Analytical Research on Minor Structures in North Dakota for GRIT Database

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Introduction

• Geographic Roadway Inventory Tool (GRIT) is a set of geographical and mapping tools designed for researchers and practitioners for engineering design and asset management purposes. The Road and Bridge Asset Management Tools Development has been advanced by Upper Great Plains Transportation Institute Advisory Council, North Dakota. In the year of 2015, Legislature appropriated funds for an asset management initiative.
Introduction (Cont’d)

• The writer of this paper has been involved the building of Minor Structures layer for GRIT (ND) map since September 2016. In the time span of 13 months, I have been working on establishing the initial database for Minor Structures GRIT Layer using physical files from 1985 with more than 3,600 records (Both county-on and county-off systems) by both county DOT and NDDOT. By matching graphical information and written information, I managed to digitize over 3,000 Minor Structure records into GRIT initial database and find several observations that could be beneficial to both engineers and researchers.
Minor Structures in North Dakota

• **Structures Under 20 Feet**
• Concrete/Steel/Timber Culverts and Stringers, Conc Slabs

• **Structures Over 20 Feet: Major Structures, Managed and Maintained by NDDOT**
Phases of Project

• **Phase 1: Initial Data Entry**
  • UGPTI Research assistants

• **Phase 2: Field Work and Validation**
  • NDDOT and County Offices

• **Phase 3: Routinely Maintenance and Updates**
  • County Offices
Climate Issues

- **Field Work could only be done between May and October**
  
  *Coldest Cities by lowest average monthly temperature*
  
  2. Grand Forks, North Dakota
  Average monthly minimum temperature: -3.1 F
  3. Fargo, North Dakota
  Average monthly minimum temperature: 0.1 F
  4. Williston, North Dakota
  8. Bismarck, North Dakota

- **There is no leaf fall map for North Dakota**
Existing “Database”
Existing “Database”

- 255 Pages of Scanned file:
- **North Dakota Department of Transportation Bridge Inventory**
- Major Structures: 84 Pages, 535 Records
- **Minor Structures: 171 Pages, 3122 Records**
  - County-on System: 56 Pages
  - County-off System: 115 Pages
## Existing “Database”

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<th>STRUCTURE NUMBER</th>
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Results and Observations

a. The relative distance from the city geographical center of minor structures appeared to be better than traditional “1xx-xx.x” recordings, while the center of cities can be questionable.
Results and Observations
Results and Observations

b. Over the 30-year span of the latest record of maintenance, the data management of Minor Structures in North Dakota is insufficient. Impacts are caused by:

1. Floods
   1997 Red River Flood of Eastern North Dakota
   2009: Nearly Statewide Flooding
   2011 Souris (Mouse) River Flooding of Minot and Rural North Central North Dakota
   2011: Missouri River flood in North Dakota

2. Snow

20-40 Feet of snow that never melts
Results and Observations

• c. Steel and concrete structures are better maintained throughout the State of North Dakota, while the existence of Timber structures would vary on its type and distance from the cities. Population density is another factor that could drive this situation.
Results and Observations

- d. To conduct better maintenance and updates on the minor structures inventory and the GRIT Map, new tools/mechanism needs to be introduced.
Contribution to Research Literature

- **The contribution of this research contains:**
  - a. Give an example of initial dataset establishment, which could be used as a reference by other states and agencies.
  - b. This research can be used as an example to draw the attention of asset management for both academia and practice concerns.

- **Further study directions:**
  - a. Optimization of asset management
  - b. Maintenance Routing and Scheduling
  - c. Traffic Safety analysis related to minor structure management
Special Thanks to

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  Associate Research Fellow
- **Brad Wentz, PE**
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- Program Director - Department of Transportation Support Center
- **Denver Tolliver, Ph.D.**
  Director - UGPTI
Comments & Questions?