really
Bad
Day

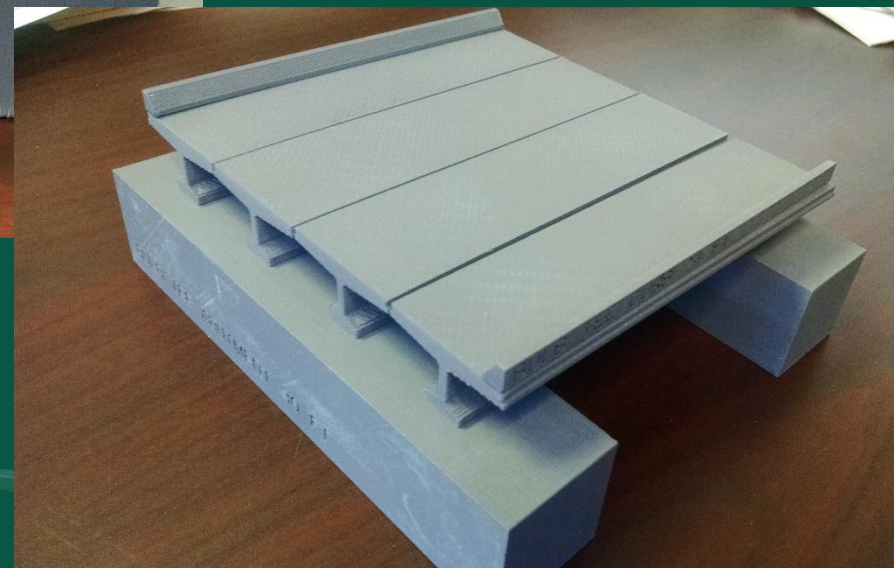


- 1968 – National bridge inspection (NBI) program initiated (requiring regular and periodic inspections)
- 1971 – National bridge inspection standards (NBIS) adopted (prescribe how, with what frequency, and by whom bridge inspections must be completed)
- 1987 – Schoharie Creek collapse (scour)
- 2007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

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



Bridge length
20' minimum





20' minimum



20' minimum

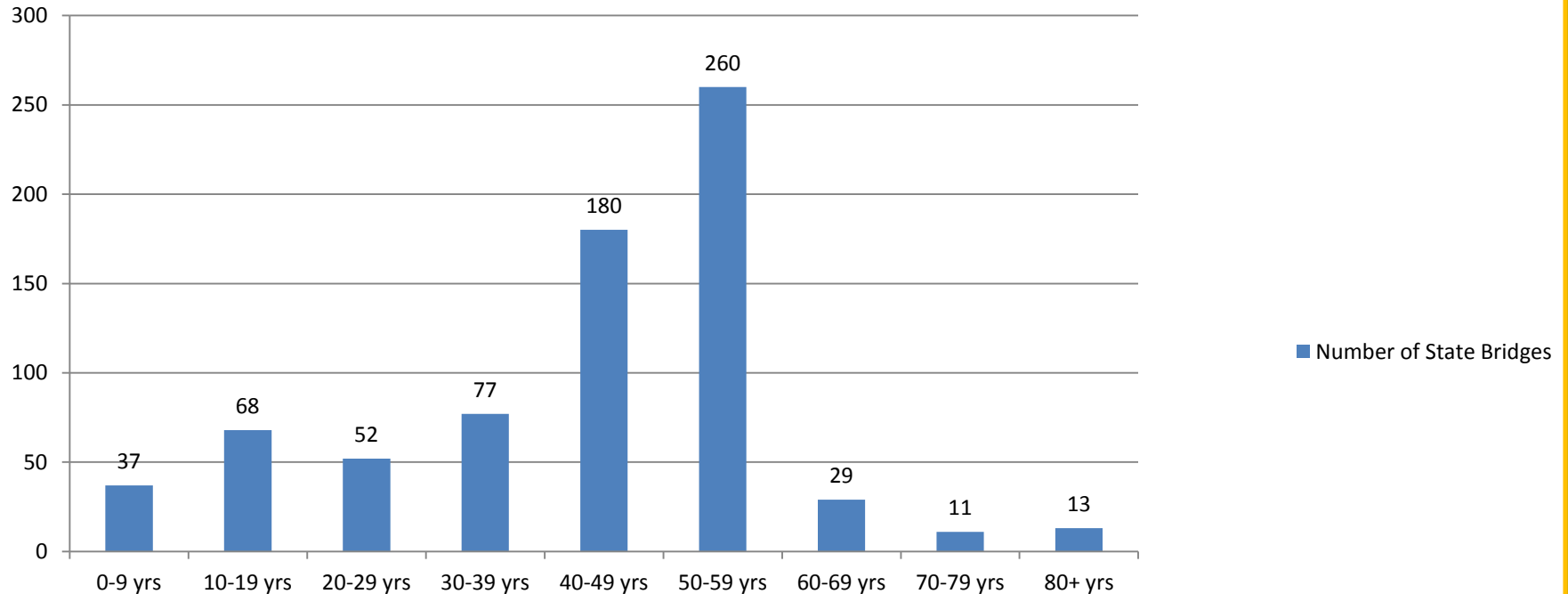
< 1/2 dia

Minor Structures

Less than 20' in length

State Bridge Age

Number of State Bridges



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 ^a 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



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

- Forrest Gump



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

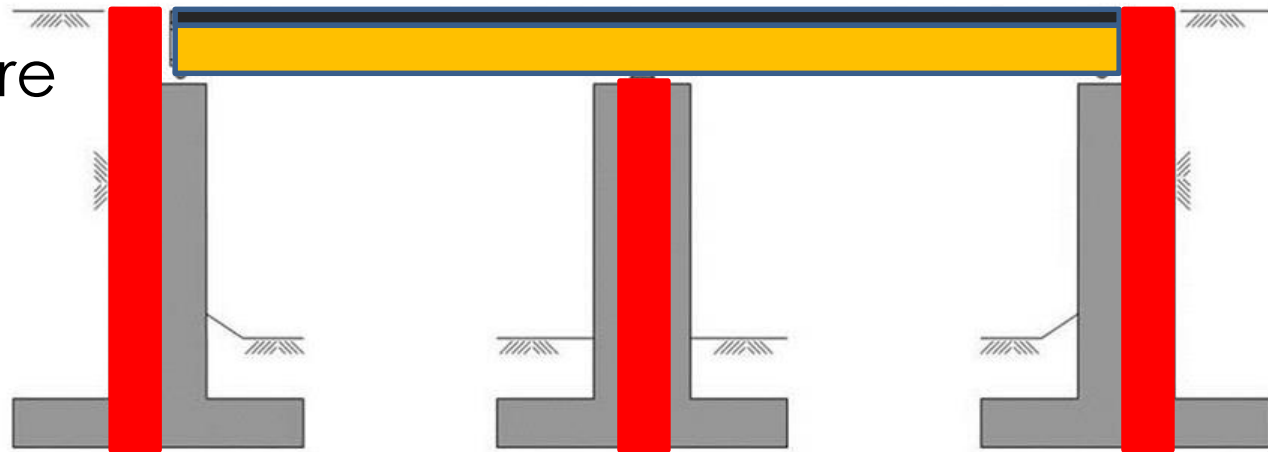
Duluth 2012



Bridge Parts

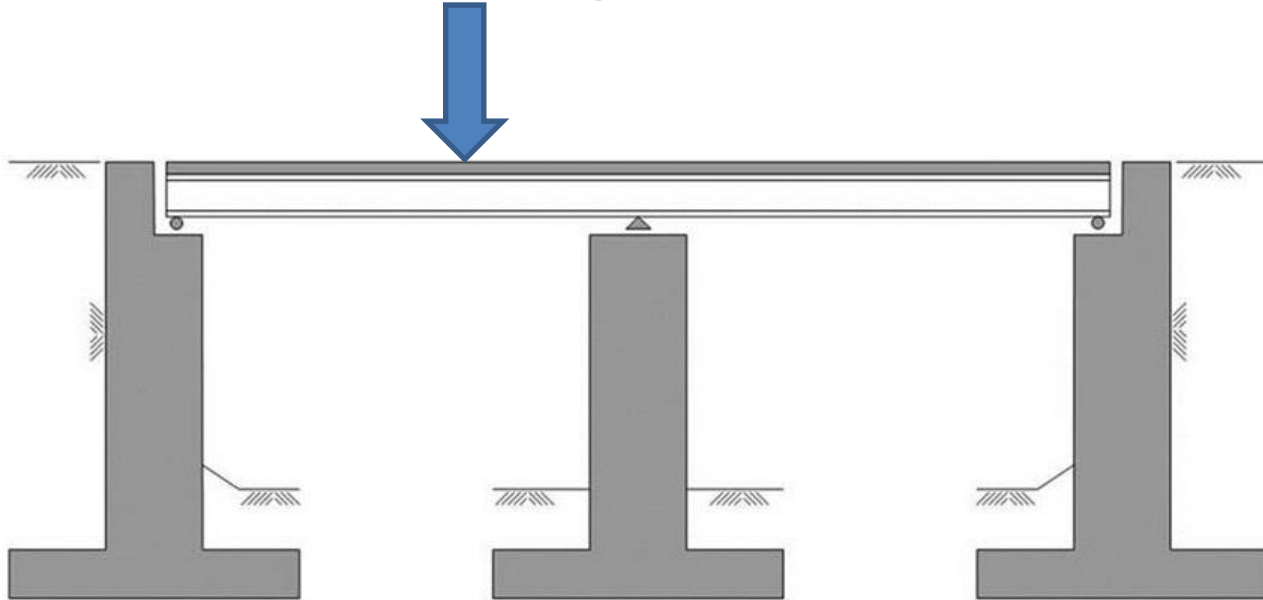
Bridge Components and Terms

- Three Major Bridge Components
 - Deck
 - Superstructure
 - Substructure



Deck

- Portion of the bridge that you drive on



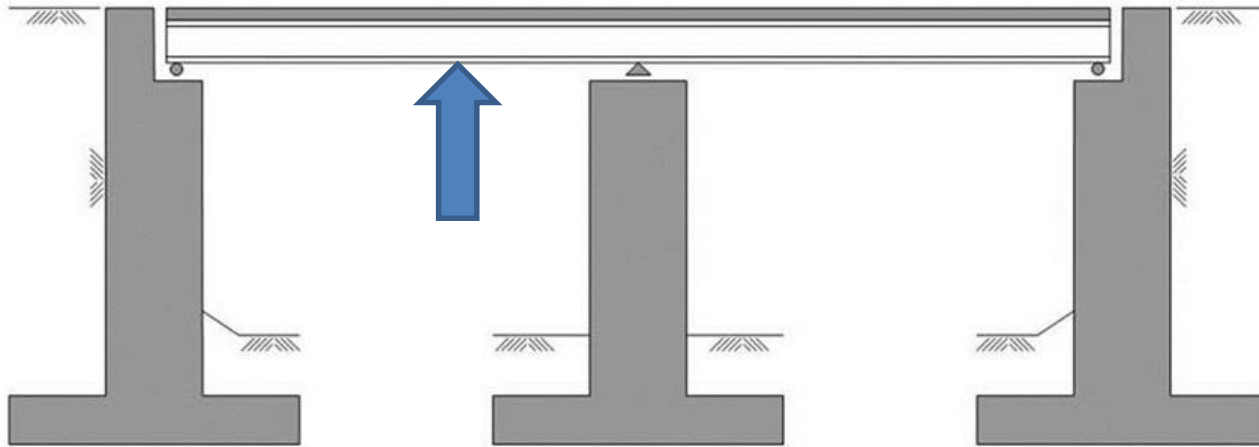


Design and Construction



Superstructure

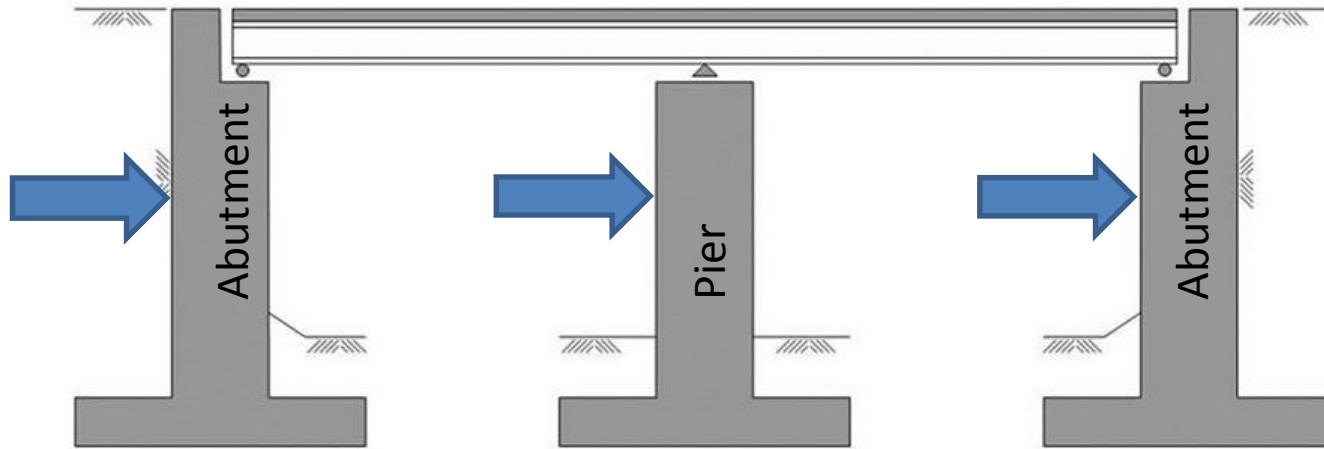
- Portion of the bridge that lies directly below and supports the deck
 - Beams, girders, truss, arch





Substructure

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



Wood Pile Foundations



Steel Pile Foundation



Bearings

- Transfer loads from Superstructure to Substructure
- $\frac{3}{4}$ " expansion with 120° F temp change - 100' bridge



← Rocker Bearing

Anchor Bolt



Beam Shapes



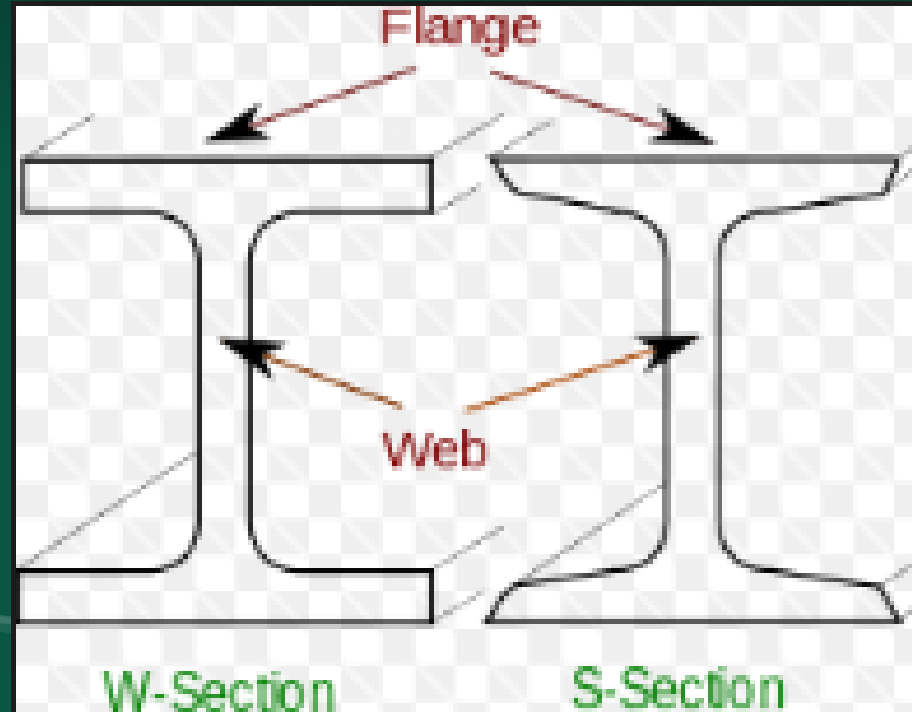


W or H – S or I Shaped

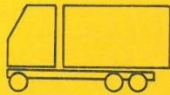
Wide Flange
W or H Beam



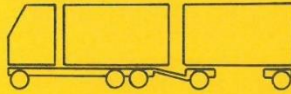
© Metals Depot



Bridge Loadings



Truck



Truck pulling one trailer.



Truck pulling two trailers.



Truck-tractor pulling one semitrailer.



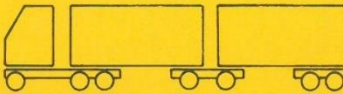
"Double Bottom"

Truck-tractor pulling one semitrailer and one trailer or semitrailer converted to a trailer with a dolly.



"Triple Bottom"

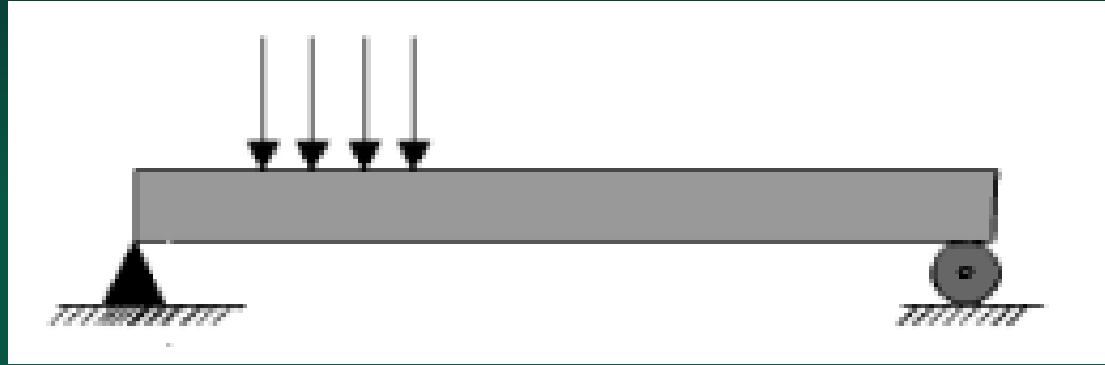
Truck-tractor pulling one semitrailer and two trailers or semitrailers converted to trailers with dollies.



"B" Train

Truck-tractor pulling two semitrailers.

Load Rating of Bridges



Unit Weights

Water = 62.4 #/cubic foot

Gasoline = 42

Ice = 56

Wood = 25 - 50

Gravel = 120

Asphalt/Concrete = 150

Aluminum = 168

Steel = 490

Dead Load

Gravel
Asphalt





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

NDDOT/FHWA Inspections

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

Structural Inventory and Appraisal Sheet

SI&A Sheet

Structure Number:	18-113-28.1	chaindate
200 System Designation	3 - County Off	Classification
201 Status	Not Deficient	12 Base Highway Network
202 Sufficiency Rating	62.00	20 Toll
Identification		21 Maint Responsibility
02 Highway District	Grand Forks District	22 Owner
03 County	Gr. Forks	26 Functional
04 City	GRACE TOWNSHIP	37 Historical Significance
05 Inventory Route	Route On Structure	100 Defense Highway Designation
4 County Hwy	1 Mainline 00000 0 N/A (NBI)	101 Parallel Structure Designation
06 Feats Intersect	CREEK	102 Direction of Traffic
09 Location	2 SOUTH 1 WEST KEMPTON	103 Temporary Structure Designation
11 Milepoint	0.000	104 Highway System of Inventory Rte
13 LRS Inv Route, Subroute	-1 -1	105 Federal Lands Highways
16 Latitude	47d 47' 16.00"	110 Designated National Network
17 Longitude	97d 38' 36.00"	112 NBIS Bridge Length
GPS Coordinates XY	601621.7 5293591.9	226 Functional Under
98 Border Bridge	Unknown (P) 0.00 %	Condition
99 Border Bridge Struct No.	-	58 Deck
Structure Type and Material		59 Superstructure
43 Main Struct Type	Steel	60 Substructure
Stringer		61 Chan. & Chan. Protection
44 Approach Struct Type	Unknown (NBI)	62 Culvert and Retaining Walls
	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
108 Wearing Surface	7 Wood or Timber	63 Operating Rating Method
Membrane	0 None	64 Oper. Rating HS 14
Dk Protect	None	65 Inventory Rating Method
208 Dk Overburden	205 Gravel/Dirt	66 Inv. Rating HS 9
Age and Service		70 Bridge Posting
27 Yr Built	1949 106 Yr Reconstructed -1	209 Posted in "Tons"
42 Type of Service	1 Highway - On	Appraisal
	5 Waterway - Under	67 Structural Condition
28 Lanes on Structure	2	68 Deck Geometry
29 ADT	30 30 Year of ADT 2013	69 Underclear, Vert & Horiz
109 Average Daily Truck Traffic	-1.00	71 Waterway Adequacy
19 Bypass, Detour Length	2 Miles	72 App. Rdwy. Alignment
Geometric Data		36 Traffic Safety Features
10 Min Vert Clearance	328 Ft. 1 in.	113 Scour Critical
32 Approach Roadway Width	20 Feet	Inspections
33 Bridge Median	0 No median	90 Date of Last Inspection
34 Skew	0.00	91 Designated Inspection Frequency
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
	0.3 Ft Lt-Side	Chaining Date
51 Bridge Rdwy Width - Curb to Curb		207 Transporter Erector Routes and Sites
	25.3 Feet	212 Structure Load Rated
52 Deck Width	26.2 Feet	213 Federal Aid Project Number
53 Min Vert Clear. Over Bridge	328 Ft. 1 in.	214 Delayed Inspection
54 Min Vert Underclearance	0 Ft. 0 in.	

Not on Base Network
3 On free road
02 County Hwy Agency
02 County Hwy Agency
Rural, Local
5 Not eligible for NRHP
0 Not a STRAHNET hwy
No I| bridge exists
2 2-way traffic
Not Applicable (P)
0 Not on NHS
Not applicable
0 Not part of natl netwo
7 Good
6 Satisfactory
5 Fair
7 Minor Damage
N N/A (NBI)
P Posted for load
2 AS Allowable Stress
26 Tons
2 AS Allowable Stress
17 Tons
2.20-0-29.9%below
27 Tons
4 Minimum Tolerable
6 Equal Min Criteria
N Not applicable (NBI)
8 Equal Desirable
6 Equal Min Criteria
0 0 0 0
U Unknown Scour
September 02, 2015
24 Months
None
-1
01/01/1901
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

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

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

Geometric Data

113 Scour Critical

U Unknown Scour

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.
55 Min Lateral UnderClear. - Rt	99.9 Ft.
56 Min Lateral UnderClear. - Lt	0.0 Ft.
210 Culvert / 211 Description	

Inspections

90 Date of Last Inspection	October 11, 2016
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 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

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 immediately 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 classification, 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.

Fracture Critical Bridges

GhostsofNorthDakota.com



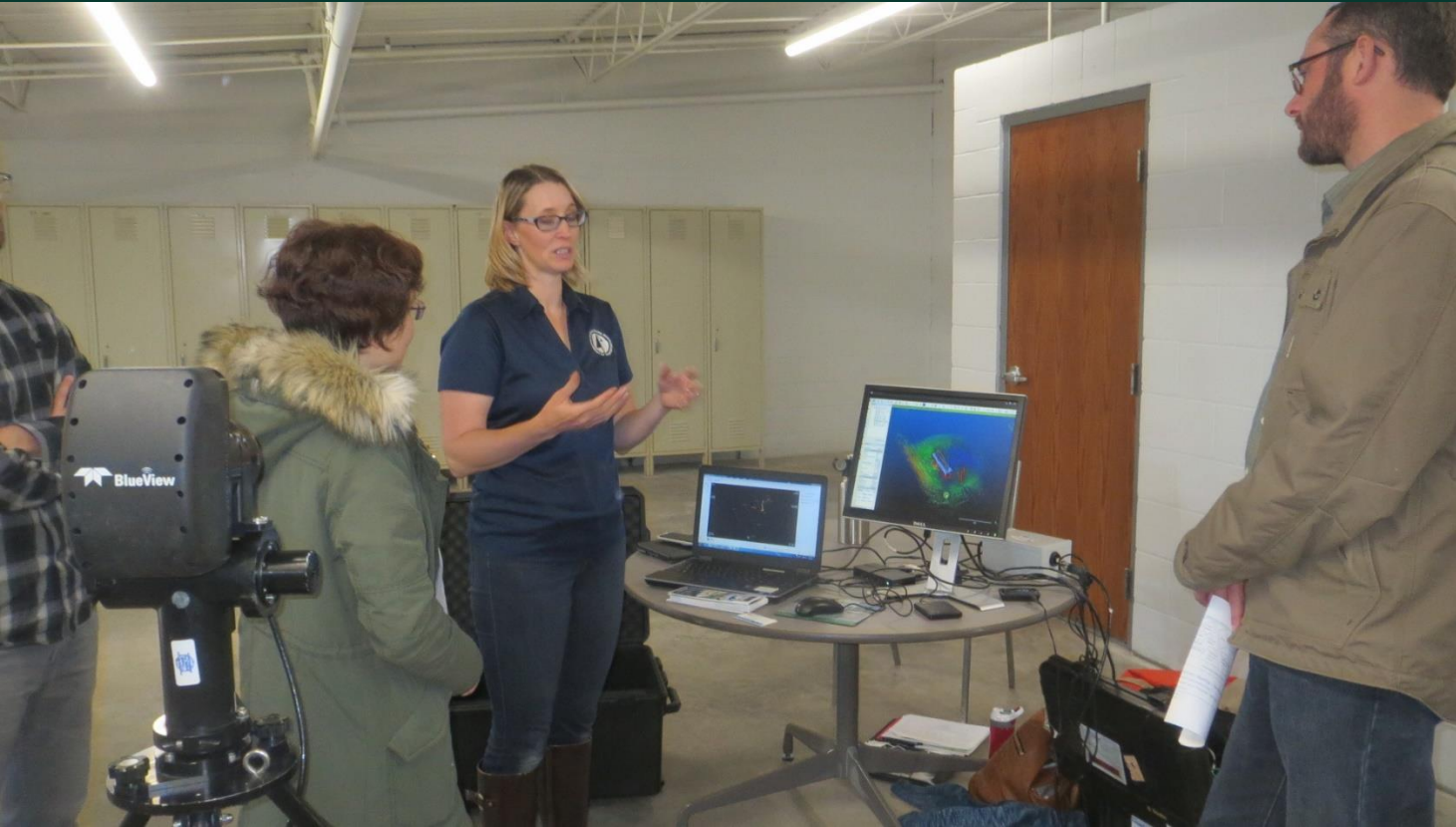
Drone Inspection Video

<https://www.youtube.com/watch?v=a4QcwQZPwCU>

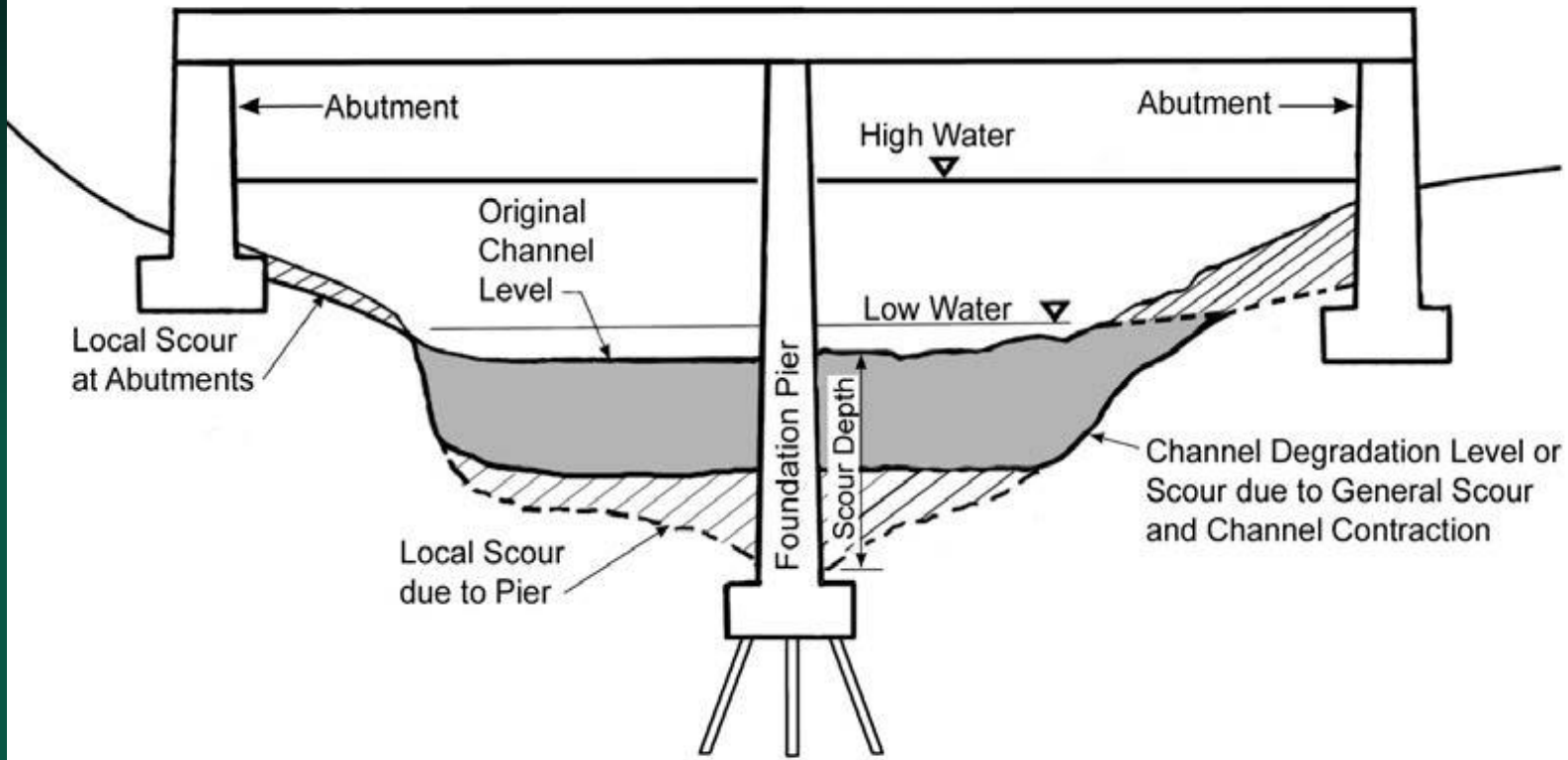


UAV BRIDGE INSPECTION RESEARCH
THE BRIDGES

Underwater Inspections











Timber

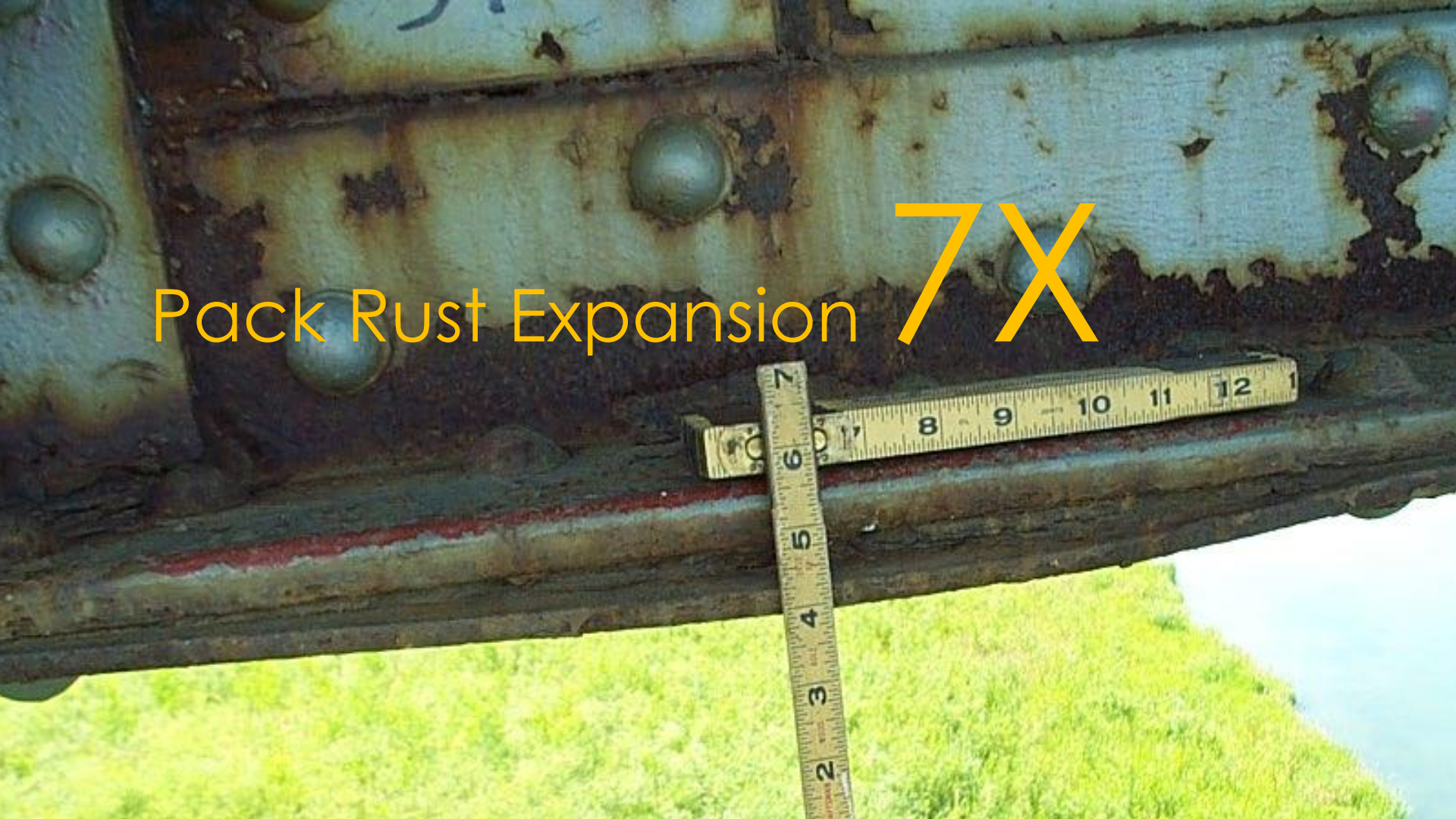
Decay
Cracks

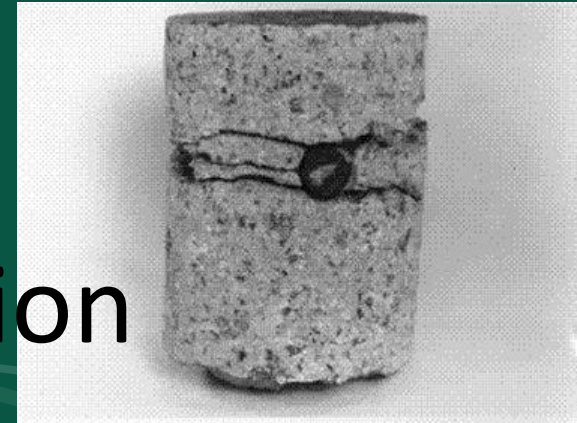
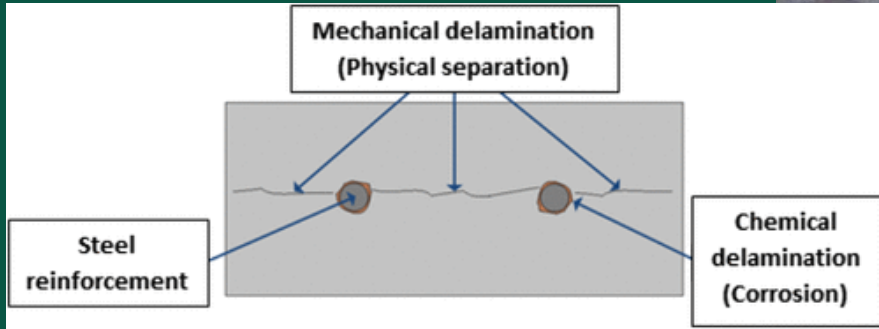
Steel and Weathering Steel



Patina is flaking

Pack Rust Expansion 7X





Concrete Delamination

Piling





Look for
damage
and gaps

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")



Guardrail Clear Zone



Table 1 CLEAR ZONE DISTANCE (in Feet from Edge of Driving Lane)³

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	24	26	28	34	**	16-18	20	22	22	24



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

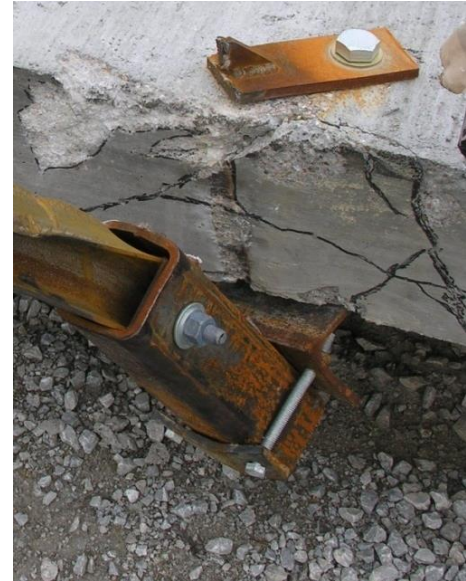


Test No. MGSBR-1

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

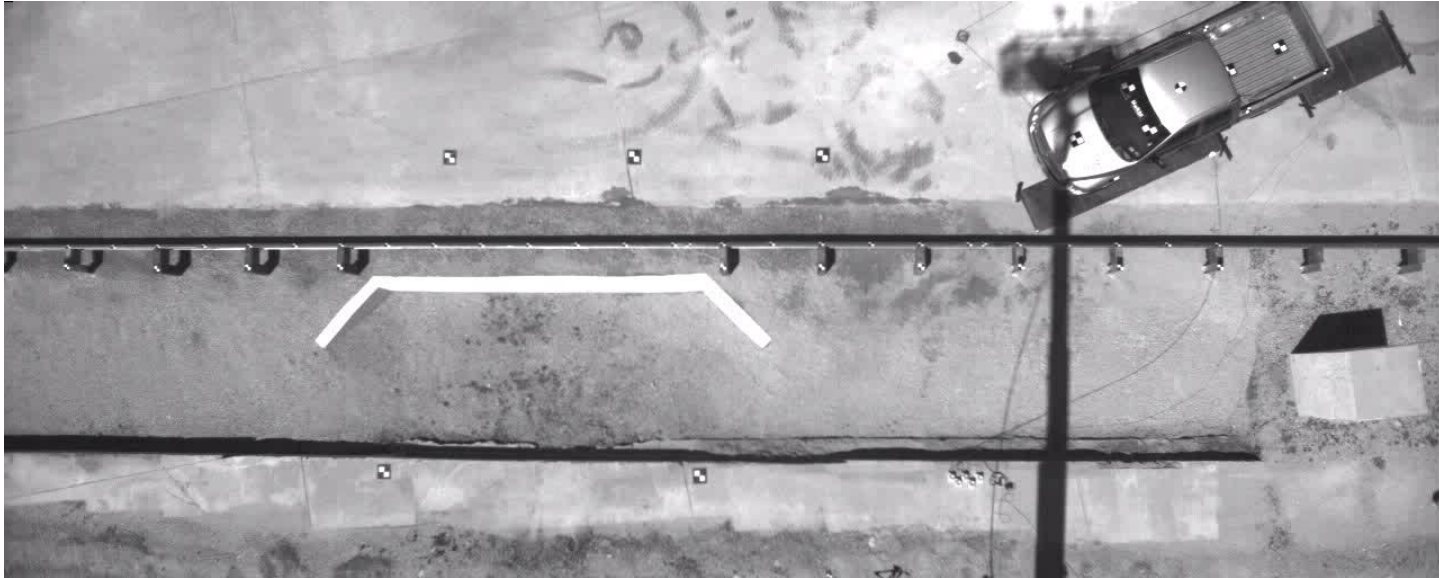


Test No. MGSBR-1



Test No. LSC-2

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





Failures











9-12-03
Traill Co. Br.



A wide-angle photograph of a gravel road stretching into the distance. The road is flanked by tall, golden-brown grasses. In the background, a white two-story house is visible on the left, and a gate or fence line is in the center. The sky is filled with heavy, grey clouds. The overall scene is rural and somewhat somber due to the weather.

McHenry County 2014



Fire Damage






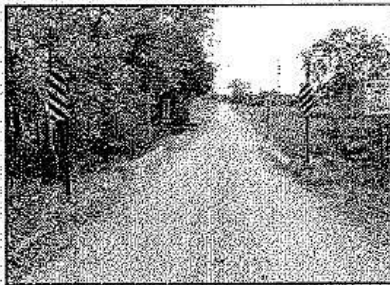
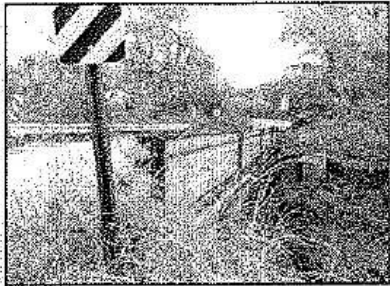
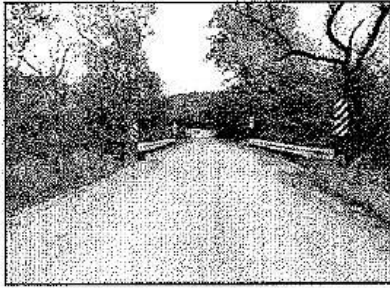








**BRIDGE OUT
USE ALTERNATE
ROUTE**



ECONOMIC IMPACT OF CLOSING LOW-VOLUME RURAL BRIDGES

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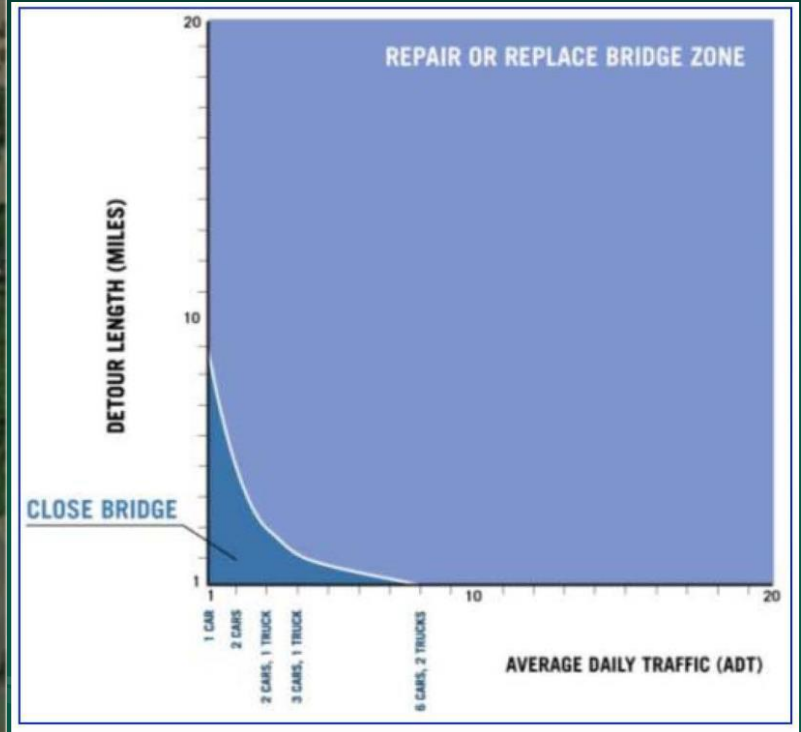
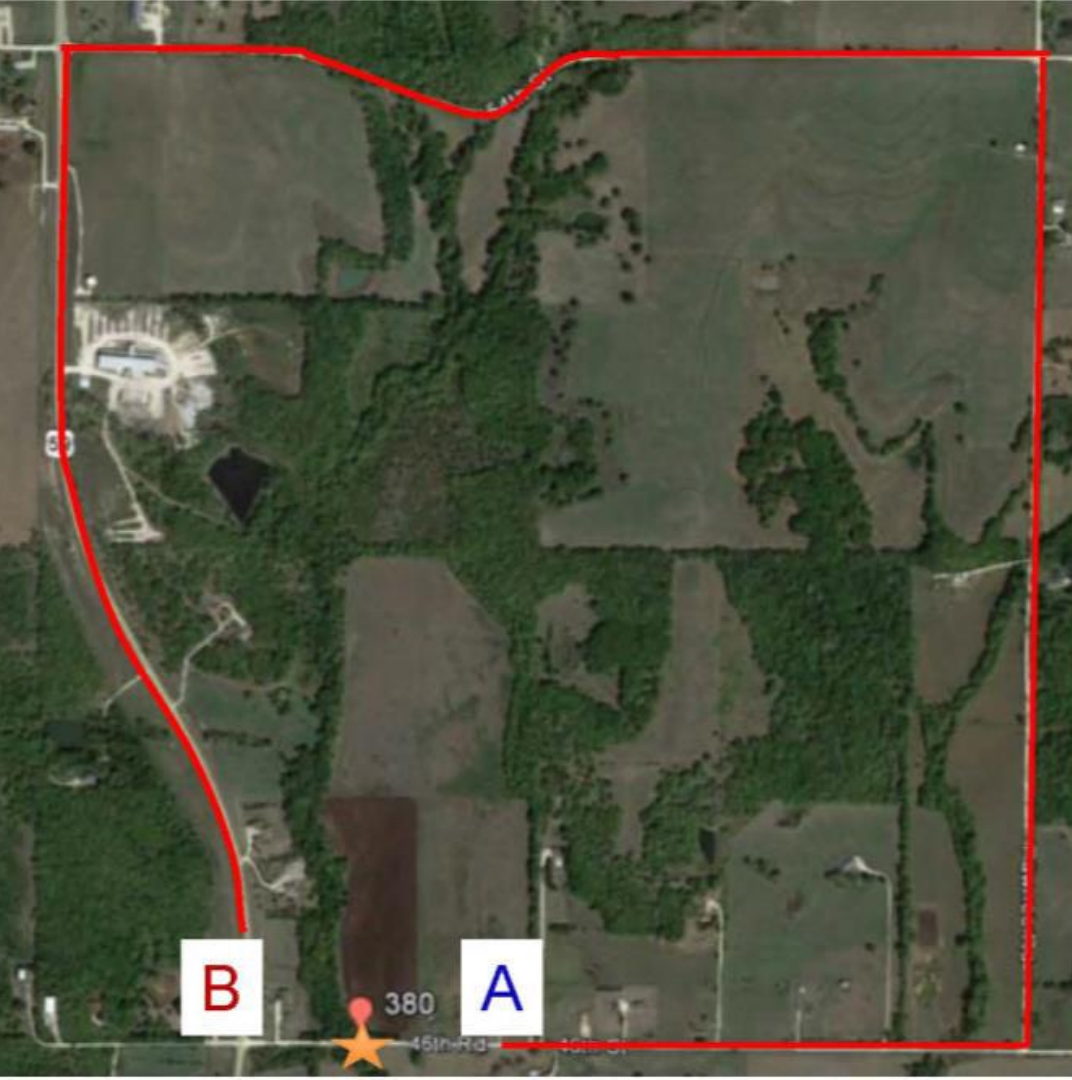
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Kansas Research



Detour Length – Closures



Flood Plan of Action

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

TOP STORY



TOP
STORY

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



TOP STORY Bottineau County Flooding



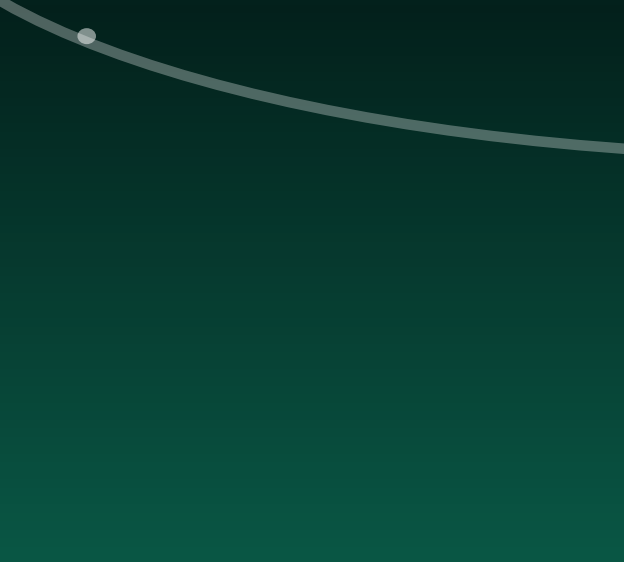
TOP STORY



TOP STORY



TOP STORY Rich Gimbel
BOTTINEAU COUNTY ROAD SUPERINTENDENT



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

Life Cycle Costs => Bridge Preservation



Construction Costs

Maintenance Costs



Salvage Value



Preventive Maintenance

- **starts when the bridge is new**

Bridge Cost Estimates

New bridge - \$200/sf

Deck replacement - \$75/sf



See no Evil



Bearing Maintenance



- Solutions







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

(ABC-Accelerated Bridge Construction) & Modular Units





Railroad Flatcar Bridges



Flatcars NOT Boxcars





Stark County Bridge Replacement









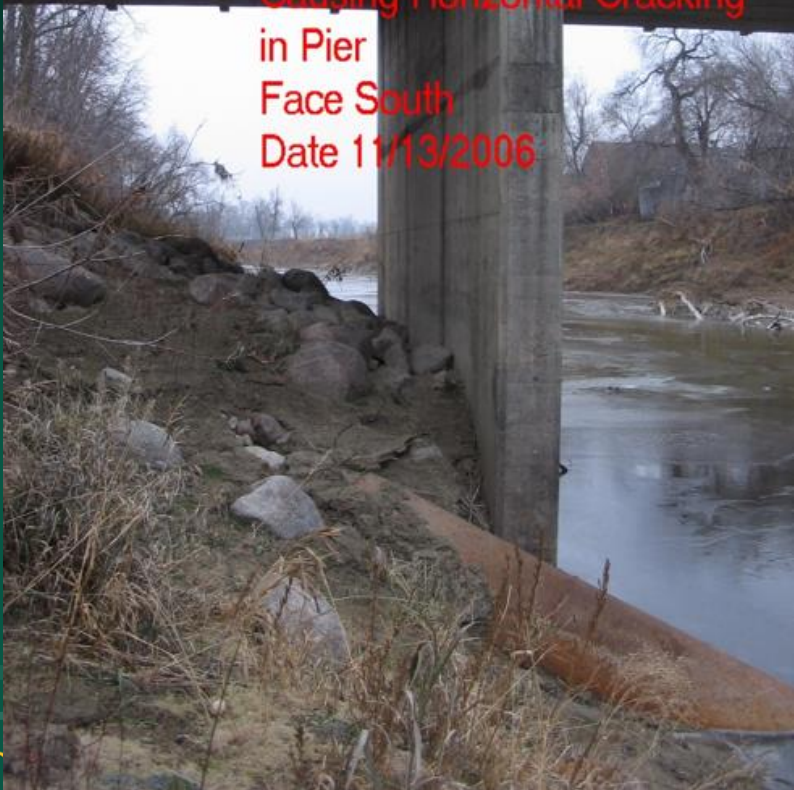


Bridge # 46-120-04.0
Direction: Up
Far North Deck Patch (2 in Deck)
02/15/05



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

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



Bridge # 32-119-85.0
Direction: North
Sediment and Tree Debris
Built Up Against West Side of
Pier. Note Farmers Fence Across
Channel Span.
02/25/05







NAND

















NDLTAP Resource Page

Ndltap.org

Your one stop shop for local road info!

Better roads save lives

Together, we can do great things.

*We look forward to working with you to
elevate the knowledge of all those that touch
our transportation network.*

*Let's help 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

**NATIONAL
TRANSPORTATION
IN INDIAN COUNTRY
CONFERENCE**

**DULUTH, MINNESOTA
SEPTEMBER 17-20, 2018**

Bridge 101

Dale C. Heglund, PE/PLS

Program Director, NDLTAP

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