2019 NDACE Conference Bridge Rehab with Local Forces

Nick West, PE
Grand Forks County Engineer

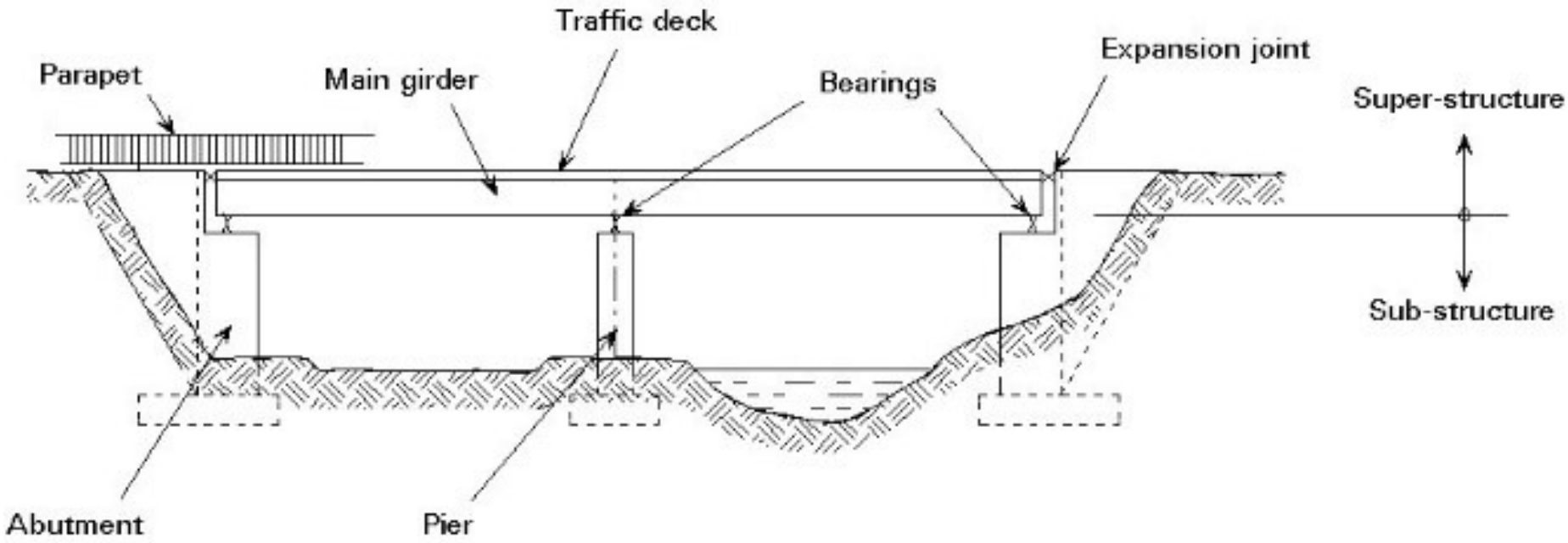
North Dakota Association of County Engineers

GRAND FORKS COUNTY
HEART OF THE RED RIVER VALLEY

Grand Forks County Inventory

- 2015 Inspection
- 279 Major Structures
- 41 Structural Deficient
- 12 Functionally Obsolete
- 70 Have a Ton Limit
  - End of 2019 down to about 50

Bridge Components 101



So Your Bridge Needs Work

- Do we need the bridge?
  - Remove Immediately
  - Deteriorate then Remove
- Deficiency is Okay – Goes to Single Family
- Rehabilitate
  - What part is the problem – Typically Beams & Deck
  - Salvaged Material
- Replace – not worth fixing

Project Selection

- Consider Tier System
- Snow Plow Routes
  - Equipment Weights ≈ 22 Tons
  - Bridges Less Than 22 Ton Limit
- Traffic Patterns – Thru Routes
- Spread Throughout County

Can’t Afford This Everywhere

Create Plan

Extract from
Veteran Employees

GRAND FORKS COUNTY
HEART OF THE RED RIVER VALLEY

Major Bridges with Ton Limit Inspection Form

	Date: 9-21-17
Bridge Number: 142-27.0	Location (Township/Section): Walle 14-23
Sufficiency Rating: 69.9	Posted Ton Limit: 32
Is bridge used/needed (yes/no/maybe) Explain:	
Usage of Roadway: (high / medium / low)	Priority Level of a Project (high / medium / low)
If no above, what should be done with exst bridge:	
If yes above: rehabilitate or replace (is substructure worth saving) See SIA, East abutment leaning	

Rehabilitate: specifically what is need: how many and size - stringers/beams, deck, material type, can it be widened, guardrail, county or contractor forces do work

Temp fix
- Consider welding supports on beams to stop abutment leaning... by some Time

Estimated Rehab Cost:

Replace: estimated replacement material type, size, length skew, erosion control, grading, elevation changes, surrounding structures, historic:

- Exst opening 25' x 8'
- Recommend Dbl 12'x8' RCBC, total length 64' w/Ends
- Raise Rodd couple of feet to increase sight distance
- Not Historic
- No skew
- Lots of Rip rap to salvage & Reuse
- No immediate upstream structures
- Slightly rusted 12" W beams salvagable, 12 Each
- move New East slightly to align channel

- contractor

Estimated Replacement Cost:

Inventory & Plan

Major Bridge Rehab/Replace Schedule
Bridges with Sufficiency Rating Under 50 or with a Ton Limit
SI&A from 2015/2016 Inspection
(Nick's preliminary analysis on how to eliminate bridges with ton limits) (this plan is continuously updated and open to discussion)

						Replacement						Rehabilitate - (assuming county forces install)											
				Rehab (H)								Metal Beams					Timber Decking/Stringers (4"x12"x28')		Timber Cap (12"x12"x30')			Total Estimated	
	Location	Sufficiency	Posted	Replace (P)	Priority Level	Materials				Install	Total Est												
Bridge No	Township	Rating	Ton Limit	No H or P (N)	High/Med/Low	Type/Size	Total Feet	$/ft	Ends ($)	($)	$	Number	Size	Length (ft)	$/Each	Total Metal ($)	Number	$/Each	Number	$/Each	Total Timber ($)	$	Comment
101-02.0	Elkmount 7-18	47.20	15	N	L																		let stand, remove, do not replace
2019 → 101-04.1	Elkmount 19-20	52.00	14	H	M							16	W12x53	27	$1,100	$17,600	35	$250	4	$900	$12,350	$29,950	
103-27.0	Logan Center 17-20	78.90	21	H	L							6	S15x42.9	37	$1,200	$7,200	45	$250	4	$900	$14,850	$22,050	
103-34.0	Loretta 20-29	51.20	32	P	L	RCBC Dbl 12'x8'x44'	44	$1,600	$21,120	$50,000	$141,520												Consider SPP
104-02.2	Elkmount 10-11	40.00	24	P	L	Bridge					$500,000												Very Low/consider closing?
105-02.0	Elkmount 11-14	44.30	30	H	M																	$90,000	(maybe RCBC?)
105-28.0	Logan Center 22-23	40.00	24	P	M	RCBC Dbl 12'x10'x44'	44	$1,800	$23,760	$50,000	$152,960												Consider Closing. Regrade Twp Rd to south
106 07.0	Ply 1 lnk 6	74.80	26	H	L							12	W16x77	36	$2,300	$27,600	44	$250	6	$900	$16,400	$44,000	
108 01.0	Inkster 5	63.30	24	H	M							16	W24x68	33	$1,900	$19,000	33	$250	0	$900	$8,250	$27,250	Quad Tee Ordered, Install 2019 8"x22"x33' Timber Stringers
110-12.0	Agnes 34-35	78.4	33	H	L							12	W12x53	25	$1,100	$13,200	33	$250	4	$900	$11,850	$25,050	8 - 12" various, 25'
110-32.0	Elmore 4-5	43.0	20	H	M																		Rehab 2019, new metal beams
111-05.0	Inkster 25-26	58.3	19	P	L	Dbl 63" CMP	80	$90	$5,400	$10,000	$22,600												Sgl 90° downstream
111-30.0	Elm Grove 31-36	59.0	23	P	M	RCBC Dbl 12'x9'x44'		$100,000		$60,000	$160,000												
112-18.0	Elm Grove 35-36	39.7	29	P	M	RCBC Tpl 16'x10'x60'	60	$3,100	$72,540	$100,000	$358,540												South branch turtle river, Bridge?
113-27.0	Grace 21-24	40.0	17	P	M	RCBC Dbl 10'x6'x44'	44	$1,700	$22,440	$50,000	$147,240												Gravel
113-28.1	Grace 24-25	62.0	27	P	L	RCBC Dbl 14'x6'x44'	44	$1,700	$22,440	$50,000	$147,240												
114-33.0	Northwood 18	27.5	14	N	L																		let stand, remove, do not replace
115-34.0	Northwood 20	49.5	33	P	M	RCBC Dbl 10'x8'x50'	50	$5,000	$43,000	$70,000	$268,000												Recalc'd, no limit, 2018
2019 → 118-05.0	Stra 25-John 30	47.8	20	P	M	RCBC Sgl 16'x6'x44'	44	$1,000	$33,200	$40,000	$97,200												minimum maintenance
118-23.0	Arvilla 26-35	45.8	16	P	L	Obl 72" CMP	80	$110	$6,000	$20,000	$34,800												
119 05.0	Johnstown 29-30	40.0	18	P	L	RCBC Dbl 10'x6'x44'	44	$1,200	$15,840	$35,000	$103,640												
119-08.1	Gilby 7-8	66.5	14	H	L							6	W12x53	24	$1,100	$6,600	32	$250	2	$900	$9,800	$16,400	
122-08.0	Gilby 10-13	75.0	27	H	L							2	W16x50	36	$1,100	$2,200	44	$250	0	$900	$11,000	$13,200	
123-04.1	Johnstown 23	52.9	32	N	L																		field approach, little use, let stand or remove
124-04.0	Johnsburg 19	48.9	18	H	M							6	W16x50	36	$1,400	$8,400	38	$250	0	$900	$9,500	$17,900	Recalc'd, no limit, 2018
125-13.2	Mekinock 1-2	51.8	14	H	M							12	W16x77	35	$2,300	$27,600	43	$250	0	$900	$10,750	$38,350	Metal Beam Ordered, Install 2019, caps okay, rock yes 30 - W12x30x 35'
125-13.4	Mekinock 1-2	76.5	28	H	L							9	S18x70	37	$2,200	$19,800	45	$250	2	$900	$13,050	$32,850	
126-04.1	Levant 20-21	70.1	24	H	M							8	S15x42.9	33	$1,000	$8,000	41	$250	2	$900	$12,050	$20,050	
126-12.1	Lakeville 32-33	53.3	28	H	L																	$65,000	quad concrete tee's about $40,000, install $25,000
127 04.1	Levant 21-28	59.4	17	N	L																		
127-07.0	Lakeville 4-9	64.4	18	N	L																		maintain, then remove
127-10.0	Lakeville 21-28	78.9	32	H	L							6	S15x42.9	28	$1,000	$6,000	36	$250	2	$900	$10,800	$16,800	maintain, then remove
127-11.0	Lakeville 28	84.3	29	H	L							4	W12x53	23	$1,100	$4,400	31	$250	2	$900	$9,550	$13,950	
127-12.0	Lake 33-Bloom 5	47.3	16	H	M							12	W30x90	45	$4,500	$54,000	53	$300	2	$1,200	$18,300	$72,300	very low priority
127-28.0	Fairfield 20-21	68.3	23	H	M							16	W27x84	37	$3,100	$49,600	46	$250	4	$900	$22,850	$72,450	Beams Ordered, Install 2019
128-14.0	Blooming 9-10	79.5	32	H	M							4	W27x84	37	$3,100	$12,400	33	$250	2	$900	$10,050	$22,450	Rehab 2018, new metal beams
128-14.1	Blooming 9-10	71.4	32	P	M	RCBC Dbl 12'x6'x44'	44	$1,500	$19,800	$40,000	$125,800												Backfill, no limit, 2018
128-19.0	Oakville 2-3	47.3	13	N	L																		medium/high priority, backwall leaning bad
129-28.0	Fairfield 22-23	71.4	33	H	L																		Not rated, To be Removed 2018 or 2019
130-21.0	Oakville 34	52.6	19	H	L							7	S12x40.8	27	$900	$6,300	35	$250	2	$900	$10,550	$16,850	
131-06.0	Turtle River 31-32	74.8	26	H	M							8	S12x40.8	24	$900	$7,200	32	$250	2	$900	$9,800	$17,000	could salvage 27' S12, install all new W12, then take salvaged beams and use on 24' bridge
131-18.0	Round Pr Rvr 11	81.4	54	H	L							4	W12x53	30	$1,100	$4,400	38	$250	2	$900	$11,300	$15,700	
2019 → 132-05.0	Turtle River 28-29	68.2	30	P	M	RCBC Dbl 10'x8'x50'	50	$1,800	$19,500	$35,000	$119,500	12	W16x77	30	$2,200	$26,400	38	$250	0	$900	$9,500	$35,900	Recalc'd, no limit, 2018 20 - S12x40.8, 30' (Trimmed)
132-23.0	Brenna 30-31	44.8	12	P	M	Dbl 60"x40' PP	80	$90	$5,200	$20,000	$32,400												RCBC Ordered, Install 2019
132-35.0	Michigan 29-30	64.3	20	H	M							9	S15x42.9	36	$1,000	$9,000	44	$250	2	$900	$12,800	$21,800	Gravel
134-34.0	Michigan 21-28	85.4	35	H	L							3	S12x40.8	25	$900	$2,700	33	$250	2	$900	$10,050	$12,750	Quad Tee Ordered, Install 2019
135-06.0	T.R. 35-Ferry 2	33.6	22	N	L																		
135-06.1	T.R. 35-Ferry 2	48.0	27	N	L																		Maintain, single family, grade road to east & remove
135-30.0	Allendale 34-35	65.3	24	H	M							12	W16x77	29	$2,200	$26,400	37	$250	0	$900	$9,250	$35,650	let stand, remove, do not replace
→ 136-09.0	Ferry 13-18	31.5	18	P	M	Bridge (RCBC?)					$500,000												stay at 26' width, could add more $15 instead
136-09.1	Ferry 14	43.0	18	N	L																		streamstats wrong, breakout BR flows to consider
136-30.0	Allendale 35-36	66.5	31	P	M	RCBC Dbl 14'x8'x44'	44	$1,800	$23,760	$40,000	$142,960												Not rated, To be Removed 2018 or 2019
change to Min Maint? → 137-09.1	Ferry East 18-19	25.5	17	N	L																		let stand, remove, do not replace
137-19.0	Ferry East 17-18	39.0	24	H	L							7	S18x70	28	$2,200	$6,800	46	$250	2	$900	$13,300	$19,900	Recalc'd, no limit, 2018
139-21.0	Ferry East 28-33	56.3	17	H	L							10	W18x50	36	$1,400	$14,000	44	$250	2	$900	$12,800	$26,800	add 4" timber under W18 to get 27", single family
139-31.0	Americus 5-8	70.1	27	H	L							12	W16x77	36	$2,200	$26,400	44	$250	2	$900	$12,800	$39,200	to residential subdivision 12 - S15x42.9, 36'
140-31.2	Americus 4-9	84.0	35	H	M							2	S12x40.8	23	$900	$1,800	31	$250	2	$900	$9,550	$13,350	
Look at 140-31.3	Americus 3-4	33.3	13	N	L																		Let stand, Consider RCBC?, min maint road
141 31.4	Americus 3	68.3	23	H	L							9	W12x45	30	$1,000	$9,000	38	$250	2	$900	$11,300	$20,300	
142-27.0	Walle 14-23	69.9	32	P	L	RCBC Dbl 12'x10'x50'	50	$1,800	$27,000	$40,000	$157,000												
142-28.0	Walle 23-26	48.3	21	P	M	RCBC Dbl 12'x10'x50'	50	$1,800	$27,000	$40,000	$157,000												
143-28.0	Walle 24-25	30.8	24	P	M	Sgl 84"x120' CMP	120	$135	$4,000	$30,000	$50,200												3100 CY fill

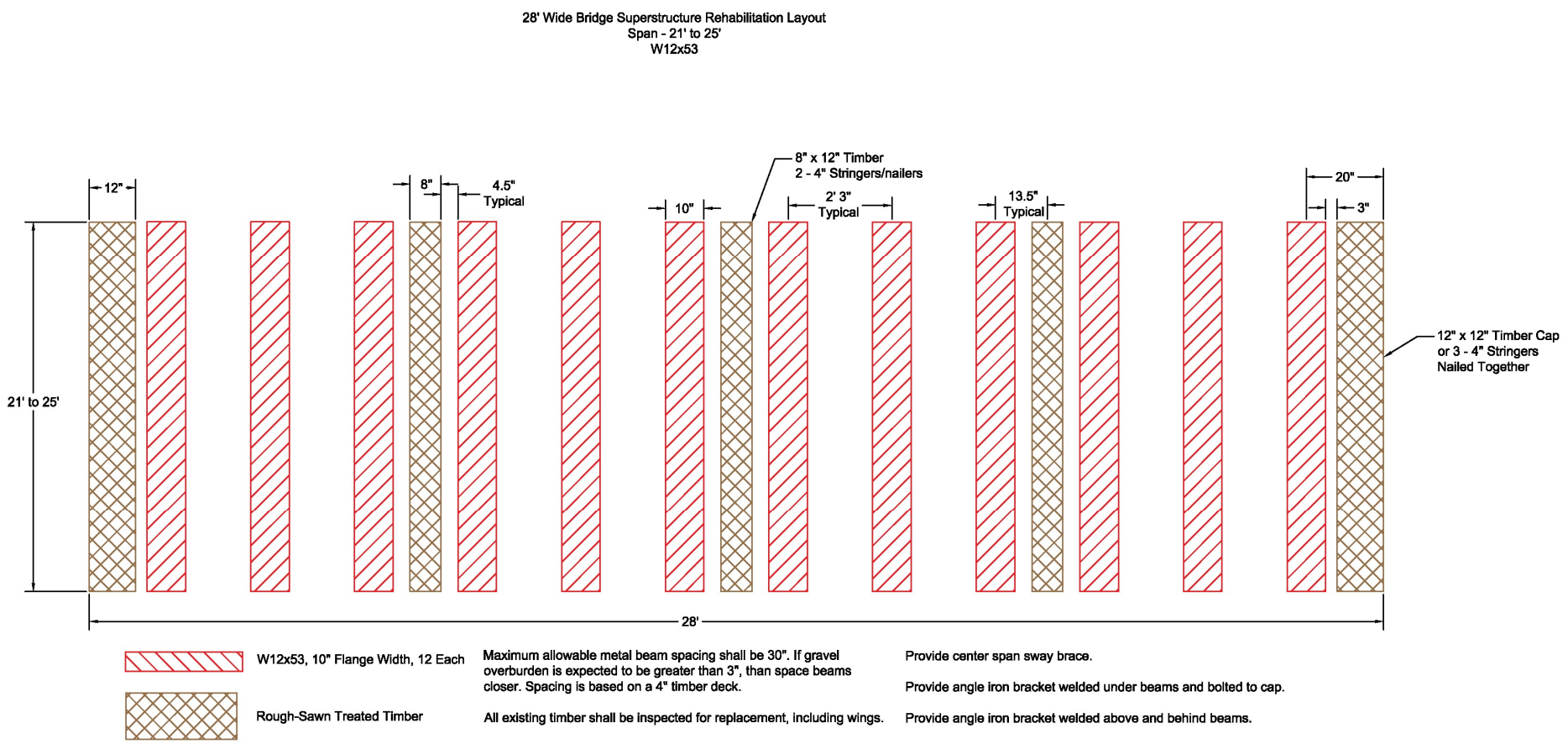
	11-truss not listed	Total Rehab (H)=	31	0	High
	3-truss on NRHP	Total Replace (P)=	20	24	Medium
	6 N, 6 P, 2 H	Total (N)=	11	38	Low
		Total Bridges=	62	62	
		<20 Tons	24		
		<15 Tons	9		
		<10 Tons	0		

Total: $3,415,600
Average: $170,780
Total: $2,308,800

Total: $862,700
Average: $28,757
Total: $392,850

Road Status Bridges Less than 20 Ton	
Trail	8
Min Maint	6
Gravel	10

Pre-Designed Beam Layouts



Not Like This

Keep Metal Beam Spacing Equal

Check SI&A Sheets

Grand Forks County
Major Bridge Ton Limit Adjustment Schedule

List of Bridges where the Operating Rating has a difference of three tons or more from the actual posted ton limit

Bridge #	Location	Operating Rating	Posted Limit	Recommended Limit	Difference from Posted		Notes
101-02.0	Elmount 7-18	23	15	23	8	Raise	12-10-18
104-02.2	Elkmount 10-11	20	24	20	-4	Lower	12-10-18
110-19.0	Larimore 4-9	9	20	9	-11	Lower	Beams ordered to Rehab 10-31-18
111-30.0	Grace 34-35	19	23	19	-4	Lower	Replace 2018 Dbl RCBC 11-20-18
113-27.0	Grace 13-24	42	17	none	25	Raise	Replace 2018 Dbl RCBC 11-20-18
113-28.1	Grace 24-25	35	27	35	8	Raise	12-4-18
115-34.0	Northwood 20	41	33	none	8	Raise	Remove Posted Limit Immediately 6-19-18
118-23.0	Arvilla 26-35	20	16	20	4	Raise	12-4-18
119-05.0	Johnstown 29-30	23	18	23	5	Raise	8-22-18
119-08.1	Gilby 7-8	20	14	20	6	Raise	6-18-18
122-08.0	Gilby 10-11 Lakeville 31	30	27	30	3	Raise	12-3-18
125-13.4	Mekinock 1 ~~Blooming 6~~	32	28	32	4	Raise	12-4-18
127-07.0	Lakeville 4-9	23	18	23	5	Raise	12-10-18
127-12.0	Blooming 5 Lakeville 33	12	16	12	-4	Lower	Beams ordered to Rehab
127-28.0	Fairfield 20-21	35	22	35	13	Raise	Beams ordered to Rehab 7-16-18
128-14.0	Blooming 9-10	48	32	none	16	Raise	Remove Posted Limit Immediately 6-29-18
131-18.0	Blooming 36 Rye 31	38	34	none	4	Raise	Remove Posted Limit Immediately 6-29-18
138-10.0	Ferry East 20-29	40	34	none	6	Raise	Remove Posted Limit Immediately 6-14-18
141-31.4	Americus 3	26	23	26	3	Raise	7-16-18
142-28.0	Walle 23-26	18	21	18	-3	Lower	12-5-18
143-28.0	Walle 24-25	27	24	27	3	Raise	Plan to Replace in Couple Years 12-5-18
					Total	21	
					Total Raise	16	
					Total Lower	5	

From 2017 NDDOT Inspection SI&A
June 2018 (by Nick West)

5 Removed Ton Limit Completely

Better to Remove!

135-34.0 Timber Rehab

135-34.0 Beam Layout

16 EA – W12x45x23’

135-34.0 Weld Bracing

135-34.0 Angle Bracing

135-34.0 Substructure

135-34.0 Riprap

135-34.0 - After

135-34.0 SI&A

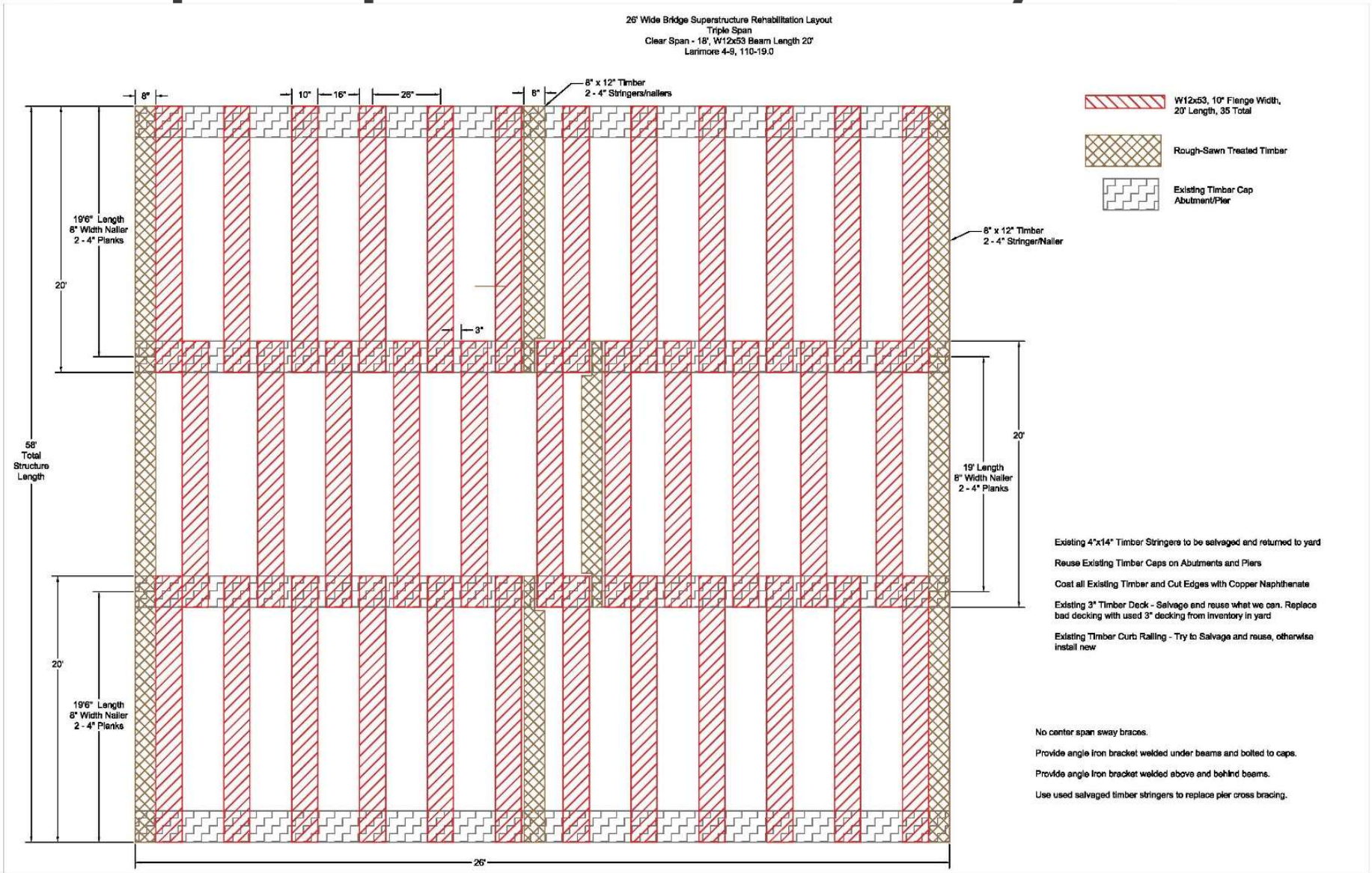
	Before	After
Sufficiency Rating	48	97
Condition Deck	7 Good	9 Excellent
Condition Super	6 Satisfactory	9 Excellent
Condition Substructure	6 Satisfactory	7 Good
Operating Rating	8 Tons	96 Tons
Inventory Rating	5 Tons	58 Tons

135-34.0 Costs

- County Forces
- Labor $5,600
- Equipment $4,600
- Materials $9,100
- Metal Beams $18,300
- Riprap $2,200
- Total $40,400

Triple Span Timber – Before Deteriorated Stingers

Triple Span Timber – Layout



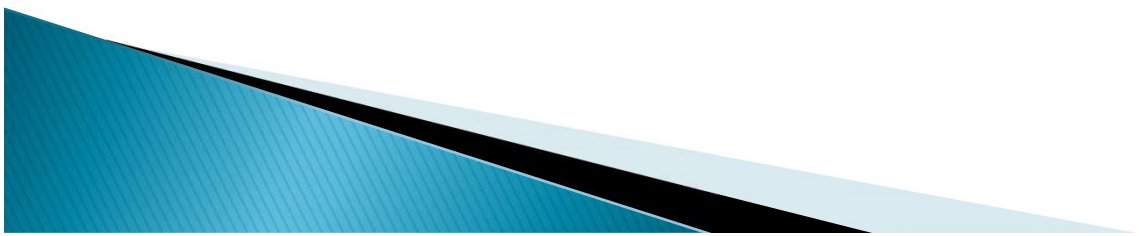
Over Piers

Triple Span – Layout

Salvaged 3” Timber Deck

60’ Triple Span Costs

- County Forces
- Labor $9,500
- Equipment $6,800
- Materials $5,100
- Metal Beams $29,000
- Total $52,200



NDDOT Inspection Notification

Structure Inspection Notification

County							
Structure Number							
Location							
Reason for inspection (new/rehabilitation/repair)							
Who performed the work?							
Was Structure previously closed? (y/		**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.)							
Did you attach any of the following information with these sheet?							
Photos		Material Spec info		Alert code		Plans	
Other							
NDDOT use only							
Based on work performed, was an inspection required? (y/n)							
If yes, date of inspection		**By who**					
If no, explain reason inspection wasn't required							

Damaged Timber Bridge

Damaged Bridge

Damaged Bridge Repaired

Stabilize Timber Cap

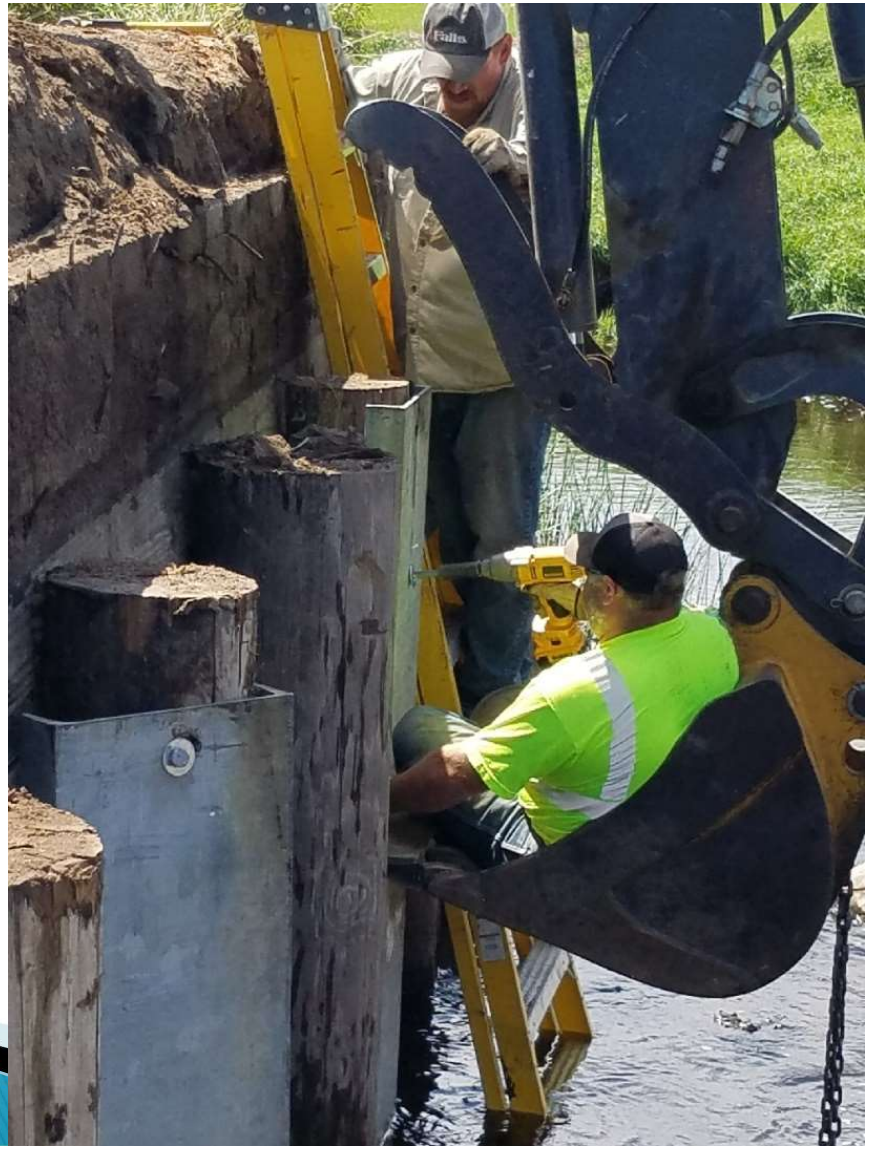
Rotten Timber Stringer

Check Hydraulics – Before

Check Hydraulics – After

Reinforcing Timber Pile

Reinforcing Timber Pile



RCBC
Broken Wing

RCBC – Broken Wing

RCBC – Broken Wing

RCBC- Broken Wing

RCBC
Broken Wing

Concrete Bridge Wing – Before

Concrete Bridge Wing – After

Bridge Riprap

A Stitch in Time

A Stitch in Time May Save Nine

Quad Tee Leading Edge

Quad Tee Leading Edge

Eroded Under Abutment

Eroded Abutment – Riprap

Low Water Crossing Option

Rehab Recommendations

- Riprap
- Determine What Part of Bridge is Problem
- Beam Spacing
- Do Not Let Normal Water Touch the Bridge
- Seal Cut Ends, Scratches, Nicks
- Widen if possible – 28’ Goal
- Sway brace
- 4” Timber Deck –Treated Copper Naphthenate
- Materials – Metal, Timber, Concrete
- Riprap

Thank You

- Gerald Sieg, Superintendent
- 56 year veteran with Grand Forks County

Questions
Nick West

- Grand Forks County Engineer
- Allendale Township Supervisor
- Office: (701) 780-8248
- Mobile: (701) 317-0126
- Email: nick.west@gfcounty.org