

MEMORANDUM

**Highway
Department**

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TO: Cass County Commission

FROM: Jason Benson, County Engineer *JB*

DATE: September 21, 2018

SUBJECT: Agenda topic for October 1st, 2018 Commission Meeting:
Adoption of the 2019-2023 Comprehensive Highway Plan

In an effort to increase efficiency and maintain a high level of transparency, the Cass County Comprehensive Highway Plan has been developed.

The Comprehensive Highway Plan acts as a document that more efficiently displays our highway and bridge data and serves as a 5 year Capital Improvement Plan (CIP). This plan is anticipated to be revisited annually. Included in the plan is a discussion of land use, highway safety, maintenance, and construction. A large amount of data is used for preparing the plan, but rather than displaying this data, maps are used to display what is most pertinent in an effort to make the plan more user-friendly and easier to update.

The Comprehensive Highway Plan was presented in draft form to the Cass County Road Advisory Committee at the July meeting.

SUGGESTED MOTION:

Adopt the 2019-2023 Comprehensive Highway Plan as an illustrative plan that provides future guidance for project planning and for this plan to be reviewed and updated annually.

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CASS COUNTY COMPREHENSIVE HIGHWAY PLAN



2019-2023

Cass County Highway Department
Cass County, North Dakota

This document was prepared pursuant to NDCC 11-31-03(2) and is intended to be used for internal planning purposes. Data used herein is deemed to be accurate, however, is not all-encompassing. Maps within are graphical displays of conditions at the time of preparation and are not to be used as a substitute for an accurate field survey.

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Plan Purpose

Cass County operates and maintains a highway system, which in conjunction with local, regional, and state systems, helps to serve the transportation needs of its residents and businesses. The Cass County Comprehensive Highway Plan provides the framework for development of the long range highway and bridge planning guidance for 2019-2023. The Plan describes system principals and standards, evaluates the existing County transportation system, identifies future system needs, develops a maintenance plan, identifies funding sources, and outlines strategies to implement the Plan. The Plan provides the framework for decisions regarding the roadway and bridge infrastructure improvements necessary to develop a safe and efficient highway system.

Note: Cass County received an additional transportation funding over the 2013-2014 and 2015-2016 biennium from the ND Legislature. However, due to state revenue reductions, we didn't receive any one time funding for the 2017-2018 biennium. This reduction in funding is shown in the reduced number of projects we expect to complete in the 2019-2023 time frame. We will continue to be proactive in identifying future projects and will be prepared if state revenues increase and one time funding returns.

Plan Updates and Proponent for Changes in this Plan

The Cass County Engineer is the chief proponent for updates to the Cass County Comprehensive Highway Plan. Working in conjunction with the Assistant Cass County Engineer and County Planner, updates will be approved through the Road Advisory Committee and the Cass County Commission.

The five year plan will serve as a living document that will be updated annually to maintain a long range focus while allowing for flexibility due to changes in construction costs, revenues, flooding, and other considerations. The plan will be reviewed and updated in June of each year. The updated plan will be forwarded to the Road Advisory Committee for approval during the July rotational meeting. The plan will then be sent to the County Commission for final approval after budget approval. The plan will provide the future project costs and will serve as the basis for the Highway Department's annual highway and bridge budget line items.

Vision and Mission

Vision - To be recognized as a premiere county road program in the Northern Plains states.

Mission - To provide and maintain an efficient, safe, environmentally sensitive, and cost effective county road system that effectively meets the citizen's needs for personal mobility and the movement of freight consistent with the importance of the economy.

Commitment - We are committed to community service and providing quality, low cost project construction, engineering, and administration. Through public involvement, working with landowners, townships, and the travelling public, we strive to deliver effective highway and bridge maintenance, rehabilitation, and new construction. Safety is paramount in everything we do. Whether plowing snow,

maintaining traffic signs, graveling rural roads, or building a new bridge, the safety of our employees and the travelling public always comes first.

Goals

Cass County's transportation goals are interdependent, mutually supportive, and apply to our transportation system's infrastructure and services. Our goals are nested with both the NDDOT and FM Metro COG transportation priorities.

1. Safe and secure transportation.
2. Sustainable and reliable mobility through planning and maintenance.
3. Communication and cooperation with landowners, townships, cities, NDDOT, and other stakeholders.
4. Transportation supports economic growth with consideration of environmental, cultural, and social impacts.
5. Cost effective construction with diversified and sufficient funding.

Summary

The 2019-2023 Cass County Comprehensive Highway Plan was prepared to assist staff and decision makers in planning for maintenance and capital improvements to the County Highway System. The plan addresses both funding and project planning, so resources are used carefully to ensure the highest return to taxpayers. The Cass County highway system consists of 634 miles of roadway covering more than 1,700 square miles and 541 bridges of which 240 span a distance of 20 feet in length or greater.

Safe, efficient, and responsive transportation infrastructure is necessary to the incidents of commerce, public safety, recreation, and education. The 2018 Cass County Comprehensive and Transportation Plan describe Cass County's commitment to transportation and can be found at:

<https://www.casscountynd.gov/our-county/planning/cass-county-comprehensive-and-transportation-plan/comprehensive-plan-current-documents>. The 2018 Cass County Comprehensive and Transportation Plan focuses on the Guiding Principles of "Regionalism, Resilience, and Livability". It also emphasizes the need to "Manage the County Highway System and collaborating with federal, state, and local officials to provide and maintain appropriate transportation systems."

This plan has been developed through compiling data from multiple sources including:

- North Dakota Department of Transportation (NDDOT);
- Fargo-Moorhead Metropolitan Council of Governments (FM Metro COG);
- Pavement Testing and Traffic Counts from Consultant Engineers;
- Cass County Highway Department;
- Cass County Planning Department;
- Cass County GIS Department; and
- Cass County Tax Equalization Office.

The Highway Department is continuing to develop its inventory of data including an analysis of structures under 20 feet in length, inventory of signage on County Highways, geo-locating culverts and

approaches on County Highways, inventory of ditch grades of all County Highways, and continued development of characteristics of each road segment. Collecting this data will further improve the County's asset management program.

Further, the plan works in concert with various regional plans and corridor studies. Staff works closely with FM Metro COG, NDDOT, and other entities of the County in planning and programming new projects. The Metropolitan Long-Range Transportation Plan guides development of the transportation system in the Fargo-Moorhead metropolitan area. Along with this larger plan, FM Metro COG has completed a number of complimentary studies that offer guidance to programming.

The development of a Regionally Significant Transportation Infrastructure in the Traffic Operations Incident Management Strategy identifies the importance of moving traffic quickly in times of disaster. Some County Highways have been identified in this strategic plan and are noted as new projects and are programmed. FM Metro COG, through the Metro Bike/Ped Committee, also creates a Bicycle and Pedestrian Master Plan every five years which helps identify needs in the system for accommodating alternate modes of traffic. Along with these plans, specific corridor studies in the metro area assist Cass County Highway anticipate or respond to necessary improvements to the system.

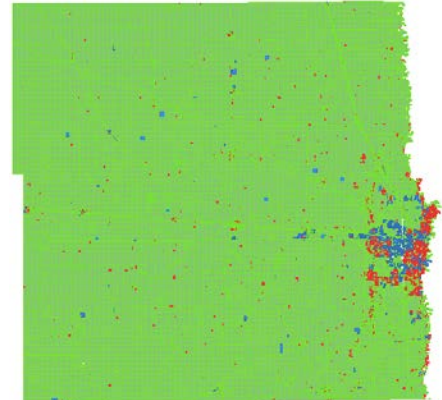


Existing and Future Land Use

The Fargo Moorhead metropolitan area has seen tremendous growth in recent years. The economic prosperity of the metro area has contributed to the growth in the surrounding communities. According to the 1990 Census, Cass County population was 102,874, grew to 123,138 in 2000, and increased 21.6% to 149,778 in 2010. The most recent Census data from 2010 to 2015 shows Cass County growing to 168,930, an increase of 12.8%. With significant growth in commercial and residential building permits, Cass County can expect continued growth. In addition to utilizing Census data to project growth, Cass County participates with the FM Metro COG in researching demographic trends as part of its long range transportation planning and modeling. It is anticipated that by the year 2030 population in Cass County could grow to over 200,000. Table 1 illustrates population in the County's largest cities.

Table 1 - Population - US Census				
City	1990 Census	2000 Census	2010 Census	2018 Census Estimated
Fargo	75,111	90,559	105,549	125,838
West Fargo	12,287	14,940	25,830	39,078
Horace	662	915	2,430	No Estimate
Casselton	1,602	1,855	2,329	No Estimate
Mapleton	682	606	762	No Estimate
Harwood	590	607	718	No Estimate
Kindred	569	614	692	No Estimate

Despite the growth and importance of the metro area, the County as a whole remains primarily agricultural. Ninety-seven percent of the approximately 1.13 million acres of land in Cass County are used for agricultural purposes. Map 1 illustrates this by showing agricultural land uses in green, commercial in blue, and residential in red. It becomes evident that the County’s land use is predominately agricultural.



Map 1: Existing Land Use

Further, the County has committed to promote development only in areas that can adequately accommodate it. The 2018 Cass County Comprehensive and Transportation Plan describe Cass County’s commitment to achieve orderly development that maintains Cass County’s rural heritage. The plan can be found at: <https://www.casscountynd.gov/our-county/planning/cass-county-comprehensive-and-transportation-plan/comprehensive-plan-current-documents>.

Highway Safety

Cass County and its agents have committed to maintaining the safest network of roads possible. The planning process takes into account road safety by implementing the most effective practices available. Commitment to educating the public, roadway safety improvements, sign maintenance and improved signing, routine road maintenance, and operational safety are all components of each project.



Cass County uses the systemic approach to highway safety. All new construction and maintenance overlays include the use of edge line rumble strip installation to separate the roadway from the shoulder while leaving on-off gaps for bicycle safety. This method can help reduce accidents that occur from running off the road (roadway departures). As of 2017, nearly all asphalt County Highways have rumble strips. The only remaining roads without rumble strips are those with a projected paving project within the next few years and our older concrete roads. Intersection improvements and safety enhancements are implemented where collisions have historically happened or where collisions may be likely. Using a systemic approach,

improvements such as flashing signals and stop signs, rumble strips, and improved signage have proven successful in past projects. Striping is performed annually on all paved County Highways.

Highway Access Ordinance #2007-1 was developed to reduce the amount of access points on County Highways for more efficient and safe operation. With design speeds on County Highways at 55 mph and the reduction of accesses to one per ¼ mile, a County Highway is able to operate with less interruption and more predictable intersections. In addition, the Ordinance regulates the design of the approach by increasing the slope of the approach to reduce severity in off road crashes.

Cass County uses crash data provided by the NDDOT in planning and implementing safety enhancements. When significant crashes occur on Cass County Highways, a general reconnaissance is performed by the County Engineer or Highway Superintendent to assess the road condition and variables that may be present.

Signs and Traffic Control Devices

Cass County utilizes the 2009 Edition of the Manual on Uniform Traffic Control Devices (MUTCD) from the US Department of Transportation, Federal Highway Administration. The MUTCD is the standard for traffic control devices and has been adopted by the NDDOT. Cass County maintains an inventory of their signs indicating condition and location in a geo-database.

Local Road Safety Plan

In 2014 the NDDOT sponsored a statewide Local Road Safety Plan (LRSP) for counties. The purpose of this plan was to develop the following:

1. Establish safety emphasis areas;
2. High priority safety strategies;
3. Identify at-risk locations;
4. Develop safety investment options;
5. Identify high priority safety projects, both proactive and reactive;
6. Position local agencies to compete for safety funds; and
7. Foster safety culture among local stakeholders.

One of the critical issues identified was the higher crash rate on rural paved roads. While gravel roads make up approximately 93% of North Dakota's 97,600 miles of rural local road system, approximately half of the severe crashes are on the paved roads that make up 7% of the rural system.

The LRSP therefore focused on the Cass County paved road network and a Risk Rating Criteria was developed for the paved roads based on: Density of Road Departure Crashes; Traffic Volume; Curve (Critical Radius) Density; Access Density; and Road Edge Risk Assessment.

To develop a comprehensive LRSP, a public workshop was held with an emphasis on the 4 E's: Engineering, Enforcement, Education, and Emergency Medical Services. Through group discussion and review of crash data, participants worked to address severe crashes on the County roadways. Critical emphasis areas discussed were: Unbelted Vehicle Occupants; Lane Departure Crashes; Alcohol Related

Crashes; Excessive Speed or Aggressive Driving; Intersection Crashes; and Crashes Involving Drivers Under Age 21.

Crash data from 2008 to 2012 was used for the countywide crash analysis. For Cass County, there were not enough crashes to be statistically reliable; therefore, decisions were based on the crashes for all cities, statewide data, or national research. The safety emphasis areas for Cass County are consistent with the state’s emphasis areas. This process revealed where crashes were overrepresented based on a comparison to statewide averages or where a large enough number of crashes represented an opportunity to substantially reduce crashes. As a result, the following safety emphasis areas were identified as priorities for safety investments:

- Driver Behavior – Young drivers, aggressive drivers, alcohol-related, and unbelted vehicle occupants; and
- Highways – Lane departure and intersection crashes.

Cass County Severe Crashes by Safety Emphasis Areas (2008 to 2012)

Safety Emphasis Areas	Statewide (% of Total)	2008 to 2012 Severe Crashes					
		Cass County		State Roads		Local System	
		%	#	%	#	%	#
Total Severe Crashes	2,231	243		82		161	
Involving Drivers Under Age 21	22%	25%	60	18%	15	28%	45
Involving Drivers Over Age 64	13%	11%	26	15%	12	9%	14
Excessive Speed or Aggressive Driving	26%	23%	57	33%	27	19%	30
Alcohol-Related	30%	23%	55	26%	21	21%	34
Distracted, Asleep, or Fatigued Drivers	9%	9%	23	10%	8	9%	15
Unbelted Vehicle Occupants	48%	37%	91	40%	33	36%	58
Pedestrian Crashes	5%	12%	29	7%	6	14%	23
Bicycle Crashes	2%	7%	18	6%	5	8%	13
Motorcycle Crashes	12%	13%	31	7%	6	16%	25
Heavy Vehicle Crashes	15%	10%	25	18%	15	6%	10
Train-Vehicle Collisions	1%	0%	0	0%	0	6%	10
Lane-Departure (Run-Off-the-Road and Head-On) Crashes	47%	29%	71	41%	34	23%	37
<i>Head-On</i>	<i>7%</i>	<i>6%</i>	<i>14</i>	<i>9%</i>	<i>7</i>	<i>4%</i>	<i>7</i>
<i>Run-off-the-Road Crashes</i>	<i>40%</i>	<i>23%</i>	<i>57</i>	<i>33%</i>	<i>27</i>	<i>19%</i>	<i>30</i>
Intersection Crashes	23%	30%	74	9%	7	42%	67
Work Zone Crashes	2%	2%	5	2%	2	2%	3

Cass County is doing quite well in regards to roadway safety. This is due to Cass County’s existing safety strategies including rumble strips, pavement markings, pavement safety edges, and improved signing. Another factor is the low number of curves in our roadways as this reduces the number of roadway departures and other safety issues experienced in other counties in our region with winding roads. With this in mind, our biggest safety issue involves our intersections. Because of adequate signing and lower traffic volumes, many of our intersections are safe and don’t require any improvements. However,

several of our intersections along ND 18, ND 38, and ND 46, as well as some intersections of two County Highways could be improved. Overall the biggest safety recommendation includes evaluating street lights, signage, pavement markings, and dynamic warning signs. We will work with the NDDOT to determine the best safety options at the intersections of state highways. We will then submit the critical intersections for safety funding for the required improvements.

At this time projects have been completed or developed for Destination Lighting, Radial T Intersection Improvement at Cass 5/10, chevron signing on curves, rumble strips/stripes, and flashing red beacons on stop signs at critical intersections.

Permitting

Related to safety and maintenance, the County relies on various permitting procedures to uphold the mission of the Department. Significant permits include:

1. Over Dimension Vehicles Permits: Ordinance #2005-2 regulates over dimension vehicles to ensure the safe practices and avoidance of damage to County Highways. Similarly the County annually enacts Spring Load Restrictions to avoid damage to the road surface and subgrade during the wet months of spring;
2. Utility Permits: The County also permits use of its right of way for utilities which includes provisions to ensure safe operation during construction activities on or near the roadway;
3. Ditch Cleaning/Drainage Permits: There is also a permitting process for ditch cleaning to better inventory what is being done and to ensure that the water resource district is adequately notified;
4. Access Permits: The County actively permits any new access to County Highways through the Highway Access Ordinance #2007-1; and
5. Subdivision Platting: The County Planning Office administers the Subdivision Ordinance which regulates growth in the County and efficiently accommodates for new roads and land use changes that may affect the County Highway System. The County Engineer reviews all new developments and assists in advising the Planning Commission.

Valuation of Highway and Bridge Assets

Cass County has invested a significant amount of funding in developing and maintaining its transportation network. Since 2000 we have spent over \$130 million in projects and maintenance on both our highways and bridges.

The current average cost to completely rebuild a paved highway is \$1.4 million. To rebuild our 309 miles of paved highway to a width of 32 feet would cost over \$433 million.

With 551 structures, our bridges and large box culverts also have a significant asset value. Of the 241 major structures (20 feet in length or greater), the average structure length is 94 feet with an average width of 28 feet. Replacement values for these 240 structures, at a cost of \$205 per square foot (cost based on the Upper Great Plains Transportation Institute study) would be just over \$140 million.

When factoring the additional cost to replace the 277 minor structures, the total replacement cost of our highway and bridge infrastructure is nearly 2/3 of a billion dollars. While no local government can bear the replacement cost of this large amount of infrastructure, it emphasizes the importance of funding and sustaining an effective maintenance program. An organized and well planned maintenance and replacement program will keep replacement costs down, efficiently spend the County's resources, extend the life of our infrastructure, and ensure the long term viability of our highway system.

Funding Maintenance and Construction

The County relies upon a combination of the 23 cent state fuel tax, state motor vehicle license fees, federal road and bridge funds, local property tax, and when available, one time state funding. Other items such as permit fees make up a very small portion of the budget. Cass County also continually pursues grant funding opportunities as they become available.

Influencing the cost of construction is the significant rise in the ND Construction Cost Index. From 2005 to 2013, ND's overall Construction Cost Index increased annually by more than 18%. Rebuilding just one mile of road can cost up to \$1.4 million. In light of this reality it is important to maintain a road maintenance policy to reduce the need for reconstruction.

While Construction Costs have increased annually at 18% since 2005, Cass County's Highway Distribution Tax Funding (without One Time Funding) has only increased 7%. North Dakota has a state tax that currently collects 23 cents per gallon of gasoline. This tax was last increased in 2005.

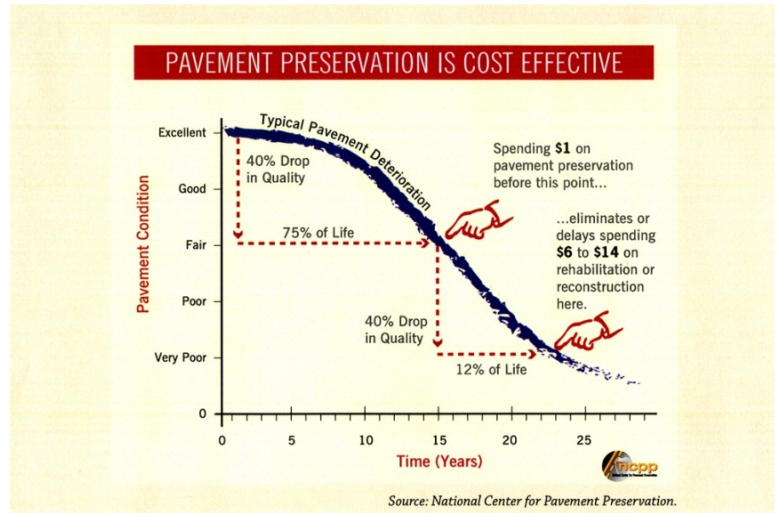
Federal funding comes from the federal gas tax of 18.4 cents, last increased in 1993. In 2000, Cass County received \$1.25 million in Federal Aid Highway Funds. With the changes from federal Fixing America's Surface Transportation Act (FAST Act), we now receive less than \$900k in Federal Aid Highway Funds, which equates to a 25% decrease. Since 2000 we have continued to receive between \$400 to \$700k in Federal Aid Bridge Funds every year. Federal Aid as a percentage of the County's total revenues has continued to decrease. In 2000, Federal Aid made up 21% of Cass County's revenues. From 2000-2005 Federal Aid averaged 19% of our total funding and from 2006-2012 it averaged 13% of our total funding. Now Federal Aid only makes up 8% of our County revenues. While our costs have increased 18% annually since 2000, our Federal Aid has decreased. Over that same time, local and state funding increased from \$7.4 million to \$15.3 million. If it were not for the growth in local and state funding, we would not be able to maintain our existing highway and bridge network. Federal Aid has become a very small component of our overall revenues and can no longer be counted on to fund major projects.

Regarding our asphalt highways, they generally require a maintenance overlay every 15-20 years. Current costs of a typical asphalt overlay in Cass County can range from \$200,000-\$450,000 per mile, depending on road width and thickness of the asphalt overlay, with the most frequent 36' wide, 2.5" thick overlay being approximately \$300,000 per mile. Under the desired maintenance schedule an overlay would occur every 17½ years. Given the current inventory in Cass County we could schedule

approximately 17 miles of asphalt overlay per year. Using the rate of \$300,000 per mile we can estimate a cost of \$5.1 million per year. If pavements are not overlaid with a new asphalt surface before they deteriorate, they will require full reconstruction.

Table 2 shows the estimated revenue for the Cass County Highway Department over the planning years. These estimates use revenue inflation rates of 1.5% for Federal Funding, 3%

for State Funding, and 4% for Local Funding. These inflation rates were developed by Metro COG. In addition, the Operation Cost inflation rate use was 4%. The Highway Distribution Tax totals are an estimate based on past funding. Estimated annual Federal Aid Highway funding is \$900,000. The chart also includes the additional Federal Aid Funding for Bridge projects. Federal Aid Bridge funding is based on need as the NDDOT has \$5 million allocated state wide for county bridges (Cass County competes for these funds based on other county needs throughout the state). Federal Aid Bridge Funding for 2016 is allocated. Funding for 2017-2020 is estimated and not allocated.



Revenue Description	2019	2020	2021	2022	2023
Property Tax	\$8,374,927	\$8,542,426	\$8,713,274	\$8,887,540	\$9,065,290
Highway Distribution Tax and Additional State Funding	\$7,500,000	\$7,650,000	\$7,803,000	\$7,959,060	\$8,118,241
Other	\$193,906	\$197,784	\$201,740	\$205,775	\$209,890
Total Revenues	\$16,068,833	\$16,390,210	\$16,718,014	\$17,052,374	\$17,393,422
Federal Aid Highway Funding	\$3,080,000	\$0	\$771,000	\$139,211	\$1,025,517
Federal Aid Bridge Funding	\$480,000	\$480,000	\$480,000	\$480,000	\$480,000
Total Revenues & Federal Aid	\$19,628,833	\$16,870,210	\$17,969,014	\$17,671,585	\$18,898,939
Total Operating Cost (not including Road/Bridge Projects)	\$6,628,232	\$6,893,361	\$7,169,096	\$7,455,860	\$7,754,094
Total Available for Road/Bridge Projects	\$13,000,601	\$9,976,848	\$10,799,918	\$10,215,726	\$11,144,845

Long Range Funding Estimates

In 2013-2014, Metro COG updated its Long Range Transportation Plan – Metro 2040. This plan contains Short-Range, Mid-Range, and Long-Range revenue estimates. These estimates also use revenue inflation rates of 1.5% for Federal Funding, 3% for State Funding, 4% for Local Funding, and an Operation Cost inflation rate of 4%. Table 3 uses the Metro 2040 revenue estimates. These estimates use standard Highway Distribution Tax funding and do not include additional one time State funding. With the continued support of one-time funding from the ND Legislature, Cass County could have an additional \$7 million per biennium and more than \$105 million over the next 30 years. When looking out to 2045, additional one time state funding only keeps up with maintaining our highway system. Continued funding at the current 2015 Legislative Session rate will allow us to annually overlay 18 miles, reconstruct 3.5 miles, replace 3-4 bridges, and complete seven miles of gravel road construction. Now that the additional one time funding was pulled back, as shown below, we would only be able to annually fund 13.5 miles of overlays, 2 miles of reconstruction, 1-2 bridges, and no gravel road construction.

<i>Table 3 - Long Range Revenue Estimates</i>				
Revenue Description	Short-Range 2019-2026	Mid-Range 2027-2036	Long-Range 2037-2046	Total
Property Tax	\$71,881,739	\$107,444,814	\$130,974,629	\$310,301,182
Highway Distribution Tax	\$64,372,268	\$96,220,075	\$117,291,734	\$277,884,077
Other	\$1,664,289	\$2,487,687	\$3,032,476	\$7,184,452
Total Revenues	\$137,918,296	\$206,152,575	\$251,298,839	\$595,369,711
Federal Aid Highway Funding	\$8,216,990	\$12,154,766	\$14,816,592	\$35,188,348
Federal Aid Bridge Funding	\$3,898,372	\$5,689,118	\$6,935,004	\$16,522,494
Total Revenues & Federal Aid	\$150,033,658	\$223,996,460	\$273,050,435	\$647,080,553
Total Operating Cost (not including Road/Bridge Projects)	\$61,074,029	\$108,909,717	\$161,212,986	\$331,196,732
Total Available for Road/Bridge Projects	\$88,959,629	\$115,086,743	\$111,837,449	\$315,883,821

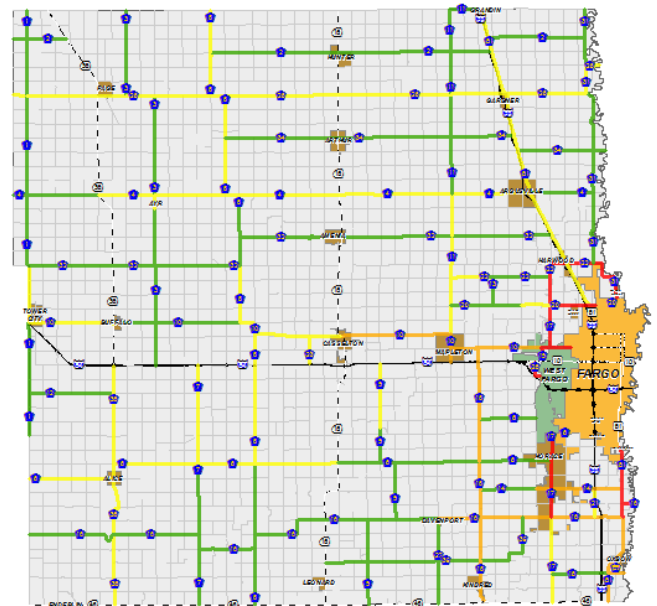
Cass County Highways: Design Standards for New or Reconstruction of Existing Facilities

The typical section of a County Highway is rural in nature with two lanes, either paved or gravel surface. Different modes of travel and location of roadways to population centers, agricultural points of traffic, or schools sometimes require different needs. Further drainage needs may vary from roadway to roadway. Table 4 summarizes the Design Standards for New or Reconstruction of Existing Cass County Highways.

Table 4 - Minimum Design Standards for New or Reconstruction of Existing Infrastructure							
Typical Section	Design Speed	Right of Way	Road Width	Turn Lanes	Min. Section Thickness	Access Controls	Bike/Ped Facilities
Two-Lane Township Gravel Section	55 mph	66 feet	28 ft	no	4" Gravel	1/4 mile spacing	N/A
Two-Lane Rural Gravel Section	55 mph	200 feet	28 ft	no	6" Gravel	1/4 mile spacing	N/A
Two-Lane Rural Paved Section	55 mph	200 feet	32 ft	no	12" Base + HBP	1/4 mile spacing	4 ft paved shoulder
Two-Lane Village Paved Section	25 mph	200 feet	32 ft	no	12" Base + HBP	Varies	4 ft paved shoulder
Two-Lane City Paved Section	25 mph	200 feet	36 ft	no	12" Base + HBP	Varies	6 ft paved shoulder
Two-Lane Metro Paved Section	40-55 mph	200 feet	36 ft	no	12" Base + HBP	1/4 mile spacing	6 ft paved shoulder
Three-Lane Metro Paved Section	40-55 mph	200 feet	50 ft	1/4 mile spacing	12" Base + HBP	1/4 mile spacing	6 ft paved shoulder and separated path

*Note: 4:1 minimum inslope, 3:1 minimum backslope, 0.05% ditch grade, 24" minimum culvert, 8' minimum ditch bottom width on all rural highway sections; minimum HS-25 design load, 5 year storm design on all bridges.

Cass County has prioritized roads to assist in such issues as maintenance, striping, and snow removal. Priorities are used to determine which roads are plowed first and the schedule for which maintenance or construction projects will be completed. Priorities are developed by the County Engineer by considering average daily traffic volumes, pavement condition, as well as important points of need such as schools, cities, and commerce. Map 2 displays these priorities; red is priority 1, orange is priority 2, yellow is priority 3, and green is priority 4.



Map 2: Road Priorities

Cass County Highways: Current Status of Paved Highways

Cass County currently maintains 309 miles of paved highways along the rural portions of the county. These highways vary in age and building materials (See Appendix 5 for pavement age), and will deteriorate at varying rates due to these factors. To determine their condition, county roads are inspected every 5 years by an independent testing consultant using a “Falling Weight Deflectometer” and given a PCI (Pavement Condition Index) rating from the results of this test. These results are used by county engineers to help shape decisions for future roadway maintenance/rebuilding. The most recent PCI survey was completed in 2017 and results are shown in Appendix 3 (next PCI testing will be in 2022). Cass County’s goal is to have an overall PCI of 93. Additionally, seal coats are applied to asphalt highways one year after paving or overlaying has been

completed to increase the life of the pavement to 15-20 years. Our overall goal is to complete another chipseal around years 8-14 to extend the life of the existing pavement before another overlay is necessary. A map showing the most recent seal coat for each highway is shown in Appendix 6.

Cass County Highways: Current Status of Gravel Highways

Cass County currently maintains 325 miles of gravel highways within the rural portions of the county. These highways vary in age, and some have been widened for future paving. Currently, the roads are maintained with weekly or bi-weekly grading depending on usage. Additionally, a budget for road repairs is prepared every year and additional gravel is added to roads requiring repairs with the allotted funds on a priority system of damage and usage. A more uniform plan for gravel roads has been adopted for the future, where a general standard of 28' road tops with a 4% crown grade will be used for future gravel grading and reshaping projects. In addition to these dimensional standards, areas with weak subgrade are retrofitted with drain tile to remove excess moisture from the subgrade or cement reinforcement sections to increase the structural capacity of the road top. Gravel roads that have become widened or flatter over time from traffic will also be reshaped. Reshaping returns the roadway back to its designed width and crown. As gravel costs and traffic increase, gravel stabilization, dust control, and subgrade stabilization are becoming more important. Over the next several years we anticipate adding more miles of stabilized gravel and more miles of roads with dust control. This will help bridge the gap between gravel roads with 100 ADT or less and paved roads with more than 400 ADT. Our gravel roads with 100-400 ADT have a need for more enhanced gravel treatments, stabilization, and dust control to adequately manage the roadway conditions as traffic increases.

Bridge Maintenance and Construction

Cass County maintains 551 structures of which 240 span a distance of 20 feet in length or greater. Inevitably these bridges will deteriorate over time. Maintenance, reconstruction, replacement, and removal needs to and does occur. The NDDOT conducts bi-annual inspections of all structures greater than 20 feet in length giving County officials an accurate inventory of existing bridge conditions. This inventory is used to conduct` planning for the most effective projects on bridges most in need. The inventory also includes structures that have been identified by inspectors with a "Code 3" status meaning that immediate attention is required. In Cass County the average age of a bridge is 40 years



old. Of the 551 structures, nearly 40% were built before 1960. Designed to the standards of their time, many of these bridges have reached the end of their design life or cannot handle the truck traffic of today. Of our 240 bridges spanning over 20 feet, and 313 bridges spanning under 20 feet, we have 44 that are structurally deficient and 8 that are functionally obsolete. If we assumed a 70 year lifespan for our structures, we need to replace at least seven per year. Since such a large number of bridges are now over 50 years old, over the next twenty years we will have a higher number of bridge replacements, further straining our finances.

Cass County Bridges: Current Status of 20 foot or Longer Bridges on County Highways

Appendix 7 shows bridges of 20 feet or longer on County Highways. On average, these bridges are in fair condition. As of 2014, we no longer have any bridges with load restrictions on the County Highway network. The NDDOT inspects all 20 foot or longer bridges on a 2 year cycle and rates each on a 0-100 scale. When this sufficiency rating falls below 50, the bridge is eligible for Federal funding. Currently, there are no bridges on County Highways that are below 50, however, there are 2 bridges in the 50-58 range. These would be potential sites for replacement in the near future as their rating falls below 50 or due to width and load restrictions.

Cass County Bridges: Current Status of 20 foot or Longer Bridges on Township Roads

Appendix 8 shows bridges of 20 feet or longer on township highways. These structures vary in condition from poor and in need of replacement to very good. There are approximately 20 bridges with a sufficiency rating below 50. Several of these have a Code 3 rating which requires priority attention. These bridges are replaced or repaired on a priority basis with input from the township officials.

Cass County Bridges: Current Status of Bridges less than 20 feet in Length

There are many minor structures that are less than 20 feet in length. The NDDOT no longer inspects these bridges. The Cass County Highway Department has developed a 5 year rotation for inspecting these structures.

Strategic Long Range 2045 Goals

Now through the year 2045, Cass County will continue to aggressively design, build, and maintain our future highway network. Below are the goals listed by decade:

Now through 2020

- Inventory, inspect, and develop a detailed maintenance/inspection program for Minor Structures (bridges/structures less than 20 feet in length).

2021 to 2030

- Reconstruct or regrade all paved County highways with inslopes less than 4:1 to a standard slope of 4:1 or flatter and a 32 foot wide paved surface.
- Construct a continuous paved highway running east-west across the County south of Interstate 94.
- Repair, replace, or remove all bridges/structures identified with a sufficiency rating less than 50 within two years of its last inspection.

2031 to 2045

- Implement a plan to regrade or reshape all gravel roads within the last 30 years to ensure we maintain a proper 28 foot wide surface, maintain 4:1 inslopes, and maintain ditch drainage and culverts.

2019-2023 Paved Highway Improvement Plan

There are numerous factors that can be and are used to make decisions regarding improvements and maintenance on the County Highway System. Many variables go into prioritizing future projects such as average daily traffic as obtained from the NDDOT and/or the FM Metro COG, PCI ratings, asphalt thickness, last year paved, last year sealed, population within the proximity, and points of commerce or increased traffic. These variables are taken into consideration when scheduling the most efficient construction schedules in upcoming years. Table 5 illustrates the proposed highway projects for the next five years that are a result of these components.

* Note: Years to be completed are illustrative and subject to change and approved annually and/or as necessary by the Road Advisory Committee.

Table 5 - Proposed Highway Improvements					
Hwy	Proejct Location	Type of Project	Funding Source (Local/Fed Aid)	Year to be Completed *	Project Cost
1	0.5 Mi. S. of I94 to 0.5 Mi. S of Hwy 12	Subgrade Repair	Local	2019	\$1,000,000
4	State Hwy 38 to Hwy 3	Mill and Overlay	Federal	2019	\$700,000
6	63rd St to 45th St (52nd Ave S)	Grading & Surfacing	Local	2019	\$800,000
6 & 17	Hwy 17 & C6 West Intersection (76th Ave S)	Grading & Surfacing	Local	2019	\$1,000,000
6	Hwy 5 to State Hwy 18	Mill and Overlay	Local	2019	\$800,000
10	Casselton School to 15th St	Grading & Surfacing	Local	2019	\$1,000,000
11	I29 West 2 Miles	Subgrade Repair	Local	2019	\$400,000
20	Hwy 11 5 Miles East	Gravel Stabilization	Local	2019	\$300,000
38	State Hwy 46 to I-94	Bituminous Overlay	Federal	2019	\$5,000,000
9	Hwy 10 to I94	Grading	Local	2020	\$700,000
10	Casselton - 15th St to Hwy 11	Grading	Local	2020	\$5,000,000
11	Hwy 4 to Hwy 26	Gravel Stabilization	Local	2020	\$420,000
22	Hwy 17 5 Miles West	Gravel Stabilization	Local	2020	\$425,000
2	Hwy 5 to State Hwy 18	Subgrade Repair	Local	2020	\$1,800,000
10	Casselton - 15th St to Hwy 11	Bituminous Surfacing	Local	2021	\$3,500,000
5 & 10	Hwy 5 & Hwy 10 Radial Tee Intersection & Shldr. Impr.	Grading & Surfacing	Federal	2021	\$1,000,000
8 & 14	Hwy 15 to WF & Hwy 15 to Horace	Gravel Stabilization	Local	2021	\$480,000
1	Hwy 32 to Hwy 4	Subgrade Repair	Local	2021	\$1,000,000
10	Hwy 1 to 1 Mile East of State Hwy 38	Mill and Overlay	Local	2022	\$1,300,000
10	Hwy 5 North to 8 Miles West	Gravel Stabilization	Local	2022	\$480,000
11	Hwy 4 to Hwy 22	Mill and Overlay	Federal	2022	\$1,500,000
16	State Hwy 18 to Davenport	Subgrade Repair & Bituminous Surfacing	Local	2022	\$3,000,000
26	Hwy 5 North to State Hwy 18	Mill and Overlay	Federal	2022	\$2,700,000
32	Hwy 32 - Sections 3 & 4 of Tower Twp	Ditch Grading	Local	2022	\$500,000
34	Hwy 11 to I29	Subgrade Repair	Local	2022	\$1,200,000
5	Hwy 26 to Hwy 34	Mill and Overlay	Local	2022	\$600,000
5	Trail Co. Line to Hwy 26	Mill and Overlay	Local	2023	\$1,200,000
9	I94 to Durbin	Grading & Gravel Stabilization	Local	2023	\$3,000,000
26	Barnes Co Line to State Hwy 38	Mill and Overlay	Local	2023	\$1,100,000
32	State Hwy 18 to C11	Gravel Stabilization	Local	2023	\$480,000

* Note: Years to be completed are illustrative and subject to change and approved annually and/or as necessary by the Road Advisory Committee.

2019-2023 Gravel Road Improvement Plan

Many factors are used to make decisions regarding improvements and maintenance of our gravel road system. Routine maintenance, motor grader operations, and annual gravelling programs are sufficient in maintaining a consistent, high quality gravel road. However, there are times where excessive moisture, poor drainage, soft subgrade, and other issues must be addressed. In addition, there are times when major reshaping or regrading of gravel roads must occur. Cass County is proactively working to reduce soft roadbeds through drain tile and subgrade repair/cement stabilization. In addition, Cass County will address significant soft spots and subgrade issues through near term drain tile and subgrade repair projects. Long term work will be done to reshape gravel roads that have become widened or flattened over time from traffic, and up to 15 miles of gravel road will be reshaped annually. This reshaping will save money over time by reducing the width of the roadway back to County design standards, which in turn reduces the overall gravel required to resurface the roadway. Table 6 illustrates the proposed gravel highway improvements.

Table 6 - Proposed Gravel Highway Improvements						
Hwy	Project Location	Length (Miles)	Type of Project	Year to be Completed	Funding Source (Local/Fed Aid)	Project Cost
38	C6 West to State Hwy 46	9	Drain Tile	2019	Local	\$250,000
UNK	To Be Determined		Drain Tile	2020	Local	\$0
UNK	To Be Determined		Drain Tile	2021	Local	\$0
UNK	To Be Determined		Drain Tile	2022	Local	\$0
UNK	To Be Determined		Drain Tile	2023	Local	\$0
1 & 11	0.5 Miles S. of I94 to 0.5 Miles S. of Cass 12 & I29 2 Miles West of Grandin	7	Subgrade Repair	2019	Local	\$1,400,000
2	Cass 5 to State Hwy 18	9	Subgrade Repair	2020	Local	\$1,800,000
1	Cass 4 to Cass 32	5	Subgrade Repair	2021	Local	\$1,000,000
34	C34 from C11 to I29	6	Subgrade Repair	2022	Local	\$1,200,000
UNK	To Be Determined		Subgrade Repair	2023	Local	\$0
UNK	To Be Determined		Reshaping	2019	Local	\$0
UNK	To Be Determined		Reshaping	2020	Local	\$0
UNK	To Be Determined		Reshaping	2021	Local	\$0
UNK	To Be Determined		Reshaping	2022	Local	\$0
UNK	To Be Determined		Reshaping	2023	Local	\$0
20	C11 to RR Tracks	5	Gravel Stabilization	2019	Local	\$300,000
11 & 22	C4 to C26 & Prosper to C17	12	Gravel Stabilization	2020	Local	\$845,000
8 & 14	C15 to Sheyenne Diversion	8	Gravel Stabilization	2021	Local	\$480,000
10	Buffalo to C5 North	8	Gravel Stabilization	2022	Local	\$480,000
32	State Hwy 18 to C11	8	Gravel Stabilization	2023	Local	\$480,000
3 & 6	I94 to C26 & C15 East 4.5 Miles	23	Chloride Application	2019	Local	\$46,000
3, 6, 20, & 22	I94 to C26, C15 East 4.5 Miles, C11 East 5 miles, & C17 West 5 Miles	33	Chloride Application	2020	Local	\$66,000
3, 6, 11, 20, & 22	I94 to C26, C15 East 4.5 Miles, C4 to C26, C11 East 5 miles, & C17 West 5 Miles	40	Chloride Application	2021	Local	\$80,000
3, 6, 11, 20, & 22	I94 to C26, C15 East 4.5 Miles, C4 to C26, C11 East 5 miles, & C17 West 5 Miles	40	Chloride Application	2022	Local	\$80,000
3, 6, 11, 20, & 22	I94 to C26, C15 East 4.5 Miles, C4 to C26, C11 East 5 miles, & C17 West 5 Miles	40	Chloride Application	2023	Local	\$80,000

2019-2023 Bridge Improvement Plan

The County utilizes bi-annual inspection reports provided by the NDDOT to identify necessary improvements to County and township structures. Funding is allocated annually to account for these necessary improvements. In addition to these improvements the County includes, in the construction schedule, necessary flood repairs which combine local and federal funds. There are approximately 40 bridges currently slated for improvements with additional funding set aside for replacing minor structures. Table 7 illustrates the proposed bridge improvements for 2019-2023.

Table 7 - Proposed Bridge Improvements							
HWY	TWP	LOCATION	PROJECT TYPE	FUNDING	STRUCTURE TYPE	YEAR	TOTAL
	Mapleton	29/32 Mapleton Township - Maple River WRD Drain 14	Box Culvert	Local	Major	2019	\$110,000
2	Bell	C2 - 22/23 Bell Twp	Box Culvert	Local	Minor	2019	\$60,000
	Everest	29/30 of Everest Township	Deck Replacement	Local	Major	2019	\$70,000
	Wiser	19/20 Wiser Twp - Dr 25	Box Culvert	Local	Minor	2019	\$90,000
	Kinyon/Noble	36 Kinyon/31 Noble - Dr 32	Box Culvert	Local	Minor	2019	\$70,000
	Noble	33/34 Noble - Dr 32	Box Culvert	Local	Minor	2019	\$70,000
							COUNTY FORCES STRUCTURES = \$470,000
	Walburg	25/36 Walburg Township - Maple River	Bridge Replacement	Federal	Major	2019	\$1,340,000
	Walburg	26/35 Walburg Township - Maple River	Bridge Removal	Federal	Major	2019	\$100,000
6	Barnes & Stanley	C6 - 33 Barnes/4 Stanley Township - Drain 27	Bridge Replacement	Local	Major	2019	\$600,000
	Stanley	8/17 Stanley - Dr 27	Box Culvert	Local	Minor	2019	\$250,000
							CONTRACTED STRUCTURES = \$2,290,000
							TOTAL STRUCTURES = \$2,760,000
	Durbin	18/19 Durbin Township - Tributary of Swan Creek	Box Culvert	Local	Major	2020	\$135,000
9	Durbin	C9 - 17/18 Durbin Township - Tributary of Swan Creek	Box Culvert	Local	Major	2020	\$225,000
	Erie	34/35 Erie Twp - Rush River Tributary	Box Culvert	Local	Minor	2020	\$60,000
	Erie	35/36 Erie Twp - Rush River Tributary	Bridge Removal	Local	Minor	2020	\$60,000
	Howes	34/35 Howes Township - Buffalo Creek Tributary - S Bridge	Box Culvert	Local	Major	2020	\$70,000
							COUNTY FORCES STRUCTURES = \$550,000
	Everest & Durbin	1 Everest/6 Durbin Townships - Swan Creek	Box Culvert	Local	Major	2020	\$275,000
	Stanley	13/24 Stanley Township - Wild Rice River	Bridge Removal	Local	Major	2020	\$150,000
	Walburg & Maple River	25 Walburg/30 Maple River - Maple River	Low Water Crossing	Local	Major	2020	\$500,000
9	Durbin	C9 - 29/30 Durbin Twp - Buffalo Creek	Box Culvert	Local	Major	2020	\$300,000
31	Harwood	C31 - 35/36 Harwood Twp - Drain 40	Box Culvert	Local	Minor	2020	\$300,000
							CONTRACTED STRUCTURES = \$1,525,000
							TOTAL STRUCTURES = \$2,075,000
	Noble	15/16 Noble - North Cass WRD Drain 18	Box Culvert	Local	Major	2021	\$60,000
	Gardner	9/10 Gardner - North Cass WRD - Drain 23	Box Culvert	Local	Major	2021	\$60,000
	Noble	27/34 Noble - North Cass WRD Drain 32	Box Culvert	Local	Major	2021	\$100,000
							COUNTY FORCES STRUCTURES = \$220,000
	Hill	28/33 Hill Township - Maple River	Low Water Crossing	Local	Major	2021	\$500,000
							CONTRACTED STRUCTURES = \$500,000
							TOTAL STRUCTURES = \$720,000
	Normanna	30/31 Normanna Twp - Dr 34	Box Culvert	Local	Minor	2022	\$60,000
26	Kinyon	35/36 Kinyon Twp - Dr 22	Box Culvert	Local	Minor	2022	\$60,000
	Gardner & Wiser	25 Gardner/30 Wiser Twp - Dr 26	Box Culvert	Local	Minor	2022	\$60,000
	Kinyon	25/26 Kinyon Township - Drain 19	Box Culvert	Local	Minor	2022	\$50,000
							COUNTY FORCES STRUCTURES = \$230,000
15	Mapleton	C15 - 8/9 Mapleton Township on Drain 14	Bridge Replacement	Local	Major	2022	\$1,000,000
	Clifton	27/34 Clifton - Maple River	Bridge Replacement	Local	Major	2022	\$1,000,000
							CONTRACTED STRUCTURES = \$2,000,000
							TOTAL STRUCTURES = \$2,230,000
	Everest	11/12 Everest Township - Wheatland Channel	Box Culvert	Local	Minor	2023	\$100,000
	Tower	34/35 Tower Township on Maple River	Box Culvert	Local	Major	2023	\$ 250,000
	Empire	4/5 Empire Township on Tributary of the Rush River	Box Culvert	Local	Minor	2023	\$ 250,000
	Clifton	10/15 Clifton Township on Maple River	Box Culvert	Local	Minor	2023	\$ 250,000
16	Pontiac	5/8 Pontiac Twp - Tributary of the Maple River	Box Culvert	Local	Minor	2023	\$250,000
	Pontiac	5/6 Pontiac Twp - Tributary of the Maple River	Box Culvert	Local	Minor	2023	\$250,000
							COUNTY FORCES STRUCTURES = \$1,350,000
32	Amenia	C32 - 22/27 Amenia Twp - Rush River	Bridge Replacement	Local	Major	2023	\$1,400,000
							CONTRACTED STRUCTURES = \$1,400,000
							TOTAL STRUCTURES = \$2,750,000
							5 YEAR COUNTY FORCES STRUCTURES = \$2,820,000
							5 YEAR CONTRACTED STRUCTURE TOTAL = \$7,715,000
							5 YEAR STRUCTURE TOTAL = \$10,535,000

2019-2023 Revenues vs Project Costs

Table 8 illustrates the revenue stream and estimated costs of the 2019-2023 Plan. Appendix 2 and 3 illustrate the proposed capital improvements over the 2019-2023 time period.

<i>Table 8 - Revenue vs. Project Costs</i>					
Revenue Description	2019	2020	2021	2022	2023
Property Tax	\$8,374,927	\$8,542,426	\$8,713,274	\$8,887,540	\$9,065,290
Highway Distribution Tax	\$7,500,000	\$7,650,000	\$7,803,000	\$7,959,060	\$8,118,241
Other	\$193,906	\$197,784	\$201,740	\$205,775	\$209,890
Total Revenues	\$16,068,833	\$16,390,210	\$16,718,014	\$17,052,374	\$17,393,422
Federal Aid Highway Funding	\$3,080,000	\$0	\$771,000	\$139,211	\$1,025,517
Federal Aid Bridge Funding	\$480,000	\$480,000	\$480,000	\$480,000	\$480,000
Total Revenues & Federal Aid	\$19,628,833	\$16,870,210	\$17,969,014	\$17,671,585	\$18,898,939
Total Operating Cost (not including Road/Bridge Projects)	\$6,628,232	\$6,893,361	\$7,169,096	\$7,455,860	\$7,754,094
Total Available for Road/Bridge Projects	\$13,000,601	\$9,976,848	\$10,799,918	\$10,215,726	\$11,144,845
Total Paved Highway Project Costs	\$9,300,000	\$5,700,000	\$5,850,000	\$8,500,000	\$5,900,000
County Bridge Project Costs	\$2,760,000	\$1,775,000	\$720,000	\$2,230,000	\$2,750,000
Chipseal, Crackseal, Striping, Reshaping, Subgrade Repair & Drantile	\$2,150,000	\$3,600,000	\$2,100,000	\$2,050,000	\$1,200,000
Total Project Costs	\$14,210,000	\$11,075,000	\$8,670,000	\$12,780,000	\$9,850,000
Differences (Revenues-Costs)	-\$1,209,399	-\$1,098,152	\$2,129,918	-\$2,564,274	\$1,294,845

Appendix 1

**2019-2023
5 Year Capital Improvement Plan
Proposed Highway Projects**

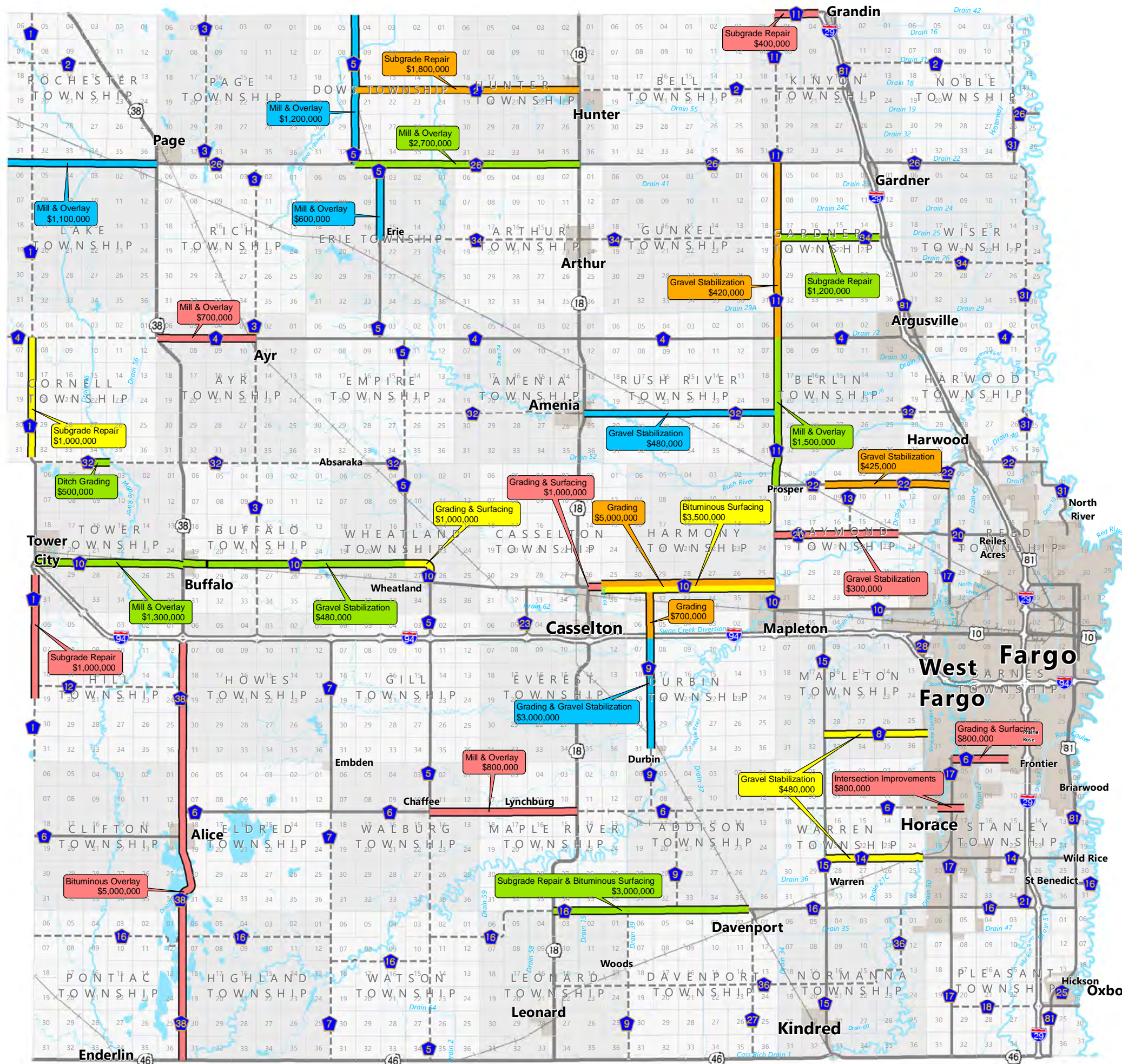
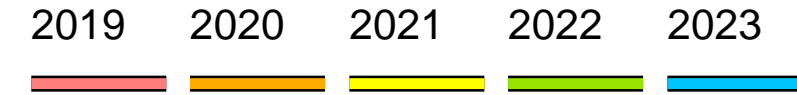


Table 5 - Proposed Highway Improvements

Hwy	Project Location	Type of Project	Funding Source (Local/Fed Aid)	Year to be Completed *	Project Cost
1	0.5 Mi. S. of I94 to 0.5 Mi. S of Hwy 12	Subgrade Repair	Local	2019	\$1,000,000
4	State Hwy 38 to Hwy 3	Mill and Overlay	Federal	2019	\$700,000
6	63rd St to 45th St (52nd Ave S)	Grading & Surfacing	Local	2019	\$800,000
6 & 17	Hwy 17 & C6 West Inter. (76th Ave S)	Intersection Improvements	Local	2019	\$800,000
6	Hwy 5 to State Hwy 18	Mill and Overlay	Local	2019	\$800,000
10	Casselton School to 15th St	Grading & Surfacing	Local	2019	\$1,000,000
11	I29 West 2 Miles	Subgrade Repair	Local	2019	\$400,000
20	Hwy 11 5 Miles East	Gravel Stabilization	Local	2019	\$300,000
38	State Hwy 46 to I-94	Bituminous Overlay	Federal	2019	\$5,000,000
9	Hwy 10 to I94	Grading	Local	2020	\$700,000
10	Casselton - 15th St to Hwy 11	Grading	Local	2020	\$5,000,000
11	Hwy 4 to Hwy 26	Gravel Stabilization	Local	2020	\$420,000
22	Hwy 17 5 Miles West	Gravel Stabilization	Local	2020	\$425,000
2	Hwy 5 to State Hwy 18	Subgrade Repair	Local	2020	\$1,800,000
10	Casselton - 15th St to Hwy 11	Bituminous Surfacing	Local	2021	\$3,500,000
5 & 10	Hwy 5 & 10 Radial Tee Inter. & Shldr. Impr.	Grading & Surfacing	Federal	2021	\$1,000,000
8 & 14	Hwy 15 to WF & Hwy 15 to Horace	Gravel Stabilization	Local	2021	\$480,000
1	Hwy 32 to Hwy 4	Subgrade Repair	Local	2021	\$1,000,000
10	Hwy 1 to 1 Mile East of State Hwy 38	Mill and Overlay	Local	2022	\$1,300,000
10	Hwy 5 North to 8 Miles West	Gravel Stabilization	Local	2022	\$480,000
11	Hwy 4 to Hwy 22	Mill and Overlay	Federal	2022	\$1,500,000
16	State Hwy 18 to Davenport	Subgrade Repair & Bit. Surf.	Local	2022	\$3,000,000
26	Hwy 5 North to State Hwy 18	Mill and Overlay	Federal	2022	\$2,700,000
32	Hwy 32 - Sections 3 & 4 of Tower Twp	Ditch Grading	Local	2022	\$500,000
34	Hwy 11 to I29	Subgrade Repair	Local	2022	\$1,200,000
5	Hwy 26 to Hwy 34	Mill and Overlay	Local	2023	\$600,000
5	Trail Co. Line to Hwy 26	Mill and Overlay	Local	2023	\$1,200,000
9	I94 to Durbin	Grading & Gravel Stabilization	Local	2023	\$3,000,000
26	Barnes Co Line to State Hwy 38	Mill and Overlay	Local	2023	\$1,100,000
32	State Hwy 18 to C11	Gravel Stabilization	Local	2023	\$480,000

* Note: Years to be completed are illustrative and subject to change and approved annually and/or as necessary by the Road Advisory Committee.

Cass County Highway Department

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Appendix 2 2019-2023 5 Year Capital Improvement Plan Proposed Structure Projects

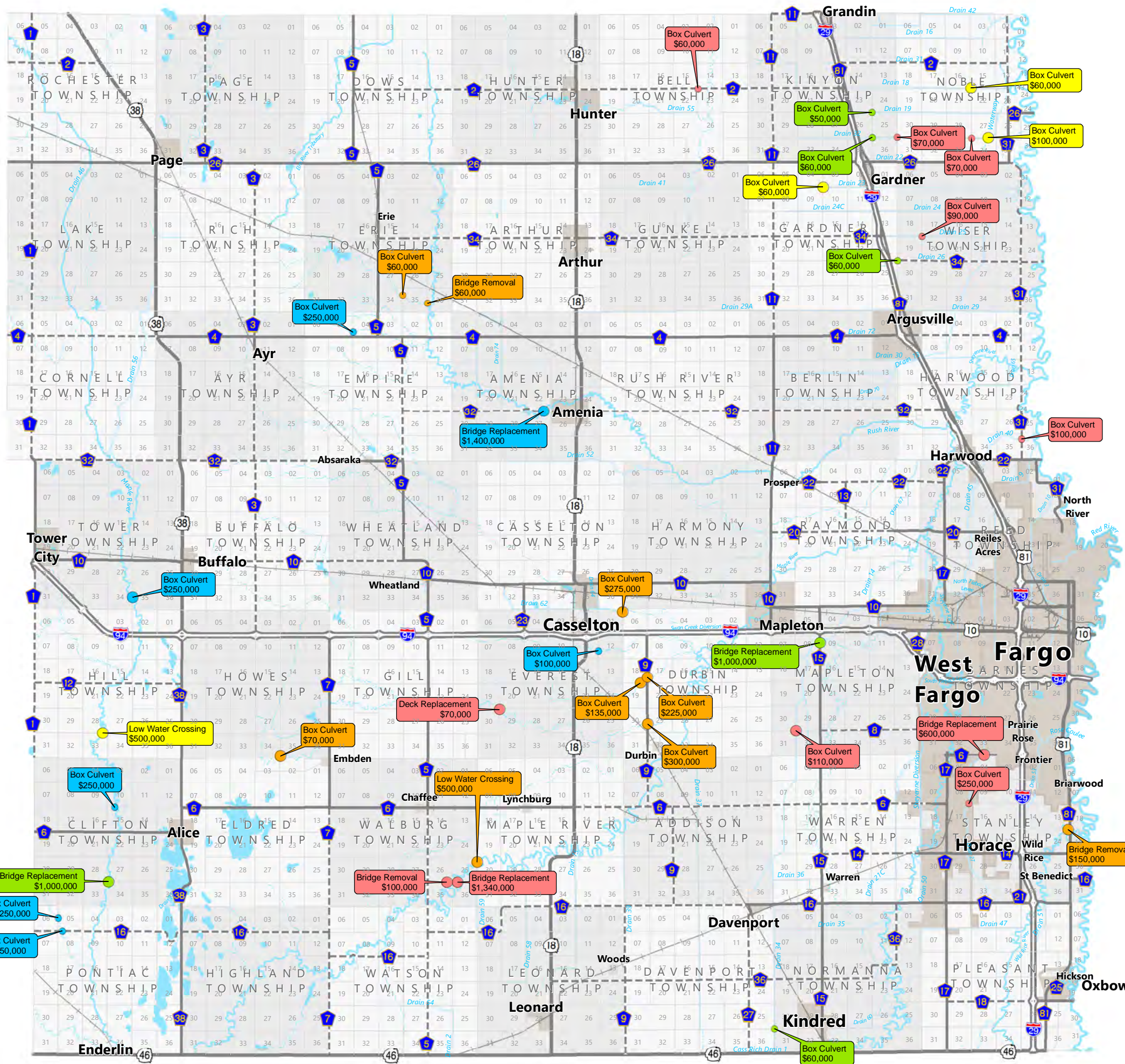
2019 2020 2021 2022 2023

Major Structure ● ● ● ● ●

Minor Structure ● ● ● ● ●

Table 7 - Proposed Bridge Improvements

Hwy	Project Location	Type of Project	Funding Source (Local/Fed Aid)	Structure Type	Year to be Completed	Project Cost
2	29/32 Mapleton Township - Maple River WRD Drain 14	Box Culvert	Local	Major	2019	\$110,000
	C2 - 22/23 Bell Twp	Box Culvert	Local	Minor	2019	\$60,000
	29/30 of Everest Township	Deck Replacement	Local	Major	2019	\$70,000
	19/20 Wiser Twp - Dr 25	Box Culvert	Local	Minor	2019	\$90,000
6	36 Kinyon/31 Noble - Dr 32	Box Culvert	Local	Minor	2019	\$70,000
	33/34 Noble - Dr 32	Box Culvert	Local	Minor	2019	\$70,000
	25/36 Walburg Township - Maple River	Bridge Replacement	Federal	Major	2019	\$1,340,000
	26/35 Walburg Township - Maple River	Bridge Removal	Federal	Major	2019	\$100,000
	C6 - 33 Barnes/4 Stanley Township - Drain 27	Bridge Replacement	Local	Major	2019	\$600,000
31	8/17 Stanley - Dr 27	Box Culvert	Local	Minor	2019	\$250,000
	C31 - 35/36 Harwood Twp - Drain 40	Box Culvert	Local	Minor	2019	\$100,000
9	18/19 Durbin Township - Tributary of Swan Creek	Box Culvert	Local	Major	2020	\$135,000
	C9 - 17/18 Durbin Township - Tributary of Swan Creek	Box Culvert	Local	Major	2020	\$225,000
	34/35 Erie Twp - Rush River Tributary	Box Culvert	Local	Minor	2020	\$60,000
	35/36 Erie Twp - Rush River Tributary	Bridge Removal	Local	Minor	2020	\$60,000
	34/35 Howes Township - Buffalo Creek Tributary - S Bridge	Box Culvert	Local	Major	2020	\$70,000
	1 Everest/6 Durbin Townships - Swan Cr.	Box Culvert	Local	Major	2020	\$275,000
	13/24 Stanley Township - Wild Rice River	Bridge Removal	Local	Major	2020	\$150,000
15	25 Walburg/30 Maple River - Maple River	Low Water Crossing	Local	Major	2020	\$500,000
	C9 - 29/30 Durbin Twp - Buffalo Creek	Box Culvert	Local	Major	2020	\$300,000
	15/16 Noble - North Cass WRD Drain 18	Box Culvert	Local	Major	2021	\$60,000
	9/10 Gardner - North Cass WRD - Drain 23	Box Culvert	Local	Major	2021	\$60,000
16	27/34 Noble - North Cass WRD Drain 32	Box Culvert	Local	Major	2021	\$100,000
	28/33 Hill Township - Maple River	Low Water Crossing	Local	Major	2021	\$500,000
	30/31 Normanna Twp - Dr 34	Box Culvert	Local	Minor	2022	\$60,000
	35/36 Kinyon Twp - Dr 32	Box Culvert	Local	Minor	2022	\$60,000
	25 Gardner/30 Wiser Twp - Dr 26	Box Culvert	Local	Minor	2022	\$60,000
	25/26 Kinyon Township - Drain 19	Box Culvert	Local	Minor	2022	\$50,000
	C15 - 8/9 Mapleton Township on Drain 14	Bridge Replacement	Local	Major	2022	\$1,000,000
	27/34 Clifton - Maple River	Bridge Replacement	Local	Major	2022	\$1,000,000
	11/12 Everest Township - Wheatland Channel	Box Culvert	Local	Minor	2023	\$100,000
	34/35 Tower Township on Maple River	Box Culvert	Local	Major	2023	\$ 250,000
32	4/5 Empire Township on Tributary of the Rush River	Box Culvert	Local	Minor	2023	\$ 250,000
	10/15 Clifton Township on Maple River	Box Culvert	Local	Minor	2023	\$ 250,000
	5/8 Pontiac Twp - Tributary of the Maple River	Box Culvert	Local	Minor	2023	\$250,000
32	5/6 Pontiac Twp - Tributary of the Maple River	Box Culvert	Local	Minor	2023	\$250,000
	C32 - 22/27 Amenia Twp - Rush River	Bridge Replacement	Local	Major	2023	\$1,400,000



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**CASS COUNTY
GOVERNMENT**

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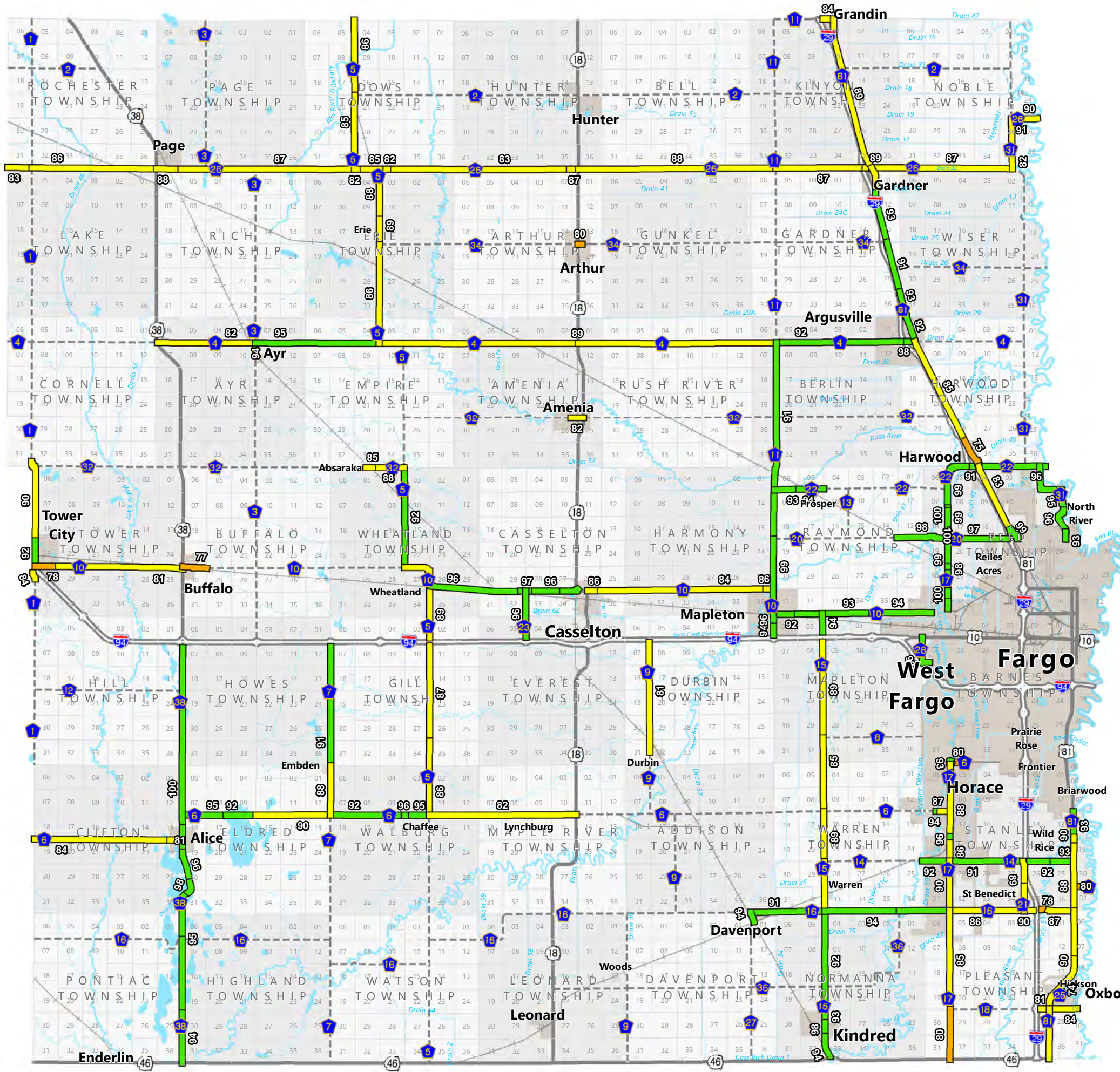
Appendix 3

Pavement Condition Index (PCI)*



	Poor PCI 0 - 65	Fair PCI 66 - 80	Good PCI 81 - 90	Very Good PCI 91 - 100
Paved Miles	0.0	7.2	179.2	121.7
% of Paved Miles	0.0%	2.3%	58.2%	39.5%

Average PCI per paved road sub-segment: 90.3
Sub-segments vary in length/width; currently there are 156 paved sub-segments



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*Pavement Evaluation completed by American Engineering Testing in 2017. The evaluation consisted of deflection testing with a Model 8002E Dynatest Falling Weight Deflectometer. Pavement surface condition assessment based on the Pavement Condition Index (PCI) method developed by the Army Corps of Engineers. The resulting data is analyzed to evaluate the structural and surface condition of the existing pavements on the tested road segments.

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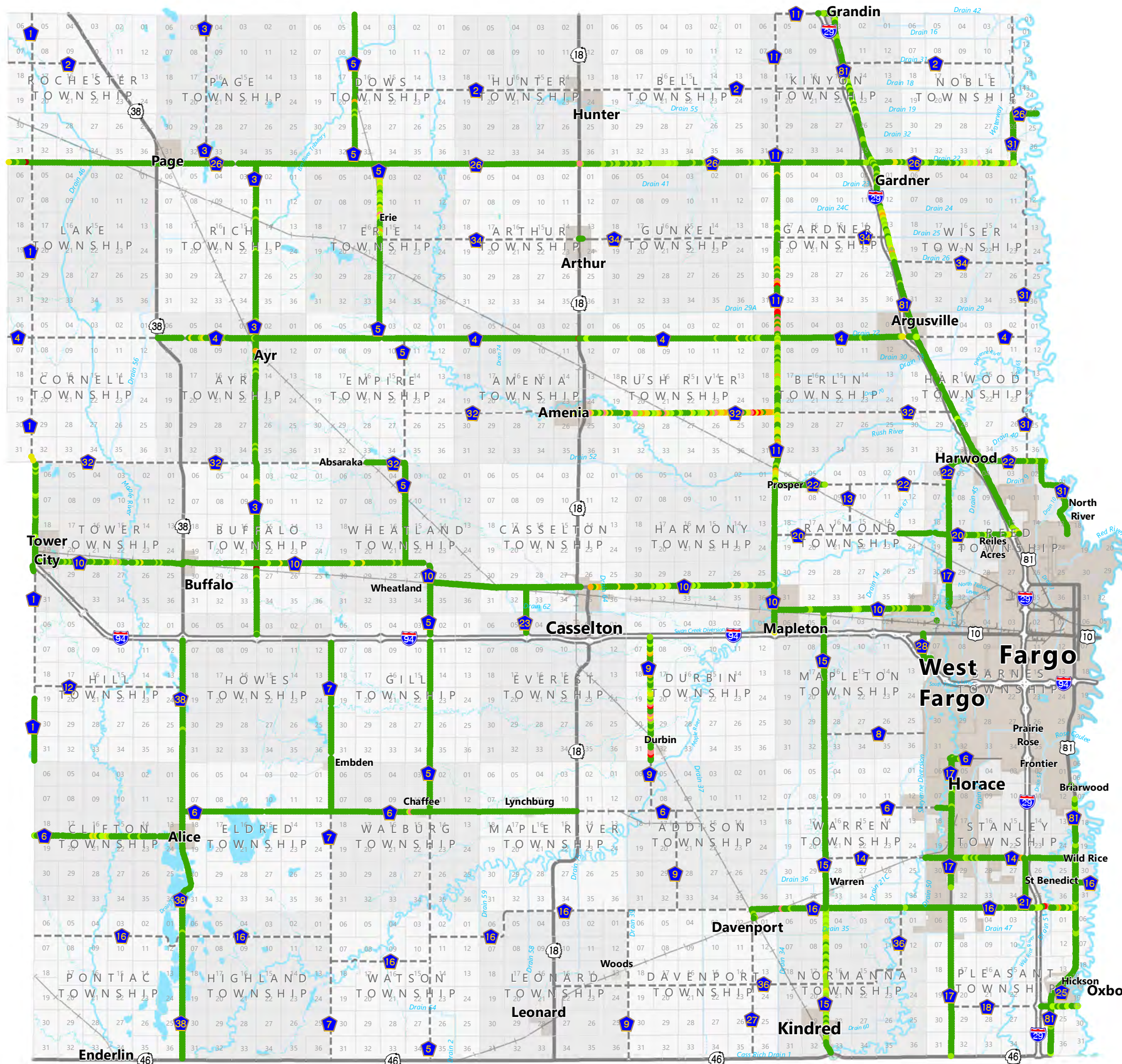
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Appendix 4

Highway Load Capacity



Tons/Axle

- 3 (worst)
- 4
- 5
- 6
- 7
- 8
- 9
- 10 (best)

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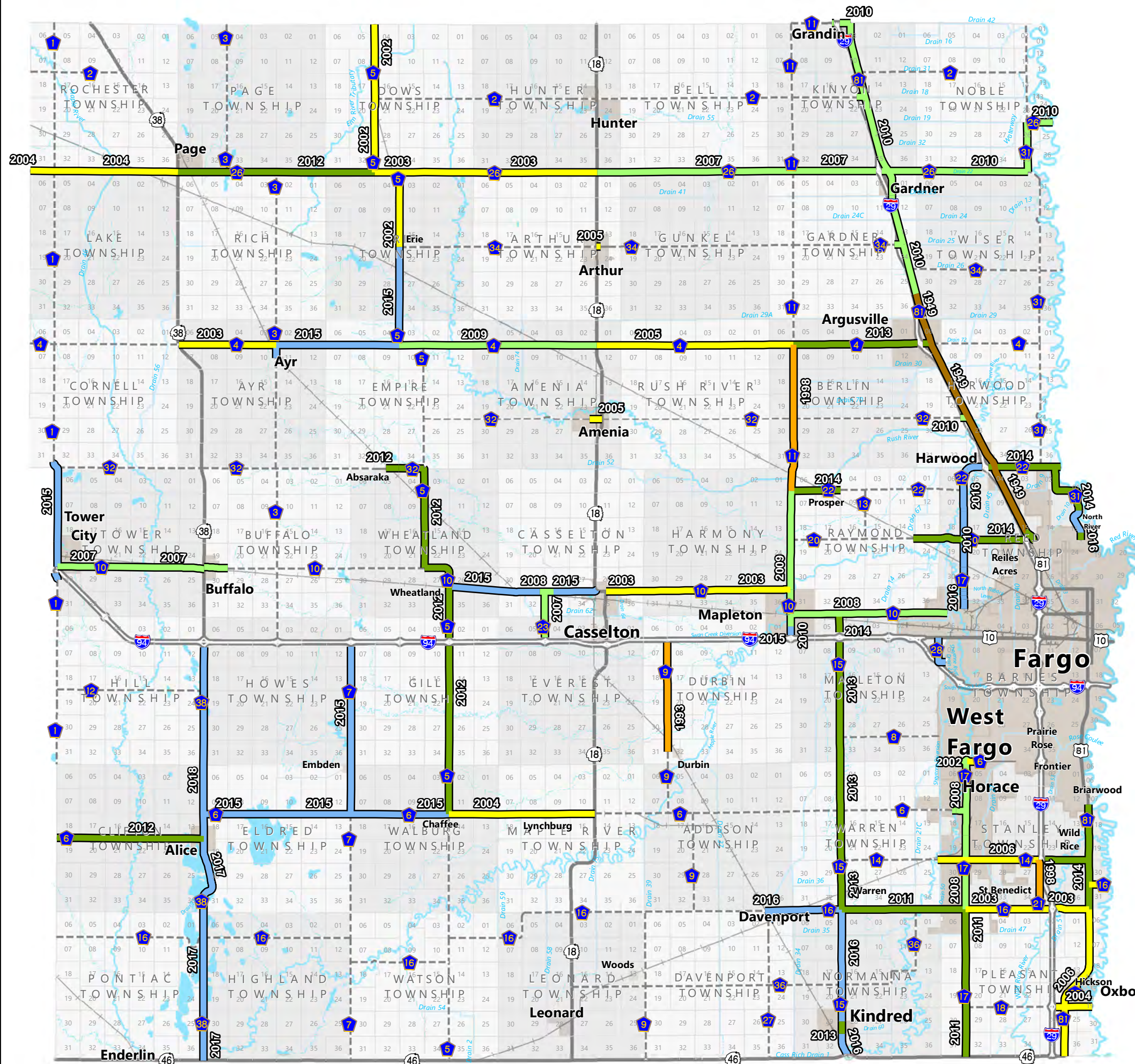
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Appendix 5

Paving Projects



Year of Last Paving

- 1949
- 1993 - 1999
- 2000 - 2006
- 2007 - 2010
- 2011 - 2014
- 2015 - 2018

Year of Last Paving	Miles	Average PCI
1949	10.64	85.50
1993 - 1999	12.41	86.75
2000 - 2006	68.34	84.85
2007 - 2010	69.67	90.75
2011 - 2014	77.57	90.82
2015 - 2018	71.24	95.17

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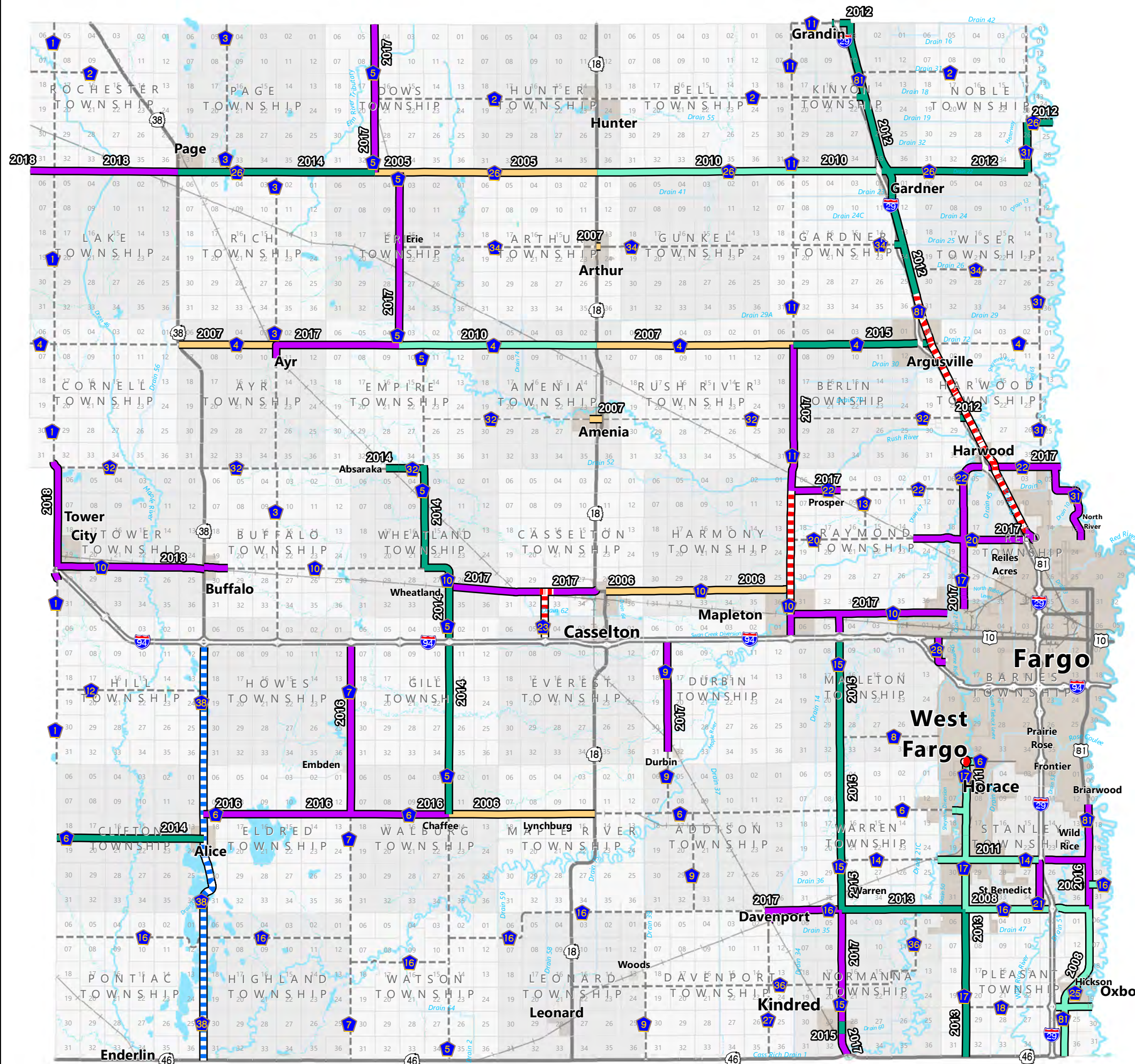
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Appendix 6

Chip Seal Projects



Year of Last Chip Seal

- 2005 - 2007
- 2008 - 2011
- 2012 - 2015
- 2016 - 2018
- Asphalt - No Chip Seal
- Concrete - No Chip Seal

Year of Last Chip Seal	Miles	Average PCI
2005 - 2007	35.04	83.85
2008 - 2011	44.18	86.92
2012 - 2015	79.96	88.56
2016 - 2018	115.00	92.67
Asphalt - No Chip Seal	16.99	97.25
Concrete - No Chip Seal	18.70	92.32

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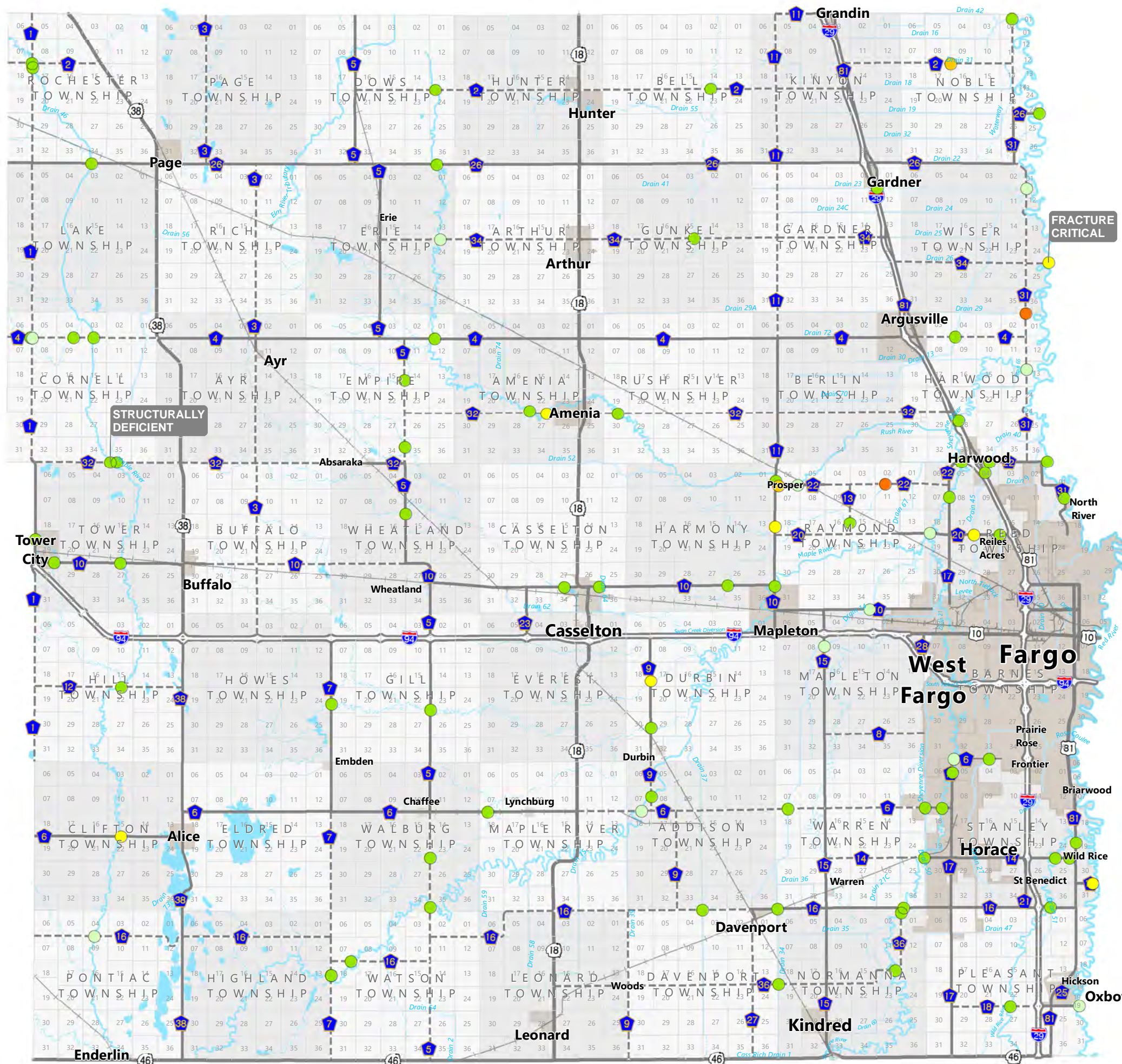
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Appendix 7

Bridges on County Roads: ND DOT 2017/2018 Bridge Inspection and Appraisal



Bridge Sufficiency Rating

- 37 - 49.9 (none)
- 50 - 59.9
- 60 - 69.9
- 70 - 79.9
- 80 - 89.9
- 90 - 100

Sufficiency Rating	Bridge Count
50 - 59.9	2
60 - 69.9	2
70 - 79.9	7
80 - 89.9	12
90 - 100	67

Average Rating: 92.97

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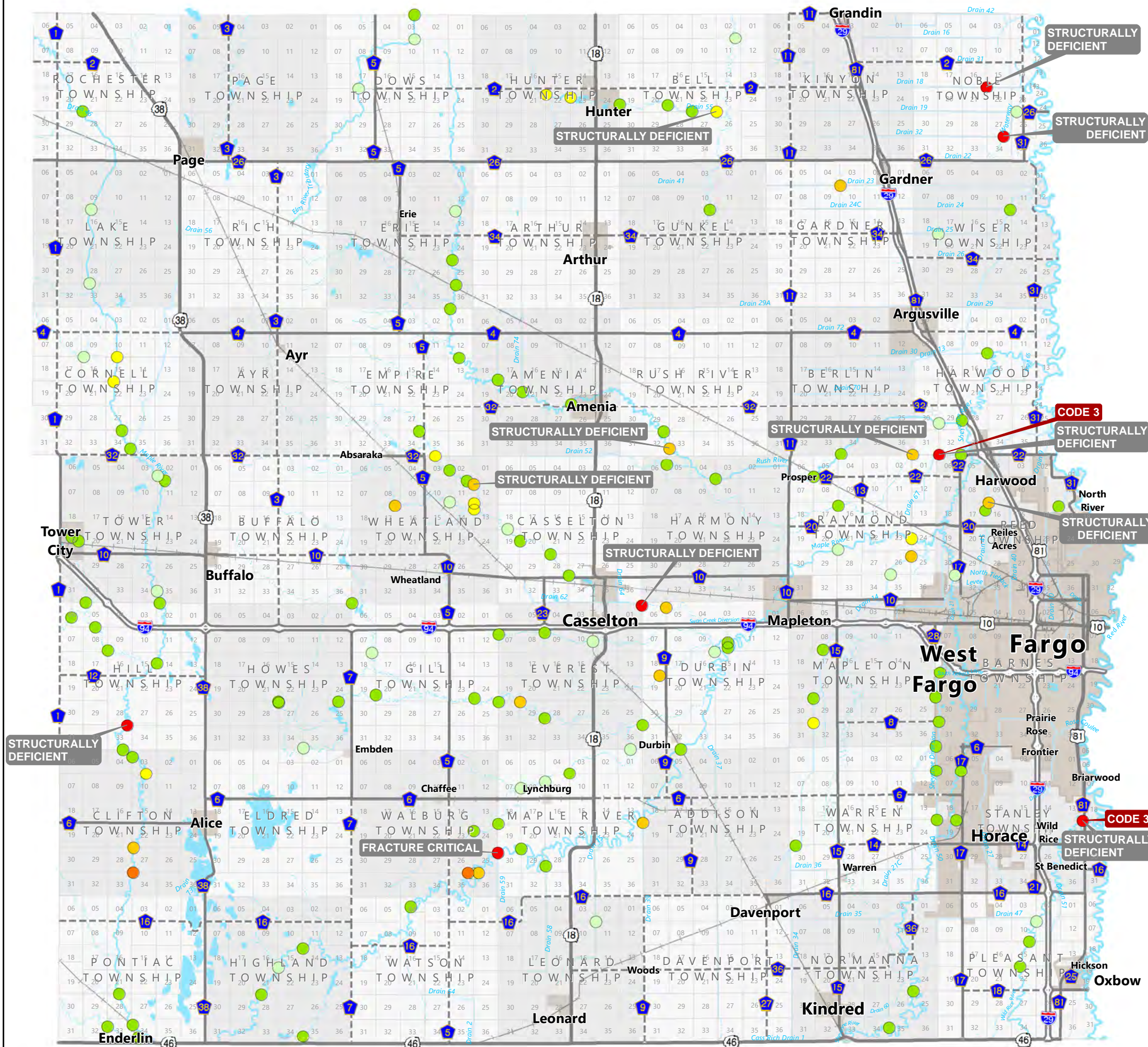
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Appendix 8

Bridges on Township Roads: ND DOT 2017/2018 Bridge Inspection and Appraisal



Bridge Sufficiency Rating

- 37 - 49.9
- 50 - 59.9
- 60 - 69.9
- 70 - 79.9
- 80 - 89.9
- 90 - 100

Sufficiency Rating	Bridge Count
37 - 49.9	7
50 - 59.9	2
60 - 69.9	13
70 - 79.9	11
80 - 89.9	28
90 - 100	86

Average Rating: 87.6

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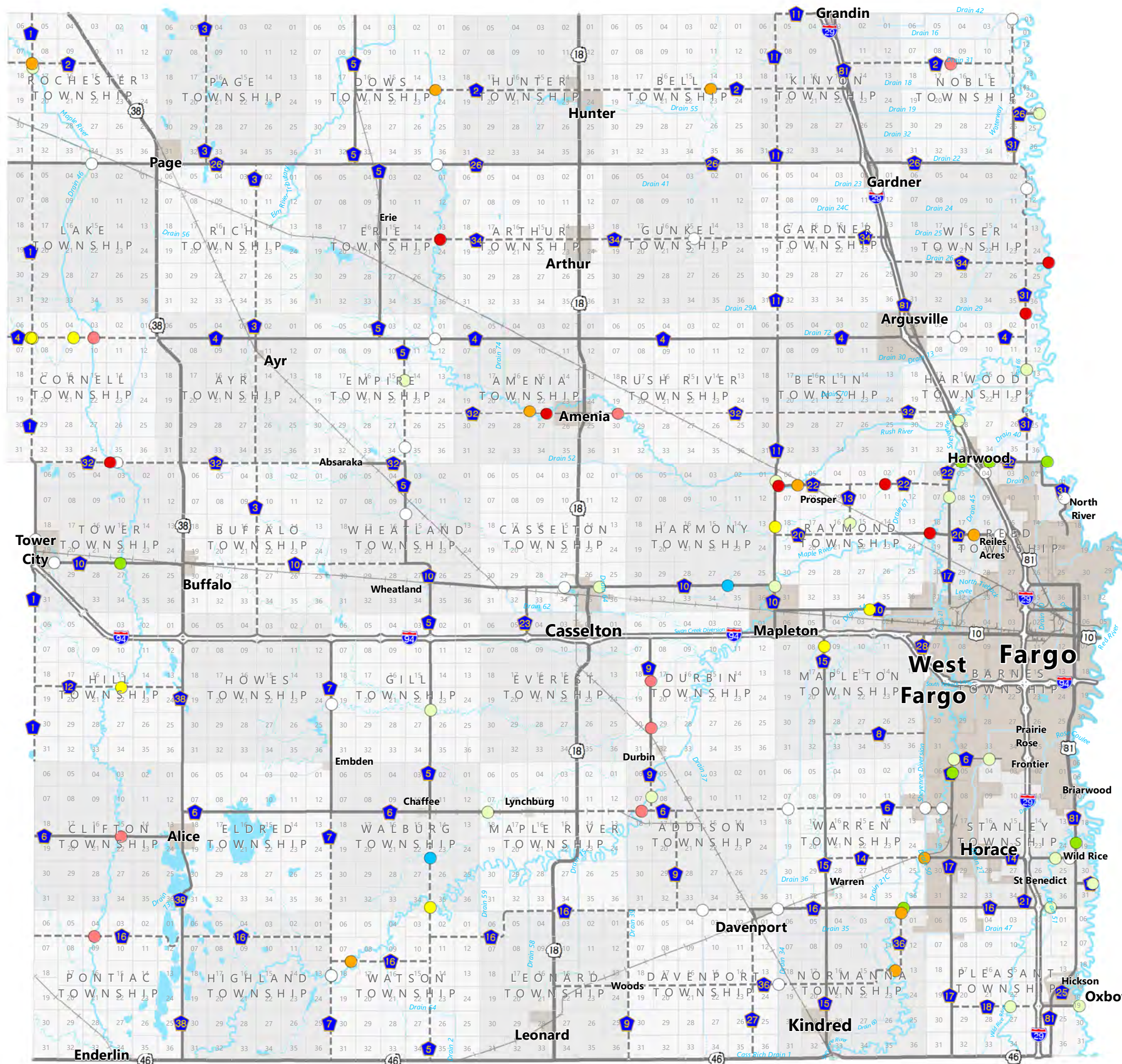
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Appendix 9

Bridges on County Roads: ND DOT 2017/2018 Curb to Curb Roadway Width



Structure Width

- under 24'
- 24' - 25.9'
- 26' - 27.9'
- 28' - 29.9'
- 30' - 39.9'
- 40' - 49.9'
- 50' +
- culvert

Structure Width	Bridge Count
under 24'	8
24' - 25.9'	8
26' - 27.9'	8
28' - 29.9'	10
30' - 39.9'	20
40' - 49.9'	7
50' +	2
culvert	27

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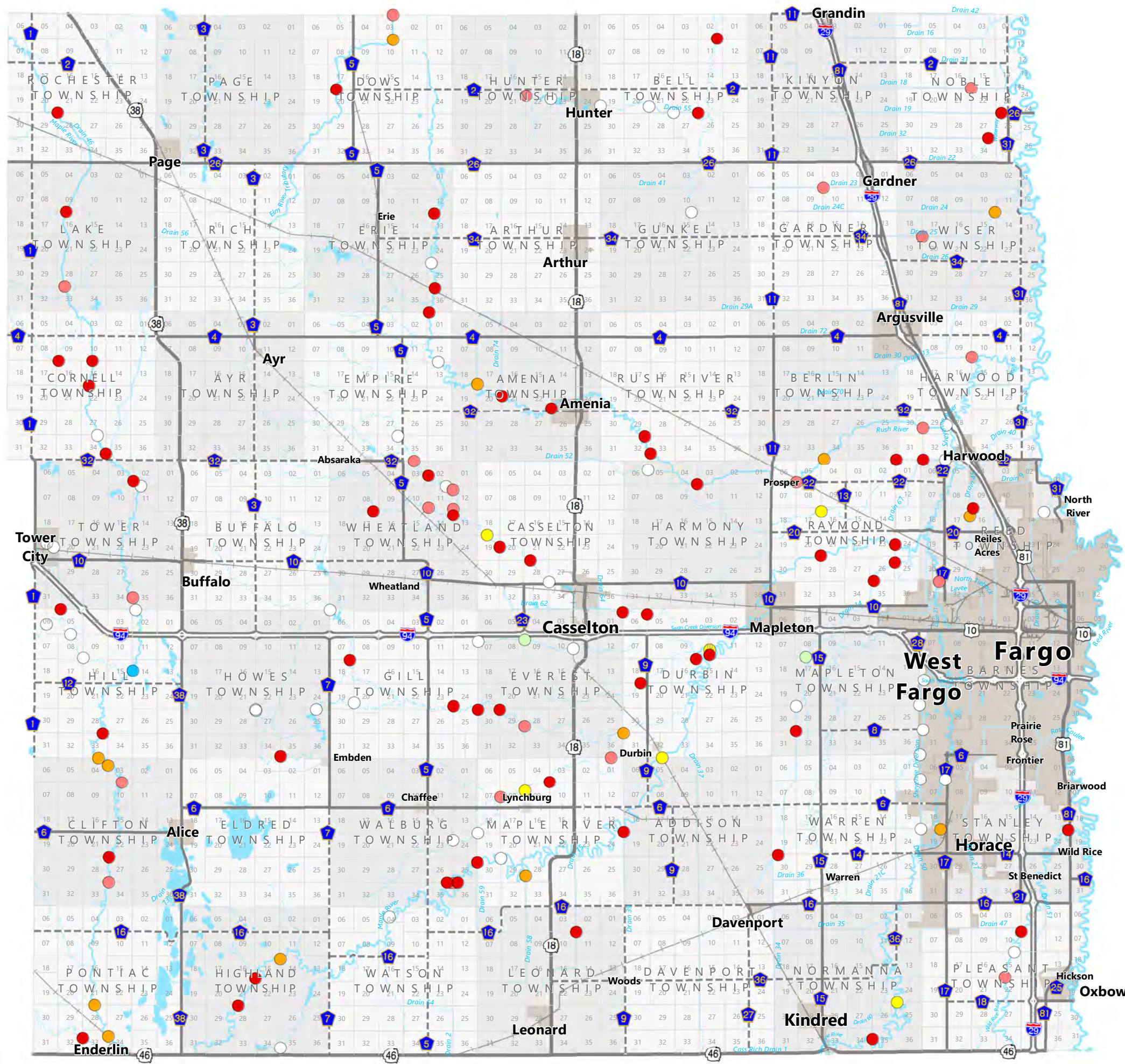
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Appendix 10

**Bridges on Township Roads:
ND DOT 2017/2018
Curb to Curb Roadway Width**



Structure Width

- under 24'
- 24' - 25.9'
- 26' - 27.9'
- 28' - 29.9'
- 30' - 39.9'
- 50' +
- culvert

Structure Width	Bridge Count
under 24'	59
24' - 25.9'	22
26' - 27.9'	13
28' - 29.9'	6
30' - 39.9'	2
40' - 49.9'	0
50' +	1
culvert	44

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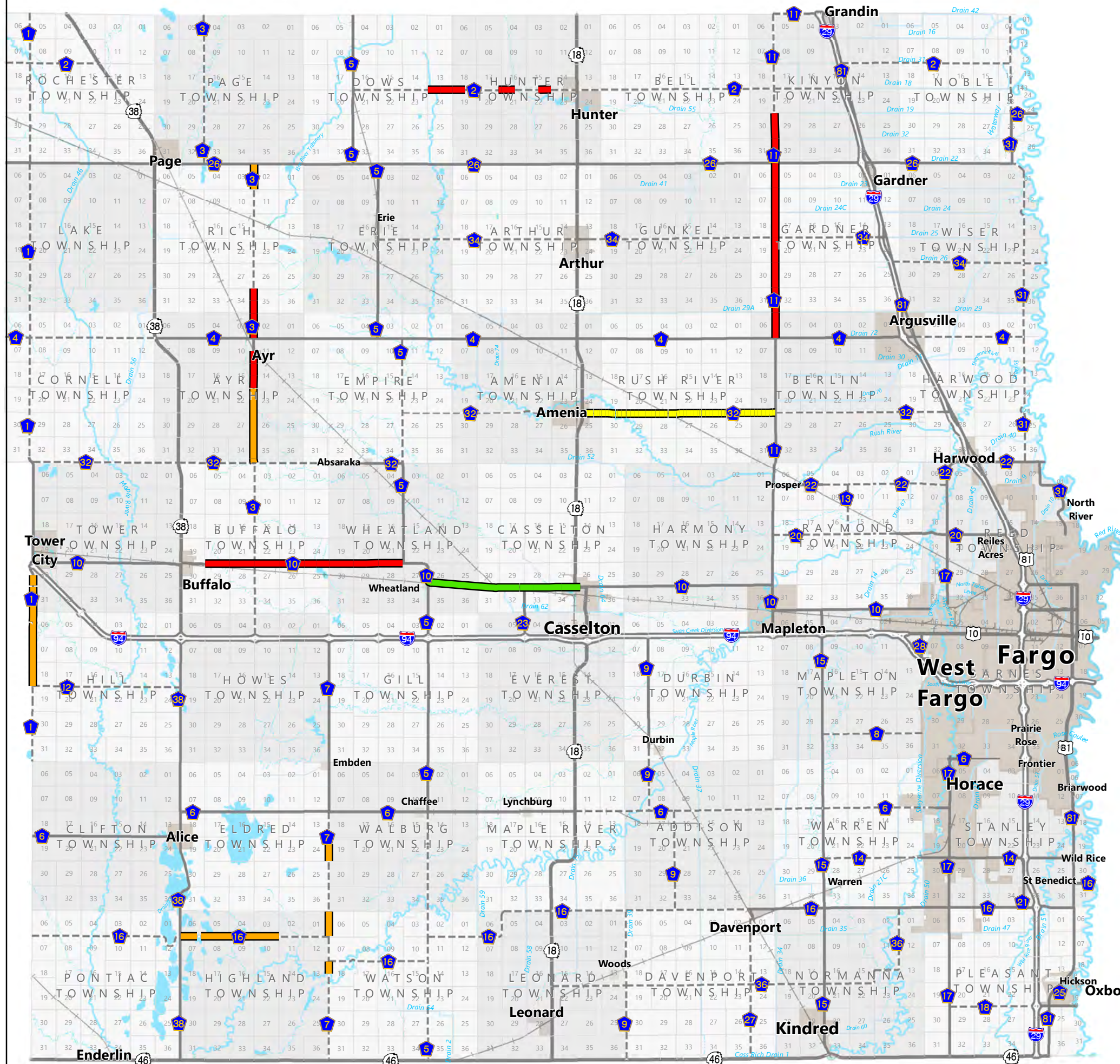
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Appendix 11

Drain Tile Projects



Year of Project

- 2011
- 2012
- 2014
- 2015

Year	Miles
2011	23.07
2012	14.25
2014	7.45
2015	6.2
Total	50.97

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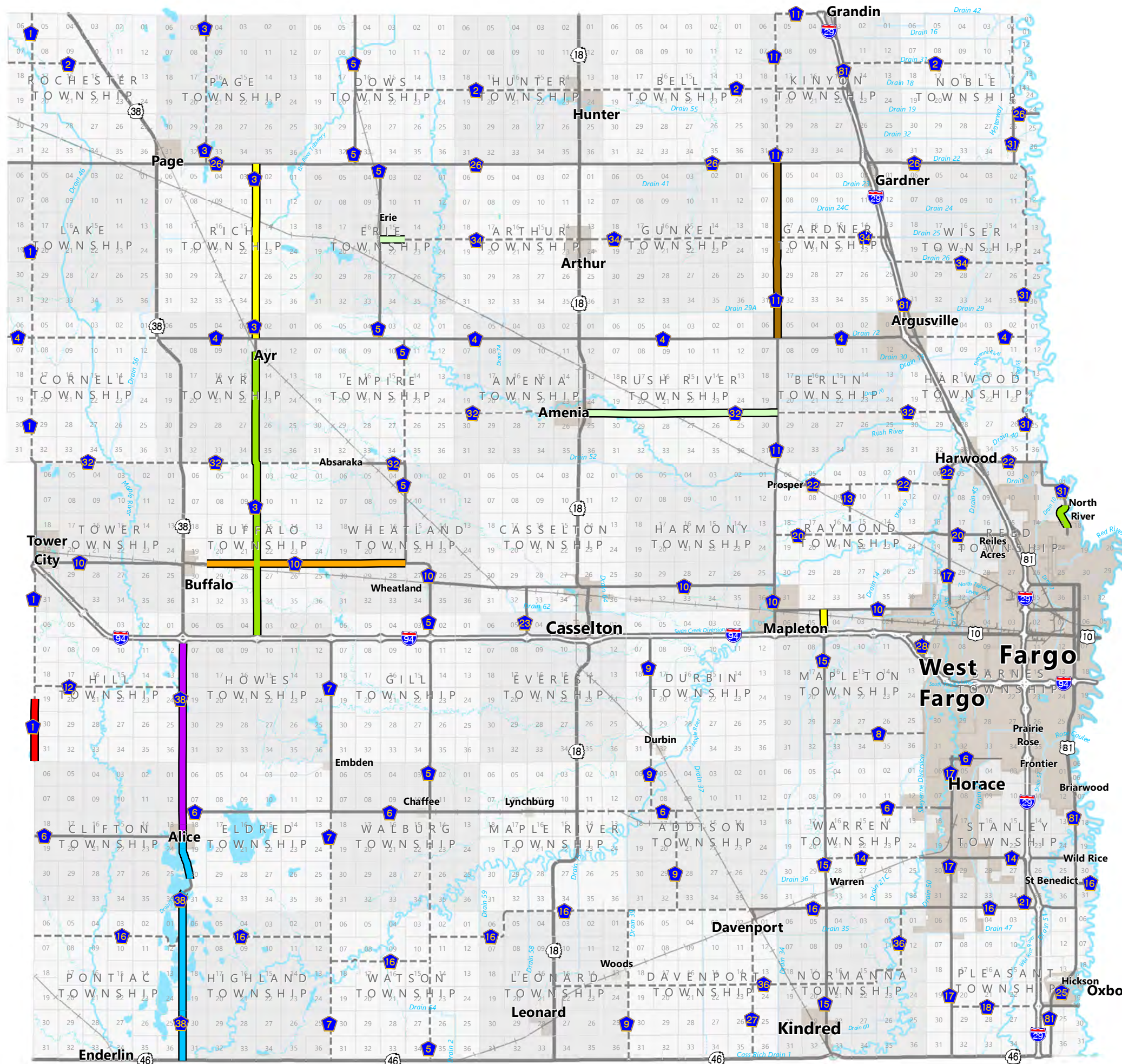


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Subgrade Repair Projects



Year of Last Project

- 2011
- 2012
- 2013
- 2014
- 2015
- 2016
- 2017
- 2018

Year	Gravel Miles	Paved Miles	Total Miles
2011	7.05	0	7.05
2012	2.51	0	2.51
2013	7.99	0	7.99
2014	7.02	0.75	7.77
2015	8.77	0	8.77
2016	11.42	1.07	12.49
2017	0	8.51	8.51
2018	0	7.77	7.77
Total	44.75	18.1	62.85

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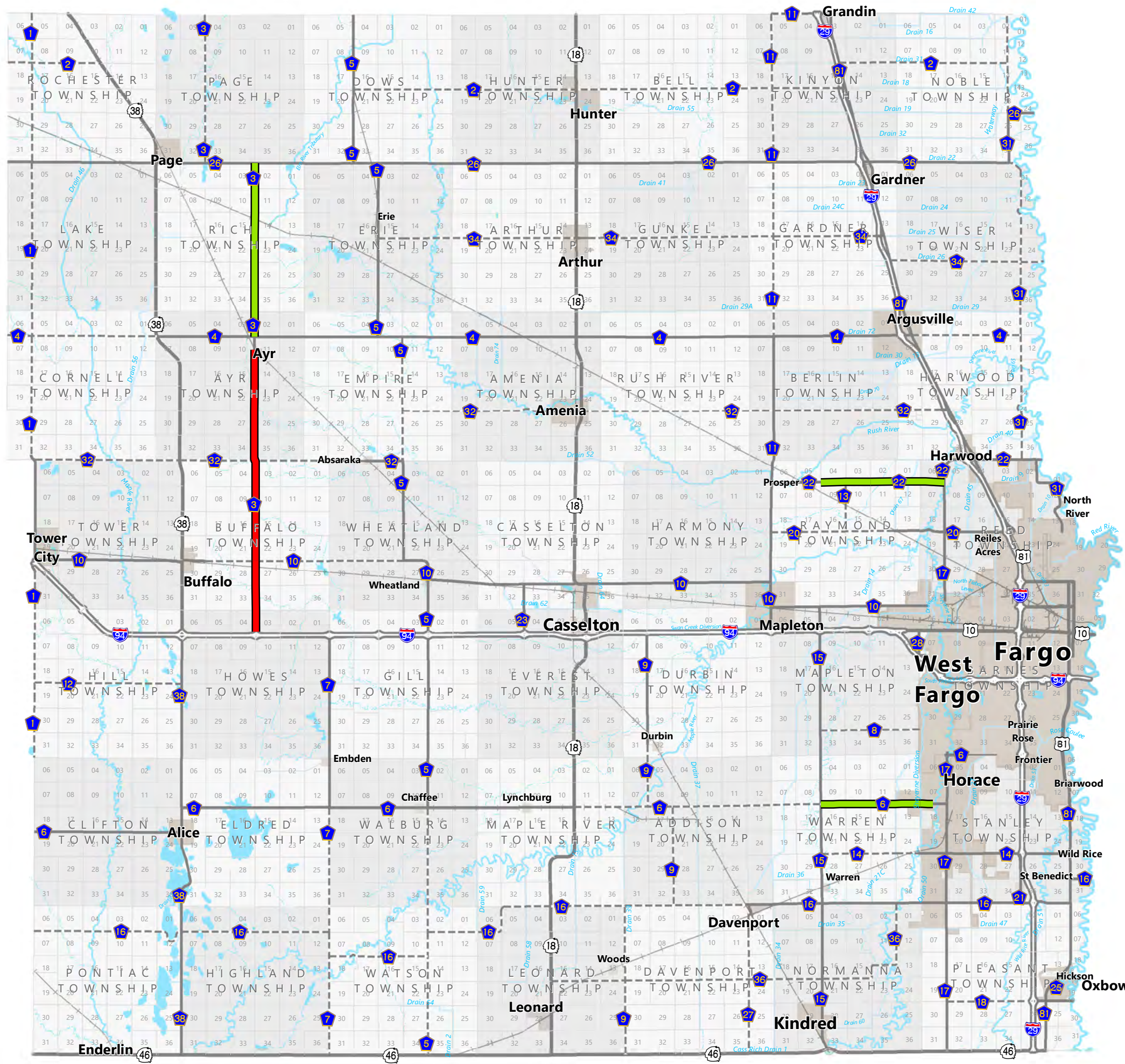
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Gravel Stabilization Projects



Year of Last Project

- █ 2016
- █ 2017

Year	Miles
2016	11.42
2017	16.55
Total	27.97

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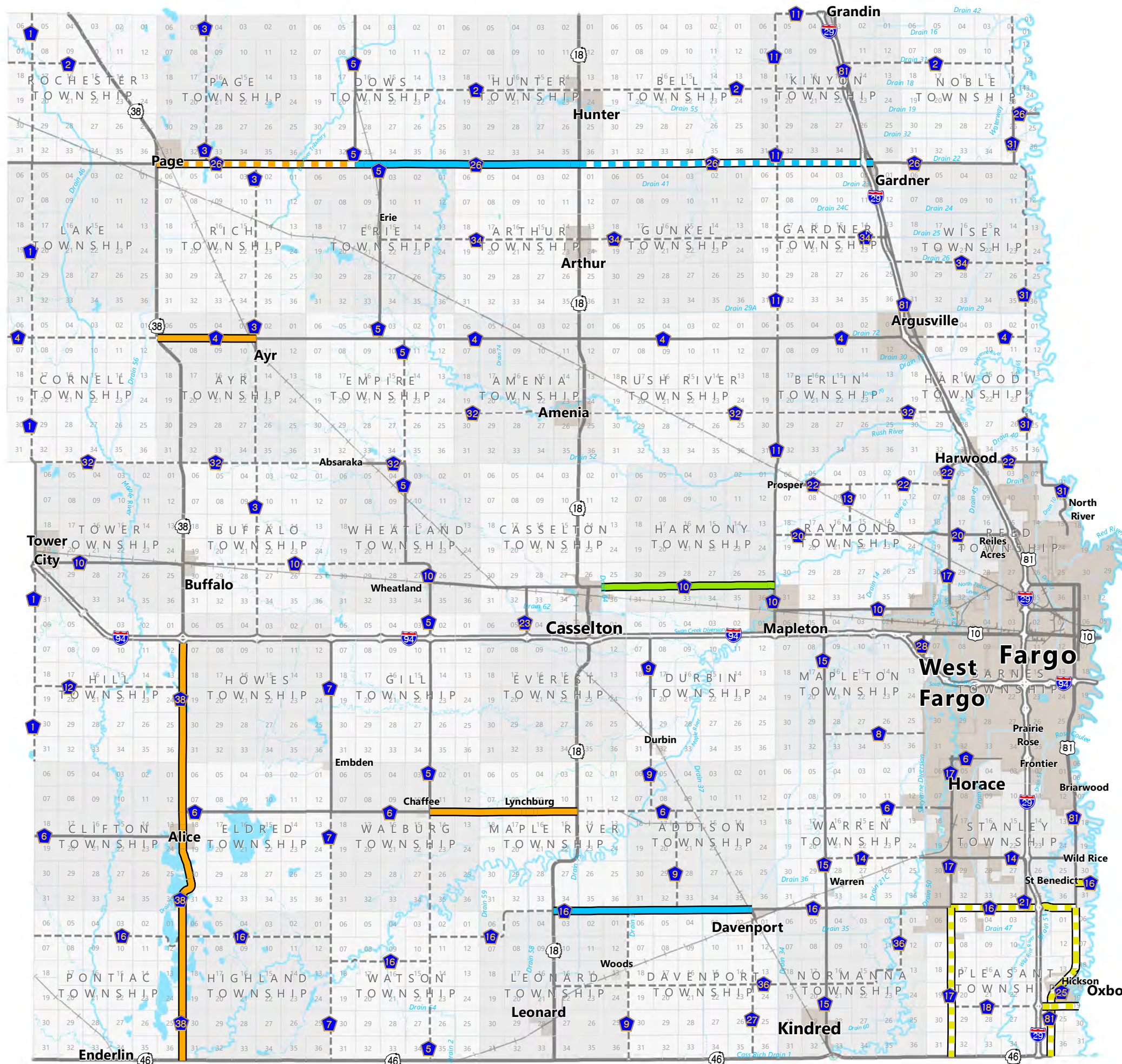
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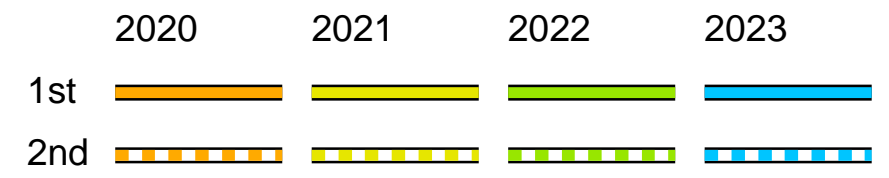
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Chip Seal Projects



Year of Future Chip Seal Project (1st & 2nd Applications*)



* Solid Line: 1st Required Application
 * Dashed Line: 2nd Long Term Pavement Preservation

Year	1st Application Miles	2nd Application Miles	Total Miles
2020	26.88	7.99	34.87
2021	0	19.21	19.21
2022	6.97	0	6.97
2023	17.03	11.58	28.61
Total	50.88	38.78	89.66

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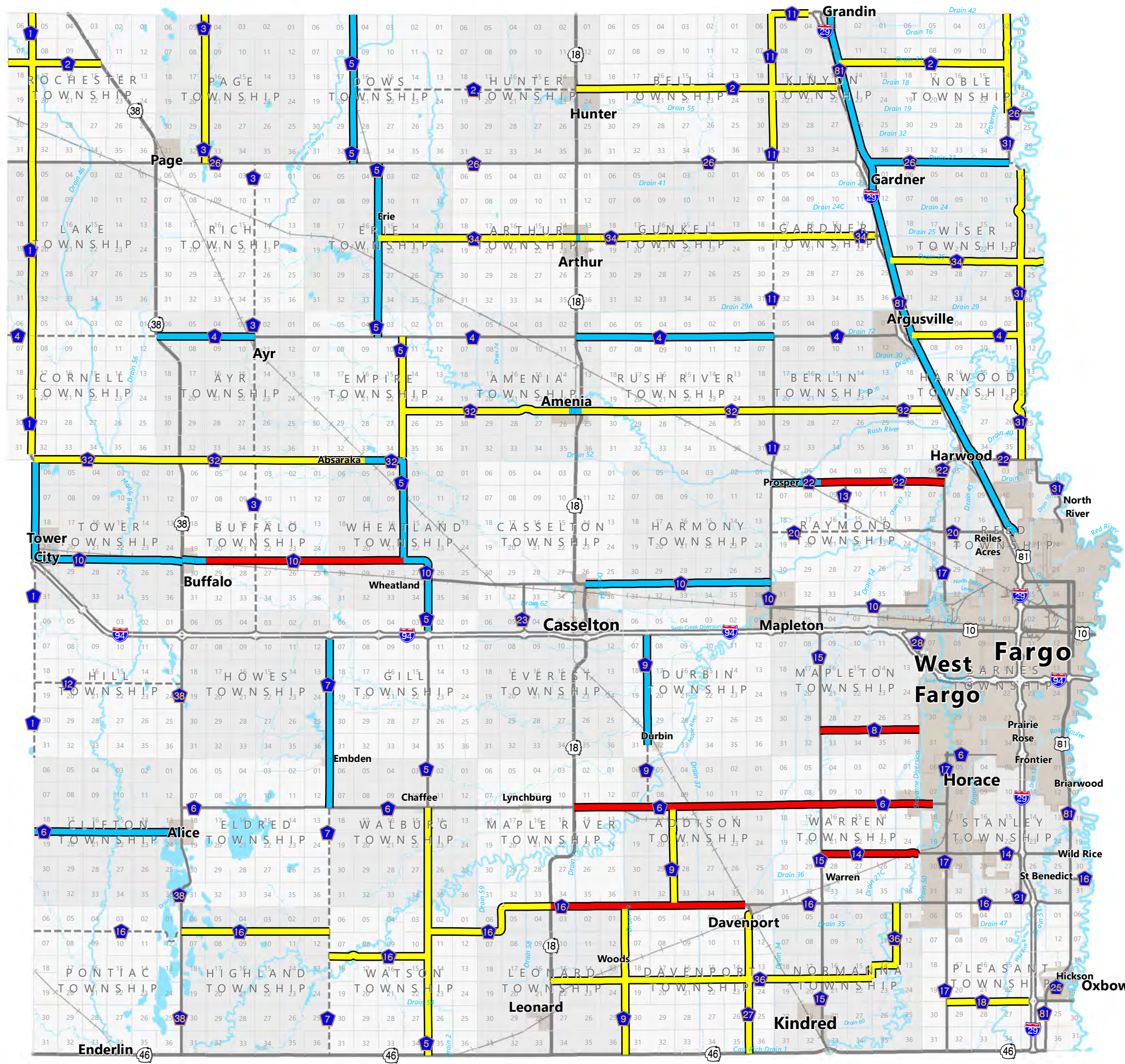


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Projected 30 Year Improvements



- Gravel - Needs Paving/Grading
- Gravel - Needs Reshaping
- Paved - Needs Widening

Type of Improvement	Miles	Cost/Mile*	Estimated Total
Gravel - Needs Paving/Grading	43.3	\$1.5 Million	\$65 Million
Gravel - Needs Reshaping	200.46	\$150,000	\$30.1 Million
Paved - Needs Widening	100.86	\$1.2 Million	\$121 Million
Total:			\$216.1 Million

*Cost per mile figures represent today's costs and do not take into account inflation.

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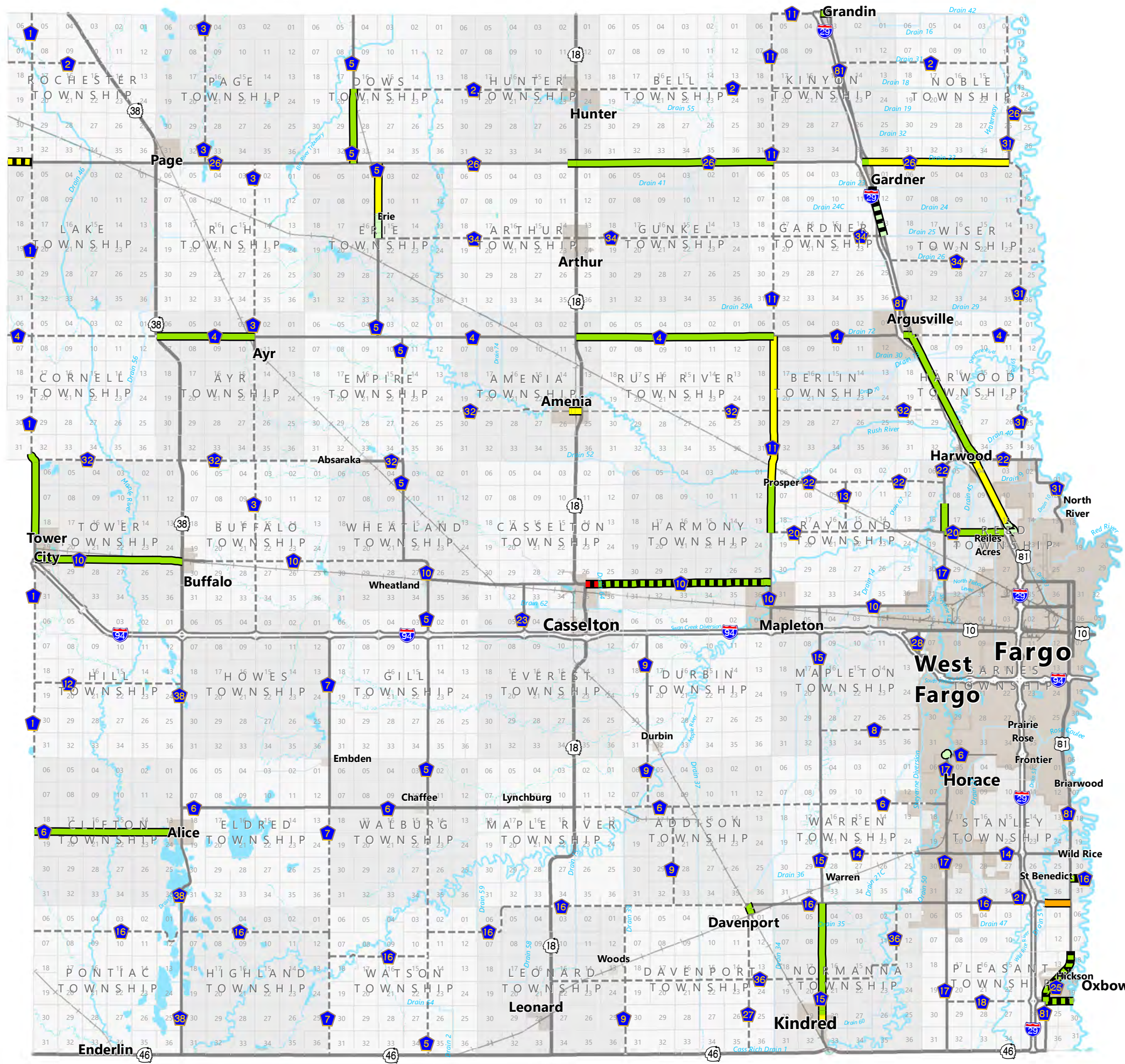
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




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Appendix 16

Recommended Pavement Overlay*



-  1.5 - 1.75 inch Mill and Overlay
-  1.5 - 1.75 inch Overlay
-  2 inch Mill and Overlay
-  2 inch Overlay
-  2.5 - 2.75 inch Mill and Overlay
-  2.5 - 2.75 inch Overlay
-  3 inch Overlay
-  3.5 inch Mill and Overlay

Recommended Pavement Overlay*	Miles
1.5 - 1.75 inch Mill and Overlay	11.32
1.5 - 1.75 inch Overlay	54.89
2 inch Mill and Overlay	2.57
2 inch Overlay	1.80
2.5 - 2.75 inch Mill and Overlay	0.98
2.5 - 2.75 inch Overlay	17.58
3 inch Overlay	1.03
3.5 inch Mill and Overlay	0.51
Total	90.68

* Recommended pavement overlay thickness needed to achieve a 10 tons/axle road (from American Engineering)

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