PAVEMENT MANAGEMENT PLAN

Brown County, SD

JUNE 2015

KLJ

FHWA Disclaimer

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CHAPTER 1 INTRODUCTION

Brown County is responsible for maintaining over 650 miles of roadway over 450 miles of which are paved county roads. These consist almost entirely of 2-lane asphalt roads. Funding levels have not allowed for extensive regular overlays, reconstruction, seal coats, and other maintenance. It seems that roads are deteriorating faster than they can be maintained. A survey from the 2012 Brown County Master Transportation Plan asked respondents to write in the biggest transportation concern for Brown County. The number one issue was road maintenance, with one respondent writing, “County roads need repairs badly.” This recognized problem is what is driving this Pavement Management Plan.

Understanding how road pavements age and deteriorate over time, both by environmental conditions and traffic loading, is critical in developing a sustainable roadway rehabilitation and maintenance program. Maintaining and rehabilitating infrastructure at appropriate times saves public dollars in the long term. Studies have found maintaining pavement through rehabilitation techniques has the potential to be 6 to 14 times more cost effective than rebuilding a deteriorated road. Figure 1 below shows that it is easier and more cost effective to maintain good roads than it is to wait and reconstruct bad ones.

Figure 1 Road Maintenance Types Over Time

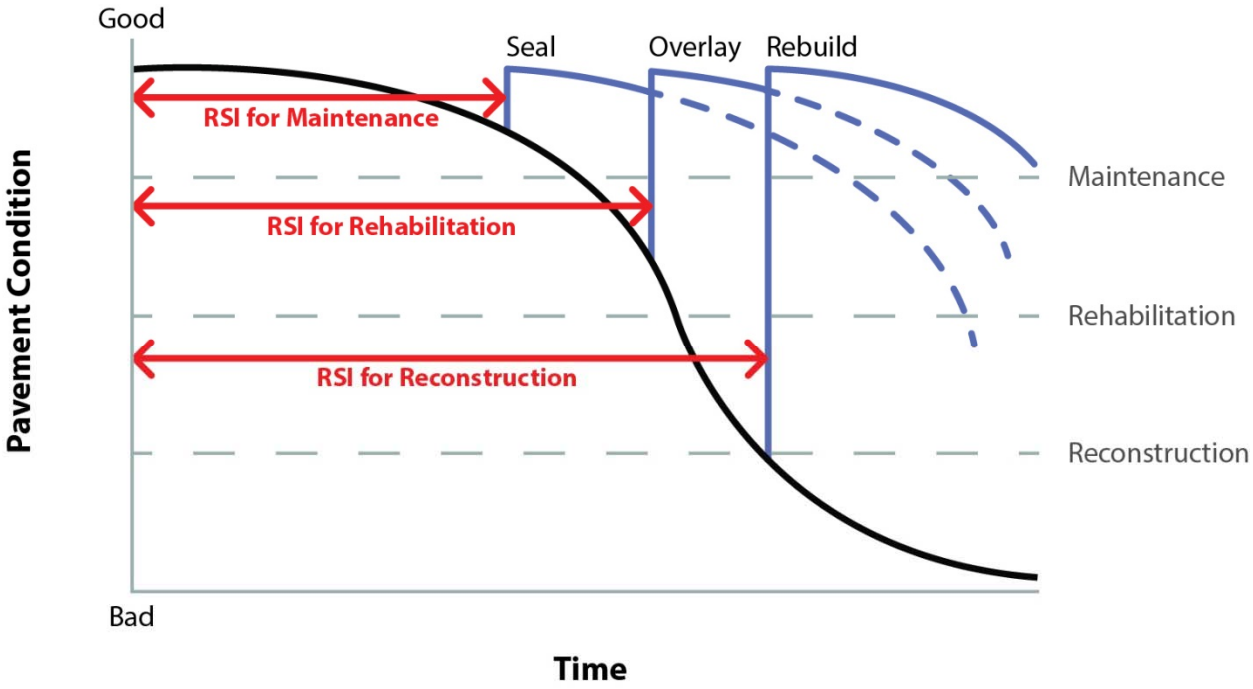


Photo of Pavement Condition on a Brown County Road

New technology and processes can streamline the maintenance scheduling process. Techniques such as Pavement Surface Evaluation and Rating (PASER) can allow a department to come up with an effective treatment plan based on the conditions of the surrounding roadways. Instead of wasting time figuring out what condition each roadway is in, using PASER ratings can rate the entire system fairly quickly. This allows more time to be put towards scheduling and budgeting. The ability to know exactly what condition all roadways under County jurisdiction is an extremely useful tool in order to schedule all preventative maintenance to keep all roadways functioning at their current condition, instead of degrading to the point where more costly corrective and emergency maintenance treatments are required.

The purpose of this study is to conduct a PASER survey of all the county roads in the study area and to determine what roads should receive what maintenance strategy in the short-term and longer-term time frame. This will help the county effectively manage their roadways while trying to maximize the value of the repairs and improvements.

CHAPTER 2 EXISTING ROADWAY CONDITION

Methodology

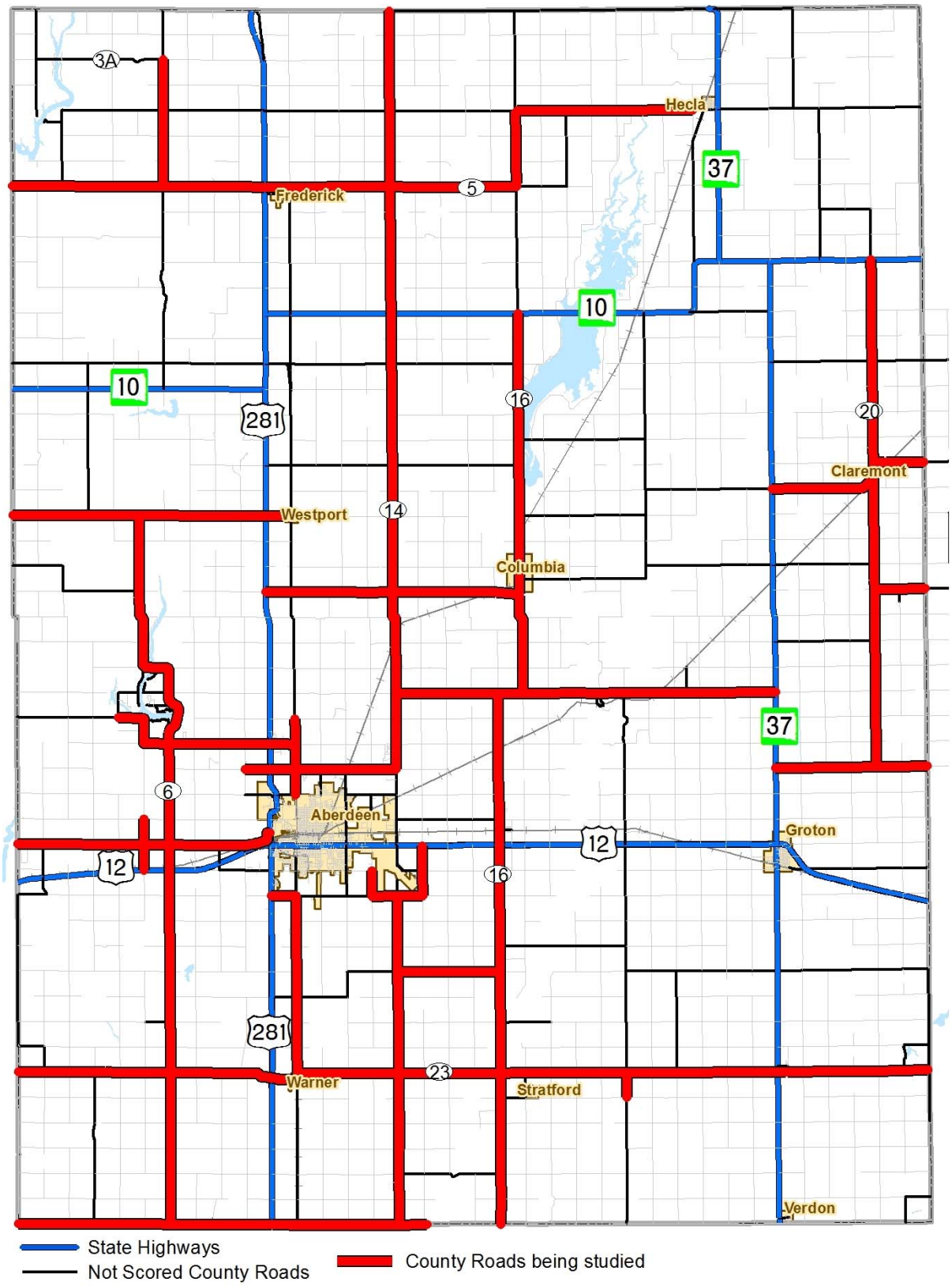
This study was focused on assessing the current condition of the roadways around the county and to develop a maintenance strategy to improve and repair the roadways. Brown County officials identified roughly 300 miles of paved county roads to be evaluated. Not all paved roads were to be evaluated for one reason or another, for example, their condition was known. Figure 2 Study Area Roads, displays the Brown County roadways evaluated in red.

Pavement Surface Evaluation and Rating (PASER)

PASER ratings are performed in order to assist agencies in identifying roadway conditions and prioritizing improvements based on a range of factors including roughness (ride), surface distress (condition), surface skid characteristics, and structural characteristics (potholes, cracking, etc.). Based on the PASER rating, different maintenance tasks are required to maintain or raise the rating for a particular section of roadway. By continuing to ensure that a good roadway remains a good roadway, the life of a roadway can be extended for a far lower upfront cost than by waiting until a more intensive maintenance task is required.

Photo of Maintenance on a Brown County Road

Figure 2 Study Area Roads



Process

In order to determine the 1 to 10 PASER rating of each segment of county roadway, each mile of study area roads were mapped out and driven. As each route was driven, a windshield survey of the road condition was noted and pictures were taken and geolocated in order to help document where and why each PASER rating was given. Factors such as the amount of cracking, potholes, rutting, shoulder condition, ability to drive at full speed, and the presence of gravel all were considered in rating the road segments. The process always included two people a driver and passenger marking the ratings. Rating values were conferred by both parties. The roadways were segmented every mile or shorter. All instances of shorter segments were driven by differing conditions. For example, while driving down Brown County Highway 6 the pavement condition was much worse for a section of a few hundred feet near low lying areas. This several hundred foot section was segmented and scored differently than the neighboring roadway. Similar conditions existed in every case of shorter segments. Consistency was important in the rating. Each of the rating values was defined and kept consistent throughout the PASER rating process. For example, severe cracking on a roadway rated it as a six and each instance of severe cracking was rated as a six consistently.

Photo of Construction on a Brown County Road

Each mile of the 400 plus miles in the study area was driven and rated in September 2014 and then again in April 2015. While most segments scored the same rating both times, some areas needed the second look.

Description of PASER Ratings

Paved county roads were all given a PASER rating between 1 and 10 based on existing conditions. Any roadway rated as a 1 was a gravel road. None of the county roads were rated as a 10. The individual PASER ratings values are described below and an example of each are provided.

PASER Rating 10:

Perfect. A brand new road with appropriate striping and shoulders. This roadway was reconstructed or overlaid in the last year. Example: State Highway 37 near Groton.

Photo of a PASER Rating 10 Road in Brown County

PASER Rating 9:

Excellent. A like new road with new striping. This roadway was reconstructed or overlaid recently. Example: County Highway 23 near 377th Avenue.

Photo of a PASER Rating 9 Road in Brown County

PASER Rating 8:

Great. No cracking, raveling or rutting. No patches or sealed cracks are visible. This roadway is not in need of repair. Example: County Highway 6 near Richmond Lake.

Photo of a PASER Rating 8 Road in Brown County

PASER Rating 7:

Good. Some cracking, no raveling or little rutting. No patches are visible. Cracks are sealed. This roadway is not in need of immediate repair. Example: County Highway 12W near 376th Avenue.

Photo of a PASER Rating 7 Road in Brown County

PASER Rating 6:

Fair. Moderate to heavy cracking or some raveling and rutting. Moderate polishing with occasional patches are visible. Cracks are mostly sealed. Example: County Highway 14 near 138th Street.

Photo of a PASER Rating 6 Road in Brown County

PASER Rating 5:

Fair. Moderate to heavy cracking with moderate rutting. Moderate patching with some patches on old patches. Limited striping. Cracks are mostly not sealed. You can still drive this road at the posted speed limit. Example: County Highway 13 near 384th Avenue.

Photo of a PASER Rating 5 Road in Brown Count

PASER Rating 4:

Poor. Heavy cracking and rutting with moderate visible potholes. Heavy patching with some patches on old patches. Limited striping. Shoulders are deteriorated. Cracks are not sealed. You cannot drive this entire road at the posted speed limit. Drivers need to slow down in areas. Example: County Highway 6 near 138th Street.

Photo of a PASER Rating 4 Road in Brown County

PASER Rating 3:

Very poor. Severe cracking and rutting with moderate visible potholes. Heavy patching with some patches on old patches. Limited striping. Shoulders are deteriorated. Areas are marked with flags. You cannot drive this road at the posted speed limit. Drivers need to slow down. Example: County Highway 6 near 140th Street.

Photo of a PASER Rating 3 Road in Brown County

PASER Rating 2:

Terrible. Heavy patching with gravel patches on failed asphalt. Limited pavement intact. No striping. Shoulders are deteriorated. You cannot drive this road at the posted speed limit. Drivers need to slow down. Example: County Highway 6 near 122nd Street north of Richmond Lake.

Photo of a PASER Rating 2 Road in Brown County

PASER Rating 1:

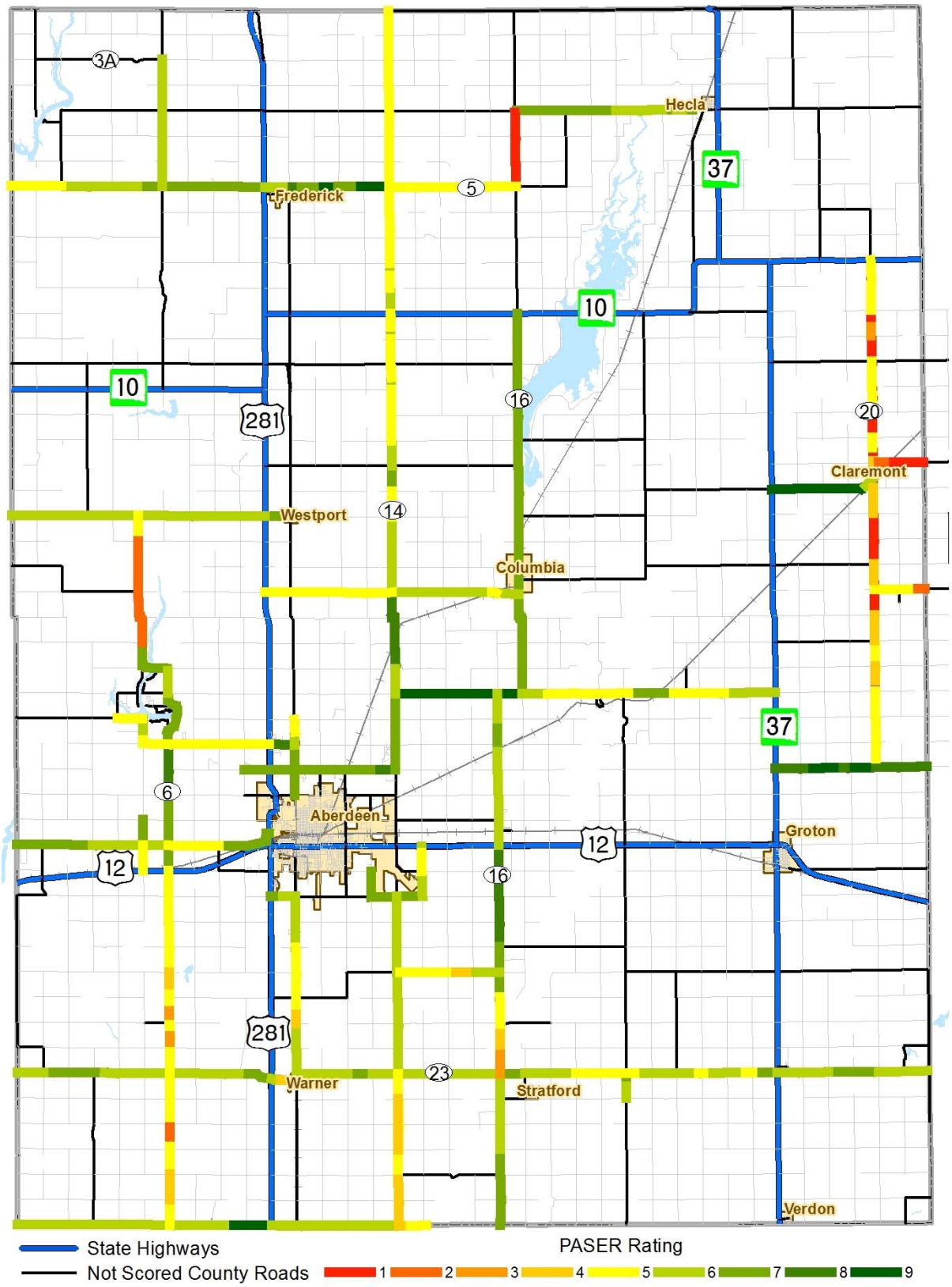
No pavement. A PASER rating of 1 indicates a gravel road section with virtually no visible pavement.

Photo of a PASER Rating 1 Road in Brown County

Map of Road Conditions

Every segment of roadway was scored and mapped. Figure 3 on the next page is a map that displays these ratings in a color coded system. Green being the highest values or best conditions and red being the lowest values or worst conditions.

Figure 3 Existing (2015) Pavement Conditions

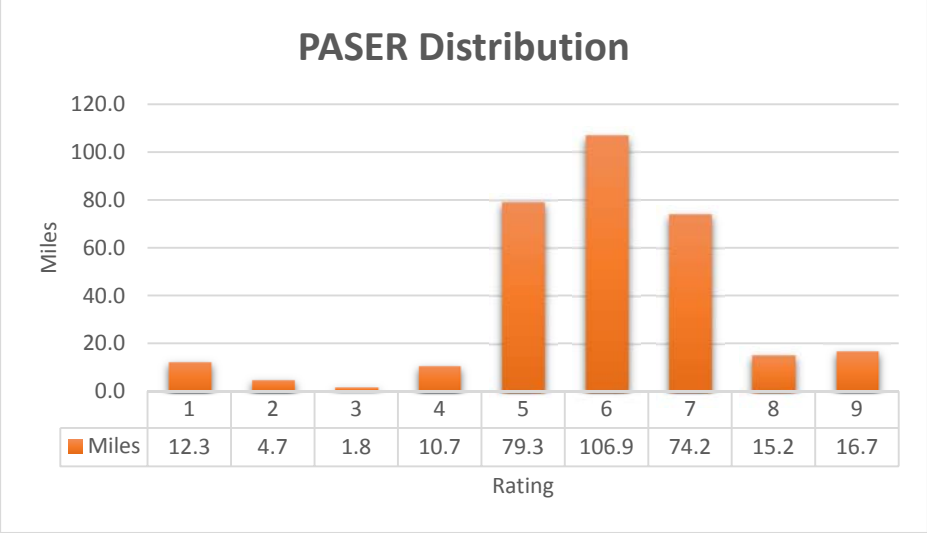


Statistics

Approximately 322 miles of county roadway were assigned PASER ratings throughout the course of the study. The average (mean) rating for Brown County's roadways was 5.9. That number may not signify much, but it does indicate that the Brown County roads scored tend to be in pretty good condition. In fact, if a rating of five is to be considered the minimum acceptable pavement condition, (able to drive at posted speed limit) then 91% of scored roads meet that standard today. This is visualized in the previous map as it indicates there are more miles of green than red. There were 12 miles of roads rated a one. These miles were either short intermittent segments along some routes or routes with planned paving.

The ratings are broken down in Figure 4 below.

Figure 4 PASER Score Distribution



CHAPTER 3 NEEDS ASSESSMENT

Methodology

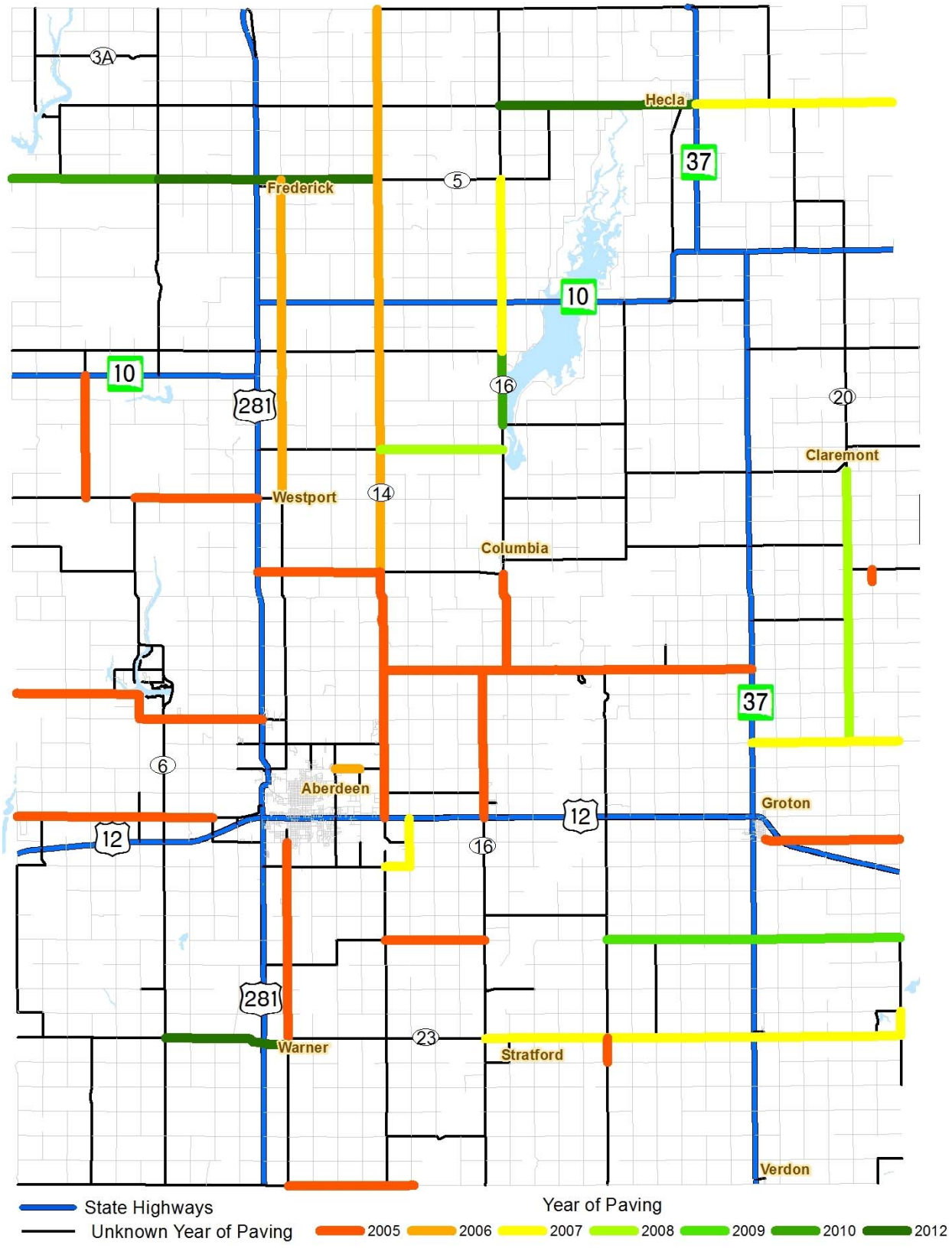
In conducting the Needs Assessment it is not as easy as simply looking at the lower scoring roads and saying that they are in the worst conditions; therefore have the most need. Other factors such as traffic volume, truck traffic, roadway safety, maintenance history, level of service needed, connections, and other factors should be considered.

Traffic volume and roadway level of service are something to be considered when developing a pavement management plan. However, in the case of the roadways in Brown County, no county road has an average daily traffic (ADT) volume greater than 1,700 or is experiencing a daily level of service other than A (which indicates free flowing traffic with no congestion). While traffic volumes should still be considered, because there is a difference between a road that has 1,200 ADT and one that has 80 ADT, level of service is not a factor that can help determine need in this case. KLJ did conduct traffic counts and Brown County also provided their 2013 traffic counts which were used in determining road priorities for future maintenance.

Brown County also provided details of historic pavement management interventions or road maintenance completed throughout the study area. This information was useful in understanding which areas have had pavement overlays in the last 10 years and which areas will likely need new overlays in the coming years. It should be noted that Brown County has performed more maintenance than just pavement overlays, but this intervention is the most likely method to improve the condition and extend the life of the road for future years. Figure 5 is a map of the areas that have received pavement overlays from 2005 through 2012. In 2011, pavement overlays were not completed.

Figure 5 is color coded similarly to Figure 3. It makes sense that the pavement overlays completed in 2005, which were substantial, would be in poorer condition at this time than those completed in 2010. A comparison of these two maps indicates just that.

Figure 5 Year of Most Recent Paving



Description of Interventions

Timing on treatments is particularly important in order to maintain an effective pavement management budget. Example: Crack sealing is best performed when temperatures are moderately cool, such as the spring or fall months. Cooler temperatures are generally when the cracks are fully open, allowing for the entire crack to be sealed. More in depth maintenance (minor overlays, chip seals, etc.) can be done in the summer months. Crack sealing can also be performed with less labor involved, so a smaller crew can handle these in the fall and spring, whereas the more intensive maintenance plans can be done in the summer when maintenance departments typically have seasonal manpower as well. Higher temperatures also lessen the cure time required, thus allowing the roadway to be opened in a shorter time frame. Full reconstruction and structural overlays are generally contracted out and are much more expensive. Sealing does need to be performed in moderation. Extensive sealing operations can result in a loss of pavement friction, which would then lead to a chip seal in order for the roadway to function properly in winter months. It is also extremely important to keep weather factors in mind, as excessive moisture can prohibit the sealant from bonding properly.

PASER Rating of 1:

This is essentially a gravel road and Brown County should determine if it is to remain gravel and can provide maintenance as such or if a full reconstruction as discussed in PASER rating 2 is needed.

PASER Rating of 2:

Due to severe deterioration, the roadway needs reconstruction with extensive base repair. In Brown County, generally these roads were in flood effected areas and need a grade raise in order to effectively fix the roadway.

PASER Rating of 3:

Patching and repair will need to be done prior to a major structural overlay (>2”). Milling and removing the deteriorated area will extend the life of the overlay.

PASER Rating of 4:

Due to significant signs of aging, a structural overlay is required (>2” or more).

PASER Rating of 5:

Primarily consists of surface aging, sound structural condition. Can benefit from a non-structural overlay (<2”) or patching where necessary.

PASER Rating of 6:

Light signs of aging. The roadway life can be extended with a sealcoat and routine crack sealing.

PASER Rating of 7:

Roadway shows very few signs of aging and can be maintained with routine crack filling.

PASER Rating of 8 and 9:

No immediate maintenance is required on these roadways. In the future, routine crack filling and maintenance should be performed to continue to extend the life of the roadway.

PASER Rating of 10:

This roadway was recently completed and no maintenance is required.

Brown County uses all of these strategies or interventions to maintain their paved roads. Much of this work is conducted in-house, using their equipment and materials. However, some of the work is contracted out to paving companies. Our cost estimates are based on contracting prices.

Brown County can typically complete the work by utilizing their staff and equipment for a lower cost.

It is known that costs can vary quite a bit in the study area. Approximate contracted out costs per mile for major maintenance tasks associated with Brown County (computed using SDDOT's average unit costs for 2013 inflated to 2015 are listed in Table 1 below). It is extremely important to keep track of all associated maintenance costs (crack sealing, seal coating, etc.). No matter how minor the task being performed, accurate and concise cost tracking will enable more accurate programming, scheduling and budgeting. Costs vary by region, so by tracking these costs it enables an accurate pavement management plan to be imposed for each specific region.

Table 1 Cost Estimates

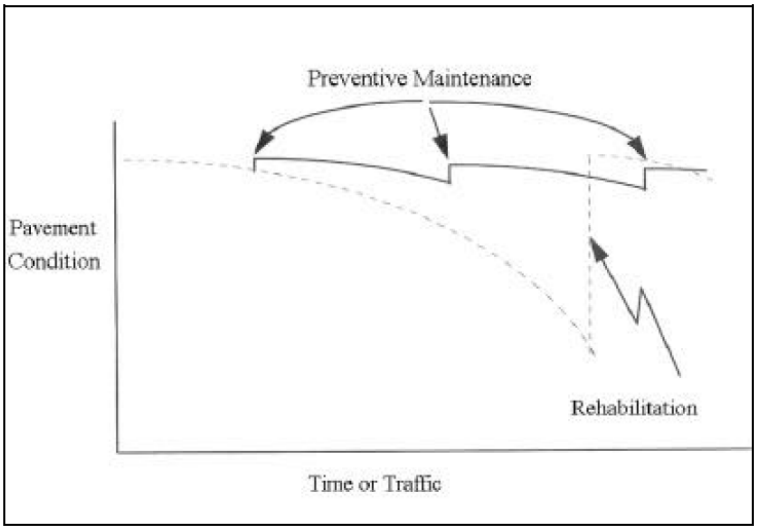
Improvement Type	Cost per Mile*
Reconstruction	$465,000.00
Structural Overlay	$225,000.00
Non-Structural Overlay	$154,000.00

*Note: Costs do not include fees for engineering, design, or construction observation.

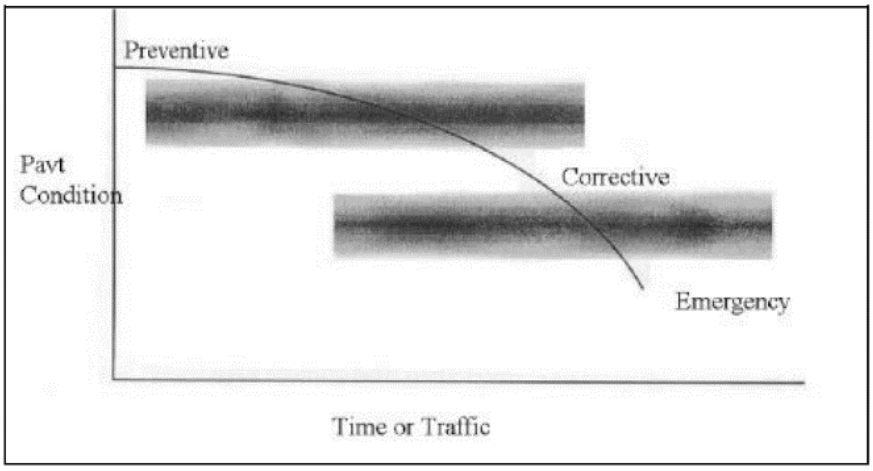
The estimated costs are assumptions in 2015 US Dollars for contracting purposes. These are estimates based on recent similar projects.

Feasible Strategies

There is a saying that you don't want to improve the worst roads first. This is backed up by research. It is more cost efficient to keep a good road in operating condition than to replace an aging road. By putting money upfront into seal coating, crack sealing, etc., the roadway's life can be extended far more efficiently than waiting until structural improvements are required (overlays, milling, reconstruction, etc.). Preventative maintenance, as indicated in the below chart, is much cheaper than corrective maintenance.



Corrective and emergency repairs occur when the roads are more deteriorated or have lower PASER ratings and require costly structural improvements or reconstruction.



CHAPTER 4 RECOMMENDATIONS

Brown County has been working to maintain their over 650 miles of county roads. For each of the last 10 years or so they have developed a tentative maintenance plan. This annual plan typically includes about 15 to 20 miles of total paving and about 40 to 60 miles of sealing. There are, of course, other maintenance activities such as patching, gravel infill and blading completed. Recent flooding also diverted efforts to just keeping the roads open.

Photo of a Road Closure on a Brown County Road

The Brown County highway department has recently had an annual operating budget dedicated to road maintenance and improvement of between five and seven million dollars. The total annual budget is around nine million dollars. Historically, they have been able to complete approximately 20 miles of pavement overlays and approximately 50 miles of sealing. This has been accomplished largely by completing a lot of the work in-house utilizing equipment owned by Brown County. This helps keep the costs low and allows for maintenance and upkeep projects to be completed throughout that year. The County has also occasionally completed more complex projects like the recent grade raise and reconstruction of County Highway 23 near 376th Avenue.

Photo of a non-structural overlay in Brown County

This amount of road surface maintenance seems to be sustainable and should be planned for going forward.

Patching and sealing projects should continue as needed to maintain roads that are in fair to good conditions (PASER rating 4 – 7).

The focus for recommendations is on pavement overlays. This preventative maintenance project does the most to address the problems of deteriorating roads and has the ability to turn a PASER rated 5 road into a 9, for example. Paving projects address all surface related issues with the road and does the most to improve the overall county highway system. Below is the priority paving list. It is a 5-year (2016-2020) plan for all pavement overlay projects throughout the county. 2015 paving projects, which came directly from county officials, were included as well; although most of these projects are currently underway or have been completed. Several of these important projects are also on the 2012 Brown County Master Transportation Plan (MTP). This is indicated in the last column in Table 2.

Table 2 Five Year Priority Paving Projects

Priority Paving List (5 Year Plan)

Number	Year	County Highway	Limits		Average PASER Rating	Type	Length (Miles)	Estimated Cost (2015 Dollars)	On MTP
			Begin	End					
1	2015	13	391st Ave	396th Ave	9.0	Non-structural overlay	5.0	completed	No
2		14	126th St	127th St	6.0	Non-structural overlay	1.0	$154,000	Yes
3		11	386th Ave	391st Ave	5.0	Non-structural overlay	5.0	$770,000	No
4		23	387th Ave	391st Ave	5.9	Non-structural overlay	4.0	$616,000	No
5		14	142nd St	144th St	4.5	Structural overlay	2.0	$450,000	No
6		13	378th Ave	379th Ave	5.0	Non-structural overlay	1.0	$154,000	No
7		5	104th St	107th St	1.0	Reconstruction	3.0	$1,395,000	Yes
8		5	391st Ave	396th Ave	4.9	Structural overlay	5.0	$770,000	No
9		21	391st Ave	395th Ave	5.1	Non-structural overlay	4.0	$616,000	No
						Year Total	30.0	$4,925,000	
10	2016	23	391st Ave	400th Ave	5.9	Non-structural overlay	9.0	$1,386,000	Part
11		12W	133rd St	134th St	5.0	Non-structural overlay	1.1	$169,400	No
12		13	396th Ave	400th Ave	5.0	Non-structural overlay	4.1	$631,400	Yes
						Year Total	14.2	$2,186,800	

Priority Paving List (5 Year Plan)

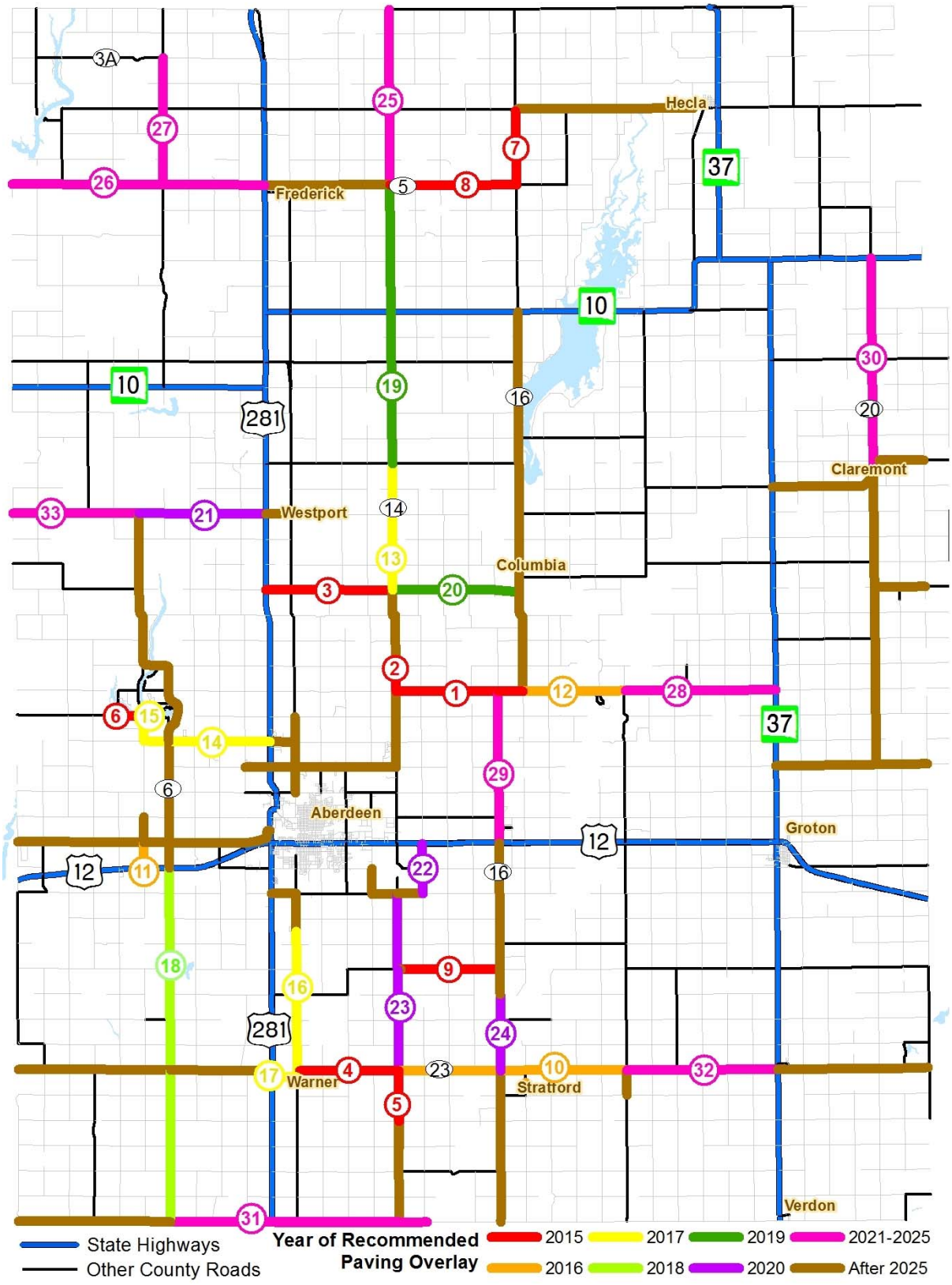
Number	Year	County Highway	Limits		Average PASER Rating	Type	Length (Miles)	Estimated Cost (2015 Dollars)	On MTP
			Begin	End					
13	2017	14	118th St	123rd St	6.0	Non-structural overlay	5.0	$770,000	Yes
14		13	379th Ave	386th Ave	4.8	Structural overlay	5.0	$1,125,000	Yes
15		13	128th St	129th St	6.5	Non-structural overlay	1.0	$154,000	Yes
16		10	137th St	142nd St	6.0	Non-structural overlay	5.3	$808,500	No
17		23	386th Ave	387th Ave	5.7	Non-structural overlay	1.0	$154,000	No
						Year Total	17.3	$3,011,500	
18	2018	6	134th St	148th St	4.7	Structural overlay	14.0	$3,150,000	No
						Year Total	14.0	$3,150,000	
19	2019	14	107th St	118th St	5.3	Non-structural overlay	11.0	$1,694,000	Yes
20		11	391st Ave	396th Ave	6.0	Non-structural overlay	5.0	$770,000	No
						Year Total	16.0	$2,464,000	
21	2020	9	379th Ave	386th Ave	6.0	Non-structural overlay	5.0	$770,000	No
22		14E	133rd St	135th St	4.8	Structural overlay	2.0	$450,000	Yes
23		14	135th St	142nd St	6.2	Non-structural overlay	7.0	$1,078,000	No
24		16	138th St	142nd St	3.2	Reconstruction	4.0	$1,860,000	Yes
						Year Total	18.0	$4,158,000	
						5 Year Total	**79.5**	**$14,970,300**	

Table 3 Priority Paving Projects Years Six to Ten

Priority Paving List (10 Year Plan)

Number	Year	County Highway	Limits		Average Rating	Type	Length (Miles)	Estimated Cost	On MTP
			Begin	End					
25	2021 - 2025	14	100th St	107th St	5.0	Non-structural overlay	7.0	$1,078,000	No
26		5	373rd Ave	386th Ave	6.3	Non-structural overlay	10.0	$1,540,000	No
27		6	102nd St	107th St	6.0	Non-structural overlay	5.0	$770,000	No
28		13	400th Ave	406th Ave	5.9	Non-structural overlay	6.0	$924,000	Yes
29		16	127th St	133rd St	6.2	Non-structural overlay	6.0	$924,000	No
30		20	110th St	118th St	3.2	Reconstruction	8.0	$3,720,000	Yes
31		27	382nd Ave	392nd Ave	6.3	Non-structural overlay	10.0	$1,540,000	No
32		23	400th Ave	406th Ave	6.0	Non-structural overlay	6.0	$924,000	No
33		9	373rd Ave	379th Ave	6.0	Non-structural overlay	5.0	$770,000	No
						5 Year Total	**63.0**	**$12,190,000**	
						10 Year Total	**142.5**	**$27,160,300**	

Figure 6 Priority Paving Projects by Year



Tables 2 and 3 and the map in Figure 6 outline a priority paving plan to focus efforts on maintaining the best county highway system possible. KLJ worked closely with Brown County and their data to develop this plan.

The year 2015 is included just to document what is currently being completed this year and to note for reference on those corridors. The information for the paving plan for 2015 came directly from Brown County with no adjustment.

The priority paving plan focuses on the next five years, 2016 through 2020, although the plan also identified corridors for the following five years, 2021 through 2025. The PASER rating values were collected in the autumn of 2014 and the spring of 2015. The values of the road conditions will change over time and focusing on a 5 year paving plan allows us to address known needs. Beyond the year 2020 it may be necessary to re-score the road conditions and reevaluate the paving priorities.

The priority paving plan lists projects for each year of the plans with total lengths ranging from 14 miles to 18 miles.

The 2016 projects came directly from Brown County's tentative plan for next year with one exception. Approximately 1 mile of County Highway 12W was added. This road has a PASER condition rating of 5 and experiences moderate to heavy truck traffic. It is also experiencing higher traffic volumes this year due to construction on US-12 west of Aberdeen.

Photo of Pavement Condition of Brown County Highway 13

The 2017 projects focus on two deteriorating corridors that have the highest traffic volume on the County Highway system, County Highways 10 and 13. These two corridors both have daily traffic in excess of 1,000 vehicle per day and both provide needed connections to Warner and Richmond Lake respectively. Both of these corridors have pavement areas rated at a 5 or worse and the overall weighted averages is below a 6. County Highway 13 was also identified as a priority in the recently completed Brown County Master Transportation Plan. These are perfect paving priority corridors. As part of the Warner connection, a 1 mile section of County Highway

23 was also included in this section and should be considered as it is in need of repair. However, there is a bridge on this section that may need work and should be considered in evaluating the timing of this pavement overlay. Finally, a stretch of County Highway 14 is included as well. This corridor has had recent overlays south of this section including work this year. The pavement overlay on this road should continue north.

Photo of Pavement Condition of Brown County Highway 6

The 2018 projects are one corridor, County Highway 6. This is a 14 mile section of some of the worst pavement conditions in the county. This corridor is in desperate need of repair with some pavement sections containing gravel and large potholes. The pavement condition ratings on this 14 mile stretch vary between 2 and 5. Some low lying areas may require some grading and stabilization activities before the overlay can be successfully completed.

Photo of Pavement Condition of Brown County Highway 20

The 2019 projects focus on two corridors, County Highways 14 and 11. For County Highway 14 this is the next 11 mile section north from the previously recommended paving in 2017. This section has some of the lowest PASER scoring on the Highway and averages a value of 5.3. This important project was also identified as a priority in the recently completed Brown County Master Transportation Plan. County Highway 11 makes an important connection to the town of

Columbia and also connects to a 2015 paving project (immediately to the west) improving the overall corridor.

The 2020 projects focus mostly on the area south of the Aberdeen Regional Airport. County Highways 14E, 14, and 16 are all in need of repair and all have average PASER ratings below 6.2. These corridors also make important connections to US-12 and the town of Stratford. Additionally, these corridor connect to other paving projects planned in previous years on County Highways 21 and 23. Year 2020 also includes a paving project planned on County Highway 9. Again this corridor is in need of repair, but can wait a few more years as it is currently rated a 6. The corridor makes an important connection between US-281 and County Highway 6 north of Richmond Lake.

Photo of Pavement Condition of a Brown County Road

There are several remaining corridors that are in need of repair, but were not prioritized in the 5 year plan because the traffic volume is lower, their current condition is slightly better, their connection is not as critical to the system or another reason not listed. These corridors are not forgotten, rather they are included in the priority paving map for the years 2021 through 2025.

The projects are listed in Table 3, Priority Paving Projects Years Six to Ten. These corridors include the northern most section of County Highway 14, County Highways 5 and 6 around Elm Lake, County Highway 13 east of Columbia, County Highway 16 from County Highway 13 to US-12, County Highway 20 from State Highway 10 to Claremont, County Highway 27 from County Highway 6 to County Highway 14 (some of which was chip sealed in 2014), and County Highway 23 from the 2016 paving project to State Highway 37. These projects should not be overlooked and if possible these projects would benefit from moving their pavement overlays to earlier dates.

Finally, beyond the year 2025 or a 10 year plan, it is difficult to list project priorities. As stated previously the road conditions change and the 2015 PASER ratings will offer little value far into the future. Also the corridors that are planned to have new pavement overlays in the coming years would likely need that treatment again beyond the 10 year time frame and it is difficult to guess at which of the newly paved roads will need treatments and when. Therefore all the rated roads that don't have a 10 year priority are shown as paving after 2025. Again, changing conditions may dictate that interventions are need on these roads sooner, but based on the analysis they are of the least priority.


KLJ