

Small Structure and Culvert Asset Management

Cole Ude
Ward County GIS Specialist

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GIS - Geographic Information Systems

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Ways to Store and Display Data

- ▶ Database
- ▶ Spreadsheet
- ▶ Line Chart
- ▶ Bar Charts
- ▶ Pie Charts
- ▶ Pivot Tables
- ▶ Bubble Charts
- ▶ Venn Diagrams
- ▶ GIS (Geographic Information Systems) Mapping

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GIS Data I Use Routinely

- ▶ Road Data
 - ▶ Reconstructed
 - ▶ Graveled
 - ▶ Paved
 - ▶ Chip Sealed
 - ▶ Crack Sealed
 - ▶ Micro Surface
- ▶ Bridge Structures
- ▶ Minor Structures
- ▶ Culvert data
- ▶ Sign Data
- ▶ Parcel Information
- ▶ Imagery
- ▶ Lidar Data
- ▶ ADT Traffic Counts
- ▶ Floodplain/FIRM
- ▶ TE Routes and Missile Sites
- ▶ Control Points and Section Corners
- ▶ Gravel Pit Locations & Gravel Quantities
- ▶ Railroad and Railroad Crossing Info
- ▶ City Limits & Zoning Jurisdictions

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GIS Data - Free

- ▶ North Dakota GIS Hub
 - ▶ <https://www.gis.nd.gov/>
- ▶ ND Department of Water Resources
 - ▶ https://www.dwr.nd.gov/info_edu/map_data_resources/mapservices.html
- ▶ Other GIS Servers
 - ▶ ND DOT - North Dakota Department of Transportation
 - ▶ USFWS - United States Fish and Wildlife Service
 - ▶ USGS - United States Geological Survey
 - ▶ ESRI - Environmental Systems Research Institute

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Bridge Structures.. What? Where? Who?

- ▶ These are the questions presented with in 2008 when Dana became the County Engineer.
- ▶ What is the small structure?
- ▶ Where is the small structure?
- ▶ Who is maintaining this structure?
 - ▶ All we had was an old bridge map with all the structures labeled in Ward County.
- ▶ Initial inspection performed in 2008 to determine what was in each location, along with an overall condition.

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What was found..?



The slide contains three photographs documenting bridge issues. The top-left photo shows a collapsed bridge structure over a stream with the date 08/12/2008. The top-right photo shows a wooden bridge structure in a field with the date 08/12/2008. The bottom photo shows a 'BRIDGE OUT' sign in a rural landscape with the date 01/05/2004.

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Next step?

- ▶ We had all the inspection information in a spreadsheet
- ▶ Formed a GIS database
 - ▶ Type
 - ▶ Size (culverts)
 - ▶ Condition
 - ▶ Material of structure/culvert
 - ▶ GPS location
- ▶ Implement into bridge maps and inspection schedules
- ▶ Prioritize structures for improvements or replacements
 - ▶ Decide whether these will happen in house by our County Staff or be bid out to be completed as a construction contract.

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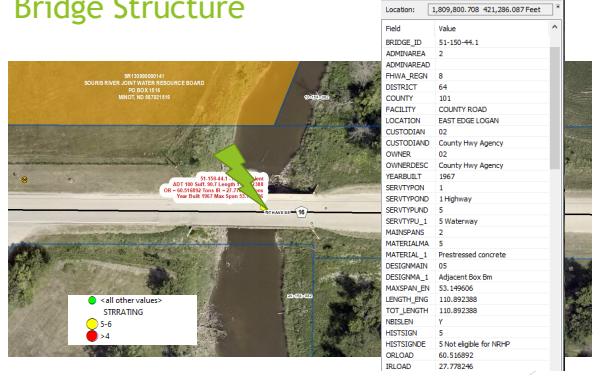
Progress



- Structure 144-25.0 (Egg Creek)
 - Restricted September 6, 2022
 - 5 ton per axle/12 tons gross
- Replaced with 4 73in x 45in CL 3 RCP Arch Pipe.
- Completed October 2024.
 - \$330,000
- Back open for the Farmers and Ranchers for the 2024 Harvest.

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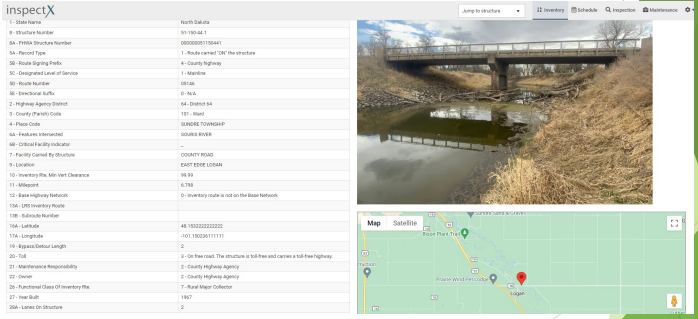
Bridge Structure



Field	Value
BRIDGE_ID	51-150-44.1
ADMINAREA	2
ADMINAREAD	
FHWA_REGION	8
DISTRICT	04
COUNTY	101
FACILITY	COUNTY ROAD
LOCATION	EAST EDGE LOGAN
CUSTODIAN	02
CUSTODIANID	County Hwy Agency
OWNER	02
OWNERSDESC	County Hwy Agency
YEARBUILT	1967
SERVTYPECD	1
SERVTYPEID	1 Highway
SERVTYPEID	5
SERVTYPEU_1	5 Waterway
MATERIALS	5
MATERIALS_1	Prestressed concrete
DESIGNMTH	05
DESIGNMTH_1	Adjacent Box Bn
MAXSPAN_LEN	53.149506
LENGTH_LEN	110.892388
TOT_LENTH	110.892388
HEISLEN	Y
HISTSIGN	5
HISTSIGDE	5 Not eligible for NRP
ORIGLAD	03.516692
BLDAD	27.779246

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InspectX



Field	Value
Structure Number	51-150-44.1
Admin Area	2 - Admin Area 101 - The Structure
Route Signing Type	4 - County Highway
Designated Lane of Service	1 - Unknown
Year Bld	1967
Structure Type	0 - Not
Highway Agency District	04 - District 04
County/Parish Code	101 - Ward
Plan Code	50426 10000000
Structure Inventory	00000 00000
Critical Facility Indicator	-
Priority Owned by Structure	00000 00000
Location	00000 00000
Inventory File, Min. Vert. Clearance	00.00
Inventory	00000
State Highway Network	0 - Inventory Code is not in the State Network
CRS Inventory Route	
Structure Number	48 1000000000
Latitude	-91.1000000000
Longitude	30.0000000000
Sign Structure Length	0
On Toll	0 - On Toll Road: The structure is toll free and carries a toll-free Highway
Maintenance Responsibility	2 - County Highway Agency
Owner	2 - County Highway Agency
Functional Class Of Inventory File	7 - Rural Major Collector
Year Bld	1967
Asset ID Structure	2

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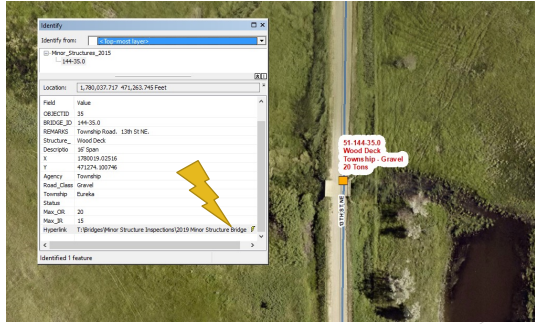
Bridge Structure linked to InspectX

<https://nddot.inspectx.co/#/bridge-summary/4339>

109A - Average Daily Truck Traffic	10
Cat29 - Deck Area	3419.91
27A - Bridge Age	1967
ExtraC - StatusWithout10Yr	
0 - Bridge Id	4339
IX_FK1 - State Id	34
ExtraD - Recall Number	51-150-44.1
Cat10 - Bridge Condition	1 - undefined

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Minor Structures



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Minor Structure PDF File



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Culvert Database Planning - 2017

- ▶ Previously done in 2008 as points
- ▶ File type
- ▶ Fields to Consider
- ▶ Drop Downs with set parameters
- ▶ Data storage
- ▶ Collection methods
- ▶ Unique number

Field	Value
FID	22
Shape	Pol/Vline 2D
LOCATION	CL
MATERIAL	CHP
SHAPE_1	ROU
SIZE	38
END_SECT_1	NONE
CONDITION	GOOD
INLET_COND	GOOD
OUTLET_C_1	GOOD
ROP_SEPA_1	N/A
ROP_SPAL_1	N/A
CHP_RUST_1	GOOD
SILT	CLEAN
SHOT	FLOW
SHOT_DATE	5/26/2017
USER	Cole
COMMENT	
PHOTO	PHOTO_2042.jpg
Updated	0
WKCComplete	

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Culvert Database Collection

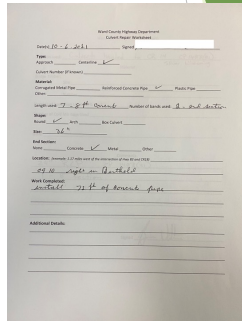
- ▶ Used VRS (Virtual Reference Station) through Midstates Wireless and a Verizon 4G LTE connection
- ▶ ArcPad
- ▶ Geo7x
- ▶ External antenna on GPS rod
- ▶ Camera built into collector
- ▶ Database created with drop downs
- ▶ Newer practices
 - ▶ iPad, external bluetooth antenna, field maps application.



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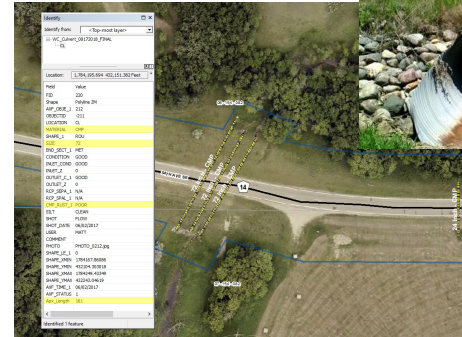
Culvert collection use/maintenance

- ▶ Maintain internally for repairs/replacements/new
- ▶ Using ArcGIS for implementation of updates in database
- ▶ Forms for staff to complete in field and hand in
- ▶ Field Maps application for field collection to continue to have the most up to date database



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Culvert Layer



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Sign Maintenance Program

- ▶ Sign Number
- ▶ Sign Type
- ▶ Description
- ▶ Sign Location
 - ▶ GPS Location
 - ▶ Distance from starting point
 - ▶ Distance from road
- ▶ Installation Date
- ▶ Last Inspection Data
- ▶ Sign Condition
- ▶ Sheeting Type
- ▶ Retroreflectivity Readings
- ▶ Post Type
- ▶ Sign Height
- ▶ Road Type
- ▶ Breakaway Type
- ▶ Side of the Road
- ▶ Direction Sign Faces
- ▶ Travel Direction

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Sign Inventory

WARD COUNTY HWY DEPT. SIGN INVENTORY SYSTEM

1. DATE	1/28/03	2. SIGN NO.	42010
3. SEGMENT	1318	4. DISTANCE	43 FEET
			1.4 METERS
5. SIDE OF ROAD	(L) R	6. DIRECTION OF TRAVEL	(S) S. E. W.
7. SIGN CODE	A1-2	8. MESSAGE	YIELD
9. SIGN SHAPE	(T) D SQ R C P O	10. REFLECTIVE GRADE	(E) HI D
11. SIGN WIDTH	36	12. SIGN HEIGHT	
13. POST TYPE	T (U) V	14. POST SIZE	1 1/2" x 1 3/4" 2" x 2"
			2 1/2" x 3 1/4" 3" x 3"
			4x4 4x6 1.12 LB 2.7
15. SIGN CONDITION	1 2 3 (4)	16. POST CONDITION	(E) P
17. POST DISTANCE FROM ROAD	6		
18. BOTTOM SIGN HEIGHT ABOVE ROAD	6		
19. SIGNS FIRST INVENTORY	1-1-1		

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Sign Repair Form

COUNTY ROAD SIGN REPAIR FORM

July 2007

DATE	SIGN #	SEGMENT	SIGN COND	REASON FOR REPAIR	ACTION & MATERIALS
6/6	0120	1009	4	Shot up	Sign (HJ)
6/8	0210	1052	4	Shot up	Sign (HJ)
6/14	0120	1005	4	Shot up	replace sign (HJ)
7/14	0210	0201	4	MISSING	(HJ)
7/26	0030	31+32	4	ranover	Anchor 12' T-Post
7/26	0010	1218	4	ranover	10' T-Post
7/26	0071	0223	4	MISSING	(HJ)
7/26	0000	1000	4	MISSING	(HJ)

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Sign Data

WARD COUNTY HIGHWAY DEPT.

REFLECTOMETRY BY SIGN NUMBER/PASS-FAIL

08/12/2015
1 of 1

FROM DATE: 8/12/2015
TO DATE: 8/12/2015

SIGN NUMBER	DATE	TIME	SIGN TYPE	ROAD NUMBER
13180010	08/12/2015	05:46:42	R1-2-36	1318

PASS

LEGEND COLOR: WHITE
LEGEND MIN: 35
BACKGND COLOR: RED
BACKGND MIN: 7
CONTRAST RATIO: 3/1

SIGN NUM	SIGN TYPE	SIGN DESCRIPTION	ROAD NUM	ROAD LOCATION
13180010	R1-2-36	YIELD	1318	

INSTALLED	LATITUDE	LONGITUDE	REFR. DIST.	SIDE OF RD.	FACES	TRAVEL DIR.
04/03/2007	48.181985N	101.555345W	43	LEFT	SOUTH	NORTH

ROAD TYPE	SIGN BLANK	SHEETING	SIGN HEIGHT	POST TYPE	BRKAWY	SIGHT DIST.
COUNTY, GRAVEL	ALUMINUM	HI PRISMATIC	6	Telespar®	YES	

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Sign Database

- Data out of Reflectometer from Sign Technician
- AS400 layout from database
- Code inside excel to remove characters and make usable information
- Made them their own unique fields
- Joined into ArcGIS shapefile from KMZ file
- Used unique sign number created by Tech for join

Name	Sign Type	Sign Description	Road Number	Sheet Type
SIGN 00100010	Sign Type: R1-2-36	Sign Description: STOP	Road Number: 0101	Sheeting - HI PRISMATIC
SIGN 00100020	Sign Type: R1-2-36	Sign Description: STOP	Road Number: 0101	Sheeting - HI PRISMATIC
SIGN 00100030	Sign Type: R1-2-36	Sign Description: STOP	Road Number: 0101	Sheeting - HI PRISMATIC
SIGN 00100040	Sign Type: R1-2-36	Sign Description: STOP	Road Number: 0101	Sheeting - HI PRISMATIC
SIGN 00100050	Sign Type: R1-2-36	Sign Description: STOP	Road Number: 0101	Sheeting - HI PRISMATIC
SIGN 00100060	Sign Type: R1-2-36	Sign Description: STOP	Road Number: 0101	Sheeting - HI PRISMATIC
SIGN 00100070	Sign Type: R1-2-36	Sign Description: STOP	Road Number: 0101	Sheeting - HI PRISMATIC
SIGN 00100080	Sign Type: R1-2-36	Sign Description: STOP	Road Number: 0101	Sheeting - HI PRISMATIC
SIGN 00100090	Sign Type: R1-2-36	Sign Description: STOP	Road Number: 0101	Sheeting - HI PRISMATIC
SIGN 00100100	Sign Type: R1-2-36	Sign Description: STOP	Road Number: 0101	Sheeting - HI PRISMATIC
SIGN 00100110	Sign Type: R1-2-36	Sign Description: STOP	Road Number: 0101	Sheeting - HI PRISMATIC
SIGN 00100120	Sign Type: R1-2-36	Sign Description: STOP	Road Number: 0101	Sheeting - HI PRISMATIC
SIGN 00100130	Sign Type: R1-2-36	Sign Description: STOP	Road Number: 0101	Sheeting - HI PRISMATIC
SIGN 00100140	Sign Type: R1-2-36	Sign Description: STOP	Road Number: 0101	Sheeting - HI PRISMATIC
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SIGN 00100190	Sign Type: R1-2-36	Sign Description: STOP	Road Number: 0101	Sheeting - HI PRISMATIC
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SIGN 00100230	Sign Type: R1-2-36	Sign Description: STOP	Road Number: 0101	Sheeting - HI PRISMATIC
SIGN 00100240	Sign Type: R1-2-36	Sign Description: STOP	Road Number: 0101	Sheeting - HI PRISMATIC
SIGN 00100250	Sign Type: R1-2-36	Sign Description: STOP	Road Number: 0101	Sheeting - HI PRISMATIC
SIGN 00100260	Sign Type: R1-2-36	Sign Description: STOP	Road Number: 0101	Sheeting - HI PRISMATIC
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SIGN 00100870	Sign Type: R1-2-36	Sign Description: STOP	Road Number: 0101	Sheeting - HI PRISMATIC
SIGN 00100880	Sign Type: R1-2-36	Sign Description: STOP	Road Number: 0101	Sheeting - HI PRISMATIC
SIGN 00100890	Sign Type: R1-2-36	Sign Description: STOP	Road Number: 0101	Sheeting - HI PRISMATIC
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SIGN 00100980	Sign Type: R1-2-36	Sign Description: STOP	Road Number: 0101	Sheeting - HI PRISMATIC
SIGN 00100990	Sign Type: R1-2-36	Sign Description: STOP	Road Number: 0101	Sheeting - HI PRISMATIC
SIGN 00101000	Sign Type: R1-2-36	Sign Description: STOP	Road Number: 0101	Sheeting - HI PRISMATIC

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Sign Database

- Sign technician database from vendor
- Grouped based off of road segments
- Sign history per individual sign
- Sign numbers
 - First four = Road Segment
 - Last four = first sign on segment number
 - Last four numbers have a 10 number gap for future added signs in between

SIGN NUM	SIGN TYPE	SIGN DESCRIPTION	ROAD NUM	ROAD LOCATION
13180010	R1-2-36	YIELD	1318	

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Symbolize Sign database

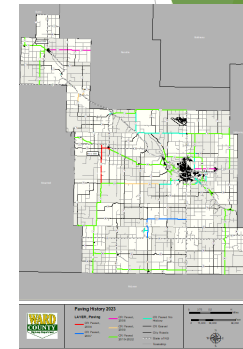
- ▶ Create a symbology group layer for sign numbers from the Manual on Uniform Traffic Control Devices (MUTCD)
- ▶ Implement into a GIS layer and share to a hosted service for out internal basemap
- ▶ Collection done using Road Vista 922 reflectometer
 - ▶ < 3 meter position fix



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Roadway Database

- ▶ GRIT
 - ▶ Keep updated yearly for construction and maintenance projects - Upper Great Plains
 - ▶ <https://dotsc.ugpti.ndsu.nodak.edu/GRIT/>
- ▶ Internal database inside of ArcGIS
 - ▶ Updated yearly for constructions and maintenance projects
- ▶ Use for planning internally for years to come for budgets
- ▶ Make sure roads don't slip through cracks for maintenance



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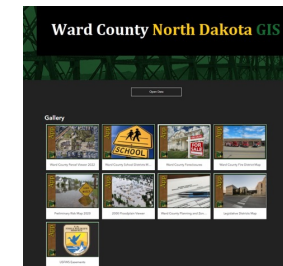
Road Centerline Data

- ▶ County Road Number
- ▶ Segment Number
- ▶ Street/Avenue
- ▶ Federal Aid Number
- ▶ Road Surface Type
- ▶ Road Class
- ▶ Year Constructed
- ▶ Last Year Paved
- ▶ Last Year Chip Sealed or Micro Surfaced
- ▶ Last year Crack Sealed
- ▶ Last year Graveled
- ▶ Epoxy Striping Year

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Ward County hosted GIS

- ▶ Public viewers
- ▶ Internal Viewers
- ▶ ArcGIS online hosted
- ▶ Hosted imagery service
- ▶ External sources utilized from state/federal agencies
 - ▶ Federal USFWS layers
 - ▶ ND Voting Layers
 - ▶ NDSWC and ND Hub Imagery
- ▶ [Ward County GIS Homepage](#)



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