



MEMORANDUM

Date: May 22, 2020

To: Diane Wessel, Administrator
Cc: Village Board
Fm: Andy Rowell, Director of Public Works
Re: **ROADWAY CONDITION REPORT AND MAINTENANCE PLAN**

BACKGROUND INFORMATION

The Village has approximately 71.58 certified miles of public streets under its jurisdiction, at an estimated value of over \$27 million presently. Most Village streets have been urbanized with the addition of curb & gutter and storm sewer to control storm water flow. Almost all Village roads have an asphalt pavement surface.

Maintaining streets in good repair is a primary objective of the Public Works Department. This requires a combination of scheduled maintenance activities and timely capital improvements to provide a sustainable transportation system for residents and businesses, transporting goods and services within and through our community.

The intent of this memo is to:

- Present the current condition state of roadways within the Village
- Identify trends observed in these roadway conditions
- Explain the primary maintenance activities needed to maintain asphalt roads
- Provide analysis and recommendations for paving needs

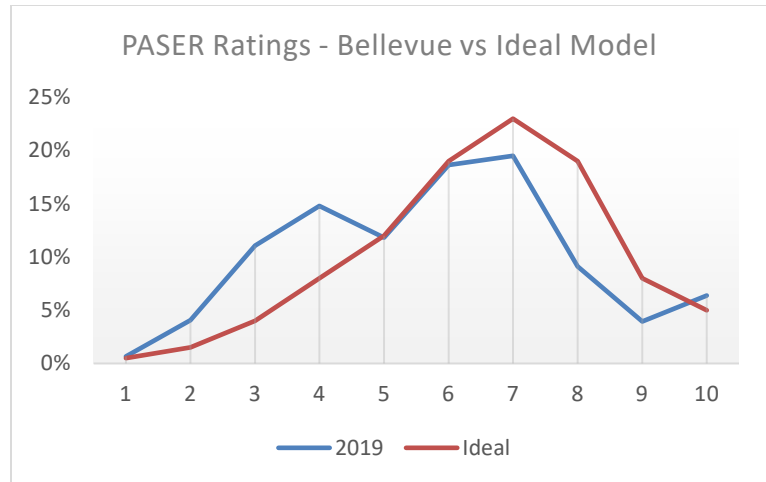
CURRENT CONDITIONS

An assessment of the roadway surface conditions was made using data in the Wisconsin Pavement Surface Evaluation and Rating System (PASER). The PASER ratings are submitted to the Wisconsin DOT (WisDOT) in odd-numbered years, and become part of the WisDOT local roads inventory (WISLR), which includes such things as road and shoulder width, pavement type, construction year, maintenance history. The system also analysis and budgeting tools.

The most recent ratings were completed in summer 2019 by Village and Cedar Corp staff. The Village uses the WISLR inventory and PASER ratings to help evaluate conditions and to prioritize projects and select cost effective strategies for pavement preservation.

The following table shows Bellevue's 2019 PASER rating breakdown. A "10" is considered a newly constructed pavement surface, while a "1" is a pavement that needs full reconstruction. Additional information on each rating value can be found from the PASER user manual sheets in Attachment A. The line chart below shows Bellevue's ratings in comparison to a model PASER rating curve.

2019 ratings		
PASER	%	Typical Improvement
1	0.66	full reconstruction
2	4.06	paving w/ repair
3	11.06	full depth paving
4	14.79	mill & overlay
5	11.81	patch & sealcoat
6	18.64	sealcoat
7	19.51	crack fill
8	9.13	crack fill
9	3.96	none
10	6.38	New pavement
100		



The ideal rating curve is a shifted bell curve where the highest percentage of roads is in the "7" category, and where the percentage of pavements "1-3" are less than those "9-10". Following this ideal curve should allow an agency to keep ahead of failing pavements with capital improvements and required maintenance activities.

Bellevue does have its highest percentage ratings in the "6-7" range, but there is a large bump up in the "3-4" rated roads. There is also a lower than desired percent of roads in the "8-9" ratings. This indicates that there are more pavements in need of capital improvements than those that have recently received improvements. It also indicates that Bellevue may be behind in needed maintenance.

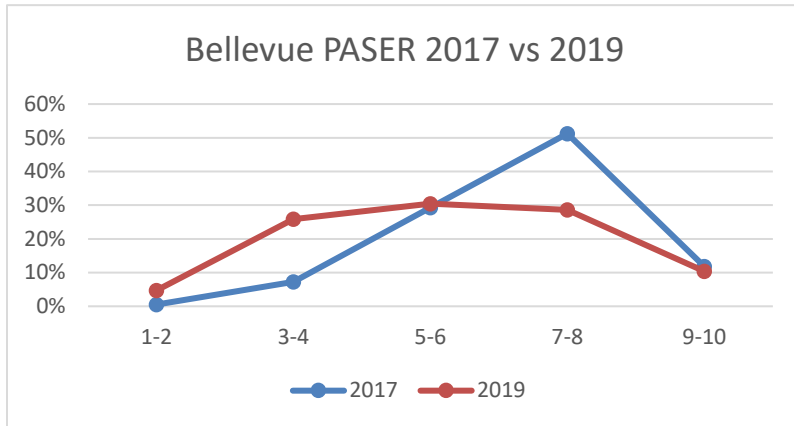
The following table compares the percent of roads rated in each category group for years 2017 and 2019.

Rating	Year 2017	Year 2019	Value change	% change	Improvement needed
1-2	0.52	4.72	4.2	808%	Reconstruct
3-4	7.23	25.85	18.62	258%	Paving
5-6	29.23	30.45	1.22	4%	Patching/Sealing
7-8	51.23	28.64	-22.59	-44%	Crack Filling
9-10	11.78	10.34	-1.44	-12%	None

As can be seen from the data, there was a major downgrade in pavement condition ratings between 2017 and 2019. The increase in pavements rated "1-2" increased by over 800%, and those rated "3-4" increased over 250%. Over 30% of all pavements are rated a "4" or less. The ideal amount would be half this amount.

Additionally, pavements rated "7-8" reduced by 44%, meaning a large portion of roads have fallen from a good to a fair rating. It is critical that appropriate maintenance treatments be applied to attempt to bring these pavements back to a good rating. Citing the PASER manual, "once significant deterioration begins, it is common to see pavements decline rapidly. This is usually due to a combination of loading and the

effects of additional moisture. As a pavement ages and additional cracking develops, more moisture can enter the pavement and accelerate the rate of deterioration.”



This chart illustrates the percentage of roads in each category group. A shift can be seen from the 2017 data to the 2019 data where there are now far less roads considered good or fair and more roads considered poor

However, it is unlikely the actual pavement condition would have dropped that much in two years. Some of this downgrade may be attributed to the fact that different people rated the pavement between these two years. Some of the rating is subjective, where one person may rate a road slightly different than another person.

In 2019 a collaborative rating review was made between Public Works staff and Cedar Corp staff. Since the ratings last year, I made a review of several roads and ratings and believe the ratings are in line with the guidance in the PASER manual. I conclude that pavements were likely rated higher than actual in 2017 and previous years.

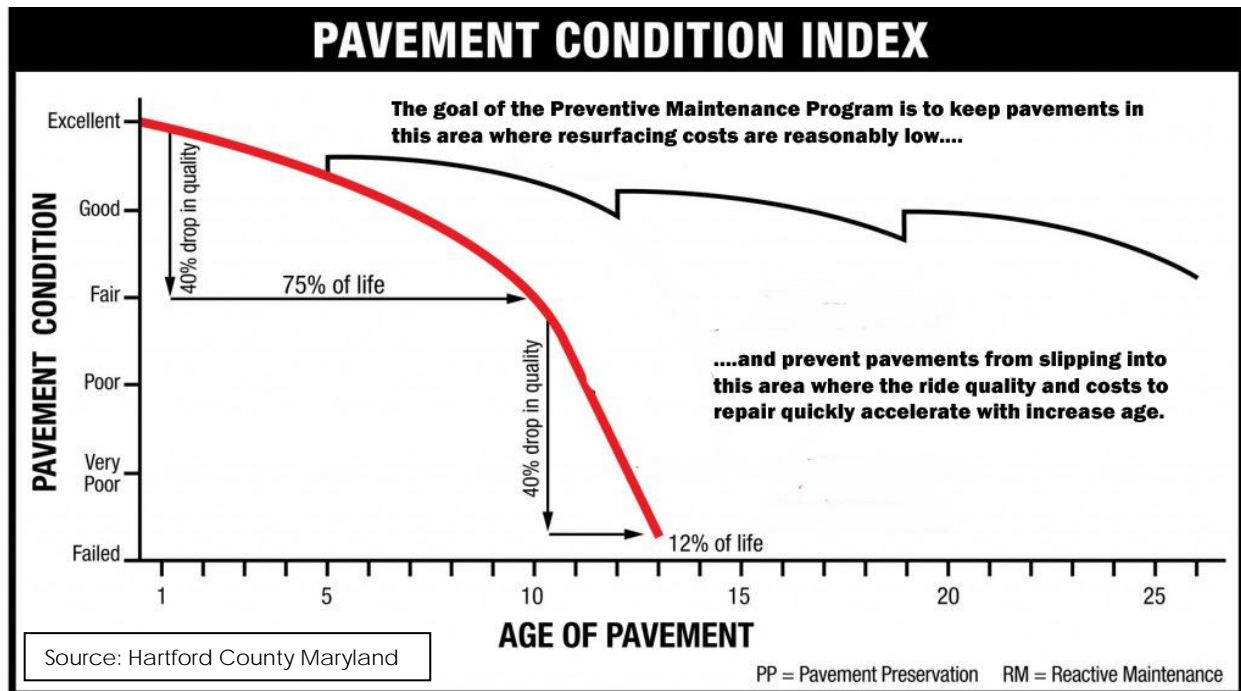
No matter how the ratings were derived, two distinct areas of concern are shown in the data:

1. The percent of pavements that dropped below a "7". Roads rated "7" and above can normally be maintained cost-effectively with crack filling. Pavements rated below "7" typically need a more aggressive maintenance treatment.
2. The percent of pavements that dropped below a "5". Roads rated "4" and lower are generally considered "too far gone" to apply cost effective maintenance treatments. These roads are now destined for a high cost capital paving project, either a mill and overlay, or a full depth pavement replacement, depending on the types and severities of distresses present.

Appendix B provides a map that illustrates the road segments that are in need of either maintenance or capital projects currently based on the PASER ratings. Per this data over 34 miles of roadways are in need of maintenance and over 20 miles require a capital paving or reconstruction improvement.

PAVEMENT PRESERVATION TREATMENT RECOMMENDATIONS

Asphalt roadways have specific maintenance activities that should be completed on a schedule to extend the useful life. The following schematic shows what a cost-effective approach to maintaining pavements may look like.



The goal with this approach is to maintain pavements around the “good-fair” threshold. Keeping pavements in this range allows for cost-effective maintenance activities such as crack filling and sealcoating to stretch the life of pavements. Pavements typically deteriorate slowly the first several years. But with no maintenance, the average pavement will start to deteriorate much faster around the 10-year mark.

The Village has been crack filling on a yearly basis, which when done at the correct times extends pavement life well. Crack filling pavements with minor cracking (centerline and cross cracks every 50 feet or so) can maintain the pavement as good. Crack filling should be planned every 5-7 years depending on cracking extent. A review of crack filling records shows that many pavement sections have only been crack filled once, which is not sufficient. \$50,000 a year has been spent the past few years.

There appears to be a lack of consistent maintenance after initial crack filling. The Village has not used pavement sealing on urban roads as a maintenance activity, which would be the next cost-effective strategy to use. The combination of crack filling and then sealing pavements rated in the “5” range can generally improve the rating to a “7” or above. Poor rated pavements are not cost effective to seal.

Many roads in the Village have deteriorated to a point where conventional crack filling will not suffice. If areas of cracking are generally isolated, permanent patching is an effective option. Some patches require full depth replacement with hot mix asphalt. Others may be possible to fill with a more flowable material such as mastic patch (this is the material that was demonstrated a few weeks ago behind the Village garage). A combination of these could be cost-effective for the Village. In recent years the Village has done spot full depth asphalt patching, targeting bad dips in the roadway, severely failed pavement spots, and manhole and inlet structures, at a cost of \$50,000 per year.

Pavement sealing of crack filled and patched roads is the next step. Sealing urban streets would use a spray mixture of asphalt emulsion (oil), fine aggregates, polymers, and other additives that cures by evaporation. This is different than a chip seal, where asphalt emulsion is sprayed and then aggregate is spread on top, rolled and cured. Chip sealing is more suited for rural applications and is recommended to extend the life of rural unimproved roads on the east side of the Village.

Sealing urban streets is estimated at \$50,000 per mile of improved urbanized street and may be expected to provide 7 years of extended life. Chip seal may provide the same life extension at a cost of \$20,000 per mile of unimproved rural road.

PAVEMENT SCHEDULE RECOMMENDATIONS

In review of past CIP documents, the Village has set thresholds for reaching 18-25 years of life for an overlay, and 25-30 years of life for a full depth paving project. These goals are higher than industry standards, where overlays are given a useful life of 12 years, and full depth pavements 20 years. I believe because of the nature of most of our subdivision roads it is possible to stretch out past the industry standard, but not quite as far as those listed earlier. I believe a good target is the low end of the above ranges, with 18 years for overlays and 25 years for full depth pavements.

When roads are reconstructed the road base should give at least 50 years of useful life. For subdivision roads the base should last even longer. For pavement, the intent is to keep a smooth finished surface. An overlay over a sound base is the desired and most cost-effective paving application, but consistent maintenance must be done to keep the pavement in at least fair condition for an overlay to be considered.

The following table shows some scenarios for expected life span and miles needed to pave each year to keep up on failing pavements for our existing 71 miles of roads.

Life	miles/ year	miles/ 2yrs	Project cost/mile	Project cost/year	Project type
18	3.94	7.89	\$330,000	\$1,301,667	overlay
20	3.55	7.10	\$330,000	\$1,171,500	overlay
22	3.23	6.45	\$440,000	\$1,420,000	combination
25	2.84	5.68	\$550,000	\$1,562,000	full depth
28	2.54	5.07	\$550,000	\$1,394,643	full depth

An asphalt overlay capital project will cost about 60% that of full depth paving. If assessments are made for paving, this may be a more attractive cost to property owners, even if paving has to occur more often. It also means the Village would gain more miles of improvement with the amount that can be borrowed for.

The miles paved through Village projects in 2017 was 2.7 miles and in 2019 was 1.4 miles. Paving is generally in odd numbered years and no miles are now planned for 2020. This equates to just over 1.0 miles per year the past 4 years. At current pace it will take 70 years to repave all Village roads. The Village should target at least 3.25 miles of paving each year with a combination of full depth paving and overlay projects. This will allow roads to be paved within the expected useful life cycle. Over time the trend can move from full depth projects to more overlays, which will save costs.

To note, over 15 miles of improved roads (21% of all village streets) were built in the late 1980s and early 1990s and are due for a capital improvement. A quick analysis shows 12 miles are rated "4" or under, and 7.5 of these miles are rated "3" and under needing immediate attention, most likely full depth pavement replacement or full reconstruction where major base issues are present. The remaining 3 miles built in this timeframe are rated a "5" or better and may still be sound enough where an overlay would be an option.

These 15 miles include most subdivision roads in the Skyview/ Lyndale area, Keehan/ Bluestone, Cumberland/ Canyonland, Aquarius/ Gemini, Eldorado/ Seville, Conesta Dr, and many other segments. All of these streets are recommended for paving in the next couple of years. Analysis of these roads to determine the 2021 CIP schedule is ongoing.

STAFF RECOMMENDATION

Public Works, Finance, and Administration staff seeks guidance from the Board regarding how the Village should continue forward with pavement maintenance and capital improvements.

Public Works advises a more aggressive maintenance program to keep roadway pavements serviceable longer. Timely maintenance will allow pavements to meet and likely exceed the expected useful life. Staff advises to use mastic patching in spot locations and to begin a pavement sealing program for pavements that can benefit from this approach. These activities combined may be expected to increase overall maintenance costs by \$125,000 per year.

Staff also advises a target of at least 3.25 miles of paving each year on average over the next several years to address pavements in need of repair. A combination of mill and overlay and full depth pavement replacement will be used to increase the miles of paving completed. The following table summarizes the recommended approach and costs for pavement maintenance and capital projects.

Application	Type of Application	Cost/ SqYd	Life	Cost/ Year/ SqYd	Target Miles/ Year	Target Budget/Year	Target Year in Life Cycle
Crack fill	maintenance	\$ 0.50	7	\$ 0.07	10	\$ 100,000	Yr 3, Yr 10, Yr 17
Patch and Sealcoat Urban	maintenance	\$ 2.50	7	\$ 0.36	3	\$ 150,000	Year 10
Mill & Overlay 1.5"	capital improvement	\$ 16.50	18	\$ 0.92	1.75	\$ 577,500	
Full depth shape & pave 3+"	capital improvement	\$ 27.50	25	\$ 1.10	1.50	\$ 825,000	

REQUESTED ACTION

Provide direction on the types of maintenance and paving projects to target. Provide a general budget amount to target.

ATTACHMENTS

- APPENDIX A Select PASER manual information
- APPENDIX B WISLR Maintenance vs Capital Improvement maps

APPENDIX A

Rating pavement surface condition

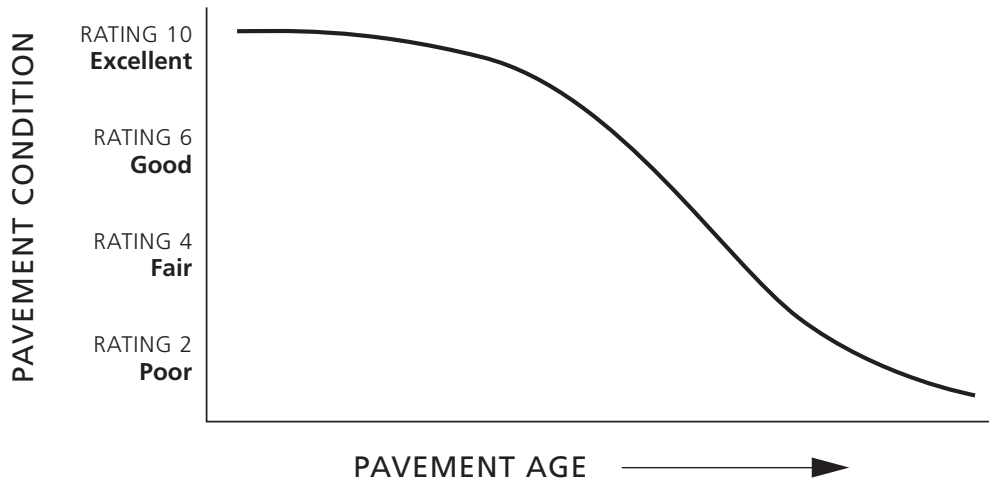
With an understanding of surface distress, you can evaluate and rate asphalt pavement surfaces. The rating scale ranges from **10—excellent** condition to **1—failed**. Most pavements will deteriorate through the phases listed in the rating scale. The time it takes to go from excellent condition (10) to complete failure (1) depends largely on the quality of the original construction and the amount of heavy traffic loading.

Once significant deterioration begins, it is common to see pavement decline rapidly. This is usually due to a combination of loading and the effects of additional moisture. As a pavement ages and additional cracking develops, more moisture can enter the pavement and accelerate the rate of deterioration.

Look at the photographs in this section to become familiar with the descriptions of the individual rating categories. To evaluate an individual pavement segment, first determine its general condition. Is it relatively new,

toward the top end of the scale? In very poor condition and at the bottom of the scale? Or somewhere in between? Next, think generally about the appropriate maintenance method. Use the rating categories outlined below.

Finally, review the individual pavement distress and select the appropriate surface rating. Individual pavements will **not** have all of the types of distress listed for any particular rating. They may have only one or two types.



In addition to indicating the surface condition of a road, a given rating also includes a recommendation for needed maintenance or repair. This feature of the rating system facilitates its use and enhances its value as a tool in ongoing road maintenance.

RATINGS ARE RELATED TO NEEDED MAINTENANCE OR REPAIR

Rating 9 & 10	No maintenance required
Rating 8	Little or no maintenance
Rating 7	Routine maintenance, cracksealing and minor patching
Rating 5 & 6	Preservative treatments (sealcoating)
Rating 3 & 4	Structural improvement and leveling (overlay or recycling)
Rating 1 & 2	Reconstruction

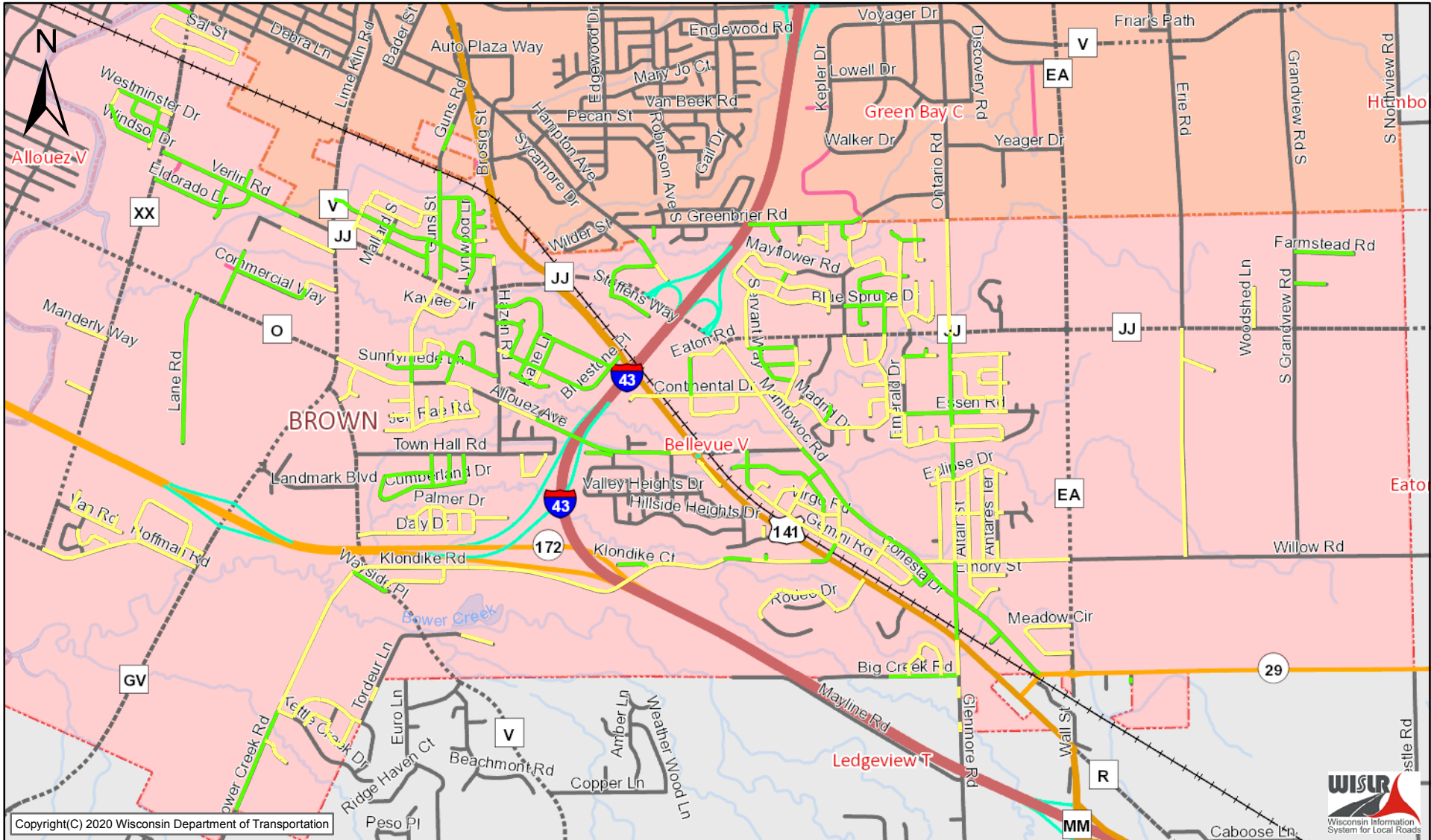
Rating system

Surface rating	Visible distress*	General condition/ treatment measures
10 Excellent	None.	New construction.
9 Excellent	None.	Recent overlay. Like new.
8 Very Good	No longitudinal cracks except reflection of paving joints. Occasional transverse cracks, widely spaced (40' or greater). All cracks sealed or tight (open less than 1/4").	Recent sealcoat or new cold mix. Little or no maintenance required.
7 Good	Very slight or no raveling, surface shows some traffic wear. Longitudinal cracks (open 1/4") due to reflection or paving joints. Transverse cracks (open 1/4") spaced 10' or more apart, little or slight crack raveling. No patching or very few patches in excellent condition.	First signs of aging. Maintain with routine crack filling.
6 Good	Slight raveling (loss of fines) and traffic wear. Longitudinal cracks (open 1/4"–1/2"), some spaced less than 10'. First sign of block cracking. Slight to moderate flushing or polishing. Occasional patching in good condition.	Shows signs of aging. Sound structural condition. Could extend life with sealcoat.
5 Fair	Moderate to severe raveling (loss of fine and coarse aggregate). Longitudinal and transverse cracks (open 1/2") show first signs of slight raveling and secondary cracks. First signs of longitudinal cracks near pavement edge. Block cracking up to 50% of surface. Extensive to severe flushing or polishing. Some patching or edge wedging in good condition.	Surface aging. Sound structural condition. Needs sealcoat or thin non-structural overlay (less than 2")
4 Fair	Severe surface raveling. Multiple longitudinal and transverse cracking with slight raveling. Longitudinal cracking in wheel path. Block cracking (over 50% of surface). Patching in fair condition. Slight rutting or distortions (1/2" deep or less).	Significant aging and first signs of need for strengthening. Would benefit from a structural overlay (2" or more).
3 Poor	Closely spaced longitudinal and transverse cracks often showing raveling and crack erosion. Severe block cracking. Some alligator cracking (less than 25% of surface). Patches in fair to poor condition. Moderate rutting or distortion (1" or 2" deep). Occasional potholes.	Needs patching and repair prior to major overlay. Milling and removal of deterioration extends the life of overlay.
2 Very Poor	Alligator cracking (over 25% of surface). Severe distortions (over 2" deep) Extensive patching in poor condition. Potholes.	Severe deterioration. Needs reconstruction with extensive base repair. Pulverization of old pavement is effective.
1 Failed	Severe distress with extensive loss of surface integrity.	Failed. Needs total reconstruction.

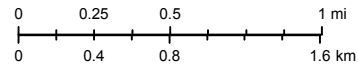
* Individual pavements will not have all of the types of distress listed for any particular rating. They may have only one or two types.

APPENDIX B

WISLR Map - Pavement Review



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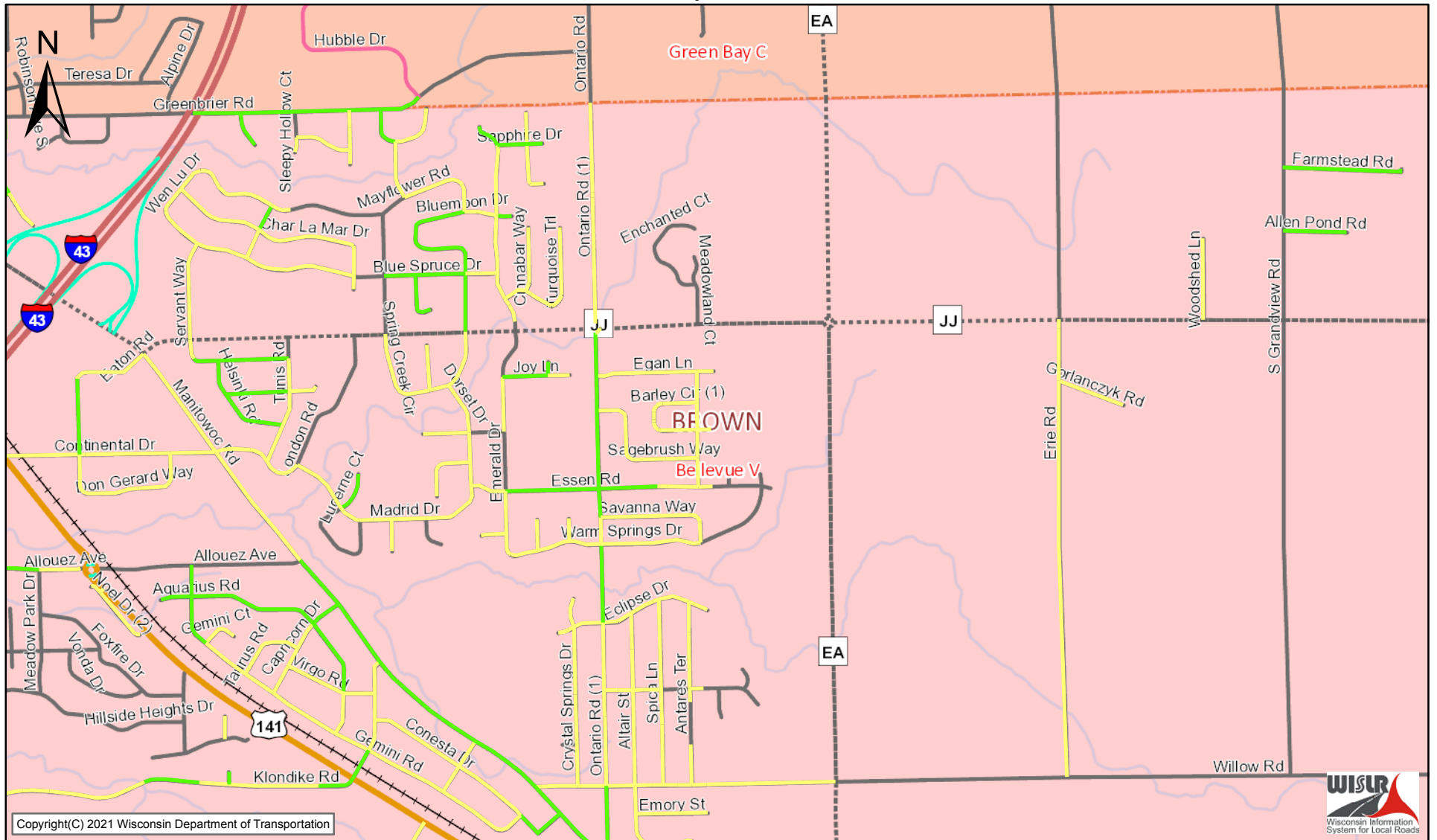


- wislr-f13**
- Maintenance
 - Capital
 - No Improvement
- State Trunk Network**
- USH Highway
 - USH Connecting Highway
 - State Trunk Highways
 - STH Connecting Highways
 - Interstate Highway
 - Frontage Road
 - Wayside
 - Rest Area
 - Weigh Station
 - Connector
 - County Forest Roads
 - Other County Roads
 - Local Roads**
 - Municipal/Local Roads
 - Ineligible Roads
 - County Trunk Hwy
 - Lakes
 - Rivers
- Counties**
- City
 - Village
 - Town
 - Counties

Yellow indicates Maintenance needed
 Green indicates Capital Improvement
 Gray indicates no improvement needed

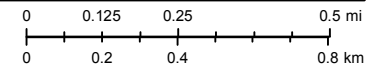


WISLR Map - Northeast



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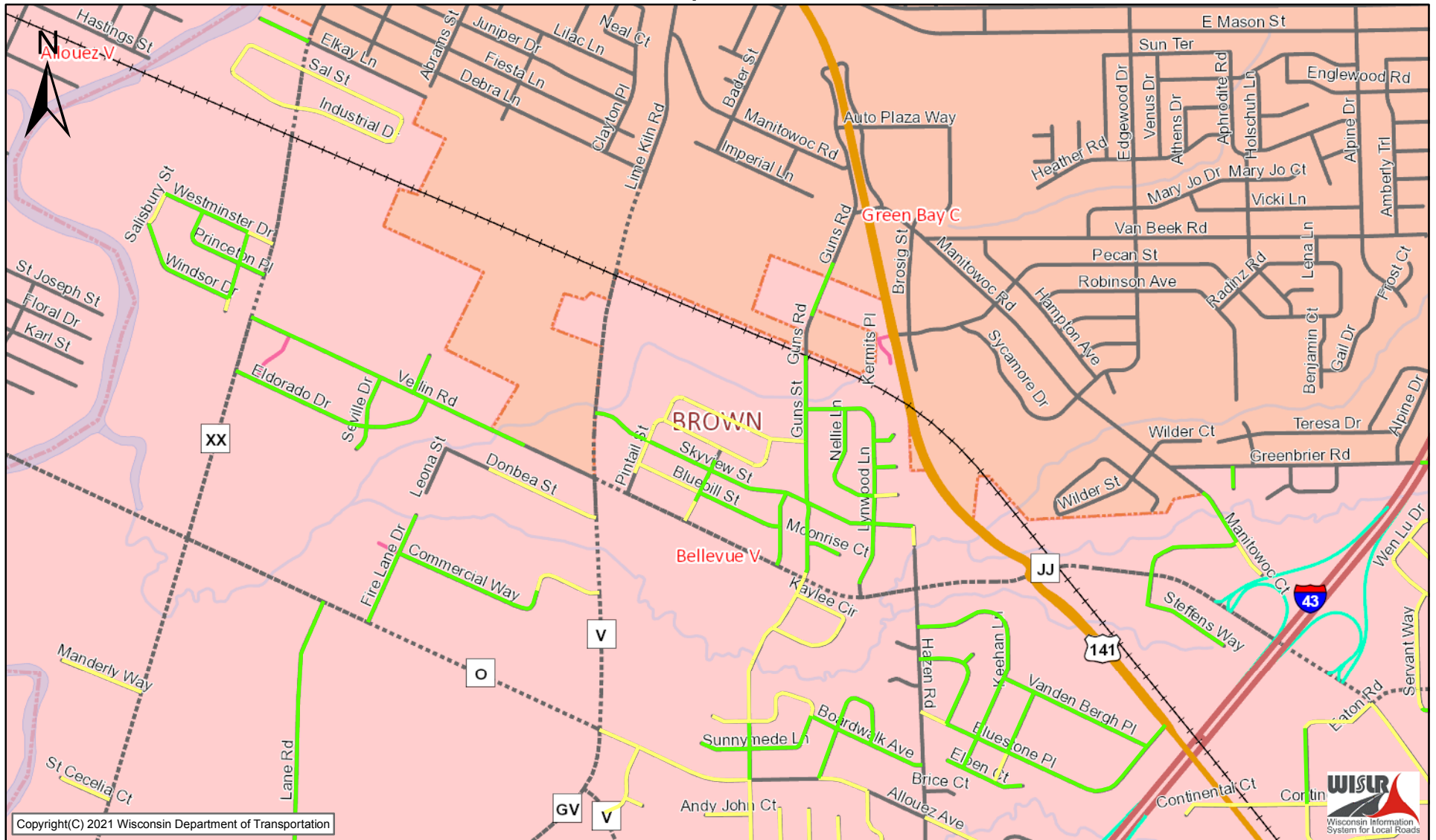
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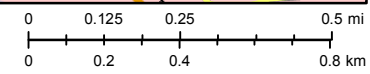
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|----------------------------|-------------------------|---------------------|-----------------------|------------------------------|
| wislr-f13 | USH Highway | Frontage Road | County Forest Roads | Lakes |
| Maintenance | USH Connecting Highway | Wayside | Other County Roads | Cities/Villages/Towns |
| Capital | State Trunk Highways | Rest Area | Local Roads | City |
| Railroads | STH Connecting Highways | Weigh Station | Municipal/Local Roads | Village |
| State Trunk Network | On-Off Ramp | County Roads | Ineligible Roads | Town |
| Interstate Highway | Connector | County Trunk Hwy | Rivers | Counties |



WISLR Map - Northwest



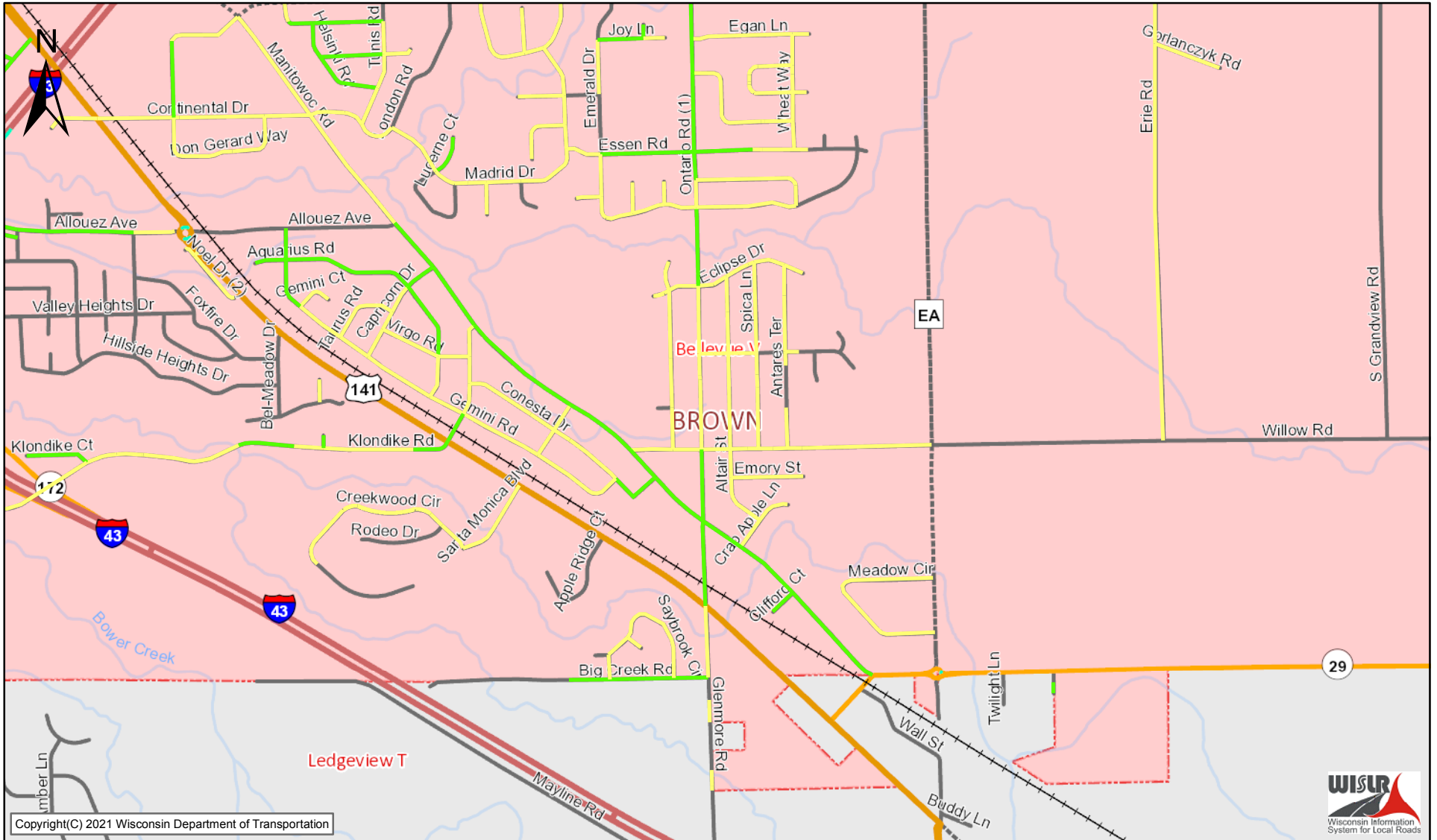
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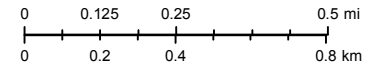
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| wislr-f13 | USH Highway | Frontage Road | County Forest Roads | Lakes |
| Maintenance | USH Connecting Highway | Wayside | Other County Roads | Cities/Villages/Towns |
| Capital | State Trunk Highways | Rest Area | Local Roads | City |
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WISLR Map - Southeast

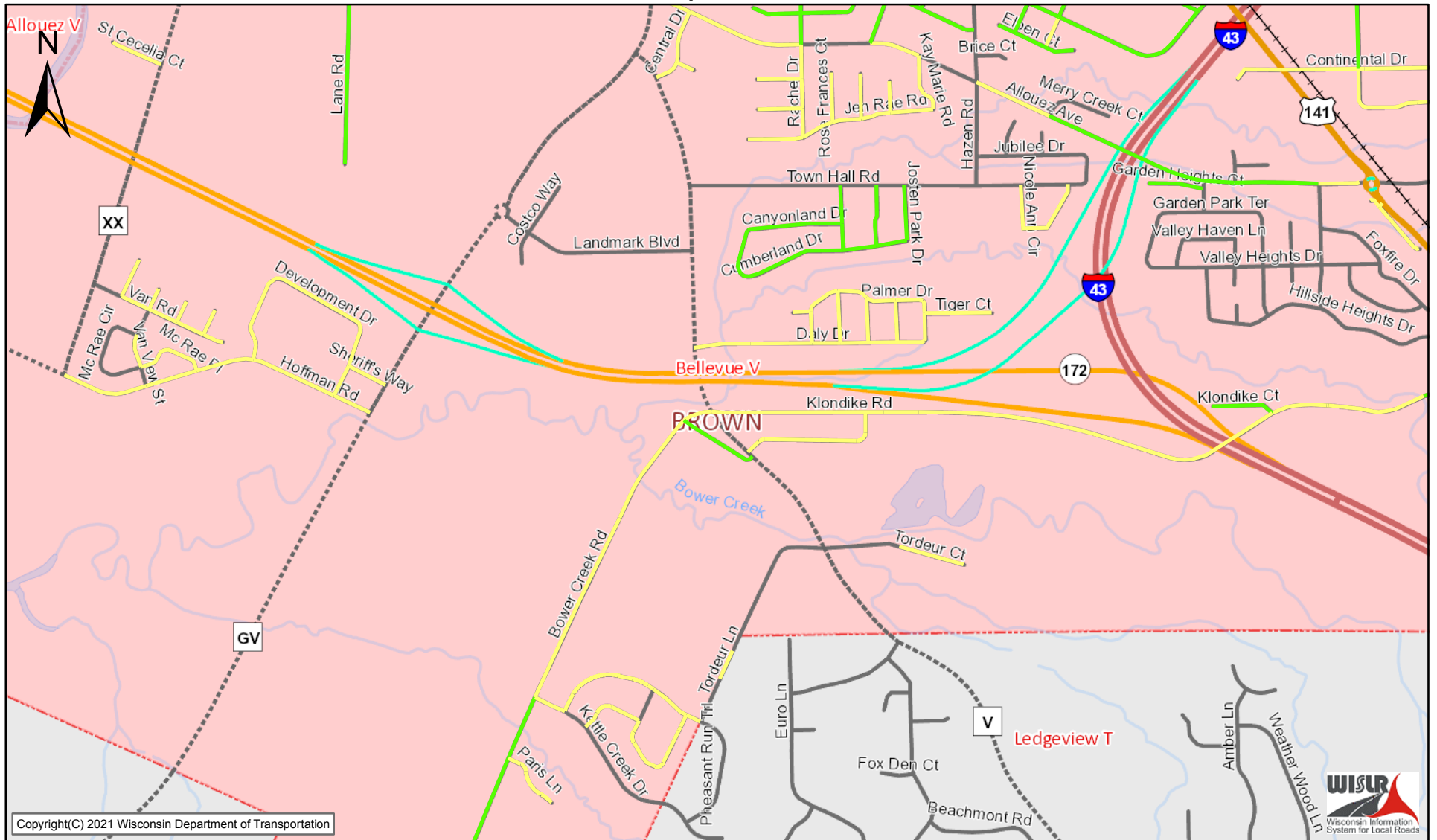


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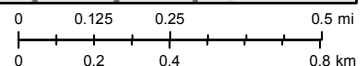
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| wislr-f13 | USH Highway | Frontage Road | County Forest Roads | Lakes |
| Maintenance | USH Connecting Highway | Wayside | Other County Roads | Cities/Villages/Towns |
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WISLR Map - Southwest



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|----------------------------|-------------------------|---------------------|-----------------------|------------------------------|
| wislr-f13 | USH Highway | Frontage Road | County Forest Roads | Lakes |
| Maintenance | USH Connecting Highway | Wayside | Other County Roads | Cities/Villages/Towns |
| Capital | State Trunk Highways | Rest Area | Local Roads | City |
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