Noble County Highway Department

Transportation Asset Management - Highways

2021 Road Rehabilitation and Maintenance Plan

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Purpose

This document was developed in conjunction with the *Road Evaluation Report* as a budgetary tool to prioritize pavement rehabilitation and maintenance projects based on lifecycle cost to maximize the annual road repair budget. This plan provides an engineering method to determine pavement rehabilitation needs, detailed cost estimate of those needs and prioritization of projects within the entire system. This document provides both an annual plan and a five-year projection for road improvements. The projected plan documents the Noble County Highway's intent in both scope and timeline; however, the scope of work is subject to change based on available funding and is therefore, not guaranteed. Additionally, changes may be made to the plan when either beneficial or necessary based on changes in road condition.

Several road factors are considered when developing the road plan. The following are a list of road factors used to develop a balanced and sustainable road improvement plan.

Road Condition

The road condition value is based on the rating from the Road Evaluation Report. Road rating values are based on the PASER scale.

A roadway given the rating of “1” represents a roadway that has complete structural failure. The pavement surface with this rating displays excessive surface distress and loss of structural integrity; the roadway surface is failed and needs total reconstruction. A rating of “9” indicates the pavement surface is in excellent condition, displaying no visible signs of distress, and having a quality rating of new construction. A rating of "10" is used as a placeholder for new roads, while a rating of "0" is used to designate gravel roads.

Roads with PASER ratings of 8-9 (Excellent - Very Good) requires only routine maintenance such as: ditch cleaning, shoulder grading and minor patching or sealing to prevent drainage and environmental issues.

Roads with PASER ratings of 6-7 (Good) require preservation applications, such as crack sealing, surface sealing or pavement rejuvenation. These applications address minor deficiencies and provide additional protection at a fraction of the cost of reconstruction. Preservation techniques are the most cost-effective treatments to extend the surface life of roadways.

Roads with PASER ratings of 4-5 (Fair) require rehabilitation, such as patching, wedging or webbing of hot mix asphalt (HMA) combined with a complete surface seal, such as a double chip and seal or HMA overlay. The purpose of rehabilitation is to address minor structural issues and seal the roadway before it requires major reconstruction. Rehabilitation is more costly than preservation, but considerably more cost effective than reconstruction.

Roads with PASER ratings of 1-3 (Poor - Failed) require structural improvements, such as partial depth reconstruction (PDR), full depth reclamation (FDR) or reconstruction. These methods are the least cost-effective approach, but are required to regain structural integrity. See *Figure 1 - County Wide Road Rating Map* for a complete inventory of road condition data.

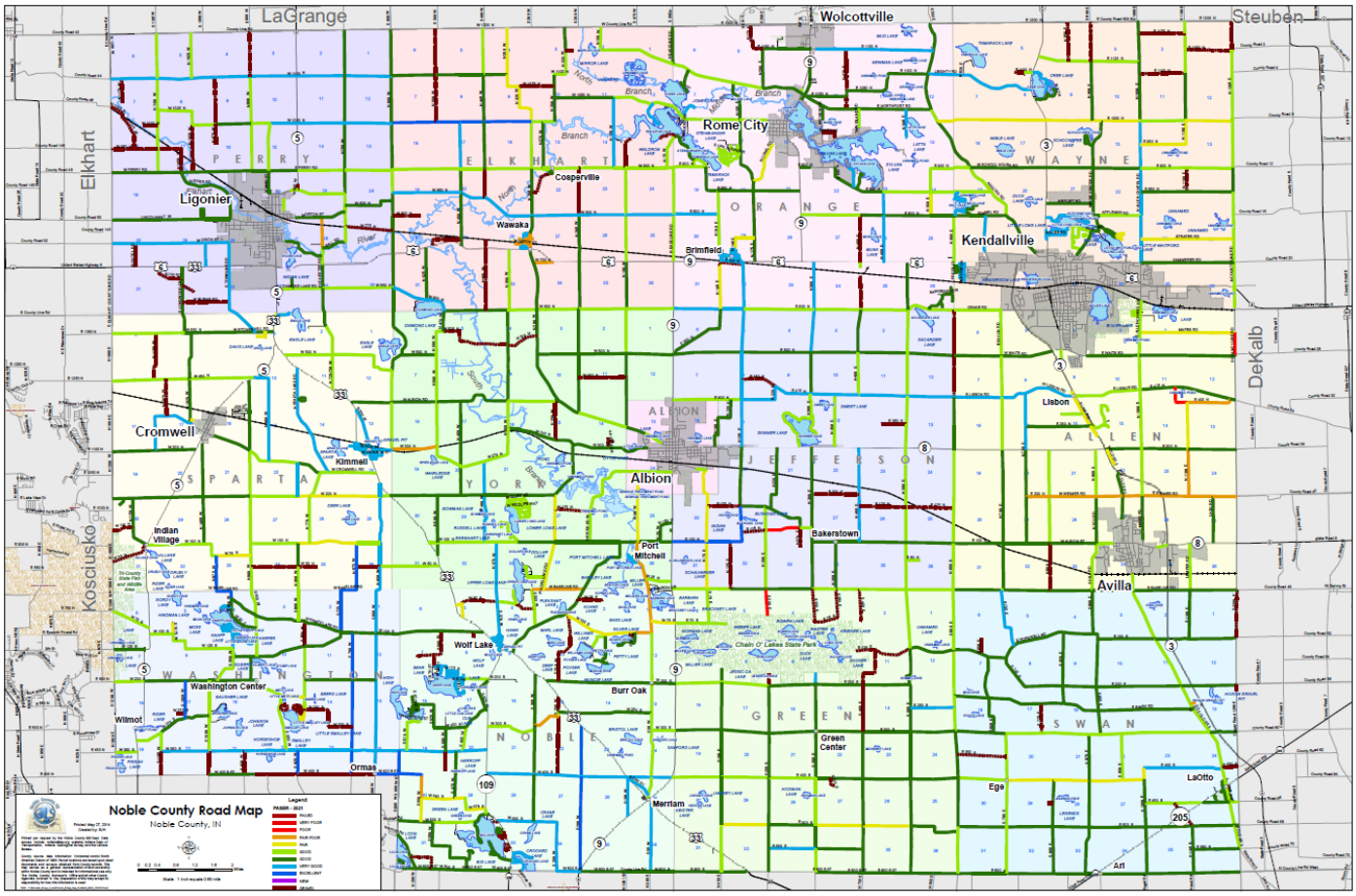

Figure 1 - 2021 County Wide Road Rating Map

Road Priority (Traffic Volume)

The Noble County road network consists of more than 812 center-line miles of paved and gravel roads. This network does not include State Routes, city streets located inside incorporated cities and private roads. The roads in the network have four different functional classifications, Primary Roads, Secondary Roads, Local Roads and Town/Subdivision/Lake Roads.

Primary Roads consist of about 26% of road system. These roads carry highest volumes of traffic and provide connection between State Routes and Cities/Towns. The Average Annual Daily Traffic (AADT) on primary roads is 500+ vehicles per day (VPD.)

See *Figure 2 - County Priority Road Rating Map* for a complete inventory of primary road ratings.

Secondary Roads consist of about 7% of road system. These roads carry moderate volume of traffic and provide connection between primary roads. The AADT on secondary roads is between 250-500 VPD.

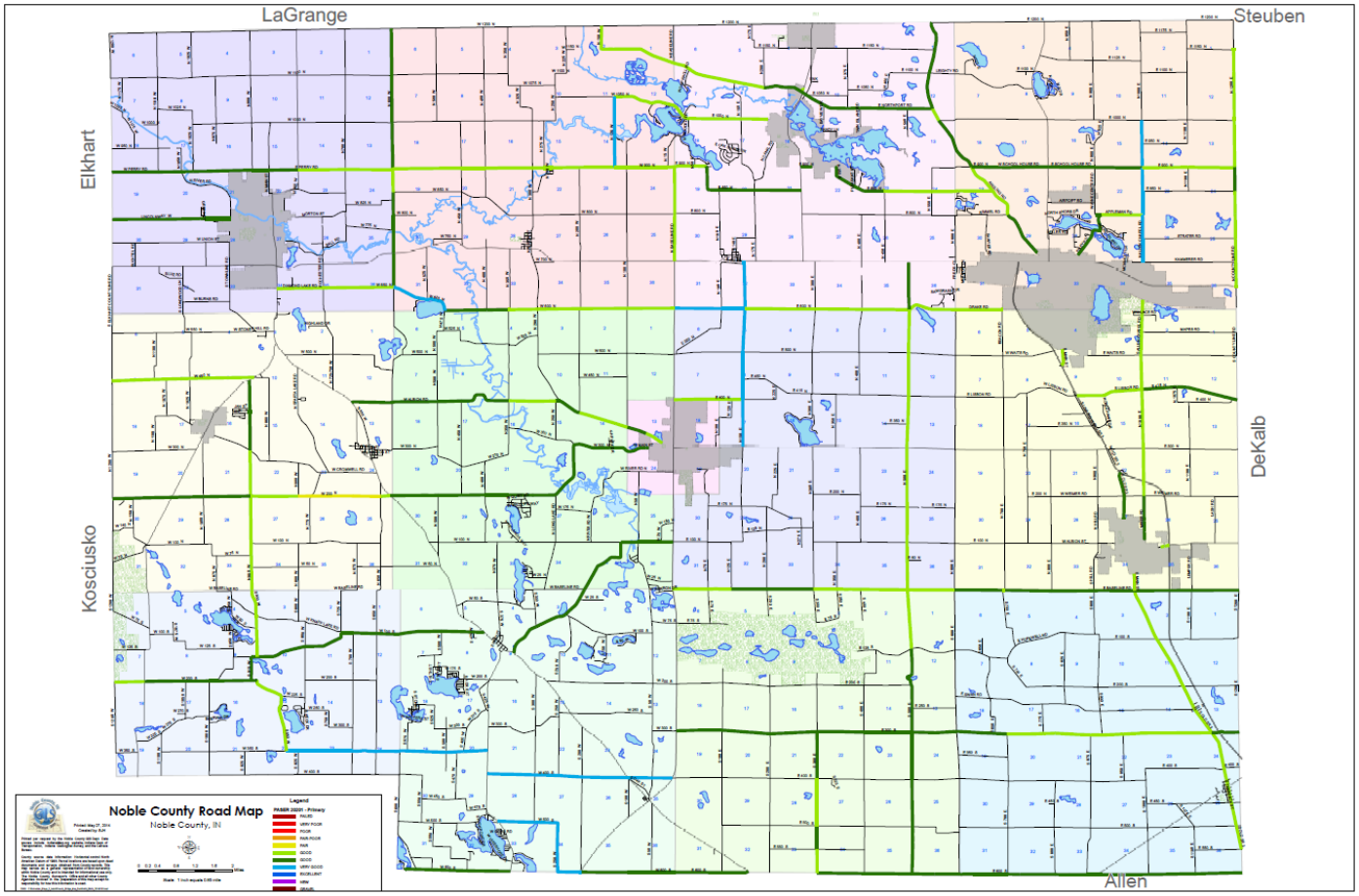

Figure 2 - County Priority Road Rating Map

Local Roads comprise of 59% of the county road network and generally consist of the north-south, east-west "grid network" of roads. These roads carry low volume of traffic with an AADT typically less than 250 VPD. The remaining 9% are located in unincorporated Towns, Subdivisions and around the numerous county lakes. These roads carry low volume of traffic, but have increased pedestrian traffic and are often utilized for residential activities.

Population Density

Although, town, subdivision, lake and local residential roads are not high-volume roads, they are important to the safety and well-being of the public that utilizes them for residential activities.

Residential roads are urban districts as defined by the Indiana Code that are built up with structures devoted to business, industry, or dwelling houses situated at intervals of less than two hundred (200) feet for a distance of at least one-fourth mile.

See *Figure 3 - County Residential Roads Rating Map* for a complete inventory of residential road ratings.

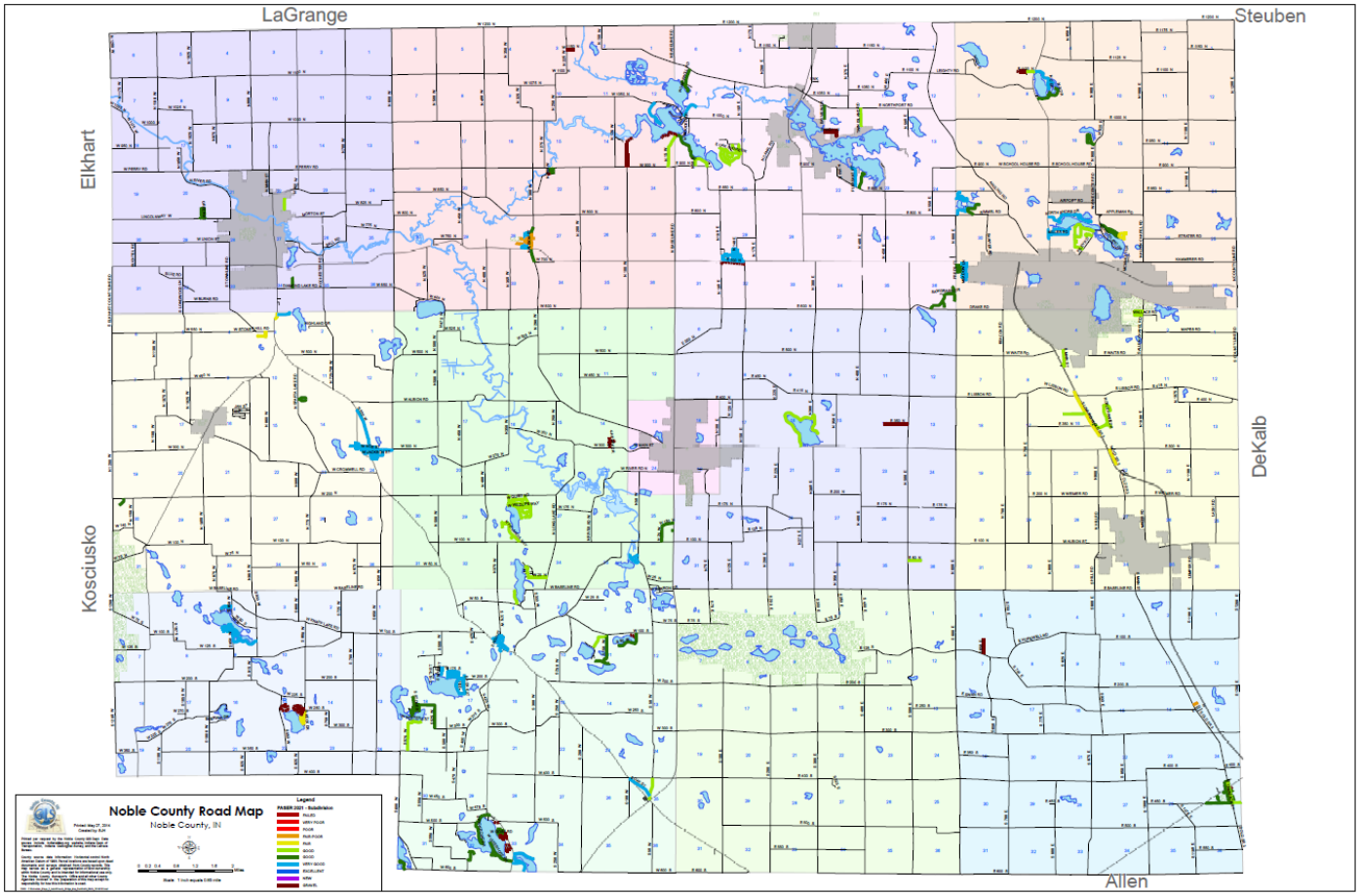

Figure 3 - County Residential Roads Rating Map

Transportation Plan

The rate at which pavement deteriorates depends on its environment, traffic loading, original construction quality and interim maintenance. Even using the best engineering methods, there are still many unknowns that prevent pavement management from being an exact science. Typically, roads constructed around the same date and in a localized vicinity, see similar deterioration curves. Additionally, keeping construction crews in a localized area results in significant savings in time and fuel and results in better bid prices.

Putting these factors together, we utilize a long-term approach to road maintenance that systematically works through all county townships, but localizes project types, such as reconstruction or paving, to individual regions on an annual basis.

Prioritization

Managing the maintenance and rehabilitation within a limited budget while balancing all of these road factors is a challenging task. The most transparent way to prioritize road projects is through clearly stated goals and a long-term plan to meet those goals. The following is a list of the long-term goals that drive the annual plan:

1. *Primary Roads* - The primary roads are the backbone of the county highway system and maintaining them in good condition is paramount to the connectivity and safety of the highway system. Our goal is to keep all primary roads at a rating of 6 or better with a goal of an average rating of 7.00. Currently 99.2% of our primary roads are rated at a 6 or better with an average rating 6.67.

2. *Preservation* - The main goal of the county highway is to stretch the road repair dollars as far as possible. The most cost-effective way to extend the service life is by keeping good roads in good condition through preservation treatments. Our goal is to perform preservation treatments on at least 10% (80+ miles) of the Noble County Highway network annually. The five-year plan 2021-2025 prioritizes preservation treatments, averaging more than 100 miles of preservation treatments annually.

3. *Reconstruction* - In 2016 a goal was set to repair 10 miles of poor roads annually through reconstruction or structural overlays. The method of reconstruction utilized by Noble County Highway provides a considerable cost savings over traditional reconstruction methods, but is constrained by the number of hours in-house staff has available each year. The 2021 plan keeps us on track to exceed our goal by completing reconstruction to 2.0 miles and utilizing Community Crossings Grant Funds for structural overlays on 8.5 miles of poor roads.

4. *Residential Roads* - Historically, Town/Subdivision/Lake roads have not been maintained or improved on a long-term planning schedule or at all. In 2016, we set a 5-year goal to complete rehabilitation or preservation work in every residential road rated less than good (7.) As of 2021, 93.8% residential roads have a rating of 6 or better with an average rating of 6.94. Residential road ratings have increased each year, from 5.07 in 2017 to 6.06 in 2018, 6.25 in 2019 and 7.25 in 2020.

5. *Road Improvements* - As more road funding becomes available, the highway department will be able to make road improvements in addition to meeting the previous four goals. This will include, functional HMA overlays on primary roads, intersection improvements, minor road widening on narrow roads and upgrading gravel roads through in-house reconstruction methods.

Drainage

The most important feature to any road is to maintaining appropriate drainage. Before any road work is completed, a drainage assessment is performed. In general, most road preservation and maintenance work only require minor drainage maintenance. This includes cleaning of existing roadside ditches, removal of excessive sand from plowing operation and ditching and berming in areas with inadequate roadside drainage.

Several subdivisions in the county have not had proper drainage installed. In 2016, a full assessment of all subdivisions was performed on a project by project basis. This assessment is contained in *Appendix C - Subdivision Scoping Report.* This report contains a full breakdown of all drainage work for each project and is updated biannual, with the current version being 2020.

Reconstruction projects are assessed for drainage improvements. The highway department collaborates with the surveyor's department on any regulated drains that needs highway culverts replaced or resized. Additionally, roadside ditches are established and all crossing culverts and driveway culverts are replaced as needed.

Lastly, regular drainage work is completed through the year by the highway department as needed, separate to any specific road improvement work.

Right of Way

In general, all road maintenance and rehabilitation work can be completed utilizing the existing highway right of way. A majority of county roads are centered on a 40' right of way. During the limited times when additional right of way is required (mostly during bridge projects or federal aid projects,) right of way is purchased following all required guidelines and requirements.

Safety items are maintained as part of the highway right of way services. This includes highway road striping, proper signage and guardrail as required. These items are replaced in-kind or upgraded as needed.

Repair Methods

The key to effectively programming road repairs is scheduling the correct repair at the correct time. Historically, Noble County Highway Department has only been able to utilize a handful of repair methods. In an effort to maximize service life and minimize maintenance costs, the highway department has looked at new in-house reconstruction methods, as well as more effective contracted preservation methods. The following is an explanation of each repair method and how it is best utilized.

Preservation

Asphalt Sealant - Asphalt sealants are a clear coat that is applied to roads in very good to excellent condition (8-9.) The sealant penetrates the top ¼" of pavement and provides an extra layer of protection from environmental effects further extending the service life before deterioration begins.

Rejuvenator - Rejuvenators are an emulsion-based material that is applied to roads rated good to very good (7-8.) The rejuvenator provides a specific mix of oils and resins that are designed to penetrate oxidized (aged) pavement and restore its original properties.

Crack seal - Crack seal is the method of filling and sealing cracks within the pavement. This type of work applies to roads that are in good condition (6-7), but are beginning to crack. There are two methods of crack seal that Noble County Highway has available. The first method utilizes in-house forces and equipment. The highway department equipment is set up to use an emulsion (30% water) that is squeegeed into cracks. Sand is placed on top to prevent vehicles from tracking tar.

The second method is contracted utilizing special materials and equipment. The contracted crack seal is an asphalt binder (PG 64-22) or polymer modified asphalt binder (PG 76-22) with suspended fiber added to the heating kettle. The material is pressure injected into cracks using a special wand. *Figure 4* and *Figure 5* show each respectively. Although the contractor method is more expensive, it provides a significantly better seal and does not require highway department labor.

Figure 4 - In-house Crack Seal

Figure 5 - Contractor Crack Seal

Chip & Seal - Chip and Seal is a method of placing a uniform coat of tack on the roadway and then applying a uniform coat of stones (chips) over the tack. When done correctly, this provides a complete seal over the entire roadway width. When done incorrectly, tar bleeding or loose stones can occur. Noble County Highway Department has made significant changes to this process, including the purchase of a new distributor in 2014 and a new full width chip spreader in 2021. The highway uses BM-90S polymer modified cutback sealing asphalt and #11 stone (limestone, native stone or slag.) This work is performed on roads rated good (6.)

Slurry Seal - Slurry seal is an asphalt emulsion mixed with fine aggregate (sand) that is uniformly applied to roads rated as good (6-7.) This work replaces missing fine aggregate in existing surfaces, fills in minor cracks and increases skid resistance. This work requires specialty equipment and is therefore contracted.

Microseal - Also known as Micro Resurfacing is an application of a polymer modified asphalt emulsion mixed with small to fine aggregate that is uniformly applied to roads rated as good (6.) The polymer allows the material to stack on itself resulting in a thin smooth asphalt overlay. This work requires specialty equipment and is therefore contracted.

Rehabilitation

Double Chip and Seal - This work is two applications of Chip and Seal using a #9 stone for the first layer followed by a #11 stone for the second layer. This type of work is applied to roads rated fair to good (5-6.)

Double Microseal - This work is two applications of micro surfacing. The first layer fills in voids and ruts follow by second uniform layer resulting in a leveled smooth asphalt overlay. This type of work is applied to roads rated fair to good (5-6.)

HMA Overlay - This work consists of paving with a ~1.5" lift of Hot Mix Asphalt (HMA) surface. This type of work is applied to level roads rated fair-good to fair (4-5.)

Structural Overlay - This work consists of paving with a 2"- 3" lift of HMA binder or base followed by a 1.5" lift HMA surface. This type of work is applied to roads rated fair-poor (4.)

Wedge - This work consists of leveling wavy or uneven sections of roadway using an asphalt-based material.

Reconstruction

Noble County Highway Department has developed a partial-depth reclamation process as a cost-effective road reconstruction technique. This type of work is applied to roads rated failed to poor (1-3.) This process focuses on drastically improving a road's base instead of improving the surface through expensive overlays. The base is strengthened through the addition of new high-quality aggregate and chemical modified using calcium chloride and lime hardening. Other reclamation processes utilize asphalt or cementitious materials; however, we have found calcium chloride to be significantly more cost effective and easier to install. The year before reconstruction, the roadside drainage (culverts / ditches) is improved to current standards.

Prior to any work being complete, core samples are taken to verify subbase depth and existing road materials. This can significantly change the amount of material added or the depth of reclamation.

The first step in our process is to layout additional aggregate on the roadway as seen below. Noble County Highway utilizes recycled concrete or Duraberm, a heavy aggregate that contains natural lime (CaO) from the steel production process. Duraberm has a gradation similar to INDOT No.53 / No. 73 aggregate and is an ideal road base material. An average of 2.5" of aggregate is tailgated over the desired roadway width and graded to a uniform cross section. During this process, the road can be widened up to 2' on each shoulder.

Next, the material is treated with Calcium Chloride (42%) at a rate of 0.5 gal per square yard. The hygroscopic and deliquescent properties of Calcium Chloride allow the base to absorb moisture from the air and resist evaporation. This results in long-term ideal moisture content which provides a denser, stronger base due to higher surface tension and retention of fine aggregates. Additionally, the moisture from the Calcium Chloride activates the lime in the Duraberm resulting in lime hardening ($CaO + H_2O > Ca(OH)_2$.)

See *Figure 5 - Triaxial Strength Data*. Noble County uses 2.5" of aggregate per 8" of reclamation, which is ~30% blend. High percentage slag blends may have expansion issues and are not as cost effective as the 30% blend.

Triaxial Data	Unconfined Compression	
	No Aging	28 Day
Existing Roadway	23.0 psi	46.5 psi
W/ 30% Blend	26.4 psi	80.9 psi
W/ 40% Blend	39.5 psi	85.3 psi
W/ 50% Blend	57.5 psi	90.3 psi
W/ 60% Blend	61.8 psi	96.0 psi

Figure 6 - Unconfined Compression (Duraberm)

Next, the material is recycled into the road base at a Depth of 8" using a Bomag MPH125 Recycler. Core samples or historical data should be reviewed before recycling to ensure that the subbase is not punctured during the process. Following the recycler, a Bomag BW213PD Sheepsfoot Roller is used for initial compaction.

Next, a grader sets rough grade on the road, followed by a pneumatic rubber tire roller. This is followed by another grader that sets final grade and a steel drum roller. Once final grade is set, the surface is treated with Calcium Chloride (42%) at a rate of 0.25 gal per square yard. This is to aid in the curing process and also acts as dust control by retaining fine aggregate. The road is left to cure for 28 days, while open to traffic. Following this period, any required maintenance is addressed and a surface treatment is applied. Noble County uses either a triple chip and seal with fog seal or 1.5" HMA overlay as the surface course.

Noble County has been working jointly with Levy Technical Laboratories to test their in-house reconstruction method. The following are testing results from 2016:

California Bearing Ratio: 0.1 Penetration - Initial 25.1 PSI, Final 60.8 PSI.
0.2 Penetration - Initial 33.3 PSI, Final 81.1 PSI.

Proctor: Initial - Moisture 6.55%, Density - 132.9 PCF
Final - Moisture 7.10%, Density - 138.4 PCF

Unconfined Compression:

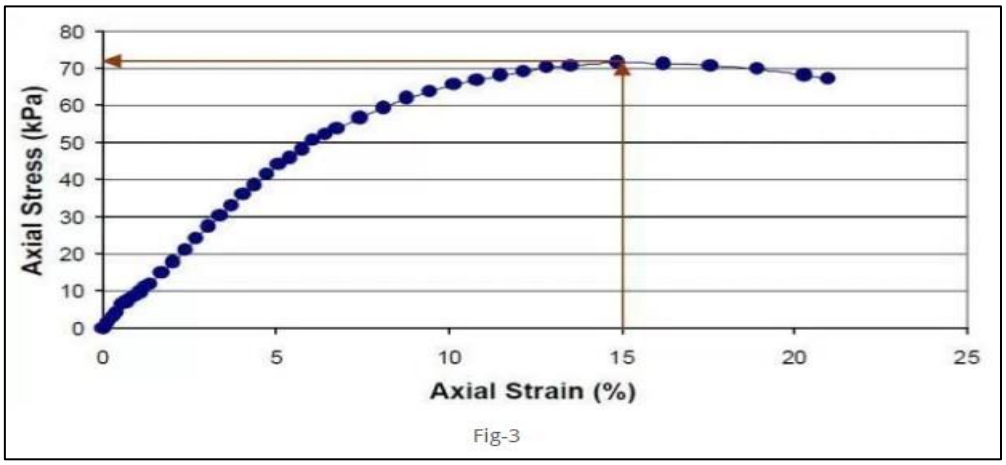

Figure 7 - Unconfined Compression (Stress vs. Strain)

2021 Road Projects

Road segments are assigned the appropriate repair and projects are prioritized to meet the annual goals for the current year and look ahead at a 5-year projection. See *Table 1 – 2021 Road Improvement Projects* and *Appendix A - 2021 Roadway Asset Management - 5 Year Projection*.

Estimated Service Life (ESL)

Estimated Service Life (ESL) is a conceptual metric used to manage the highway network. An engineered ESL value is assigned to each roadway segment based on its road condition rating. The service life of a road is defined as the time (in years) from new construction to when the road has deteriorated to a condition that no longer meets acceptable standards.

Using the PASER rating, the Remaining Service Life (RSL) was estimated for each road segment. *Figure 6 - Estimated Remaining Service Life* shows the relationship between PASER rating and pavement remaining service life.

The service life of a pavement can be extended through preservation treatments, rehabilitation or reconstruction. A comparison of condition ratings, repair cost and cost per additional ESL is listed in *Table 4 - Average Road Repair Cost per Rating.*

Estimated Remaining Service Life	
Rating	**RSL**
10	20
9	17
8	14
7	11
6	9
5	6
4	4
3	2
2	1
1	0

Figure 8 - Remaining ESL

Road Name	Start point	End point	Miles	Work performed	Cost	Year	Cum Cost
CR 200 N	CR 750E	CR 1200E	4.5	2" HMA Surface	$348,500	2021	$348,500
CR 1100E	CR 200N	CR 400N	2	2" HMA Surface	$152,500	2021	$501,000
CR 400N	CR 1075E	CR 415N	1.2	2" HMA Surface	$97,000	2021	$598,000
CR 1075E	CR 415N	CR 400N	0.3	2" HMA Surface	$26,000	2021	$624,000
CR 1200E	Waits Rd	Mapes Rd	0.5	2" HMA Surface	$42,500	2021	$666,500
Baseline Rd	Intersection	CR 600E	1	Int. Improve.	$84,985	2021	$751,485
Brookside Ests.	Subdivision	6,400	0.45	Concrete Repair	$131,090	2022	$882,575
CR 300N	Albion (town)	Long Lake Rd.	2	Crack seal	$13,000	2021	$895,575
CR 200N	Long Lake Rd	US 33	3	Crack seal	$19,500	2021	$915,075
Anglin Rd	CR 800 N	Northport	3	Crack seal	$19,500	2021	$934,575
Albion Rd	US 33	Albion	6	Crack seal	$39,000	2021	$973,575
CR 415N	CR 500E	CR 1000 E	5	Crack seal	$32,500	2021	$1,006,075
CR 400S	CR 1000E	Old SR3	1.75	Crack seal	$11,375	2021	$1,017,450
Southwood Shr.	Subdivision	5,549	0.43	Crack seal	$2,795	2021	$1,020,245
CR 600E	US 6	CR 800N	1	Single chip seal	$11,000	2021	$1,031,245
Strater Rd	CR 1000 E	CR 1200 E	2	Single chip seal	$22,000	2021	$1,053,245
CR 50W	CR 100N	River Rd	1.5	Single chip seal	$16,500	2021	$1,069,745
CR 225S	CR 915 W	CR 800 W	2.25	Single chip seal	$24,750	2021	$1,094,495
CR 75N	CR 975W	CR 900W	0.75	Single chip seal	$8,250	2021	$1,102,745
CR 50N	CR 650W	US 33	1	Single chip seal	$11,000	2021	$1,113,745
CR 200N	US 33	CR 900W	3	Single chip seal	$33,000	2021	$1,146,745
Mapes Rd	CR 1000E	CR 1200E	2	Single chip seal	$22,000	2021	$1,168,745
CR 500 N	US 33	CR 600 W	3	Single chip seal	$33,000	2021	$1,201,745
CR 75 S	SR 5	1200 W	0.3	Single chip seal	$3,300	2021	$1,205,045
CR 325/350 W	CR 1200 N	CR 1000 N	2.5	Single chip seal	$27,500	2021	$1,232,545
CR 200 S	SR 109	Bear Lake	0.7	Single chip seal	$7,700	2021	$1,240,245
CR 50S/450W	US33	US33	0.5	Single chip seal	$5,500	2021	$1,245,745
Canal Rd	CR 175E	Rome City	1.25	Single chip seal	$13,750	2021	$1,259,495
CR 550E	CR 800N	CR 900N	1	Single chip seal	$11,000	2021	$1,270,495
CR 500S	CR 100E	CR 200E	1	Single chip seal	$11,000	2021	$1,281,495
CR 500S	CR 300E	CR 500E	2	Single chip seal	$22,000	2021	$1,303,495
CR 300S	CR 1200E	CR700E	5	Single chip seal	$55,000	2021	$1,358,495
CR 400S	CR 600E	CR 1000E	4	Single chip seal	$44,000	2021	$1,402,495
CR 450S	1000E	Old SR3	1.8	Single chip seal	$19,800	2021	$1,422,295
CR 900 N	CR 1200W	Baseline Rd	12	Single chip seal	$132,000	2021	$1,554,295
Frick's Addition	Subdivision	4,987	0.34	Single chip seal	$3,740	2021	$1,558,035
CR 850W	CR 350 S	CR 225S	1.25	Single chip seal	$13,750	2021	$1,571,785
CR 75S	CR 50W	SR 9	0.5	Single chip seal	$5,500	2021	$1,577,285

Table 1 – 2021 Road Improvement Projects

Road Name	Start point	End point	Miles	Work performed	Cost	Year	Cum Cost
CR 550W	CR 400S	CR 500S	1	Single chip seal	$11,000	2021	$1,588,285
CR 450S/475S	CR 550W	SR 109	1.5	Single chip seal	$16,500	2021	$1,604,785
CR 700E	SR 8	CR 600N	3	Single chip seal	$33,000	2021	$1,637,785
Skinner Lake	Subdivision	18,304	1.56	Single chip seal	$17,160	2021	$1,654,945
CR 600W	CR 825N	CR 1200N	3.25	Single chip seal*	$19,500	2021	$1,674,445
CR 400W	CR 1000N	CR 1200N	2	Single chip seal*	$12,000	2021	$1,686,445
CR 1000N	Angling Rd.	CR 1200E	6.1	Double chip seal	$143,350	2021	$1,829,795
CR 300N	CR 500W	CR 600W	1	Double chip seal	$23,500	2021	$1,853,295
CR 750N	CR 140E	CR 175E	0.4	Double chip seal	$9,400	2021	$1,862,695
CR 140E	CR 750N	Brimfield	0.3	Double chip seal	$7,050	2021	$1,869,745
400 East	US6	800N	1	Reconstruction(G)	$61,100	2021	$1,930,845
1050W	900N	Dead End	0.5	Reconstruction(G)	$30,550	2021	$1,961,395
50N	650W	675W	0.5	Reconstruction(G)	$30,550	2021	**$1,991,944**

Table 2 – 2020 Road Improvement Projects (continued)

2021 Road Repair Cost	
Preservation	**Cost (per mile)**
Crack Sealing	$6,500.00
Single Chip Seal	$11,000.00
Fog Seal	$3,600.00
Asphalt Sealant	$11,500.00
Rejuvenator	$13,000.00
Slurryseal	$26,500.00
Microseal	$37,500.00
Rehabilitation	
Minor Patching / Wedging	$11,000.00
Major Patching / Wedging	$22,000.00
Double Microseal	$50,000.00
Double Chip Seal	$23,500.00
Triple Chip Seal	$36,500.00
HMA Overlay (1.5")	$60,877.50
Reconstruction	
Major HMA Overlay (4.0+")	$157,307.46
Partial Depth Recon. (6" Base only)	$24,599.50
Full Depth Recon. (12" Base only)	$49,199.00
Traditional Reconstruction	$279,559.46

Table 3 - Road Repair Cost

2021 Average Road Repair Cost per Rating						
Rating	**Repair**	**Cost (per mile)**	**ESL (yrs)**	**Avg**	**Avg. Cost**	**Cost / ESL**
7 - Good	Crack Sealing (In-house)	$2,000.00	1	1	$6,666.67	$2,027.78
	Crack Sealing (Contract)	$6,500.00	2 - 4	3		
	Asphalt Sealant	$11,500.00	5 - 7	6		
6 - Good	Single Chip Seal	$11,000.00	4 - 6	5	$16,833.33	$2,502.69
	Rejuvenator	$13,000.00	4 - 7	5.5		
	Slurryseal	$26,500.00	8 - 10	9		
5 - Fair	Double Seal + Minor Patching	$22,000.00	6 - 10	8	$36,500.00	$4,145.83
	Microseal	$37,500.00	6 - 10	8		
	Double Microseal	$50,000.00	8 - 12	10		
4 - Fair	Double Seal + Major Patching	$45,500.00	6 - 10	8	$55,792.50	$5,958.42
	HMA Overlay (1.5")	$60,877.50	8 - 12	10		
	Double Micro + Minor Patching	$61,000.00	8 - 12	10		
3 - Poor	PDR + Triple Seal + Fog	$64,699.50	8 - 15	11	$111,003.48	$8,991.17
	Major HMA Overlay (4.0+")	$157,307.46	10 - 16	13		
2 - Very Poor	PDR + HMA (2")	$105,769.50	12 - 14	13	$156,137.98	$10,141.78
	FDR + Major Overlay	$206,506.46	16 - 18	17		
1 - Failed	Traditional Reconstruction	$279,559.46	20 - 25	22.5	$278,208.00	$12,364.80

Table 4 -Average Road Repair Cost per Condition Rating

Treatment	Miles	ESL	Add Service Life (years)
Crack Seal	21.18	3.00	64
Single Chip Seal	62.95	6.00	378
Double Chip Seal	7.80	10.00	78
Concrete Repair	0.45	30.00	14
2" HMA Surface	8.50	20.00	170
Reconstruction(G)	2.00	15.00	30
2021 Total			733

Table 4 -Additional Service Life Calculations

Cost Estimates

Each project is assigned the appropriate and most cost-effective repair. Cost data and an Estimated Service Life analysis is completed, see *Table 5 - Additional Service Life Calculations.* This results in a projected schedule of work to be used with the annual budget. The anticipated budget for 2021 is approximately $1,992,000 with $1,492,000 coming from the Highway General Fund and $500,000 coming from a Community Crossings Grant.

Summary

In summary, this report provides an engineering method to maximize the annual road budget. Additionally, the plan provides a long-term road plan with the flexibility to refocus annually when new data is available.

The current plan will provide an additional 733 years of estimated service life at a cost of $1,992,000. This is a major decrease from 2020, 934 years of estimated service life at a cost of $2,366,400. However, it is important to note that the 2019 plan was focused on making major structural repairs in subdivision areas. Correcting these deficiencies makes the subdivisions much more cost effective to maintain going forward.

Previous years:

- 2019 Road Plan - 557 years at a cost of $3,300,000
- 2018 Road Plan - 1181 years at a cost of $3,265,000
- 2017 Road Plan - 928 years at a cost of $2,442,000
- 2016 Road Plan - 876 years at a cost of $2,125,000
- 2015 Road Plan - 805 years at a cost of $1,530,000
- 2014 Road Plan - 740 years at a cost of $1,597,000.

A summary of 5-year projected work is attached as *Appendix B - Pavement Treatment Summary*.