2024 PAVEMENT ASSET MANAGEMENT PLAN

AND SUPPLEMENTAL TRANSPORTATION ASSETS

City of Goshen Pavement Asset Management Plan 2024

Approved by:

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Definitions

Alligator Cracks – Interconnected cracks that form small pieces, usually one inch to 6 inches in size.

Block Cracks – Interconnected cracks that form large blocks, usually at right angles.

Distortion – Shoving or rippling surface material displaced crossways to the direction of traffic.

Flushing – The excess asphalt on the surface caused by a poor initial asphalt mix design.

Longitudinal Cracks – Cracks that run parallel to the direction of traffic.

Maltenes - The n-alkane-soluble molecular components of asphalt, which is the residue remaining after petroleum refiners remove other useful derivatives such as gasoline and kerosene from crude oil.

Patches – Original surface repaired with new asphalt material.

Polishing – A smooth slippery surface caused by traffic wearing off sharp edges of aggregate.

Potholes – Holes or loss of pavement material.

Raveling – The progressive loss of pavement material from the surface downward.

Reflection Cracks – Cracks in overlays that reflect the crack pattern in the pavement underneath.

Rutting – The displacement of unstable material or traffic compaction that creates channels in wheel paths.

Slippage Cracks – Crescent or rounded cracks in the direction of traffic.

Transverse Cracks – Cracks that run perpendicular to the flow of traffic.

Plan Overview

The City of Goshen is responsible for maintaining the city's transportation assets, including roadways and culverts. The City of Goshen has set both short-term and long-term condition targets for their roadways. In order to meet the long-term targets, the City of Goshen must continue to plan, budget, and adjust projects on the roadways to reach these standards.

The purpose of this plan is to rate the current pavement conditions of each roadway segment to identify the maintenance, repair, and replacement activities needed. The City of Goshen has approximately 146 centerline miles of roadway, which is approximately 300 lane miles of roadway. Utilizing PASER guidelines, the results of the survey will help to develop maintenance, repair, and replacement programs in consideration of available funds. This plan will be updated annually, with the PASER survey to occur annually as well.

This asset management plan is performance based. The objectives of this plan are measurable and support our day-to-day operations as well as our strategic goals. The city has developed this plan with resiliency in mind to give our roadways the best level of service possible through extreme Indiana weather. Funding decisions will be made from this plan, such as where to allocate funds across our roadway network, based off of thorough analysis. This asset management plan will rely on quality information and data to make such analyses and should be revisited annually at a minimum to ensure data are up to date. In order to best serve the city, it is recommended to have an operational year from November 1st through October 31st. This operational time frame ensures the city can maintain compliance with annual reporting requirements for funding and grant opportunities.

This plan is designed to improve the overall condition of the City of Goshen's pavement assets. While immediate progress may not be noticeable, following the steps outlined in this plan should increase the average rating of the city's pavement network. The City of Goshen wishes to keep as many roads in the good condition as possible, and as many roads in the fair condition as possible. This means the city will aim for an average PASER score of 4.0 or higher on Local roadways, and a PASER score of 6.0 or higher on Arterial or Collector roadways. They City of Goshen will also work to move all roads in poor condition to good or fair condition. If for any reason the average rating of the city's pavement network decreases noticeably, this plan should be revised to address any insufficiencies.

What is the PASER System?

PASER stands for Pavement Surface Evaluation and Rating. The PASER system is a comprehensive pavement management system that involves collecting data and assessing several road characteristics, such as roughness, surface distress, surface skit conditions, and structure. Surface condition is one of the most vital elements in any pavement management system. Using the simplified rating system that is presented in the Asphalt PASER Manual to evaluate our roadways, combined with our inventory data, can be very helpful in planning future budgets and setting priority target areas.

Each year the City of Goshen will inventory all local roadways, evaluate the condition of the pavement surface, and use the condition evaluations to set priorities for projects and select alternative treatments based on the overall condition of the road segment. Using the PASER scale, a road segment is given a score of 1 – 10, with 10 being used to score a brand new segment and 1 being used to score a segment that has completely failed. To more closely identify the treatment that should be used to the entire segment, the segment is given a score based off of the worst area within the segment. The following section provides guidance of all possible PASER scores and their appropriate treatment and maintenance activities.

PASER Rating of 10

Roads with a PASER rating of 10 are road segments of brand new construction. They do not have any visible distresses and require no treatments. Maltene Replacement Treatment can be added to extend the life of the roadway.

PASER Rating of 9

Roads with a PASER rating of 9 are road segments of new construction or road segments with a recent overlay. They do not have any visible distresses and require no treatments. Maltene Replacement Treatment can be added to extend the life of the roadway.

PASER Rating of 8

Roads with a PASER rating of 8 are road segments that have no longitudinal cracks except reflection of pavement joints. Occasional transverse cracks widely spaced (40’ or greater). All cracks sealed or tight (open less than 1/4"). Treatments are crack sealing in order to extend the life of the road segment one to three years.

PASER Rating of 7

Roads with a PASER rating of 7 show first signs of aging. Very slight or no raveling occurring, 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 with little or slight crack raveling. No patching or very few patches in excellent condition. Treatments are crack sealing in order to extend the life of the road segment one to three years.

PASER Rating of 6

Roads with a PASER rating of 6 show signs of aging but have a sound structural condition. Slight raveling (loss of fines) and traffic wear. Longitudinal cracks (open 1/4" to 1/2") some spaced less than 10’. First sign of block cracking. Slight to moderate flushing or polishing. Occasional patching in good condition. Treatments are crack sealing to extend the life of the road segment one to three years.

PASER Rating of 5

Roads with a PASER rating of 5 show signs of surface aging but has a sound structural condition. Moderate to severe raveling (loss of fine and coarse aggregate). Longitudinal and transvers 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. Treatments are milling and resurfacing to extend the life of the roadway five to ten years.

PASER Rating of 4

Roads with a PASER rating of 4 show significant aging and first signs of need for strengthening. Severe surface raveling. Multiple longitudinal and transverse cracking in wheel path. Block cracking (over 50% of surface). Patching in fair condition. Slight rutting or distortions (1/2” deep or less). Road treatments are milling and resurfacing, along with 25% full-depth patching to remove deterioration to extend the life of the roadway five to ten years.

PASER Rating of 3

Roads with a PASER rating of 3 need patching and repair prior to major overlay. 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. Road treatments are milling and resurfacing, with 50% patching to remove deterioration to extend the life of the roadway five to ten years.

PASER Rating of 2

Roads with a PASER rating of 2 have severe deterioration. Alligator cracking (over 25% of surface). Severe distortions (over 2” deep). Extensive patching in poor condition and potholes. Road treatments are full reconstruction.

PASER Rating of 1

Roads with a PASER rating of 1 have completely failed. Severe distress with extensive loss of surface integrity. Treatments are full reconstruction.

PASER Survey and Work Plan

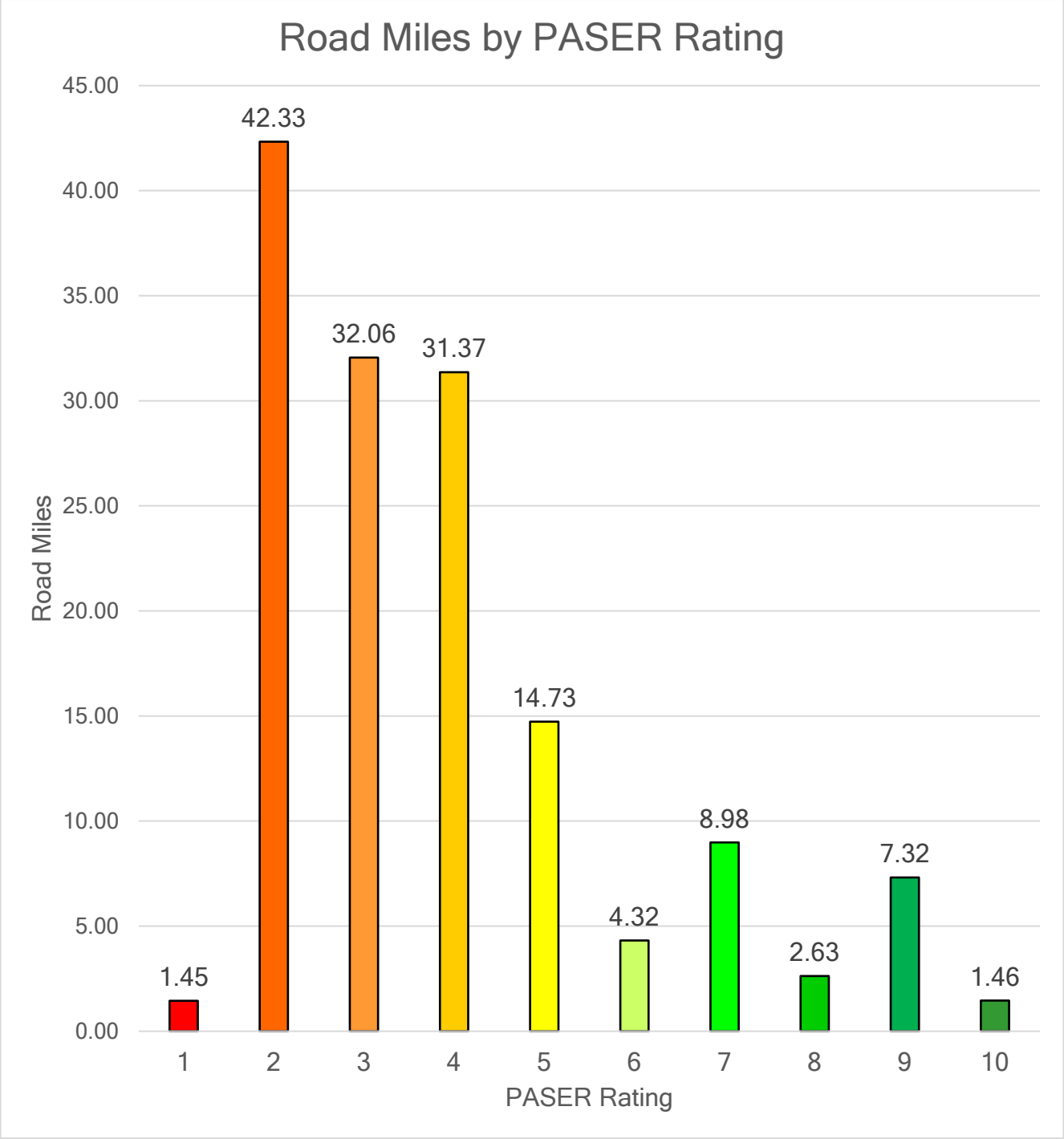
The City of Goshen has created roadway segments by breaking the roads into segments from intersection to intersection. Each roadway segment is given attributes for width and length from the city's geographic information system (GIS). The City of Goshen utilized 3-person teams to perform the PASER survey. Each roadway segment was driven and surveyed, then an appropriate score and photo were uploaded into a mobile GIS application designed in coordination between the Goshen Street Department and the city's GIS Coordinator which directly suits the functions and operations of our team. The survey was performed during April 2024, and any road segments that received treatment were reevaluated after their applied treatment in order to provide an accurate PASER score. All team members who have performed the survey and applied rating scores to roadway segments have been fully trained through Indiana's Local Technical Assistance Program (LTAP). A full training of the city's GIS application was also given to all team members who use it.

Goshen's Existing Roadway Conditions

The City of Goshen currently has 146.64 miles of roadway. The current average PASER rating across all roadway segments is **4.01**, with a weighted PASER rating of 3.90. A PASER score of 4.0 is deemed acceptable for low traffic, local roadways. However, Arterial and Collector roadways that see much more traffic are deemed to require a PASER score of 6.0 in order to maintain service to Goshen residents and non-resident travelers. A full list of our roadway inventory can be found at the end of this document as Appendix A. The table below shows the mileage summary for the associated PASER rating.

The charts below show the mileage summary for the associated PASER rating.

Rating and Mileage Summary		
Rating	Road Miles	Percentage
1	1.48	1.01%
2	42.89	29.29%
3	32.98	22.52%
4	31.62	21.59%
5	14.63	9.99%
6	4.44	3.03%
7	9.01	6.15%
8	2.63	1.79%
9	5.27	3.60%
10	1.50	1.02%

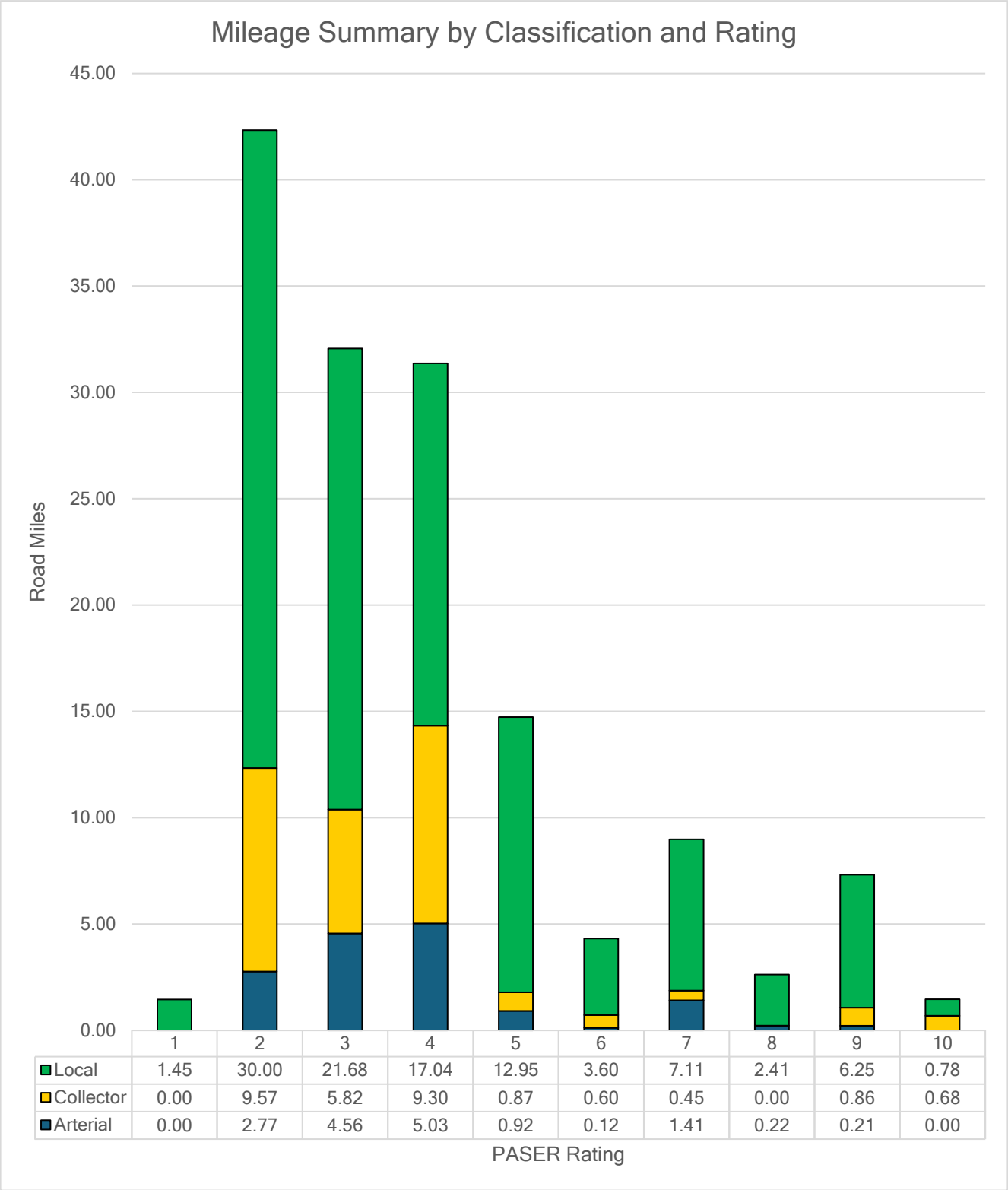


We can take our data one step further and introduce the road classes. The classes that make up the City of Goshen's road network are Local, Collector, and Arterial. Of the city's overall mileage, there are 103.25 miles of Local roadway, 28.15 miles of Collector roadway, and 15.24 miles of Arterial roadway. The average PASER rating for Local roadway is 4.05, the average PASER score for Collector roadway is 3.66, and the average PASER score for Arterial roadway is 4.22.

The table below shows the mileage summary for the associated PASER rating, sorted by road classes.

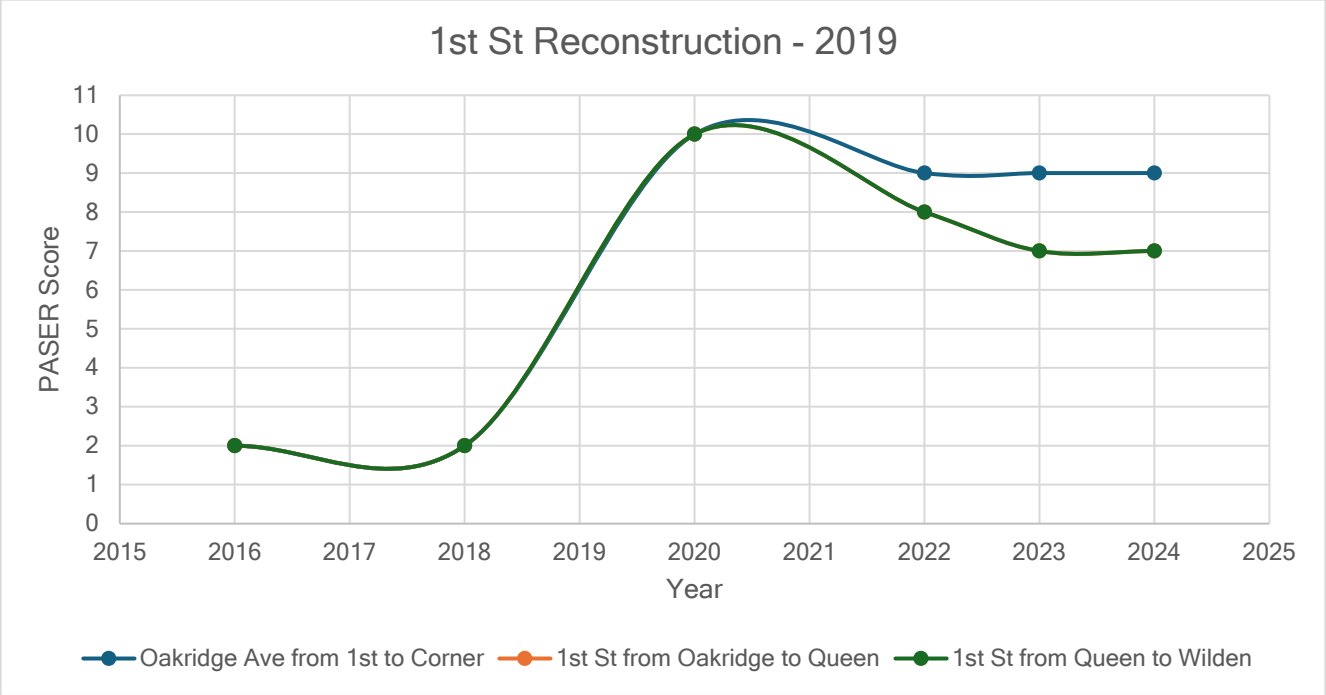
	Rating	Road Miles	Percentage
Arterial	1	0.00	0.00%
	2	2.77	18.16%
	3	4.56	29.92%
	4	5.03	33.00%
	5	0.92	6.02%
	6	0.12	0.78%
	7	1.41	9.28%
	8	0.22	1.44%
	9	0.21	1.41%
	10	0.00	0.00%
	Total	**15.24**	100.00%
Collector	1	0.00	0.00%
	2	9.57	33.98%
	3	5.82	20.68%
	4	9.30	33.03%
	5	0.87	3.09%
	6	0.60	2.13%
	7	0.45	1.61%
	8	0.00	0.00%
	9	0.86	3.04%
	10	0.68	2.43%
	Total	**28.15**	100.00%
Local	1	1.45	1.40%
	2	30.00	29.05%
	3	21.68	21.00%
	4	17.04	16.50%
	5	12.95	12.54%
	6	3.60	3.49%
	7	7.11	6.89%
	8	2.41	2.33%
	9	6.25	6.05%
	10	0.78	0.75%
	Total	**103.25**	100.00%

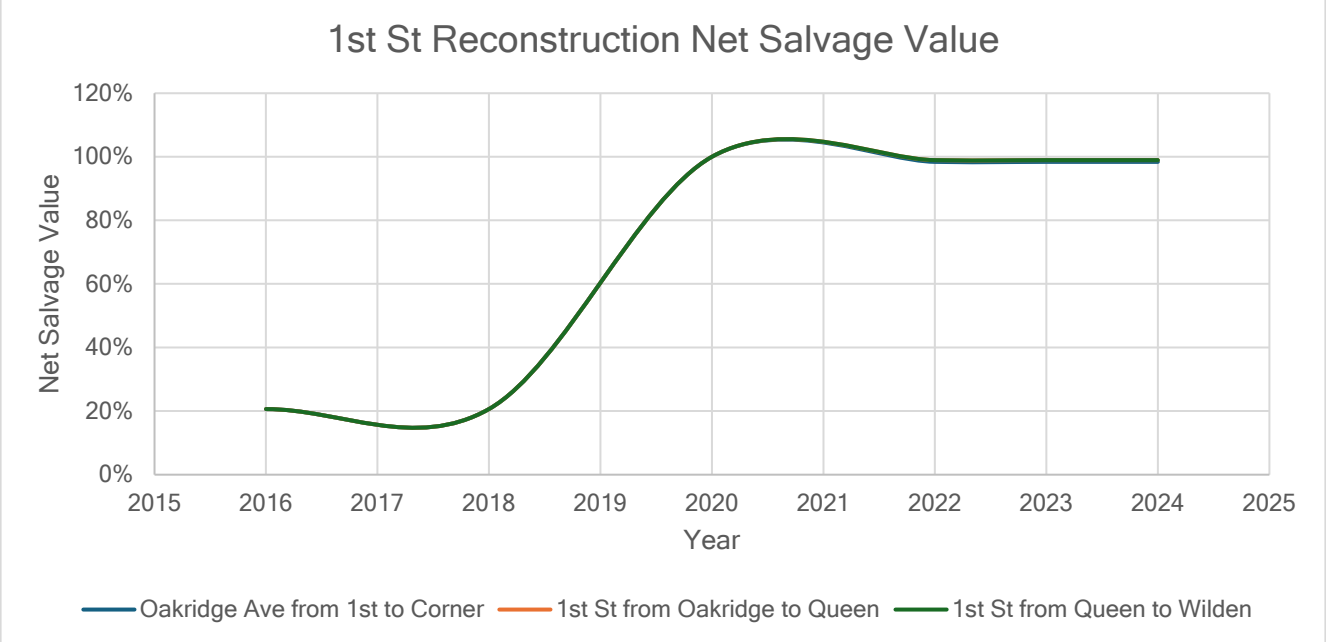
The chart below shows the mileage summary for the associated PASER rating, sorted by road classes.



	1	2	3	4	5	6	7	8	9	10
Local	1.45	30.00	21.68	17.04	12.95	3.60	7.11	2.41	6.25	0.78
Collector	0.00	9.57	5.82	9.30	0.87	0.60	0.45	0.00	0.86	0.68
Arterial	0.00	2.77	4.56	5.03	0.92	0.12	1.41	0.22	0.21	0.00

The charts below represent some of the further analysis that has been performed on Goshen's roadway network. Graphing degredation of our roadways has helped determine effective levels of treatment, both good and poor, at different PASER ratings, as well as monitoring the consistency of our PASER analysis. Additionally, net salvage values can be obtained from the current condition of these roadways to determine the gap between the cost of new roadway and its current condition. These charts are available for all roadyway segments that have received treatment since the start of Goshen's PASER data collection in 2016.





Pavement Maintenance and Cost

The City of Goshen is taking an approach to road maintenance known as the mix of fixes. A mix of fixes approach puts funding towards pavement in need of major rehabilitation or reconstruction, but also addresses roads in good and fair condition in an effort to extend their useful life. The mix of fixes used in the City of Goshen are preventative maintenance, non-structural preservation treatment, rehabilitation or structural repairs, and reconstruction or replacement. These methods will be assessed annually to determine treatment effectiveness.

Preventative Maintenance

Preventative maintenance are treatments applied to pavements that are in relatively good condition. These are typically low cost treatments that slow the rate of deterioration, such as crack sealing or matlene replacement.

Non-structural Preservation Treatment

Non-structural preservation treatments are a broad category of treatments which can include preventative maintenance activities as well as minor rehabilitation activities, such as thin overlays, micro surfacing, chip seal, or seal coating. Usually less than 2 inches in depth, and used to treat signs of distress such as block cracking and transverse cracking.

Rehabilitation or Structural Repairs

Rehabilitation or structural repairs are necessary when assets have deteriorated significantly and more subtantial treatments are needed. Rehabilitation treatments include structural enhancements to the pavement that extend the service life and improve the ability to carry traffic loads, such as mill and pave treatments.

Reconstruction or Replacement

When assets are considered to have failed, they are candidates for reconstruction or replacement. Reconstruction usually requires the complete removal and replacement of the existing pavement structure.

Cost Summary

The following table summarizes the required funds to treat the City of Goshen's roadway network with their appropriate treatments.

Cost Summary					
Rating	**Total Miles**	**Treatment**	**Estimated Cost Per Mile**	**Estimated Cost**	**Typical Performance Periods**
10	1.46	No Treatment Required	$ -	$ -	0 Years
9	7.32	Maltene Replacement Treatment	$ 27,500.00	$ 201,193.18	5 - 7 Years
8	2.63	Crack Sealing	$ 10,000.00	$ 26,265.63	1 - 3 Years
7	8.98	Crack Sealing	$ 10,000.00	$ 89,822.37	1 - 3 Years
6	4.32	Crack Sealing	$ 10,000.00	$ 43,211.20	1 - 3 Years
5	14.73	Milling and Resurfacing	$ 300,000.00	$ 4,419,819.44	5 - 10 Years
4	31.37	Milling and Resurfacing with 25% Patching	$ 350,000.00	$ 10,977,945.34	5 - 10 Years
3	32.06	Milling and Resurfacing with 50% Patching	$ 400,000.00	$ 12,824,576.67	5 - 10 Years
2	42.33	Full Reconstruction	$ 750,000.00	$ 31,746,904.88	20 - 30 Years
1	1.45	Full Reconstruction	$ 750,000.00	$ 1,086,768.05	20 - 30 Years
			Total:		**61,416,506.76**

The costs listed above are reflective of the treatment option most likely to be used by the City of Goshen and the estimations based on costs of recent project bids. Total costs to provide city residents with a perfect roadway infrastructure shows the importance of treating roadways at higher scores rather than letting them fail. This number is approximately $800,000 ***less*** than the previous year showing a positive trend in roadway treatment needs unlike previous years. The following table shows the cost to replace the City of Goshen's roadway infrastructure if every segment were to fail.

Class	**Arterial**	**Collector**	**Local**	**Total**
Miles	15.24	28.15	103.25	146.64
Cost	$11,430,000.00	$21,112,500.00	$77,435,500.00	**$109,980,000.00**

If every roadway segment in the City of Goshen were to deteriorate and fail, the total cost to reconstruct every roadway segment in the infrastructure would cost **$109,980,000.00** based on current bid estimations. This number is almost twice the overall total of the city's entire operating budget for a single year. This cost is not feasible for the City of Goshen to spend on roadway and reinforces the need for an asset management program in order to extend the life of the roadway. The following table gives an example of what a series of treatments could look like for a single roadway segment in the City of Goshen's infrastructure.

Preservation Strategy

The following table represents the estimated cost per life cycle of a single roadway segment in the City of Goshen's roadway network. The cost is broken down by the estimated year and estimated PASER score of the roadway segment and the appropriate treatment to be applied for such a condition.

Year	Estimated PASER Score	Treatment	Estimated Cost
2	9	MRT	$2,750.00
7	8	Crack Seal	$1,100.00
10	6	Crack Seal	$1,100.00
13	4	Mill and Overlay	$33,000.00
18	7	Crack Seal	$1,100.00
21	6	Crack Seal	$1,100.00
24	3	Mill and Overlay	$33,000.00
27	6	Crack Seal	$1,100.00
30	2	Reconstruction	$82,500.00
Segment cost per life cycle			$156,750.00
Segment cost per year			$5,225.00
Total number of segments			1344
Total budget needed per year			**$7,022,400.00**

These numbers represent the average road segment length of 0.11 centerline miles long using the numbers first mentioned in the Cost Summary section of this asset management plan. If you take the price per segment per year and apply it to all 1,344 segments in the City of Goshen's roadway network, the total comes out to **$7,022,400.00** per year in order to keep up with maintenance costs of all roadways based on current bid estimations.

Treatment Summary

The following table shows the total mileage of treatements applied to the city's roadway network for the previous 5 years.

Treatment	2020	2021	2022	2023	2024	Costs
Crack Seal	18.37	8.46	4.54	12.25	17.58	**$ 612,000.00**
Overlay - 1.5"	0.41	0.19	1.68	0.34	0	**$ 196,500.00**
Mill and Resurface - 1.5"	0	0	3.3	0	0	**$ 990,000.00**
Mill and Resurface - 2"	0.58	3.92	0	1.9	0.66	**$ 2,294,500.00**
Mill and Resurface - 4"	0	0	0	0.56	0	**$ 224,000.00**
Reconstruction - Asphalt	0.45	3.53	1.02	1.4	0.24	**$ 4,980,000.00**
Reconstruction – Concrete	0.7	0.4	0.67	0	0	**$1,539,900.00**
Full Depth Reclamation with Asphalt	0	0	0	0.2	0	**$ 90,000.00**
Rejuvenator	0	0	0	0	3.64	**$ 100,100.00**
Total Miles	19.36	12.65	9.52	16.65	22.12	--
Costs	**$1,349,450.00**	**$4,368,350.00**	**$2,509,300.00**	**$2,129,500.00**	**$ 670,400.00**	**$ 11,027,000.00**

It should be noted that 2024 is substantially lower than previous years. This is due to a timing issue with a roadway project. Planned roadway work scheduled for 2024 is going to occur in 2025 ***in addition to*** work scheduled for 2025. Without knowing what the annual budget will be for the street infrastructure, it is better to look at allocations based on a percentage approach, rather than a dollar amount. The main preservation treatment types that the City of Goshen will be applying to the roadway will be Maltene Rejuvination, Crack Sealing, Milling and Paving, and Full Reconstruction. It is suggested that the City of Goshen allocate their budget in order to address all four treatment types, with the percentage of the budget large enough to encompass applying Maltene Rejuvination to all PASER rating 10 roadway segments. A possible allocation split for the budget would be 45% allocation towards Full Reconstruction, 45% allocation towards Milling and Paving, 5% allocation towards Crack sealing, and 5% allocation for Maltene Replacement, up to the amount needed, then the remaining allocation to be used towards Milling and Paving.

The following table is an example of the budget allocation based on the described percentages above for a total of $2,500,000.00.

Treatment	Cost per Mile	Allocated Budget	Total Miles
Rejuvenation	$25,000.00	$100,000.00	4
Crack Sealing	$10,000.00	$100,000.00	10
Mill and Paving	$400,000.00	$800,000.00	2.0
Full Reconstruction	$750,000.00	$1,500,000.00	2.0

This allows for approximately 2 miles of full reconstruction, 2 miles of Milling and Paving, a substantial amount of crack sealing, and 4 miles of Maltene Replacement Treatment needed for 2025. These numbers will change depending on annual needs. Funding allocations are bound to fluctuate based on proposed projects and roadway needs. However, total funding spent will not change. This exclamates the importance of determining which roadway treatments need completed at which time. Previous analysis has shown that roadway degradation occurs too quickly and treatments need monitored closely moving forward. If proposed treatment plans as part of this AMP do not address the fast degradation issues, adjustments should be made to slow down the rapid deterioation of our roadway surfaces.

Drainage and Right of Way

Right of Way

The City of Goshen maintains Right of Way (ROW) data for all public roadways within city limits. All ROW measurements are contained directly in our roadway segment inventory which is submitted annually to the State of Indiana. These ROW measurements help Goshen determine ROW utilization, showing both limitations and areas where potential infrastructure expansions can occur. As the City of Goshen starts a new project, a survey is performed to ensure ROW data is accurate and can support the proposed infrastructure work. If enough ROW is not present for proposed work, additional ROW would be required and appropriate steps to obtain ROW will be taken in accordance with Indiana regulations.

Drainage

The City of Goshen maintains drainage information within our service boundaries. Drainage classifications are contained directly in our roadway segment inventory which is submitted annually to the State of Indiana. Our Department of Stormwater has detailed knowledge of any drainage concerns and is consulted before any work is done. As projects are surveyed, drainage on these roadways will be evaluated. If there are any drainage issues, they will be addressed and corrected during design and construction. The City of Goshen's drainage consists of curb and gutter, ditches, swales, and stormwater infrastructure. Generally, our drainage is adequate, with less than 10% of our roadways having poor drainage due to lack of infrastructure. Having available infrastructure is not beneficial unless the infrastructure is properly maintained and in good working order. Maintenance is regularly performed on drainage assets to ensure stormwater is collected and/or removed from the roadway adequately and safely.

Additional Transportation Assets

A transportation network is comprised of a complex network of assets working together to ensure safe and compliant travels for all. When installed correctly and followed accordingly, roadway transportation assets allow vehicles, bicycles, and pedestrians alike reach their destinations quickly and safely. The City of Goshen strives to maintain this network in a good condition, and has established maintenance programs for each asset.

Signs

Signs regulate many aspects of transportion, including vehicular movements, restrictions, and even pedestrian safety warnings. These are just a few of the reasons why maintaining a good condition on signs is of the upmost importance. The City of Goshen has approximately 8,900 signs in it's transportation network that are owned and maintained by the city, the state, or private entities. These signs are all spatially mapped providing accurate locations for our sign network. Knowing the location of these signs and their intended function helps to analyze both the strength of our network and any potential safety gaps that need addressed. Along with being mapped, data is collected with each sign and includes owner, size, Manual on Uniform Traffic Control Devices (MUTCD) type and code, mounting height, condition, and related pole information. The City of Goshen established a maintenance program through an adopted ordinance and resolution requiring that signs are replaced every 10 years, or when they no longer meet retroreflectivity minimum standards, whichever comes first.

Sidewalks

Sidewalk is an essential piece of infrastructure that allows pedestrians to reach their destinations while giving them a designated travel area outside of the flow of vehicular traffic. Designated travel areas are meaningless if they are not kept in a condition where they are accessible and usable to the public. The City of Goshen has approximately 58 miles of sidewalk infrastructure in it's transportation network. All sidewalks have been evaluated for connectivity, width, and trip hazards. It was determined that trip hazards are among the highest concerns for safety while traversing a sidewalk, and took priority in our inventory efforts. In addition to our sidewalks, Goshen has collected an inventory of curb ramps and currently has approximately 1,650 in total. Curb ramps are an essential piece of transportation infrastructure which allow residents to easily traverse between walking paths and the hard surfaces they cross. Knowing where these are and what condition they are in will help to ensure they can be maintained in a condition that does not hinder transportation activities.

Pavement Markings

Pavement markings are safety driven indicators helping to maintain and regulate the flow of traffic on roadways. The City of Goshen is actively working on collecting a pavement marking inventory for the entire city, including details such as width and retroreflectivity. The MUTCD contains both regulations and guidance on how pavement markings need to be and should be used. Maintaining an up-to-date inventory of pavement markings will ensure that safety standards are upheld and minimum standards are achieved. The MUTCD mandates that new retroreflectivity standards must be maintained on pavement markings for roadways with speed limits of 35 MPH or higher, effective September 26, 2026. The City of Goshen is working on a policy to ensure minimum retroreflectivity standards are maintained on pavement markings by the September 26, 2026 deadline.