NDSU UPPER GREAT PLAINS TRANSPORTATION INSTITUTE

2024 ND Co./Twp./Tribal Needs study update review

- Needs study has 3 parts:
  - Gravel Roads
  - Paved Roads
  - Bridges
- 20 year study period – 2024 to 2043

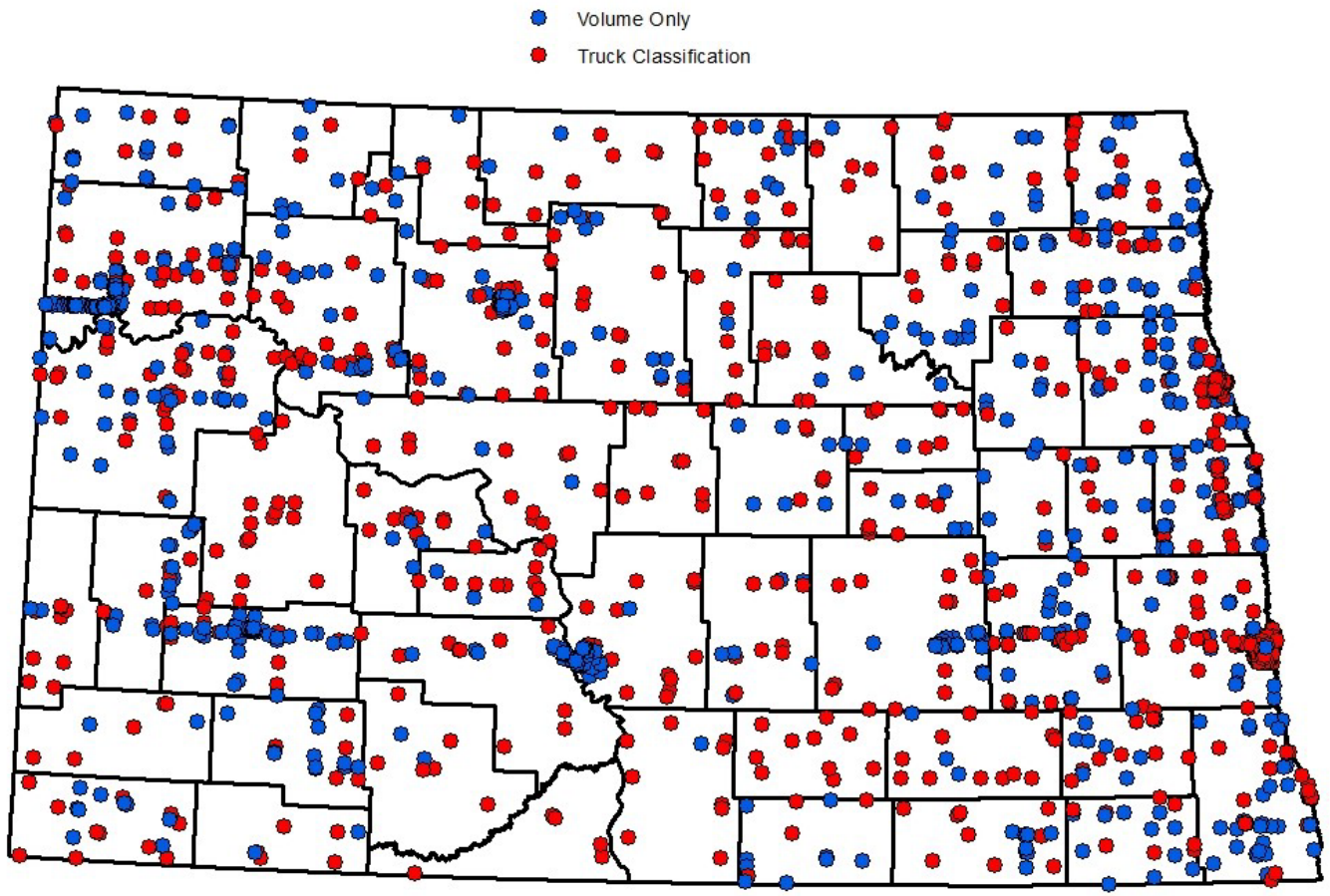
Needs studies began in 2010

- 2010 study: UGPTI estimated road investment needs for the 2011 session
  - 21,500 new wells & increased ag. production
- 2012 study: updated investment needs
  - 46,000 new wells, ag. production, & initial bridge study
- 2014 Study: more comprehensive data
  - Higher roadway costs, ag. production, & 60,000 new wells
- 2016 Study: First study with GRIT and oil scenario analysis
- 2020 study: First study with a 4-year gap between studies.
  - First study where it was known that funding distribution was partially tied to results
- 2022 study: Updated bridge analysis methods and classification counts
  - Inflationary impacts

Comparison to Previous Study

Category	2020-2039 ($M)	2022-2041 ($M)	% Change
Unpaved	$6,056.34	$6,506.61	7.43%
Paved	$2,668.49	$3,291.69	23.35%
Bridges	$498.81	$715.57	43.46%
Total	$9,223.64	$10,513.87	13.98%

Traffic Counts are a key part of the study



Freight Model Groups

- Agriculture
  - Corn
  - Wheat
  - Soybeans
  - Barley
  - Canola
  - Sunflowers
  - Dry Edible Beans
  - Sugarbeets
  - Potatoes
- Oil
  - Fresh Water
  - Rigs
  - Equipment
  - Fuel
  - Mud
  - Pipe
  - Produced Water
  - Outbound Oil

Gravel Surveys are sent out

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2023 COUNTY ROAD NEEDS STUDY

County: _____

Contact: _____ _____ _____
Name Phone Email

Preparer: _____ Date Prepared: _____

Aggregate Description

To determine the type and quality of aggregate used in your county, please check all boxes that apply. For example, if your county uses crushed, specification base gravel – select gravel, crushed material and specifications.

- ☐ Gravel
- ☐ Scoria
- ☐ Pit Run
- ☐ Screened
- ☐ Crushed Material
- ☐ Specifications
  - ☐ Fractured Faces
  - ☐ PI
  - ☐ Other _____
- ☐ Tested
- ☐ Other_____

Placement Practices

When aggregate overlays are placed in your county, please select the all practices that are used to apply an aggregate overlay.

- ☐ Truck Drop and Blade
- ☐ Windrow/Equalize
- ☐ Water/Rolling/Compaction
- ☐ Reshaping
- ☐ Pulling in Shoulders
- ☐ Soft Spot Repair
- ☐ Other_____

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Operational Tasks

In this section, please provide a percentage of tasks that are done using county resources versus the percentage of work done by a contractor. For example, if your county owns the pit and does all of the crushing using county labor, 100% would be entered into the first column, and 0% in the second column.

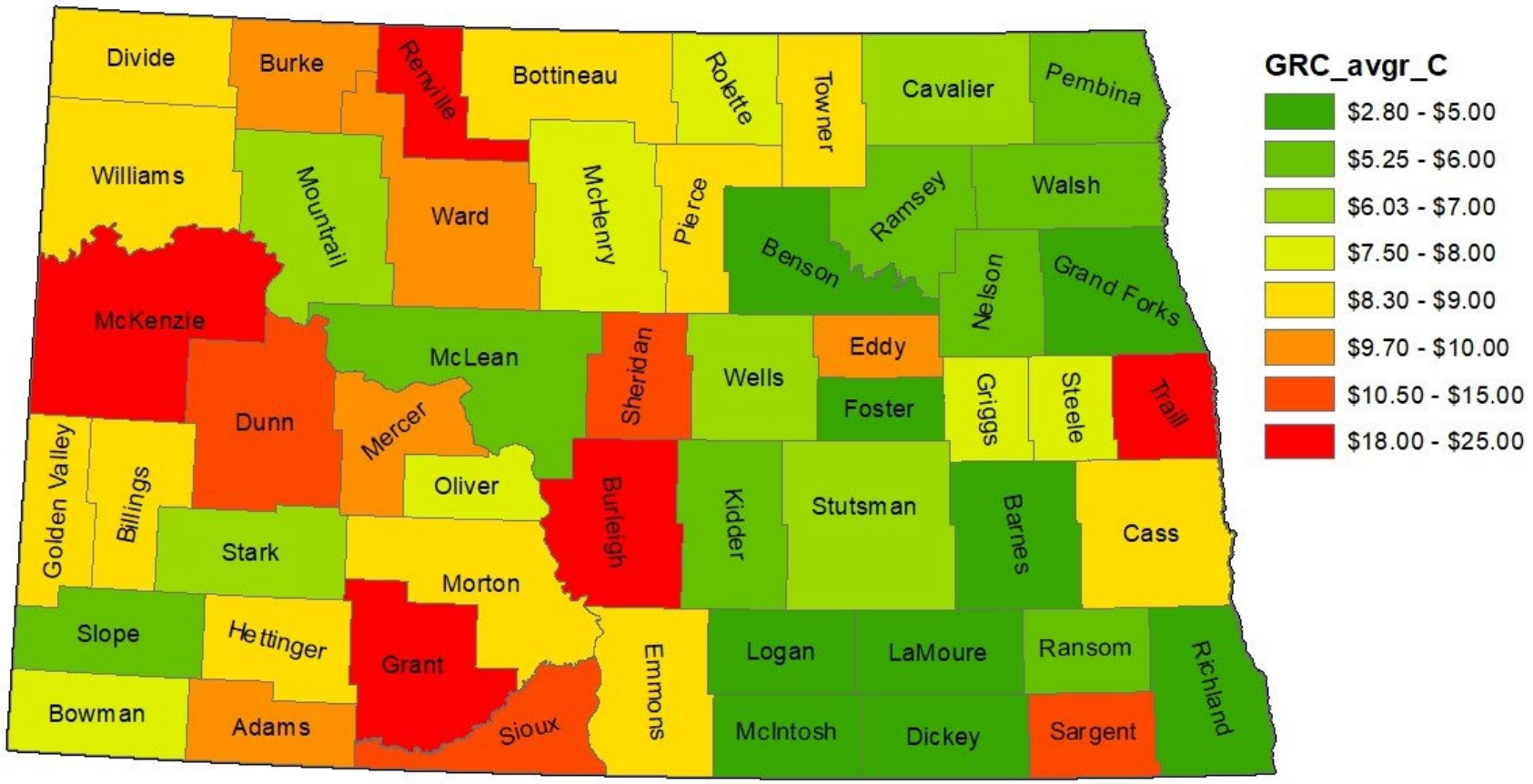
	Performed by:	
Task	County	Contractor
Crushing		
Hauling		
Placement		
Blading		
Dust Control		
Base Stabilization		

Gravel Road Costs

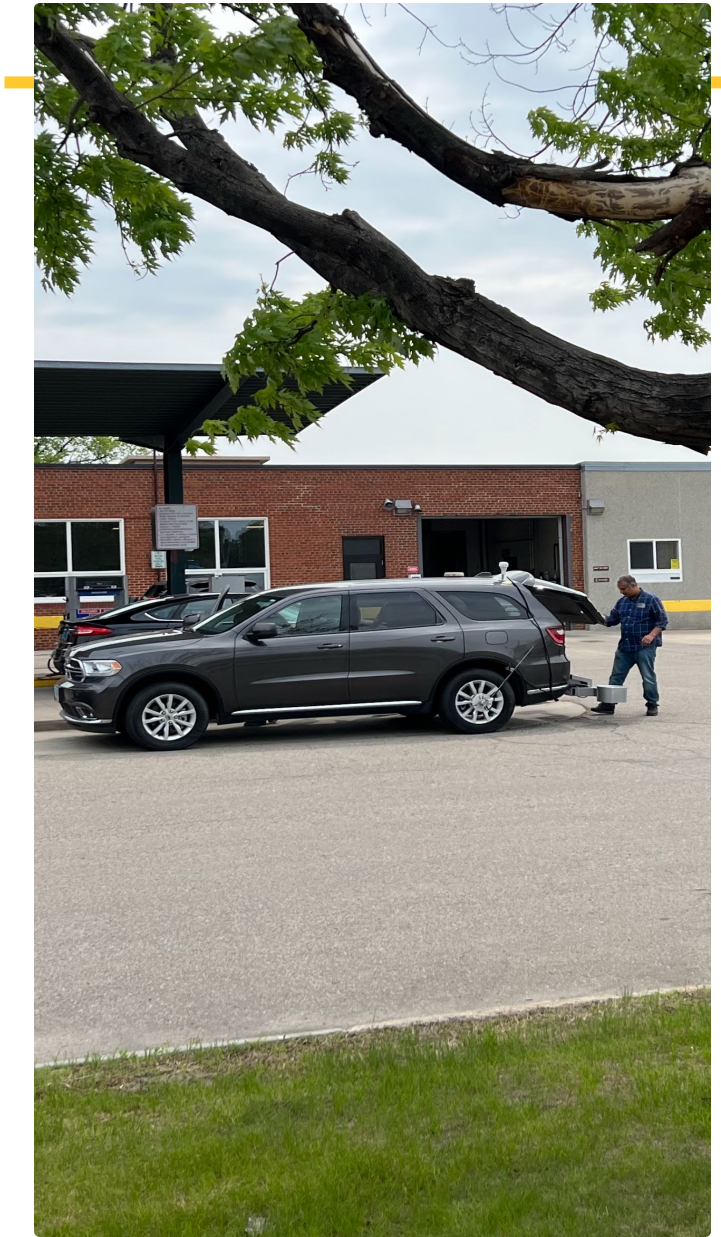
Please report costs for gravel for county roads in the table below. The table asks for unit costs for graveling, maintaining, and operating gravel roads. If you are quoting contractor prices, please circle "yes" in the right-hand column.

Gravel/Scoria Cost			Is this Contractor Price?
Average Gravel/Scoria Cost (crushing & royalties at the pit)		❑ Per cu. yard ❑ Per Ton	❑ Yes ❑ No
Average Transportation Cost from Gravel Origin		❑ Per loaded mile ❑ Per cu. yard ❑ Per Ton	❑ Yes ❑ No
Average trucking distance for aggregate		❑ Miles one-way ❑ Miles roundtrip	
Truck Payload		❑ Cu. Yards ❑ Tons	
Placement Cost		Per Mile	❑ Yes ❑ No
Blading Cost		Annual cost per mile	❑ Yes ❑ No
Dust Suppressant Cost		Per mile	❑ Yes ❑ No
Base Stabilization Cost		Per mile	❑ Yes ❑ No

2022 Gravel Costs

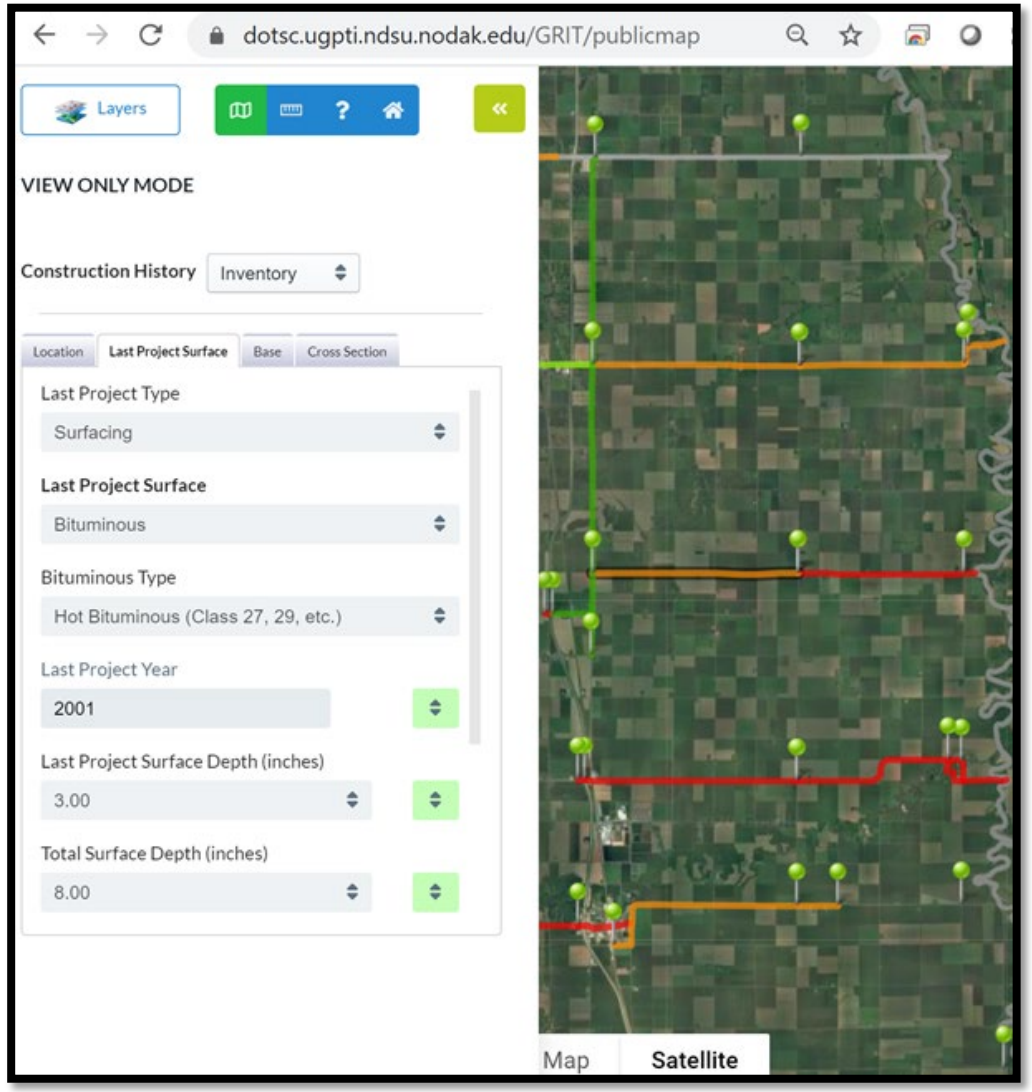


New Pavement Analysis Equipment for 2024 study

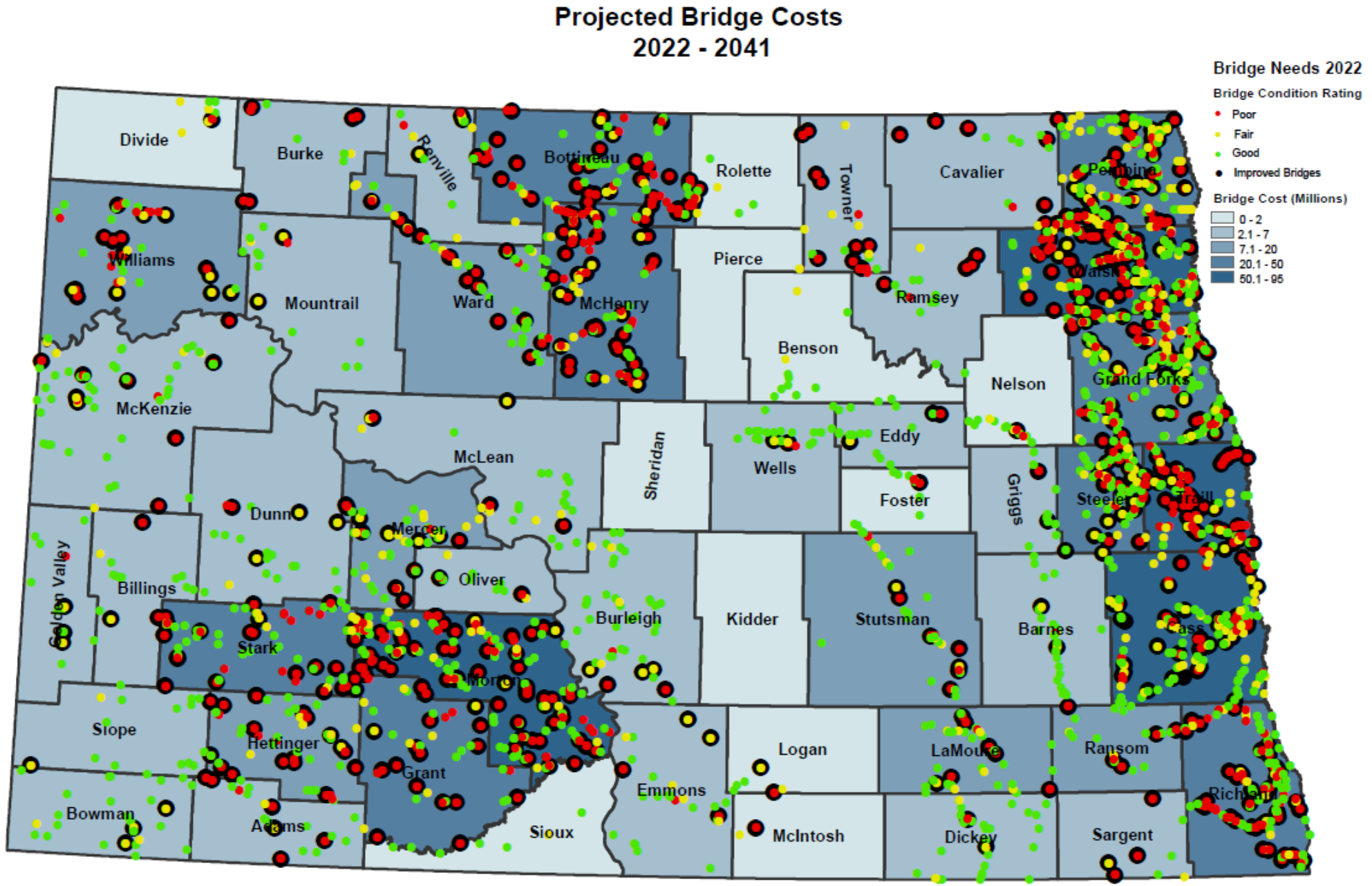


Pavement Data Collection Uses GRIT

- **Geographic Roadway Inventory Tool (GRIT)**
  - Easy to use web-map based inventory tool
  - Available and in use by all ND Counties
  - Four Layers of Information
    - Construction History
    - Construction Planning
    - Minor Structures
    - Load Restrictions



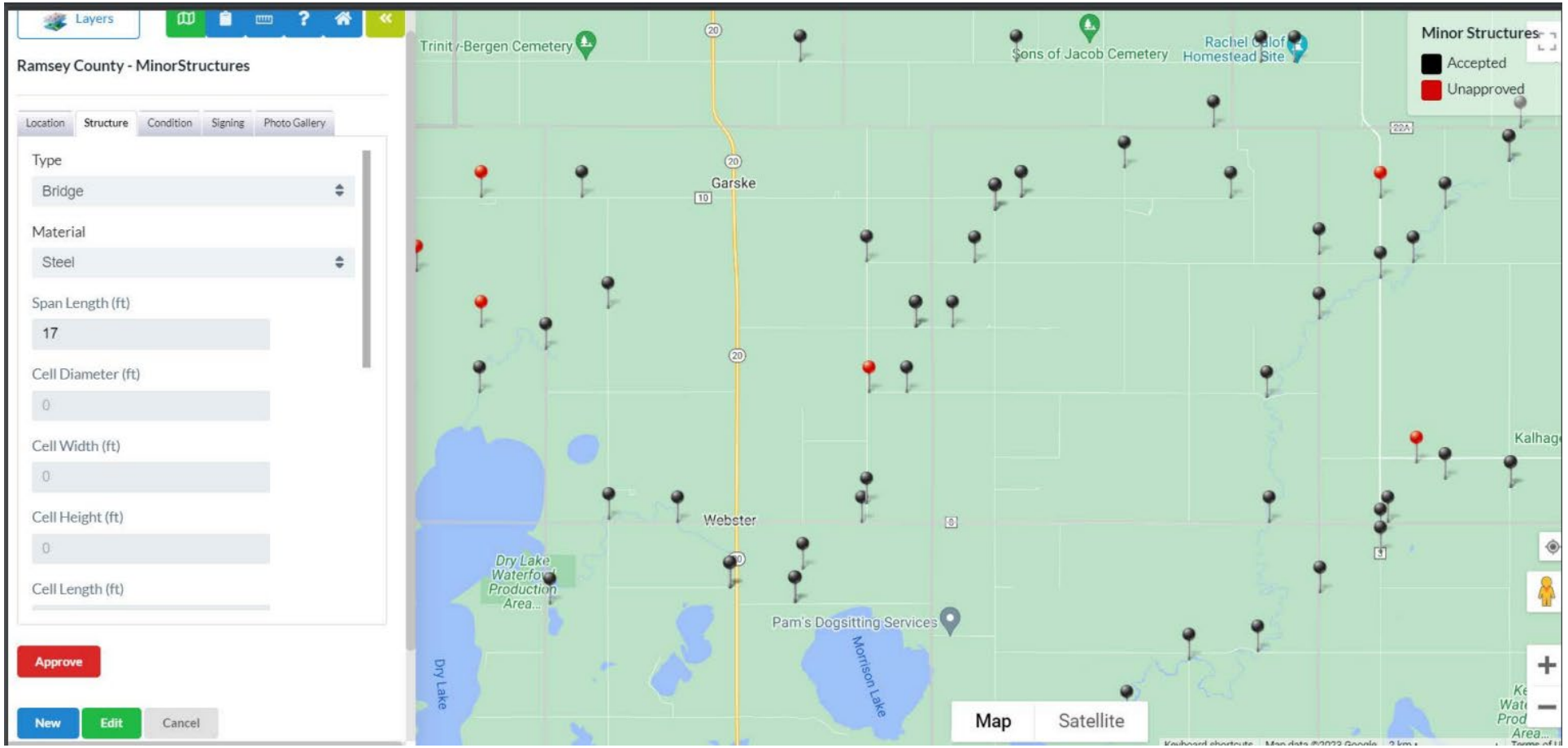
Bridge Needs



2024 Study to include minor structures needs

- For structures with 8’ to 20’ span or >50 SF waterway openings
- Will be based on 1985 ND DOT inventory imported into GRIT
- Counties need to approve if structures are still in place or have been replaced.

Minor Structures 1985 ND DOT inventory imported to GRIT

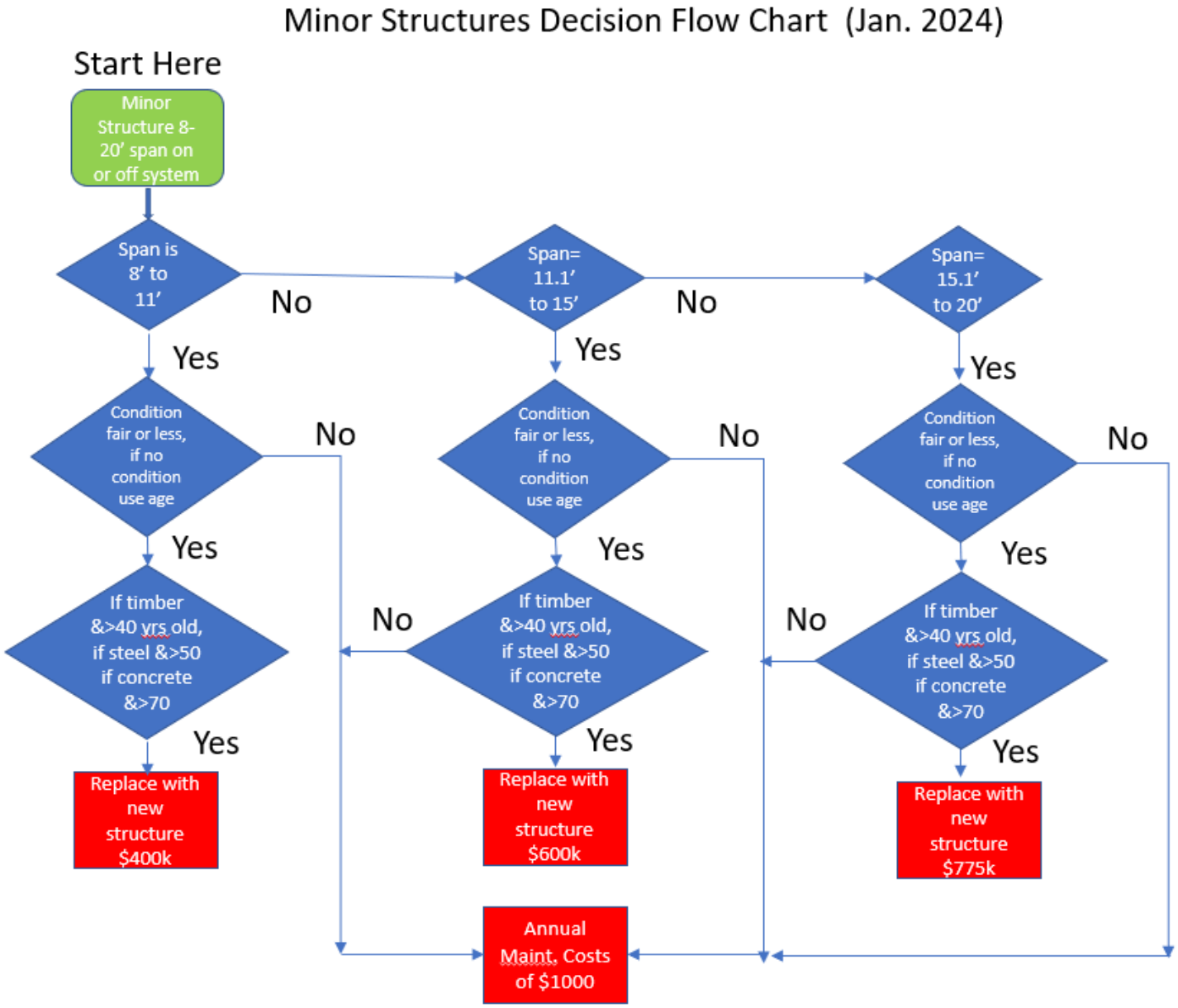


Minor structures proposed costs

Group A: 8' to 11' span	Group B: 11.1' to 15' span	Group C: 15.1' to 20' span
$400,000 replacement cost	$600,000 replacement cost	$775,000 replacement cost

If < 40 years old structures would draw maintenance needs of $1500 per year

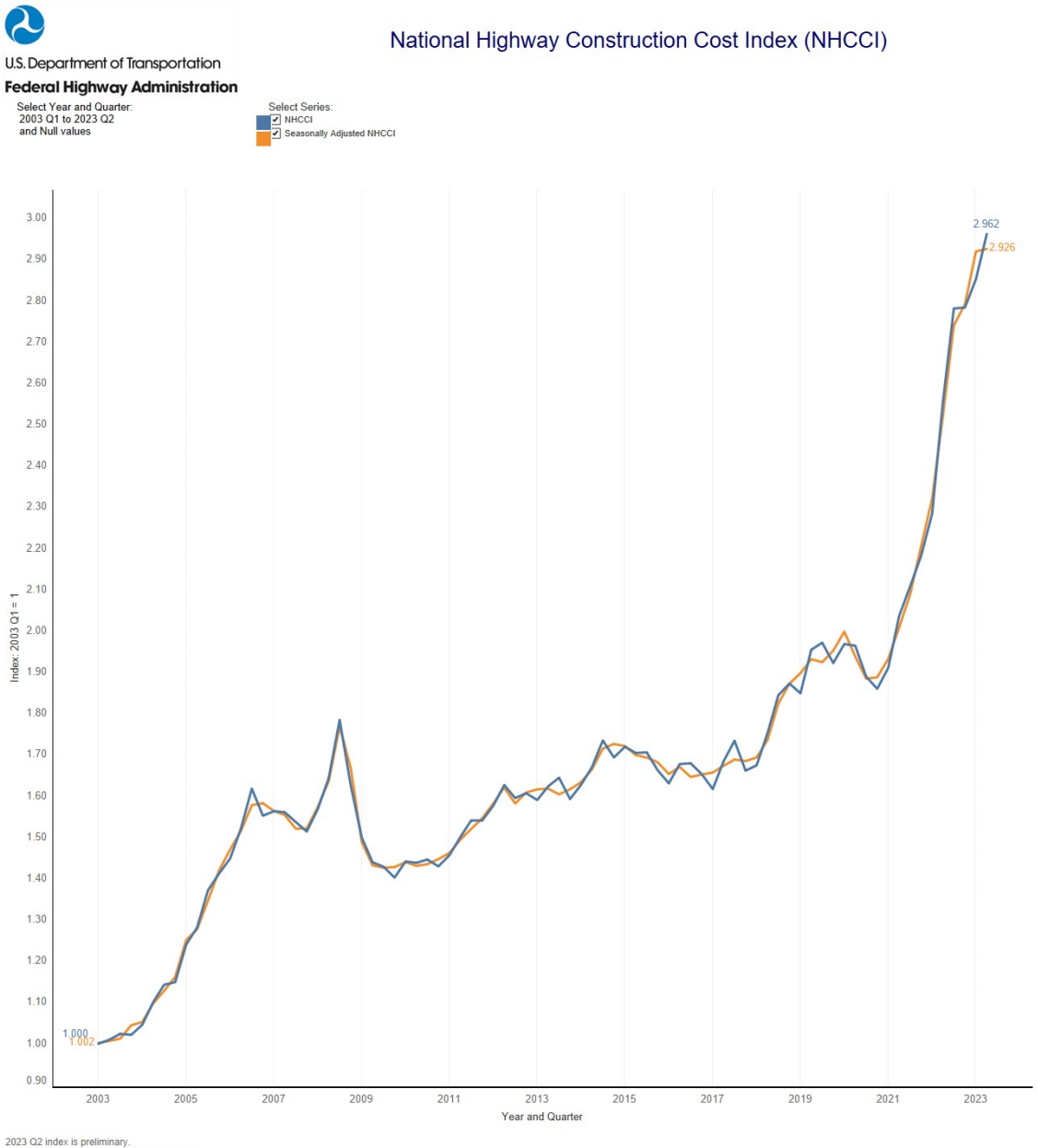
Minor Structures Decision Tree



Needs study costs models

- Gravel costs – County Surveys
- Pavement costs – County construction project bid reports, NDDOT Price sheet list & National Highway Construction Cost Index (NCHHI)
- Bridge costs – County bridge replacement projects including box culverts

NHCCI is up 27.5% for Q2 – 2023 since Q1 2022



2024 Needs-Major Bridge Structures

Proj. Length (miles)	New Length	# of spans	width(ft.)	Old Br. Type	New Br. Type	Old length' x width'	Old width in ft.	New Road Width & Surf. Type	New Square feet deck area	Low Bid	Cost plus Engineering	Contractor	Ratio of new length to old	Cost per square foot
0.95	70	1	30	Timber	Prestr. Box beam	41	24.5	28' gravel	2100	865109	1038130.8	Schoeder	1.707	$494
0.108	114	3	30	Timber 3 span	Prestr. Box beam	78	?	24' gravel	3420	1464452	1757342.4	Schoeder	1.462	$514
0.128	164	3	30	Timber 5 span	Prestr. Box beam	147	?	24' gravel	4920	1039072	1246886.4	Schoeder	1.116	$253
0.191	208	3	32	3 span concrete	Prestr. Box beam	154	?	32' paved	6656	2486295	2983554	Schoeder	1.351	$448
0.178	252	3	30	3 span steel gird.	3 span box beam	141	28	28' gravel	7560	2069719	2483662.8	Indust. Bldrs.	1.787	$329
0.133	132	3	30	?	Prestr. Box beam	120	28	28' gravel	3960	2813431	3376117.2	Swingen's	1.1	$853
0.098	96	2	38	Single span steel	Prestr. Box beam	31	28	32' paved	3648	2376948	2852337.6	Indust. Bldrs.	3.097	$782
0.01	134	3	38	2 span concrete	Prestr. Box beam	84	26	38' paved	5092	2993814	3592576.8	Schoeder	1.595	$706
									37356		19330608		13.21	
									Ave. Cost per SF =		517.469965	Ave. length ^=	1.652	

note: cost was $370/sf in 2022 report now $517 which is up 39%

Length increase ratio for new from old is 1.652, was 1.7 in last study report.

Proposed Costs for Needs Study

- Gravel Needs based on individual costs
- Pavement costs $4436/inch-foot increasing to $4853 (+9.4%)
- Major Bridge costs were $370/SF increasing to $517/SF (+39%)
- Multi box culverts up $800k to 1134k (41%)

Have a Great Conference!

- Thank you to all of the counties, tribal groups and townships for their response to our requests for data.
- Any questions?

Bridge Preservation & Maintenance

2024 County Roads Conference

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NORTH DAKOTA LOCAL TECHNICAL ASSISTANCE PROGRAM

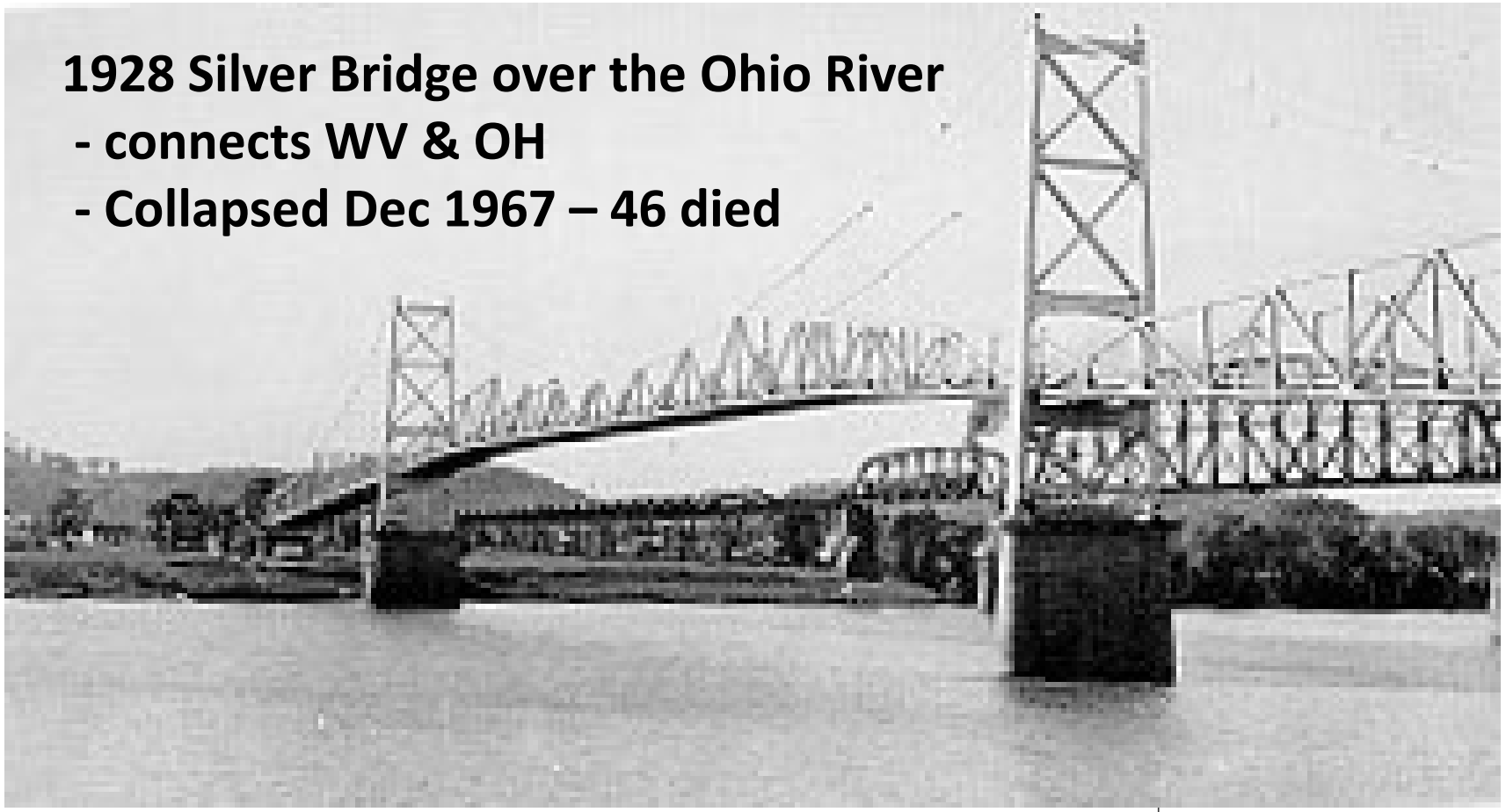
NDLTAP Partners

- NDDOT
- FHWA
- NDIRF
- WDEA
- NDTOA
- APWA
- ATSSA
- NDACE
- NDACO
- NDLC
- Consultants

Upcoming Events

- ND Transportation Conference
  - March 5th & 6th – Event Center Bismarck
  - Late fees applied after February 4th
- NDTOA Regional Workshops (Feb 12th – Mar 1st)
- ATSSA How to Conference – March 11th – 13th in Fargo
- Roadway Foundation Basics – March 26th
  - Linton
- Work Zone Safety – March 27th
  - Focused on short term or temporary work zone (1-8 hrs.)
  - Bismarck
- ND Asphalt Conference
  - April 2nd & 3rd – Bismarck Hotel & Conference Center
- Vision Zero Conference
  - April 3rd & 4th – Bismarck State College
- National Bridge Preservation Conference
  - September 9th-13th – Salt Lake City

History


1928 Silver Bridge over the Ohio River
- connects WV & OH
- Collapsed Dec 1967 – 46 died

History

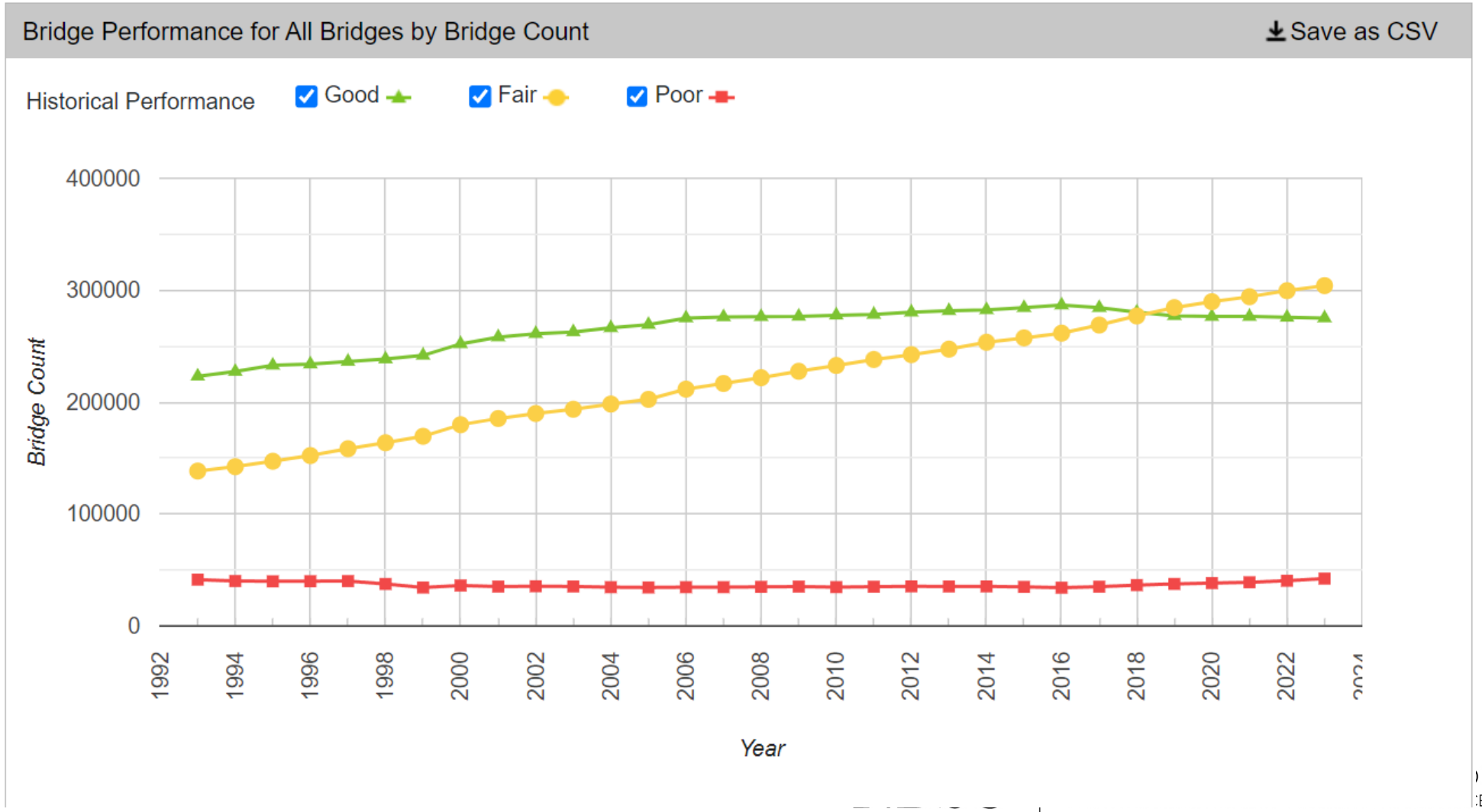
Silver Bridge collapse Dec. 15, 1967

https://www.fhwa.dot.gov/highwayhistory/national_bridge_inspection_standards.cfm

Daily Commutes

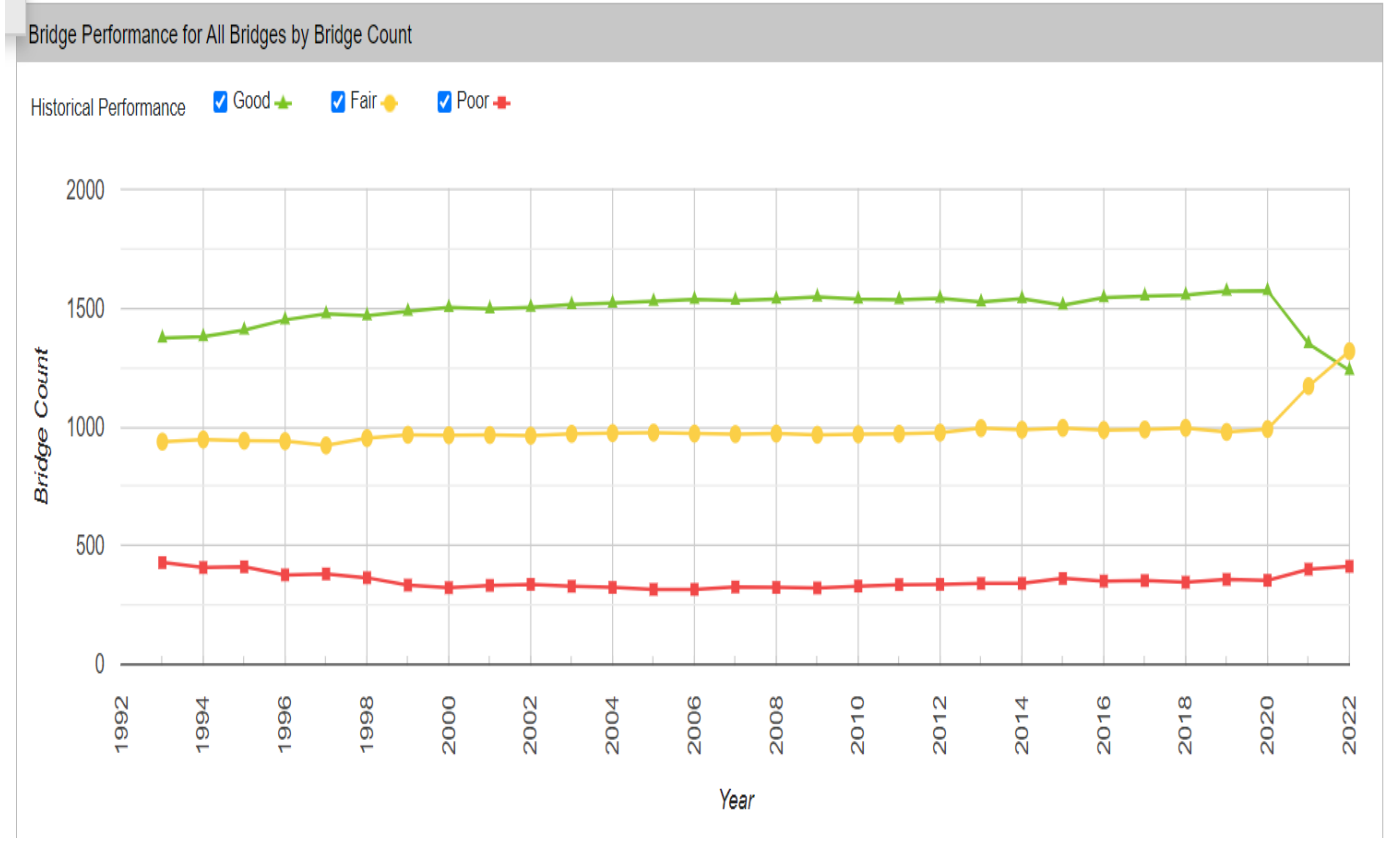
- Work Commute
  - Average is 41 miles, to/from
- If there is a bridge every 5 miles, you are crossing a bridge 8 times per day one way and maybe do not even realize it.

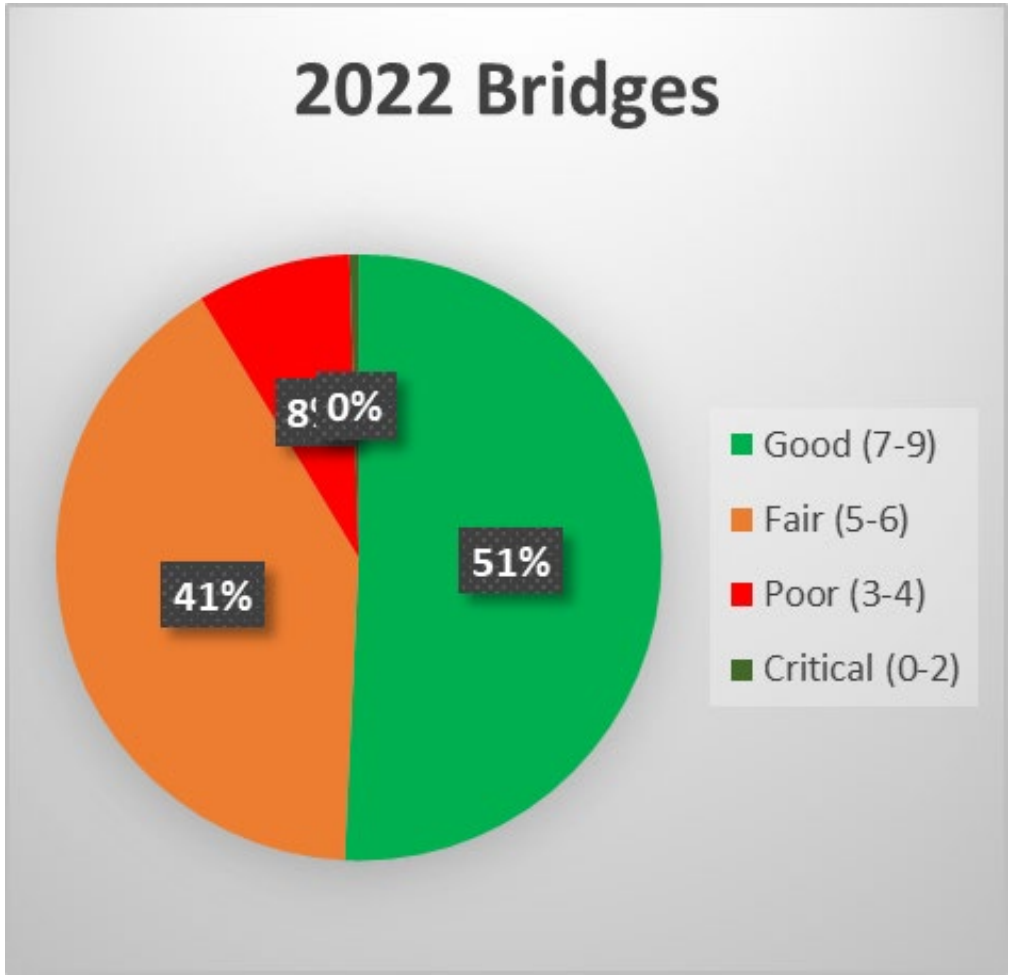
Bridge Conditions in US



Bridge Conditions in ND

Inspection data through 2022 reports





Asset Management

- Approximately 3,100 bridges (=> 20’) owned by a County of City
- Bridges are expensive and Large Asset for any agency

Mobility and Freight Movement

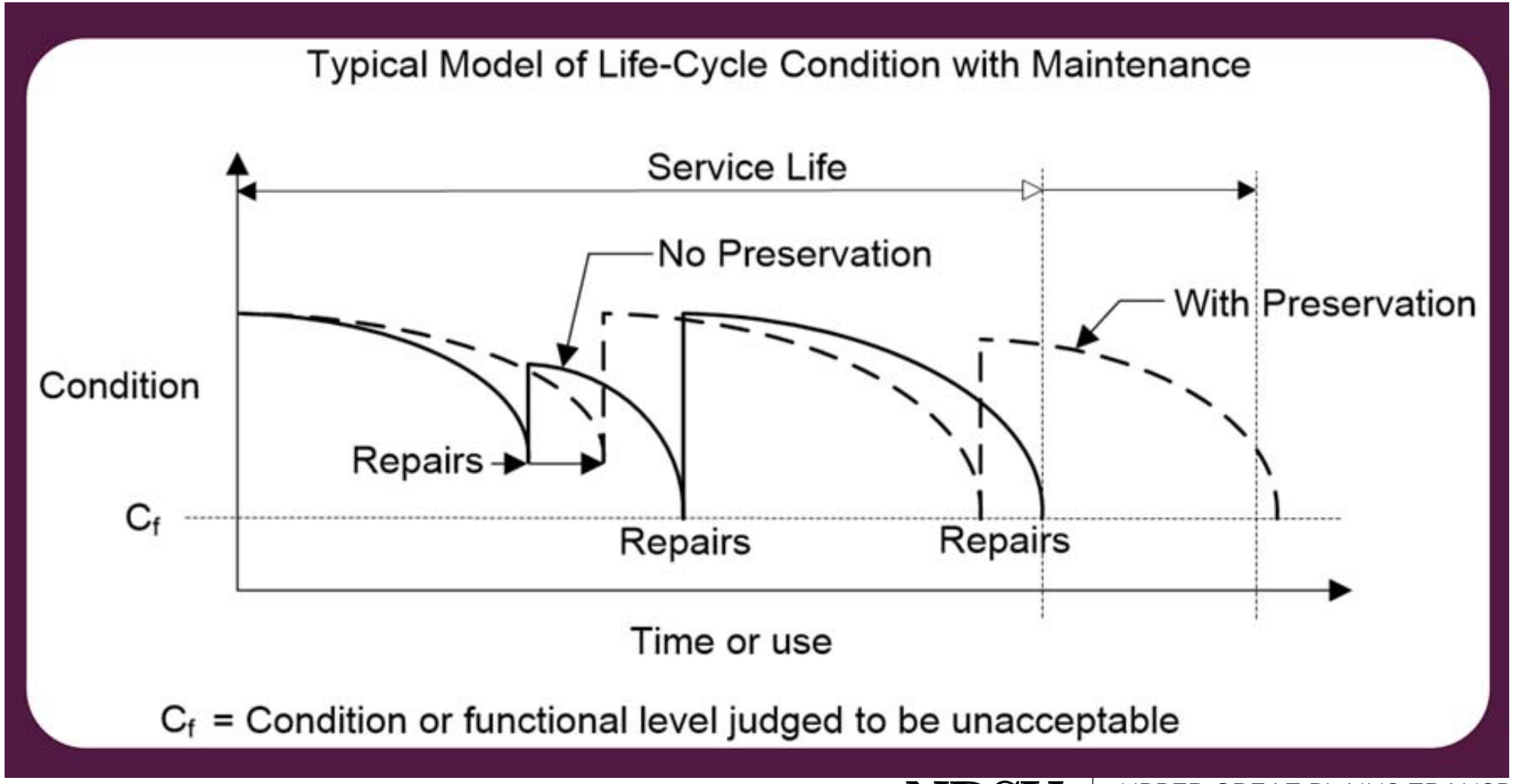
- “Each year, North Dakota’s freight system moves approximately $173 billion worth of freight. From 2016 to 2045, freight moved annually in North Dakota is expected to increase 128 percent by value (inflation-adjusted dollars), the second highest increase in the nation.”

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

Design Life

- House
  - 50 to 60 years
- Vehicle
  - up to 200K miles
- Roadway
  - 20 to 30 years
- Bridges
  - 75 to 100 years
  - Previously it was 50 years

Example of Life Cycle Cost



Preservation/Maintenance

- 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
- Extend their useable life
- Keeps bridges in service w/o modification to bridge capacity, design type, material, or function

Preservation/Maintenance - Benefits

- Reduce agency costs
  - Extends the useable service life
  - Can avoid or delay major repairs or rehabilitation
- Reduce user costs
  - Detours
    - Closures – repairs or rehabs or early replacement
    - Load carrying issues
- Hopefully avoid a complete Failure

Preservation/Maintenance - Candidates

- Things to consider
  - Bridge condition
    - New, good, and fair
    - What about poor bridges?
  - Bridge material
  - Route or classification of road
  - Load carrying capacity
  - Cost

Preservation/Maintenance - Components

- Deck
- Bearings
- Superstructure
- Substructure
- Bridge/Guard rail
- Approach panels
- Scour/Drainage
- Miscellaneous

Deck

- Material Type
  - Concrete
  - Timber
  - Asphalt
  - Steel – not covered

Deck

- Clean – annually or more if needed
  - Sweep or clear vegetation and debris from the deck
  - Flush or wash the bridge deck
  - Open up drains

Deck – Concrete (Cracks)

Deck – Concrete (Cracks)

Deck – Concrete (Cracks)

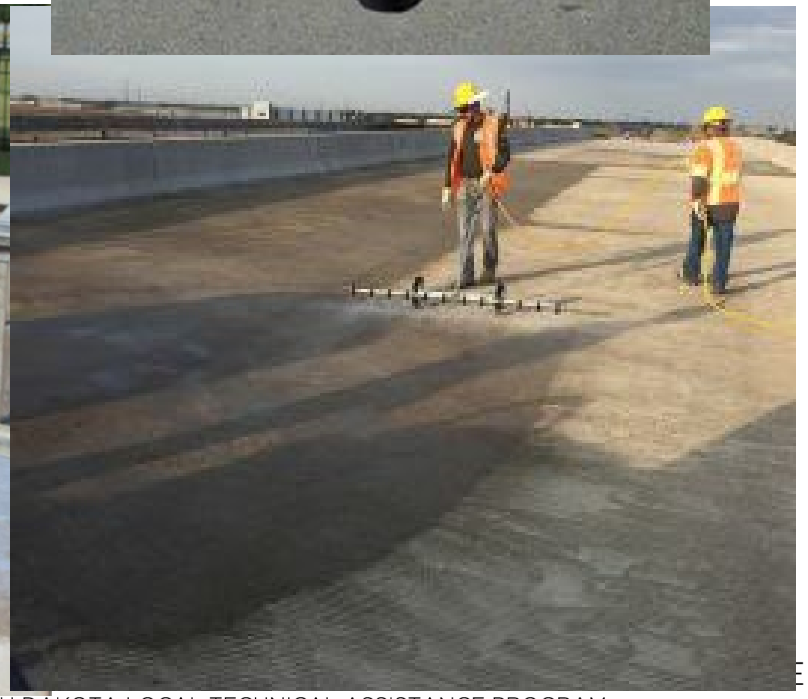
- Prior to crack sealing
  - Delamination survey depending on bridge deck age
  - Look at spall repairs, etc. if needed
- Crack sealers (MNDOTS approved crack sealers)
  - Paulco TE-2501 (MNDOT and NDDOT)
  - Dural 50 LM (MNDOT)
  - TK-9000 (MNDOT)
  - TK Products TK 2110 (MNDOT and NDDOT)

Deck – Concrete (Seal entire deck)

- Silanes (40% or 100%)
- Epoxy Resins
- Healer/Sealers

Deck – Concrete (Silanes)

- Consistency similar to water
- Applied with a spray bar or garden sprayer



Deck – Concrete (Silanes)

- Silanes (MNDOTS approved Silanes)
  - MasterProtect H 440HZ
  - TK - Tri - Silane 590 – 40
  - Certi-Vex Penseal 244 40%
  - Protectosil CHEM-TRETE 40 VOC
  - TK Products TK 590-100 (MNDOT and NDDOT)
  - Protectosil BHN
  - BASF MasterProtect H 1000 (NDDOT)
  - Advanced Chemical Technologies SIL-ACT ATS-100 (NDDOT)
  - Evonik Protectosil 300S (NDDOT)

Deck – Concrete (Epoxy or MMA Resins Overlays)

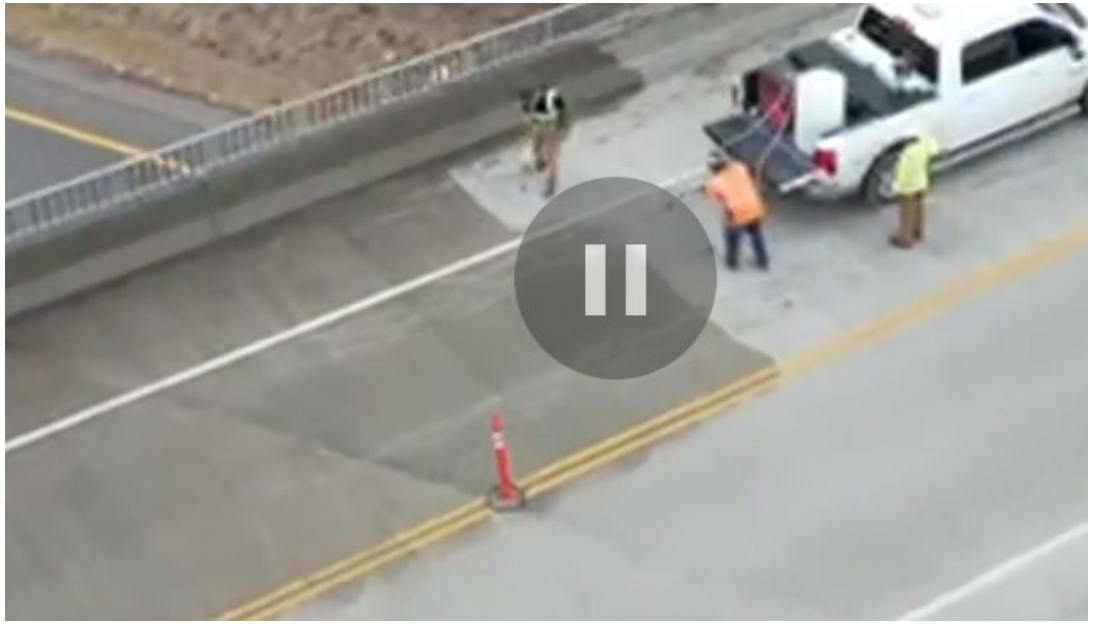
- Mix components together
- Spread over the deck
- Aggregate placed over and embedded into resin

Deck – Concrete (Epoxy or MMA Resins Overlays)

- Epoxy (polymer) Resins (SDDOT Approved products)
  - CIS PRECISION Epoxy Binder
  - E-Bond 526
  - EP50 – Overlay
  - EPX50
  - Sikadur 22 Lo-Mod FS

Deck – Concrete (Healer Sealers)

- Some chemically bond to concrete, expands when it comes in contact with water to fill cracks



Deck – Concrete (Healer Sealers)

- Products
  - BridgeDECK Protectant (non epoxy or MMA)
  - Various Epoxy/MMA products

Deck – Spall Repair Material

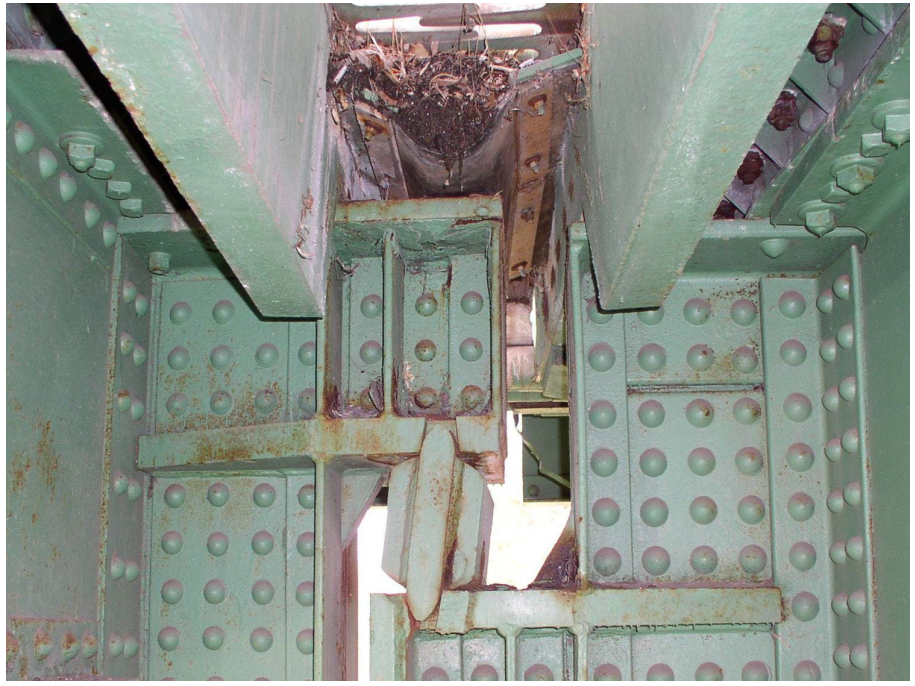
- Material for Spall Repair on concrete (NDDOT Approved Material)
  - Ceratec Pavemend VR
  - SpecChem RepCon V/O
  - Sika SikaQuick VOH
  - BASF MasterEmaco N425

Deck – Joints

- Ideal Deck Joint
  - Watertight
  - Accommodates full range of movement
  - As durable as the deck
  - Low maintenance

Deck – Joints

- Common Problems
  - Poor bond or seal damage allowing water & debris to enter
    - Damages concrete edges and substructure below

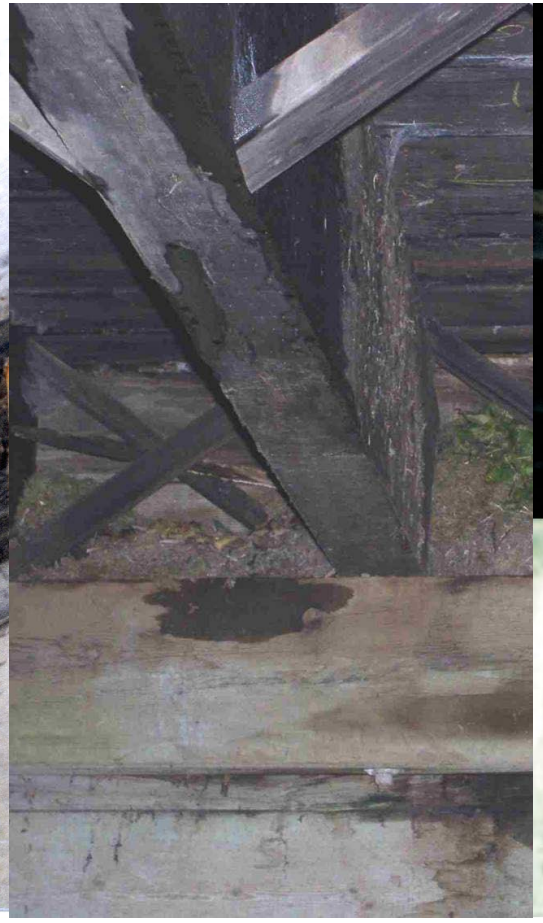


Deck – Joints

Deck – Joints (Abutment/Pier Caps)

- Silanes (MNDOTS approved Silanes)
  - MasterProtect H 440HZ
  - TK - Tri - Silane 590 – 40
  - Certi-Vex Penseal 244 40%
  - Protectosil CHEM-TRETE 40 VOC
  - TK Products TK 590-100 (MNDOT and NDDOT)
  - Protectosil BHN
  - BASF MasterProtect H 1000 (NDDOT)
  - Advanced Chemical Technologies SIL-ACT ATS-100 (NDDOT)
  - Evonik Protectosil 300S (NDDOT)

Deck – Joints

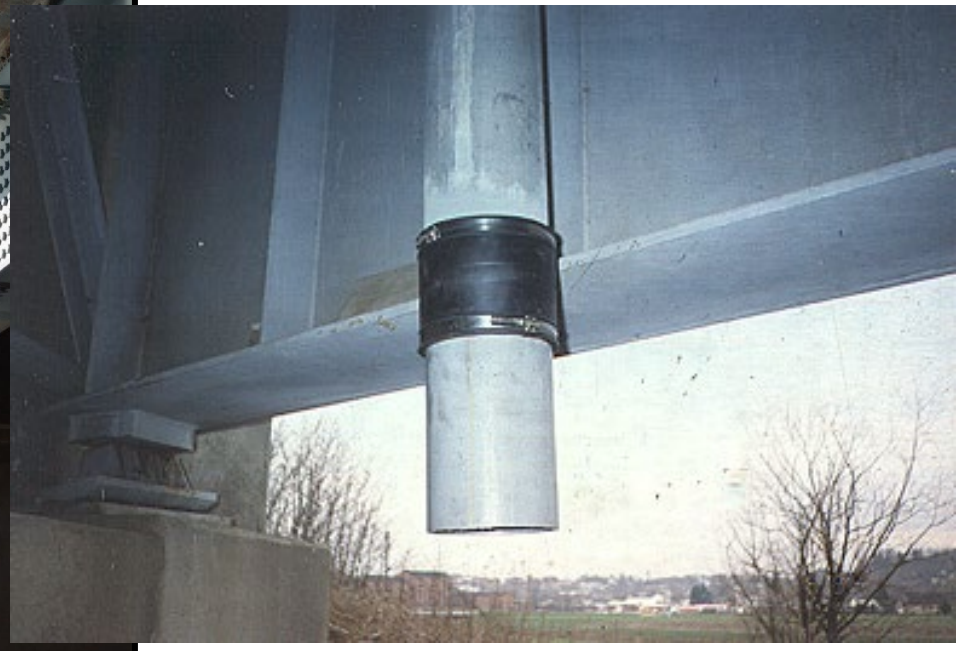


Deck – Joints

Deck – Joints

Deck – Drains

Deck – Drains



Deck

Deck

Deck - Timber

- Look for damage and gaps

Deck - Timber

- Look for damage and gaps

Deck - Timber

- Add Longitudinal runners to protect deck

Deck – Asphalt over Concrete

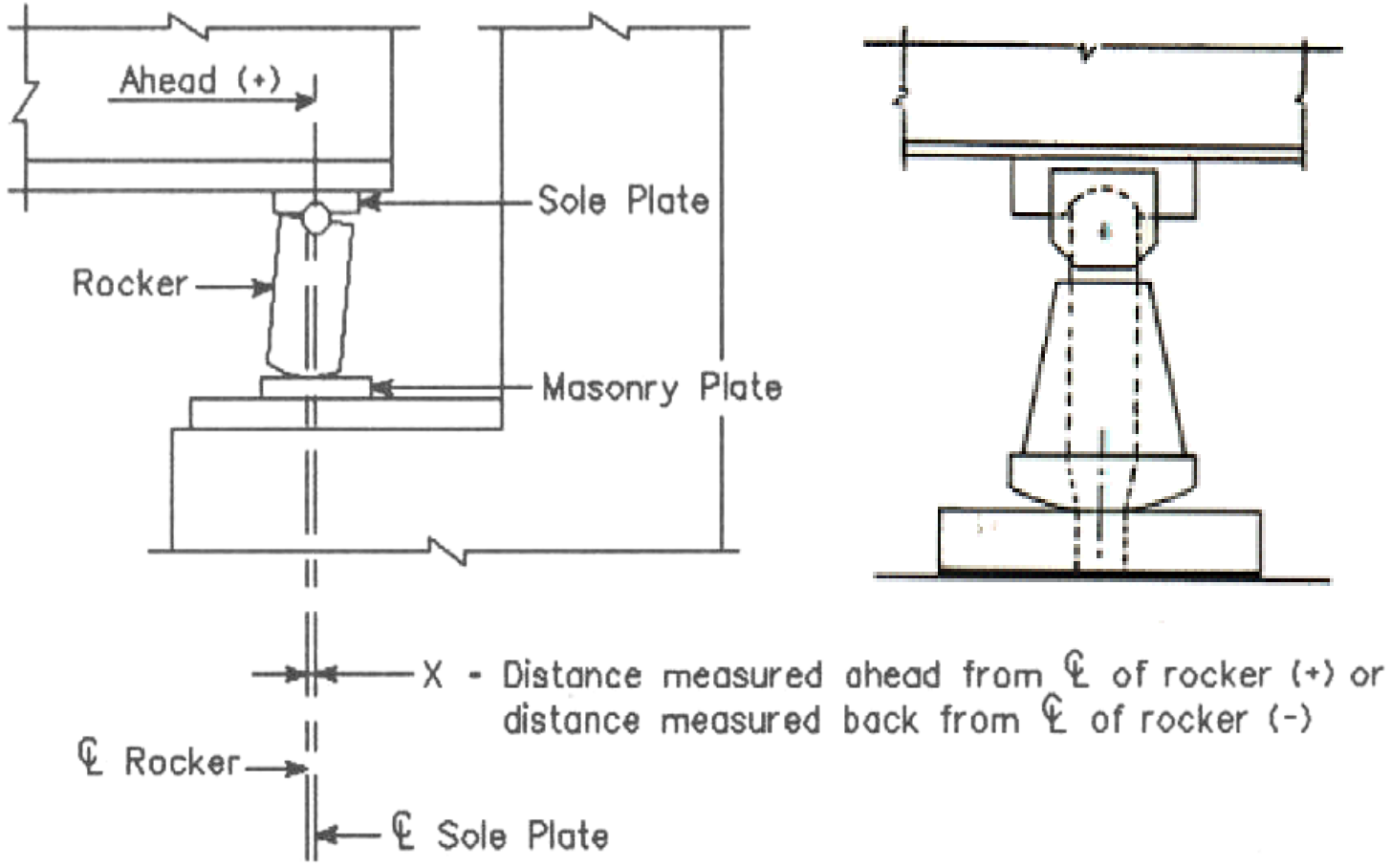
Deck - Asphalt

Deck - Asphalt

- Bonding issues
- Trap chlorides

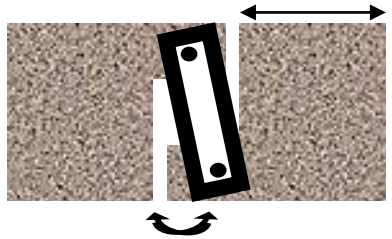
Bearings

- Position is important

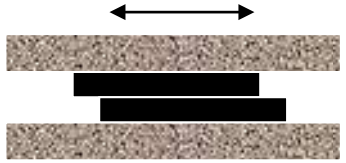


Bearings

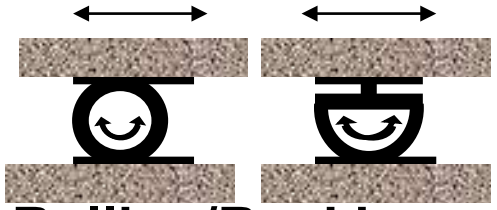
- Type of bearings



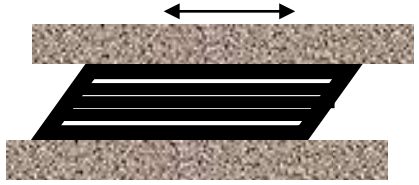
Swinging



Sliding



Rolling/Rocking



Stretching

Bearings

Bearings

Bearings

- Lubrication of Bearing
  - Ultimate Penetrating & Lubricating Oil
  - LE, Inc. Pyroshield 5100 Syn Open Gear Grease

Superstructure

- Steel
- Concrete
- Timber

Superstructure

Superstructure

Superstructure

Superstructure

Superstructure

Superstructure

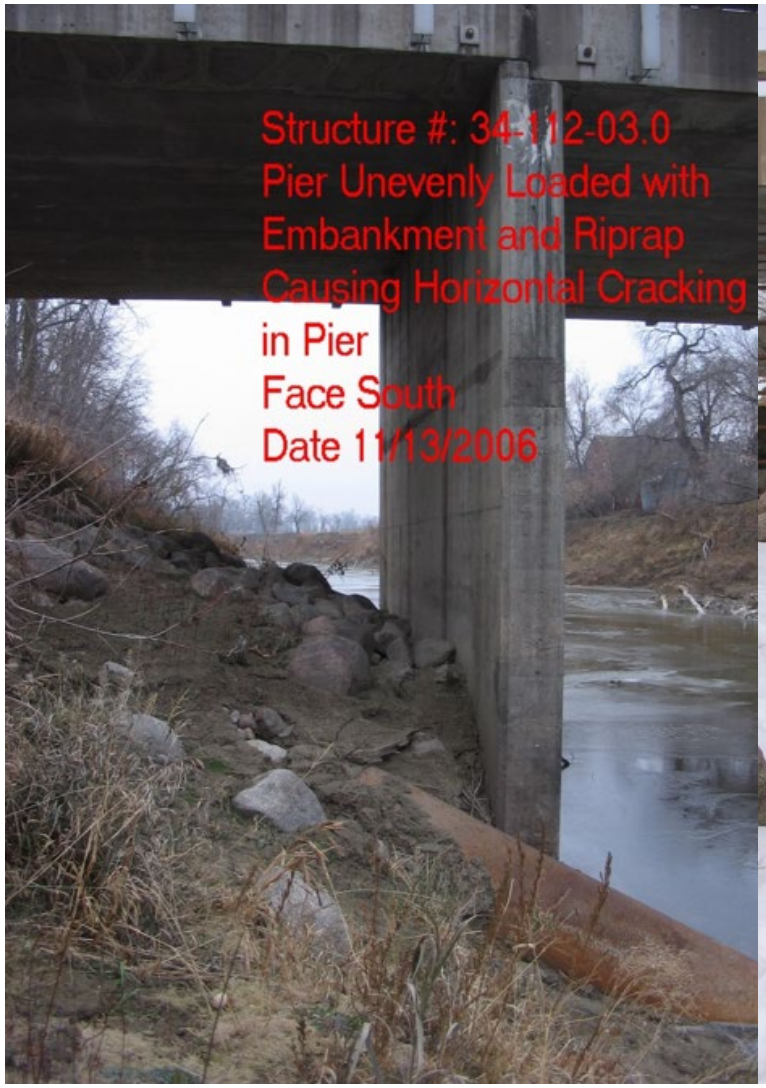
Superstructure

- Treat exposed areas with:
  - Tenino Copper Naphthenate
  - “Roof coatings”

Substructure

- Concrete
- Timber

Substructure



Substructure

Substructure

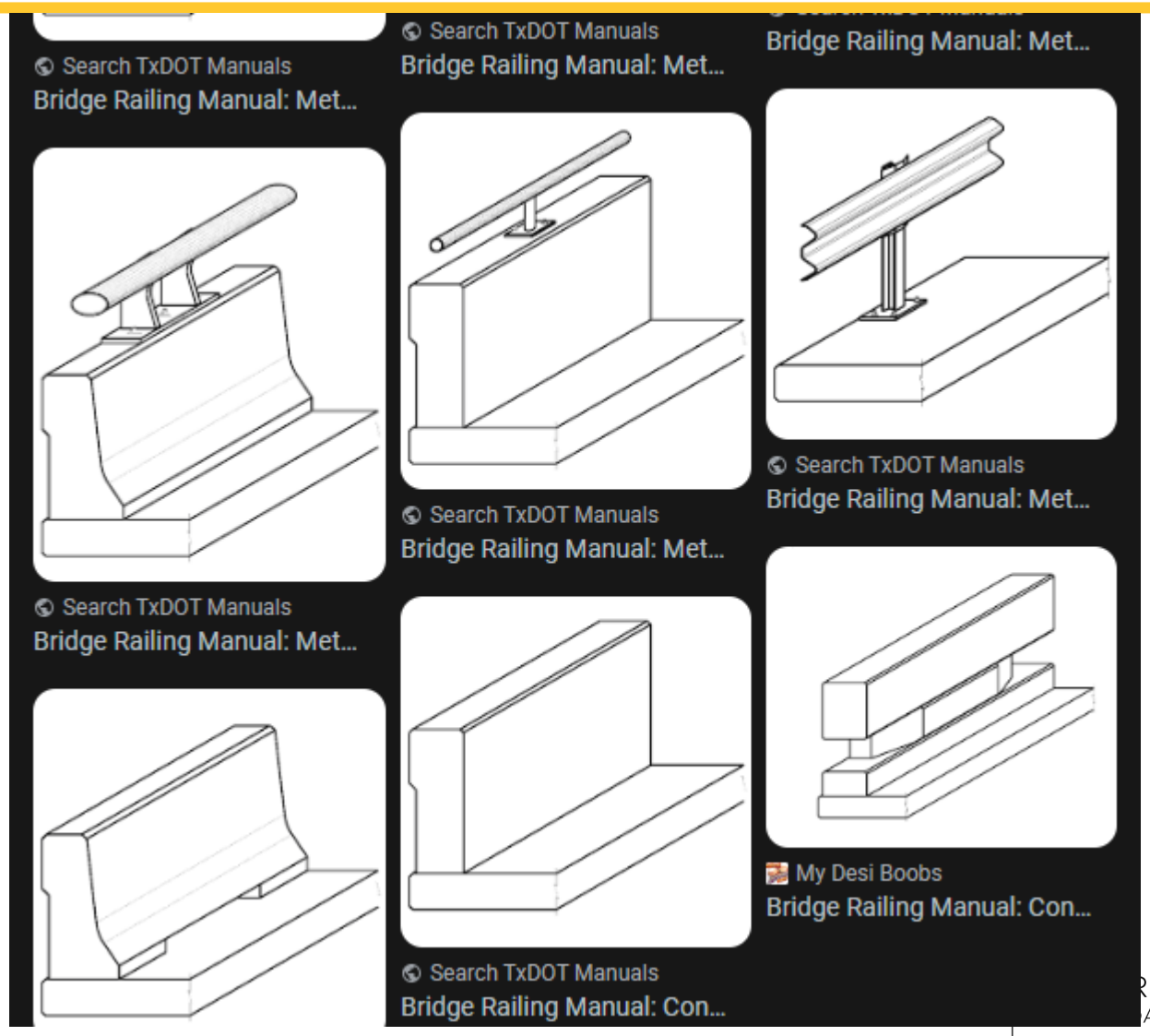
Substructure

Substructure

Bridge Rail & Guardrail

Bridge Rail & Guardrail

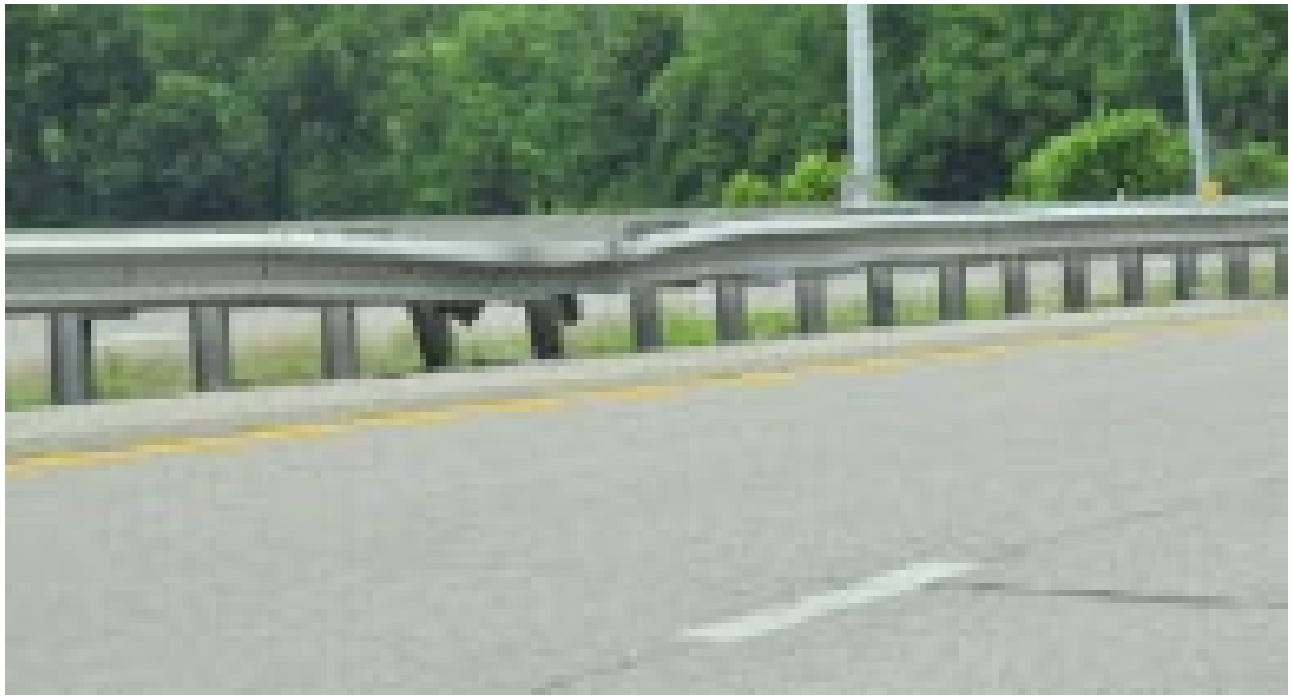
Bridge Rail & Guardrail



Bridge Rail & Guardrail

Bridge Rail & Guardrail

- Guardrail at correct height?
  - MSG system (28”-31”)
  - If >33” or <28”, look at adjusting
  - Older system, <26.5”, adjust to proper height



Bridge Rail & Guardrail

- Damaged rail or non-manufactured holes cut or torch in Guardrail needs to be replaced

INSTITUTE

Bridge Rail & Guardrail

- Deflected more than 9” in 25’ – replace
  - Also look for damaged or missing posts
- Look for damaged or missing bolts at splices

Bridge Rail & Guardrail

- Rail element fully seated into Impact Head?
- Is the rail kinked or bent?
- End post broken, missing, anchor cable missing, steel bearing plate missing or buried?

Approach panels

Scour/Drainage Maintenance

Scour/Drainage Maintenance

Scour/Drainage Maintenance

Scour/Drainage Maintenance

Scour/Drainage Maintenance

Scour/Drainage Maintenance

Misc. Items

Misc. Items

Scheduled Maintenance and Preservation

- Sweep and wash decks
- Clean joints, seal joints, and repair if needed!
- Clean Drains (extend or redirect if needed)
- Seal cracks
- Seal your deck, tops of piers/abutments/columns, splash zones
- Treat exposed Timber cuts and where water may sit
- Paint exposed steel
- Clean and lubricate bearings
- Install and maintain scour countermeasures

Scheduled Maintenance and Preservation

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

Scheduled Maintenance and Preservation

Bridge Component	Bridge Preservation Type	Activity Description	Preventive Maintenance Type	Action Frequency (years)
All	Preventive Maintenance	Sweeping, power washing, cleaning	Cyclical	1-2
Deck	Preventive Maintenance	Deck washing	Cyclical	1
		Deck Sweeping		1
		Deck Sealing/Crack Sealing		4-5
		Thin polymer (Epoxy) overlays		10
		Drainage cleaning/repair		As needed
		Joint cleaning		
		Deck Patching	Condition Based	1- 2
		Chloride extraction		1 -2
		Asphalt overlay with membrane		12-15
		Polymer modified Asphalt overlay		6-12
		Joint seal replacement		10
		Drainage cleaning/repair		1
	Repair or Rehab Element	Rigid concrete overlays	Condition Based	As needed
		Structural Reinforced concrete overlay		
		Deck joint replacement		
		Eliminate joints		
Super	Preventive Maintenance	Bridge approach restoration	Cyclical	2
		Seat and beam ends washing		2
	Repair or Rehab Element	Bridge rail restoration	Condition Based	As needed
		Retrofit rail		
		Painting		
		Bearing restoration (replacement, cleaning, resetting)		
		Superstructure restoration		
		Pin and hanger replacement		
		Retrofit fracture critical members		
Sub	Preventive Maintenance	Substructure Restoration	Condition Based	As needed
		Scour Counter Measure		
		Channel Restoration		

Scheduled Maintenance and Preservation

Description	Frequency
Cyclical Preventative Maintenance	
Sweep Deck & Approach Slabs	Yearly (Spring)
Clean Expansion Joints	Yearly (Spring)
Wash Deck	Yearly (Spring)
Clean Deck Drains	Yearly (Spring)
Clean Beams, Abutments, & Piers	Yearly (Spring)
Clean Bearings	Yearly (Spring)
Lubricate Bearings	Yearly (Spring)
Crack Seal Bridge Deck	3 Years
Apply Deck Surface Treatment	6 Years
Seal Abutments & Pier Tops	6 Years
Seal Concrete in Splash Zone	6 Years
Condition-Based Preventative Maintenance	
Repair Deck Drains	As needed
Repair Concrete on Bridge Deck	As needed
Repair Concrete on Barriers & Curbs	As needed
Repair Bridge Railing	As needed
Repair Expansion Joints	As needed
Repair Concrete Sidewalks	As needed
Repair and Level Approach Slabs	As needed
Repair Bearings	As needed
Repair Spalled Concrete on Beams	As needed
Repair Spalled Concrete on Substructure	As needed
Repair Erosion & Correct Drainage Issues	As needed
Repair Riprap	As needed
Repair Scour	As needed
Repair Slope Protection & Seal Joints	As needed
Remove Debris near Substructure and Abutments	As needed
Remove Trees and Shrubs near Structure	As needed
Spot Painting	As needed
Remove Graffiti	As needed

Resources

- TSP2
- TSP2 Pocket Guides
- Concrete Bridge Deck Preservation Resource Guide
- USFS Timber Bridge Manual

Thank you

NDSU UPPER GREAT PLAINS TRANSPORTATION INSTITUTE