New Britain Borough

NEW BRITAIN BOROUGH
2017 ROADWAY CONDITION PLAN
AND
5 YEAR RECONSTRUCTION PLAN

November 8, 2017

Prepared for:
New Britain Borough
45 Keeley Avenue
New Britain, PA 18901
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Prepared by:
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I. Purpose:

New Britain Borough initialized a roadway maintenance program in May 2017 by approving a loan up to the amount of $1,000,000.-. These funds are intended to make maintenance funds available for necessary roadway repairs immediately. The Borough currently owns and is responsible for approximately nine (9) miles of roadway. This does not include the state roads which are (Butler Avenue, Sandy Ridge Road and South Tamanend).

Normally the Borough roadway restoration / maintenance projects are scheduled as funding becomes available through liquid fuels funding (a small percentage of general funds are utilized for this purpose). The problem with this process is that the necessary funding is not always available to perform all of the necessary repairs, thereby postponing repairs until funding becomes available. As the road repairs get postponed, the conditions worsen and the roadway then required additional work by the time the restoration process begins. As roadway conditions decline, it becomes more and more expensive (exponentially) to make the repairs. If a large project is required, it may be postponed for a year, or two (2) until liquid fuels funding becomes available. By that time, the roadway condition has worsened, thus requiring additional funding.

By implementing a reconstruction plan, it will become possible to upgrade all roads (where necessary) and reduce long term costs (major repairs) and migrate to more of a light maintenance plan, thereby reducing overall roadway maintenance funds.

II. Pavement Condition ratings and analysis:

Roadway condition reports are prepared in order to select and prioritize selective roadway maintenance scheduling. As mentioned above the affordable roadways (for which monies are available through liquid fuels funding (approximately $80,000.- annually)) are then scheduled for maintenance / reconstruction.

The rating process considers surface cracks, surface conditions, vehicle loads and vehicle average daily traffic (ADT).

Sub-grade Moisture:
The major reason for roadway failure is runoff entering the sub-grade. Moisture can enter through cracks in the pavement, deteriorated surfaces, along the edge of the road adjacent to curbs, roadway swales, poorly maintained drainage structures and through poor roadway grading where runoff ponds on the roadway surface. Areas of poor grading occur via pavement settlement often in the main vehicle tracks, around subsurface drainage structures where inadequate compaction was provided during installation, and in areas of poor design where the roadway was simply not designed or constructed properly.

Once water enters the sub-grade, freezing cycles contract and expand the stone (sub-base) and eventually the bituminous surface above and cause it to crack / fail. Water in the sub-grade also weakens the structural integrity of the soil (like adding water to clay (we have a lot of clay in the Borough)).

Insufficient sub-base / excessive repetitive loading:
Roadways also crack with excessive movement caused by insufficient sub-base for the current use of the road. Excessive truck traffic by way of exceeding maximum weight limits, or excessive heavy vehicle trips can cause failure in this manner. Borough roads do not receive much truck traffic except for school busses and garbage trucks. Nothing can be done about the school busses, but noting that we entertain approximately six (6) trash haulers, this repetitive, duplicated travel pattern of heavy trucks on Borough roads damages the roads and over time requires additional maintenance.

Flexible pavement design:
Bituminous is a flexible pavement, meaning that it is designed to flex with use, however it can't sustain its structural integrity with frequent or excessive movement. Concrete is a non-flexible (rigid) pavement which we do not have in any Borough streets. It is noted that Butler Avenue (state owned and maintained road) was concrete and has a concrete base under the bituminous.

Reading a roadway:

Cracks in roadways indicate that either the surface has allowed water to cause failure through freezing (excessive movement), or the sub-base is inadequate for the loads / traffic volume.

Roadways also fail due to drying out. Bituminous pavement is constructed with emulsified asphalt (oils). Over time these oils dry out primarily due to ultraviolet radiation from the sun. With a decreased oil ingredient, the pavement fails to hold together and breaks apart (similarly to how dried clay falls apart without sufficient moisture). This then allows the pavement's internal stresses to increase, causing cracks.

So when reading a road it is important to looks for both cracks and pavement that it drying out. Typically a properly constructed road, with suitable sub-grade will last for 10-20 years dependent upon the factors discussed above.

Another method to analyze roads is to prepare core samples. This is a process whereby a 3" +/- hole is core drilled directly into the pavement to the sub-grade. The material and its thickness can then be analyzed / measured to determine if ample material, density and moisture content is available. Several cores were drilled and analyzed as part of this evaluation which are included in Appendix D as prepared by Gilmore & Associates, Inc.. It is noted that only a few roads were considered in this analysis due to the poor condition of Maple Lane and the unexpected nature of the road, and sub-base material in Aarons and Mathews due to the age of the roadways. This process also provides pavement thickness measurements which are important if deep milling, or in place recycling is proposed.

Nuclear density measurements can also be evaluated which measure the density of the soil and bituminous to determine the quality of the subsurface materials.

In New Britain the roadway systems are either relatively old (built up from old dirt roads), or newer roadway surfaces which have been constructed and inspected in the near past. The older roads are usually constructed of 4" of #4 (3" stone) stone ballast with screenings (small stone) below and above, then paved over with about 3" of bituminous. This construction technique was utilized into the 1970's. More recent roads are constructed with 6" of #2A stone (3/4" stone mixed with screening) and paved with 4" of base and 1-1/2" of wearing surface. The later method provides a less labor intensive design, whilst providing additional bituminous to create a stronger road.

III. Roadway repair / maintenance methods:

There are several methods of roadway restoration / maintenance available:

Reconstruction: This process involves removing the entire roadway including the sub-base and reconstructing. This process is expensive and reserved for areas of very poor roads and areas where the roadway was constructed on un-suitable materials. We used this method partially for the reconstruction of Landis Mill Road. The sub-base was poor with a high moisture content so it was necessary to excavate portions of the road, including some sub-base areas. Soil reinforcement also had to be provided in the way of geotextile fabrics, the areas refilled with stone, the paved.

Cold in-place recycling: This process is performed with a 'train' of large equipment that excavates, mixes, adds emulsions and replaces the pavement stratum and is then paved a few weeks later. This method has a high cost of mobilization and is not economically feasible for small single road projects.

Patch repair: This process involves simply spot repairs via either milling or excavating the affected area, then restoring with stone / pavement.

Milling and Paving: This is similar to the patch repair, however addresses the entire roadway. Generally a large milling machine is employed, the old pavement is removed to the design grade elevations, often a leveling course applied to increase / correct cross slope issues and then repaved.

Overlay: This involves simply an asphalt overlay. This method is rarely used it the Borough because it raises the grade (particularly a problem in curbed areas), and does not address any cracks in the existing pavement. If the cracks are not addressed, they often reflect their way back to the surface of the new pavement (the milling operation generally corrects this issue by removing the old cracks prior to paving). A process is available however to install a fabric at the crack areas, this along with a tack coat helps to reduce reflective cracking.

Microsurfacing: This is a surface treatment only and primarily addresses the drying out of roadways. It is a cold mixed asphalt and provides a new wearing surface for pavement preservation and rehabilitation. It is polymer modified which includes latex rubber and crumb rubber to proved a longer wearing surface and to better resist reflective cracking. The process involves actual stone and polymer mix at a thickness of approximately 3/8". The process is not merely sealing the roadway, it actually proves a new wearing surface, can be used for rut filling and restores the frictional properties of the roadway regarding safety issues. It has been found that the process is not optimal for large cracks, unless they are first sealed. It is also advisable to wait a year after crack sealing prior to microsurfacing, this give the crack sealant time to firm up and prevent movement at the cracks under the new microsurface treatment.

Crack sealing: This process merely cleans, fills and seals existing cracks greater than greater than 1/8". The cracks are cleaned with high pressure air and sealed. This is an inexpensive process that can greatly extend the life of a road without requiring major repairs.

Roadway reconstruction in New Britain is performed by several methods dependent upon the situation. Generally, the cracks are addressed by crack sealing, then microsurfaced the following year. Should the roadway be too cracked for this process, it is then decided whether or not the entire road needs to be reconstructed or only partially. Partial reconstruction result in patching, and possibly crack sealing, followed by microsurfacing. Full reconstruction is usually milling and paving.

Pot hole repair: Pot holes are filled as they are noticed or reported. Repairs last anywhere from a few weeks to indefinitely depending on the type of repair and conditions during the repairs. Generally the deeper holes repairs last longer and repairs made in poor weather don't last long, but can easily be corrected upon better weather conditions.

IV. New Britain Borough roadway conditions

The road conditions have been recently inspected and analyzed as referenced in Appendix A.

V. Recommendations

The road system has been analyzed / rated based upon the existing conditions and past histories to determine the necessary restoration processes. This was performed utilizing the most effective and efficient methods available to improve the roadway system over the next 5 years considering the available resources and long term operations of the roadway system.

The rating is based upon roadway conditions considering cracks in the roadway surface as well as the surface appearance considering how dried out the bituminous surface appears. Each of these conditions are rated and then averaged. Any average condition less than 8.0 is considered to be a candidate for restoration process. The process is then selected based upon the degree of disrepair and the importance and vehicle ADT count assumptions.

The analysis revealed the following roads that are in need of more immediate attention. The types of construction were then grouped into an annual plan in order to make larger projects of type of construction technique, thereby reducing overall costs by economy of scale:

Aarons Avenue
Britain Drive
Carousel Circle
E. Butler
Elm Terrace
Evergreen Drive
Green Valley Way
Industrial Drive
Maple Lane
Maple Court
Mathews Avenue
Oak Drive
Pavilion Way
Sand Road
Service Road A
Service Road B
N. Tamaned Avenue (Iroquois to end)
Vine Street

VI. Cost analysis

The roads listed above that require attention were analyzed to determine what type of reconstruction was best suited based upon the evaluation factors listed previously in this report. A road system cost analysis along with the recommended construction has been provided in Appendix C. The total 5 year cost is approximately $880,000.-. It is noted that liquid fuels income over this time period will provide approximately $400,000.-, therefore only an additional $480,000 of reserves should be required.

VII. Conclusion and recommendations

Based upon the roadway analysis, cost estimates and proposed roadway work, the Borough roadway system will be in excellent condition by 2021 with all roads recently treated and maintained. With the new infrastructure in place, only annual maintenance and repairs will be required for quite some time.

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APPENDIX 'A'

ROADWAY CONDITIONS

NEW BRITAIN BOROUGH, BUCKS COUNTY, PENNSYLVANIA

Prepared by Mark G. Hintenlang 10/20/2017

STREET NAME	Roadway Condition Cracks	Roadway Condition Surface	Average (Cracks / Surfaces)	
Aarons Avenue	8	5	6.5	*
Algonquin Road	8	9	8.5	
Barrie Circle	9	8	8.5	
Barrie Circle (cul-de-sac)	8	8	8	
Birch Road	9	9	9	
Britain Drive	7	6	6.5	*
Buelah Road	9	9	9	
Cedar Drive - Maple to Birch	8	8	8	
Cedar Drive - Vine to Birch	8	8	8	
Cedar Drive - US 202 to Vine	8	8	8	
Carousel Circle	7	7	7	*
Cherokee Road	9	9	9	
E. Butler	8	7	7.5	*
Elm Terrace	6	7	6.5	*
Evergreen Drive	8	6	7	*
Francis Meyers Road	8	9	8.5	
Green Valley Way	6	7	6.5	*
Hawk Circle (culdesac)	8	8	8	
Heritage Lane	8	9	8.5	
Industrial Drive	8	6	7	*
Iron Hill Road	8	7	7.5	*
Iroquis Avenue (Tamanend to Pawnee)	8	8	8	
Iroquis Avenue (gas line to Pawnee)	8	8	8	
Iroquis Avenue (Cul-de-sac)	8	8	8	
Keeley Avenue (US 202 to Sioux)	9	9	9	
Keeley Avenue (Sioux to covered bridge)	9	9	9	
Lamp Post Road	10	9	9.5	
Landis Mill Road	10	8	9	
Lenape Road (Francis Meyers to north)	10	8	9	
Lenape Road (US 202 to Francis Meyers)	10	8	9	
Maple Lane	7	5	6	*
Maple Court	6	5	5.5	*
Mathews Avenue	8	5	6.5	*
Mohawk	7	9	8	
Oak Drive	8	7	7.5	*
Pavilion Way	7	7	7	*
Pawnee Road	9	9	9	
Pueblo Road (Twp. to Ute)	9	9	9	
Pueblo Road (Ute to Lenape)	9	9	9	
Sand Road (US 202 to rail road)	6	6	6	
Sand Road (Rail road to Industrial)	7	7	7	*
Sand Road (Industrial to Mathews)	7	7	7	*
Service Road A (East)	8	6	7	*
Service Road B (West)	8	6	7	*
N. Shady Retreat Road	8	9	8.5	
S.Shady Retreat Road	8	9	8.5	
Sioux Road (west)	9	9	9	
Sioux Road (east)	8	9	8.5	
Spring Lake Drive	9	8	8.5	
Stefan Place	6	7	6.5	
N. Tamanend Avenue (US202 to Sioux)	8	9	8.5	
N. Tamanend Avenue (Sioux to Pawnee)	8	9	8.5	
N. Tamanend Avenue (Pawnee to Mohawk)	7	9	8	
N. Tamanend Avenue (Mohawk to Iroquois)	7	9	8	
N. Tamanend Avenue (Iroquois to end)	6	9	7.5	*
N. Tamanend Avenue (Algonquin intersect)	9	9	9	
N. Tamanend Avenue (Mohawk intersect)	7	9	8	
N. Tamanend Avenue (Iroquois intersect)	7	9	8	
Ute Road	9	9	9	
Vine Street	7	7	7	*
Woodland Drive	9	9	9	

Condition rating 10 (Best) to 1 (Worst)

* - Average condition of cracks and surface condition less than 8.

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APPENDIX 'B'

ROADWAY HISTORY
NEW BRITAIN BOROUGH, BUCKS COUNTY, PA
Prepared by Mark G. Hintenlang 10/20/2017

STREET NAME	Improvement History	2014	2015	2016	2017**
Aarons Avenue					m**
Algonquin Road				s	
Barrie Circle	S99,CS09, CS11	s			
Barrie Circle (cul-de-sac)	S99,CS09,CS11	s			
Birch Road	CS01		c	s	
Britain Drive	OC99,CS04,CS01,BO10,CS13				
Buelah Road	OC99,CS12	s			
Cedar Drive - Maple to Birch	OC99	c		s	
Cedar Drive - Vine to Birch	M00, CS07	c		s	
Cedar Drive - US 202 to Vine	OC99,CS09	c		s	
Carousel Circle	S99,CS01,CS04,CS12	s			
Cherokee Road	M98,S99,CS01,CS04		c	s	
E. Butler		c			
Elm Terrace	S00,OC00,CS12	s			
Evergreen Drive	M92,S99,CS09	c			
Francis Meyers Road	S00,CS13	c**	c**	s	
Green Valley Way	S99,CS01,CS13	s			
Hawk Circle	OC99,CS09			s	
Heritage Lane	S99,CS09	s			
Industrial Drive	CS13				
Iron Hill Road	S03	s			
Iroquis Avenue (Tamanend to Pawnee)				s	
Iroquis Avenue (gas line to Pawnee)	OC02			s	
Iroquis Avenue (Cul-de-sac)	OC02			s	
Keeley Avenue (US 202 to Sioux)	OC99, OC11			s	
Keeley Avenue (Sioux to covered bridge)	S00, G, BO10			s	
Lamp Post Road	PC99, BO10	m			
Landis Mill Road	OC99,M10				
Lenape Road (Francis Meyers to north)	S99,CS04,CS01, BO10,M12				
Lenape Road (US 202 to Francis Meyers)	CS01,CS04MR12				
Maple Lane	OC99,CS09	c			
Maple Court	OC99,CS12	s			
Mathews Avenue	CS00,OC00,CS04				m**
Mohawk	M13(N. portion)			s	
Oak Drive	S00,CS12			s	
Pavilion Way	S99,CS01,CS12	s			
Pawnee Road	M00, CS07		c	s	
Pueblo Road (Twp. to Ute)	M02		c	s	
Pueblo Road (Ute to Lenape)	M02		c	s	
Sand Road (US 202 to rail road)	OC99,M03				
Sand Road (Rail road to Industrial)	M03				
Sand Road (Industrial to Mathews)	OC00				
Service Road A (East)	OC00				
Service Road B (West)	M03				
N. Shady Retreat Road	CS01,S03, BO10,CS11	sm**			
S.Shady Retreat Road	M99,CS11	cs			
Sioux Road (west)	M01,CS07			s	
Sioux Road (east)	M01,S03,CS09	s		s	
Spring Lake Drive	CS00,CS04,CS13			s	
Stefan Place	S99,CS01,CS13	s			
N. Tamanend Avenue (Pawnee to gasline)	OC02,BO10				
N. Tamanend Avenue (Algonquin intersect)	OC02, CS13				
N. Tamanend Avenue (Iroquois intersect)	CS13				
N. Tamanend Avenue (Mohawk intersect)	OC02,CS13				
N. Tamanend Avenue (Pawnee to end)	CS01,CS04			s	
N. Tamanend Avenue (US202 to Pawnee)	CS00,OC00,CS01,CS13			s	
N. Tamanend Avenue (US202 to Sioux)	CS00,OC00,CS01,CS09				
Ute Road	CS01,CS04	m			
Vine Street	S00	cs			
Woodland Drive	CS00, OC00	c**	c**	s	

** - Partially complete

LEGEND:

BO	year	Boxouts
CM	year	Crack seal
M	year	Mill and Pave
OC	year	Oil & Chip (double application)
S	year	Slurry Seal

APPENDIX 'C'

COST ANALYSIS

NEW BRITAIN BOROUGH, BUCKS COUNTY, PENNSYLVANIA

Prepared by Mark G. Hintenlang 11/8/2017

STREET NAME	Street Length (LF)	Street Width (FT	Street Area (SY)	2017	Cost	2018	Cost	2019	Cost	2020	Cost	2021	Cost
Aarons Avenue	1,800	18	3,600	M	$5,000	OF	$45,000					S	$7,200
Algonquin Road	220	26	636					CS	$222			S	$1,271
Barrie Circle	650	20	1,444					CS	$28,889			S	$2,889
Barrie Circle (cul-de-sac)	150	16	267					CS	$667			S	$533
Birch Road	260	26	751					CS	$1,502			S	$1,502
Britain Drive	980	36	3,920			OF	$49,000					S	$7,840
Buelah Road	660	20	1,467			S	$2,933					S	$2,933
Cedar Drive - Maple to Birch	1,080	26	3,120					CS	$1,092			S	$6,240
Cedar Drive - Vine to Birch	1,030	22	2,518					CS	$881			S	$5,036
Cedar Drive - US 202 to Vine	380	22	929					CS	$325			S	$1,858
Carousel Circle	1,990	26	5,749					CS	$2,012			S	$11,498
Cherokee Road	1,600	26	4,622					CS	$1,618			S	$9,244
E. Butler	460	22	1,124							M	$22,489	S	$2,249
Elm Terrace	300	22	733			S	$1,467					S	$1,467
Evergreen Drive	1,130	20	2,511			S	$5,022					S	$5,022
Francis Meyers Road	1,570	26	4,536					CS	$1,587			S	$9,071
Green Valley Way	380	26	1,098					CS	$384			S	$2,196
Hawk Circle	150	20	333					CS	$117			S	$667
Heritage Lane	400	26	1,156					CS	$404			S	$2,311
Industrial Drive	1,000	26	2,889			S	$5,778					S	$5,778
Iron Hill Road	1,690	26	4,882					CS	$1,709			S	$9,764
Iroquis Avenue (Tamanend to Pawnee)	440	26	1,271					CS	$445			S	$2,542
Iroquis Avenue (Cul-de-sac)	260	26	751					CS	$263			S	$1,502
Keeley Avenue (US 202 to Sioux)	1,200	20	2,667					CS	$933			S	$5,333
Keeley Avenue (Sioux to covered bridge)	1,690	20	3,756					CS	$1,314			S	$7,511
Lamp Post Road	530	26	1,531			S	$3,062					S	$3,062
Landis Mill Road	770	18	1,540			S	$3,080					S	$3,080
Lenape Road (Francis Meyers to north)	480	36	1,920			S	$3,840					S	$3,840
Lenape Road (US 202 to Francis Meyers)	480	36	1,920			S	$3,840					S	$3,840
Maple Lane	1,550	26	4,478	M	$65,000							S	$8,956
Maple Court	100	26	289	M	$5,000							S	$578
Mathews Avenue	2,680	18	5,360	M	$20,000	OF	$67,000					S	$10,720
Mohawk	360	26	1,040					CS	$364			S	$2,080
Oak Drive	1,210	26	3,496					CS	$1,223			S	$6,991
Pavilion Way	340	26	982					CS	$344			S	$1,964
Pawnee Road	1,540	26	4,449					CS	$1,557			S	$8,898
Pueblo Road (Twp. to Ute)	1,030	26	2,976					CS	$1,041			S	$5,951
Pueblo Road (Ute to Lenape)	1,160	26	3,351					CS	$1,173			S	$6,702
Sand Road (US 202 to rail road)	540	34	2,040							M	$40,800	S	$4,080
Sand Road (Rail road to Industrial)	530	26	1,531							M	$30,622	S	$3,062
Sand Road (Industrial to Mathews)	190	26	549							M	$10,978	S	$1,098
Service Road A (East)	500	20	1,111			OF	$13,889					S	$2,222
Service Road B (West)	940	20	2,089			OF	$26,111					S	$4,178
N. Shady Retreat Road	1,970	20	4,378			S	$8,756					S	$8,756
S.Shady Retreat Road	500	26	1,444					CS	$506			S	$2,889
Sioux Road (west)	1,410	36	5,640					CS	$1,974			S	$11,280
Sioux Road (east)	290	32	1,031					CS	$361			S	$2,062
Spring Lake Drive	1,120	20	2,489					CS	$871			S	$4,978
Stefan Place	340	26	982			S	$1,964					S	$1,964
N. Tamanend Avenue (US202 to Sioux)	1,100	26	3,178					CS	$1,112			S	$6,356
N. Tamanend Avenue (Sioux to Pawnee)	450	26	1,300					CS	$455			S	$2,600
N. Tamanend Avenue (Pawnee to Mohawk)	850	26	2,456					CS	$859			S	$4,911
N. Tamanend Avenue (Mohawk to Iroqouis)	700	26	2,022					CS	$708			S	$4,044
N. Tamanend Avenue (Iroqouis to end)	400	26	1,156							M	$23,111	S	$2,311
N. Tamanend Avenue (US202 to Sioux)	1,080	30	3,600					CS	$1,260			S	$7,200
Ute Road	900	26	2,600			S	$5,200	CS	$910			S	$5,200
Vine Street	1,030	26	2,976			S	$5,951	CS	$1,041			S	$5,951
Woodland Drive	240	18	480					CS	$168			S	$960
Miscellaneous Box-Out Repairs *								BO	$50,000	BO	$25,000		
				Total Cost =	**$95,000**		**$251,893**		**$110,294**		**$153,000**		**$266,222**
				Total 5 year projected cost =			**$876,409**						

LEGEND:		COST / SY OF ROADWAY
BO	Boxouts	N/A
CS	Crack seal	$0.35
M	Mill and Pave	$20.00
OC	Oil & Chip (double application)	$2.50
S	Slurry Seal	$2.00
OF	Overlay (w/ Fabric)	$12.50
*	Partial roadway construction	

2017 costs are based upon construction bids

APPENDIX 'D'

PAVEMENT CONDITIONS:

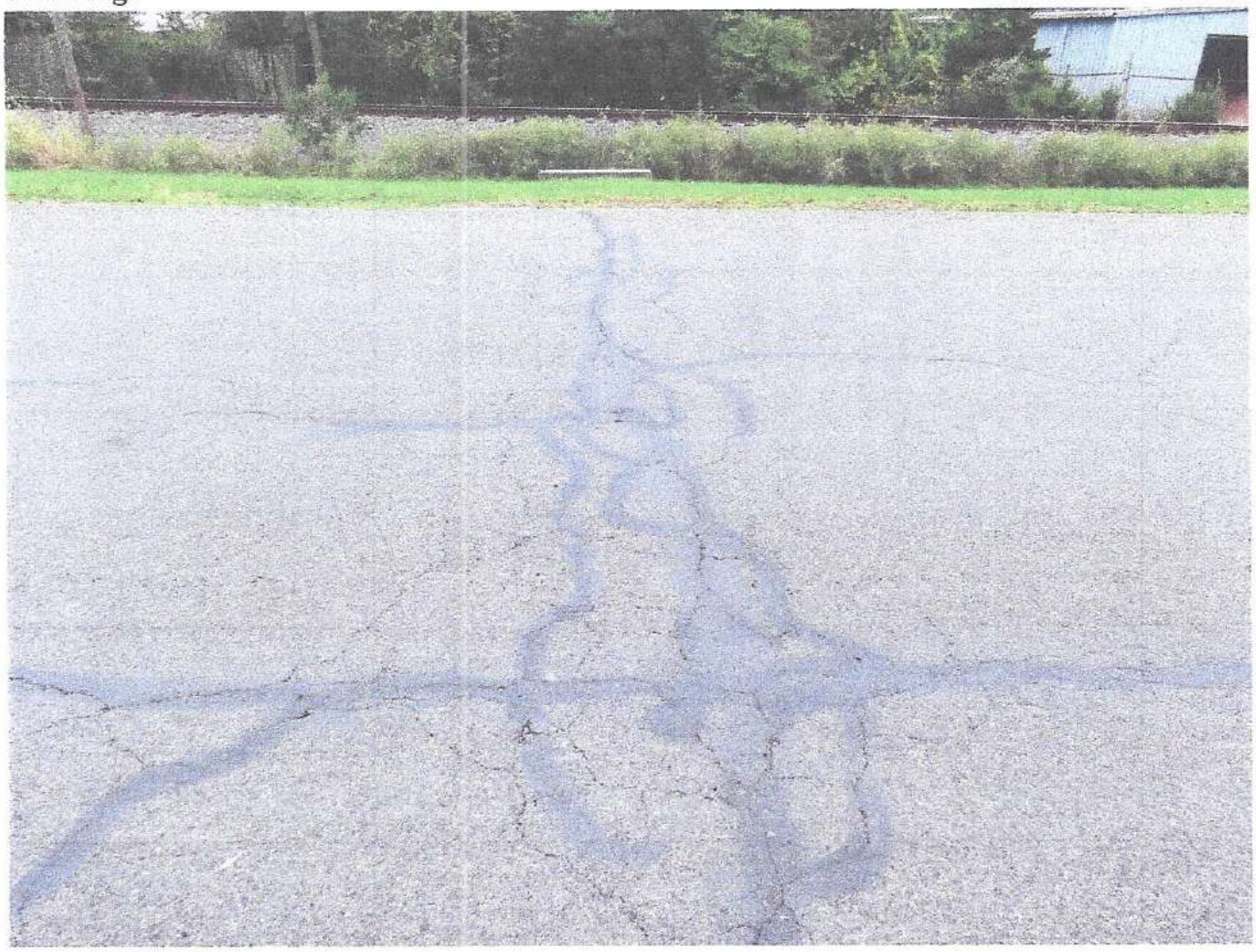
New pavement:

Rutting:

Edge failure / alligatoring:

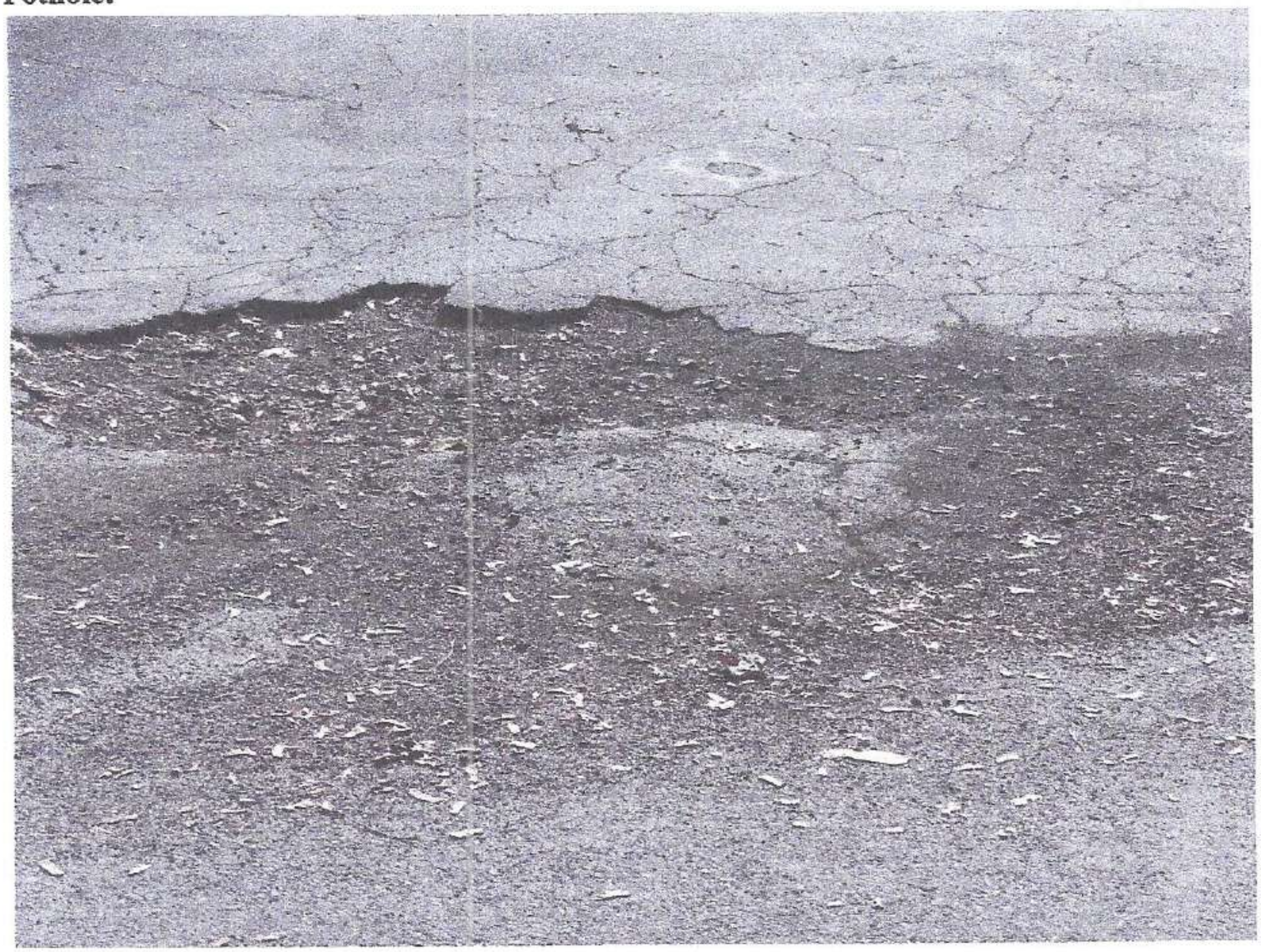
Settlement:

Cracking:



Rutting / alligatoring:

Pothole:



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APPENDIX 'E'

Gilmore and Associates, Inc. Report of Pavement Evaluations

GILMORE & ASSOCIATES, INC.
ENGINEERING & CONSULTING SERVICES

COMMONWEALTH OF PENNSYLVANIA
REGISTERED PROFESSIONAL
Gregory Allen Sullivan
ENGINEER
NO. PE-054190-E

REPORT OF
PAVEMENT EVALUATIONS

FOR

AARONS AVENUE
MATHEWS AVENUE
MAPLE LANE

FILE NO. 201703034

April 19, 2017

Prepared For:

New Britain Borough
Attention: Sam Bryant
45 Keeley Avenue
New Britain, PA 18901

Prepared By:

Gilmore & Associates, Inc.
Engineers • Land Surveyors • Planners • GIS Consultants
65 East Butler Avenue, Suite 100
New Britain, PA 18901
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1.0 PROJECT OBJECTIVE AND SCOPE OF SERVICES

Gilmore & Associates, Inc. (G&A) has prepared this report of pavement evaluations for three New Britain Borough roads: Aarons Avenue, Mathews Avenue, and Maple Lane. This pavement evaluation was performed in accordance with G&A Services Agreement No. 201703034. The study was designed and executed to evaluate the existing pavement conditions at the site, and assess the scheduled mill and overlay treatments to the existing pavement surfaces. The scope of services included a coring program and site reconnaissance at each site, and the preparation of this report.

2.0 SITE DESCRIPTIONS

Aarons Avenue, Mathews Avenue, and Maple Lane were evaluated as a part of this pavement assessment. These paved areas consist of residential roadways and cul-de-sacs located in New Britain Borough.

For site plans showing these paved areas and the core locations, refer to the Appendix.

3.0 EVALUATION PARAMETERS

G&A visited the project site to visually observe, perform subsurface investigation, and document the existing conditions of the asphalt surfaces on March 23-24, 2017. G&A conducted the evaluation to document failure types and severity at the site. G&A also documented failures via photograph and recorded approximate location, as seen on the Coring Location Sketches, attached to this report. Also while on site, G&A performed pavement coring to evaluate pavement thickness and sub stone thickness. For reference, definitions of failure types observed at on these sites are provided below:

Fatigue (Alligator) Cracking – a series of interconnecting cracks caused by fatigue failure of the asphalt concrete surface under repeated traffic loading.

Block Cracking – interconnected cracks that divide the pavement into approximate rectangular pieces and is caused mainly by shrinkage of the asphalt concrete and daily temperature cycling. Block cracking is generally not load associated as with fatigue cracking.

Edge Cracking – cracks parallel to, and near the outer edge of the pavement section accelerated by traffic loading and can be caused by frost-weakened base or subgrade near the edge of the pavement.

Longitudinal and Transverse Cracking – cracks parallel and/or perpendicular to the centerline or lay down direction. Could be caused by poorly constructed joints, shrinkage from daily temperature cycling, and reflective crack caused by cracking beneath the surface.

Patching/Utility Cuts – repaired areas of pavement that have been replaced with new material. A patch is considered a pavement defect regardless of how well it is performed, and will usually not perform as well as the original pavement section.

Raveling – wearing away of the pavement surface due to a loss of the asphalt or tar binder and dislodging of aggregate particles.

4.0 PAVEMENT EVALUATION FINDINGS

A description of G&A's observations and recommendations are provided in the following sections. Please refer to the coring results and locations of various areas in the Appendix of this report.

4.1 – Aarons Avenue

Visual Description:

Based on visual condition, we believe that the existing pavement surface on Aarons Ave is approximately 20 years old. G&A observed medium severity block cracking, low to medium severity longitudinal and edge cracking, and low severity raveling (Photo 1 through Photo 3). This pavement distress appears to be due to general pavement age, and lack of edge support and weakened subgrade near the edge of the pavement.

Coring Results Summary:

G&A extracted eight cores in this area (C-1 through C-8); the results of the coring are provided in the Appendix. In general, three to four layers of asphalt materials were encountered, totaling between 2.75 and 9.0 inches of bituminous paving. The subbase materials encountered consists of ballast stone. This material was commonly used to stabilize weak subgrades at the time of original construction. The hole could not be advanced beyond the ballast stone subbase to classify the soil subgrade.

4.2 – Mathews Avenue

Visual Description:

Based on visual condition, we estimate that the existing pavement surface is approximately 25 years old. G&A observed medium severity edge cracking, low severity longitudinal/transverse cracking, and low medium raveling, and medium to high severity potholes utility cut/patches (Photo 4 through Photo 8). This pavement distress appears to be due to general pavement age.

Coring Results Summary:

G&A extracted eight cores in this area (C-9 through C-16); the results of the coring are provided in the Appendix. In general, two to three layers of asphalt materials were encountered, totaling between 2.25 and 5.25 inches of bituminous paving. The subbase materials encountered consists of ballast stone. The hole could not be advanced beyond the ballast stone subbase to classify the soil subgrade.

4.3 – Maple Lane

Visual Description:

Based on visual condition, we estimate that the existing pavements are approximately 25 years old. In general, G&A observed medium severity alligator cracking, low severity longitudinal/transverse cracking, low to medium severity raveling, and medium severity utility cut/patches. (Photo 9 through Photo 13). This pavement distress appears to be due to general pavement age.

In one particular area, at the intersection of Maple Court and Maple Lane, a higher concentration of distress was observed. Here, G&A observed moderate to high severity alligator cracking, raveling, and potholes (Photo 14). This elevated degree of pavement distress appears to be the result of poor drainage at this location.

Coring Results Summary:

G&A extracted eight cores in this area (C-17 through C-24); the results of the coring are provided in the Appendix. In general, two to three layers of asphalt materials were encountered, totaling between 2.5 and

4.5 inches of bituminous paving. The subbase materials encountered consists of ballast stone at each core location except C-23. The subbase material encountered in C-23 consists of concrete. The hole could not be advanced beyond the ballast stone or concrete subbase to classify the soil subgrade.

5.0 DISCUSSION & RECOMMENDATIONS

According to the Street Evaluation for Rehabilitation Work 2017-2021, Aarons Avenue, Maple Lane, Maple Court, and Mathews Avenue are scheduled to receive a mill and overlay treatment in the year 2017. Outlined below are the recommended repair methods for each site based on the observed conditions:

Aarons Avenue – G&A agrees that Aarons Avenue is in suitable condition to receive a mill and overlay repair. Isolated full depth repairs should be anticipated during this process in particularly distressed areas to reduce the potential for reflective cracking resulting from distressed underlying pavement materials to remain.

Mathews Avenue, Maple Lane, Maple Court – G&A recommends that Matthews Avenue, Maple Lane, and Maple Court receive full depth asphalt replacement due to the generally poor condition of these roads, the severity of distress observed, and the condition of the underlying bituminous material. We believe that a mill and overlay treatment over a poor existing pavement section would result in reflective cracking and subsequent rapid deterioration. In addition, we recommend that consideration be given to drainage improvements along these roads. Specifically, we recommend re-grading and adding inlets at the intersection of Maple Court and Maple Lane, and edge drains or concrete swales to manage stormwater runoff along Matthews Ave. These drainage improvements will improve the pavement longevity and decrease ongoing maintenance and repairs.

General Recommendations – Mill and Overlay Areas

- Mill the existing pavement to a depth of 1.5 inches.
- Proofroll the exposed pavement using a fully loaded tri-axle dump truck to follow. G&A personnel will delineate soft or distressed areas, if present, requiring full depth removal.
- Saw cut and remove existing pavement identified by G&A personnel, and remove underlying aggregate and soil, exposing stable material.
- Backfill overexcavated areas to top of adjacent subbase elevation with compacted PADOT 2A coarse aggregate, followed by Superpave 19mm HMA binder course material, to the top of the adjacent milled surface.
- Fill/seal existing cracks in milled paving as directed by G&A field representative.
- Clean and tack coat existing milled surface.
- Install Superpave 9.5mm leveling course material as required to maintain proposed grading.
- Install 1.5 inches of new Superpave HMA 9.5 mm wearing course.

General Recommendations – Full Depth Asphalt Replacement

- Mill the full depth of the existing asphalt paving, exposing the underlying stone subbase.
- Proofroll the exposed subbase using a fully loaded tri-axle dump truck to follow. G&A personnel

will delineate soft or distressed areas, if present, requiring stone/subgrade removal.

- In weak/unstable areas identified by the proofroll. Remove underlying aggregate and soil, exposing stable material.

- Backfill overexcavated areas to top of adjacent subbase elevation with compacted PADOT 2A coarse aggregate. Place additional PADOT 2A coarse aggregate as required to establish proposed grading, accounting for the variable thickness of the bituminous paving that was removed.

- Install the following minimum pavement section:

  1.5 inches Superpave 9.5mm HMA wearing course on
  3.0 inches of Superpave 19mm HMA binder course.

Cost Implications

- Aarons Ave: the cost currently budgeted for mill and overlay of this roadway is $72,000. G&A is not recommending alterations to this scope and budget.

- Maple Lane: the cost currently budgeted for mill and overlay of this roadway is $89,556. If G&A's recommendations are implemented, we estimate the budget would need to increase to $228,510 ($215,0110 for full depth paving and $13,500 for drainage improvements).

- Maple Court: the cost currently budgeted for mill and overlay of this roadway is $5,778. If G&A's recommendations are implemented, we estimate the budget would need to increase to $13,005 for full depth paving replacement.

- Matthews Ave: the cost currently budgeted for mill and overlay of this roadway is $107,200. If G&A's recommendations are implemented, we estimate the budget would need to increase to $321,600 ($241,200 for full depth paving replacement, and $80,400 for pavement edge drainage).

The above costs estimates are based on unit rates developed from a review of recent G&A project bid tabulations. Actual bid costs will vary based on a variety of factors.

Construction Quality Assurance

The construction of the proposed pavement improvements will require field evaluation and delineation of distressed pavements and unsuitable subgrades. The quality of the field evaluations and subsequent repairs will directly impact the outcome of the pavement repair program. We recommend that New Britain Borough engage a qualified geotechnical engineer to provide construction quality assurance services during the course of this work.

6.0 LIMITATIONS

The conclusions and recommendations contained in this report are based on visual site observations and limited pavement coring and evaluation of subgrade soils. Should conditions arise which differ from those specifically stated herein, Gilmore & Associates, Inc. should be notified immediately so that our recommendations can be reviewed and revised, if necessary.

These recommendations are further based on the assumption that Gilmore & Associates, Inc. will provide technical observation during construction.

We appreciate the opportunity to be of continued service to New Britain Borough. If you have any questions, or if we can be of further assistance, please contact us at 215-345-4330.

Respectfully Submitted,

Gregory A. Sullivan, P.E.
Geotechnical & Construction Services Manager
Gilmore & Associates, Inc.

GAS/dmk

Appendix: Asphalt Coring Location Plans
Asphalt Coring Results
Photo Report

cc: Erik Garton, P.E. Vice President, Gilmore & Associates, Inc.

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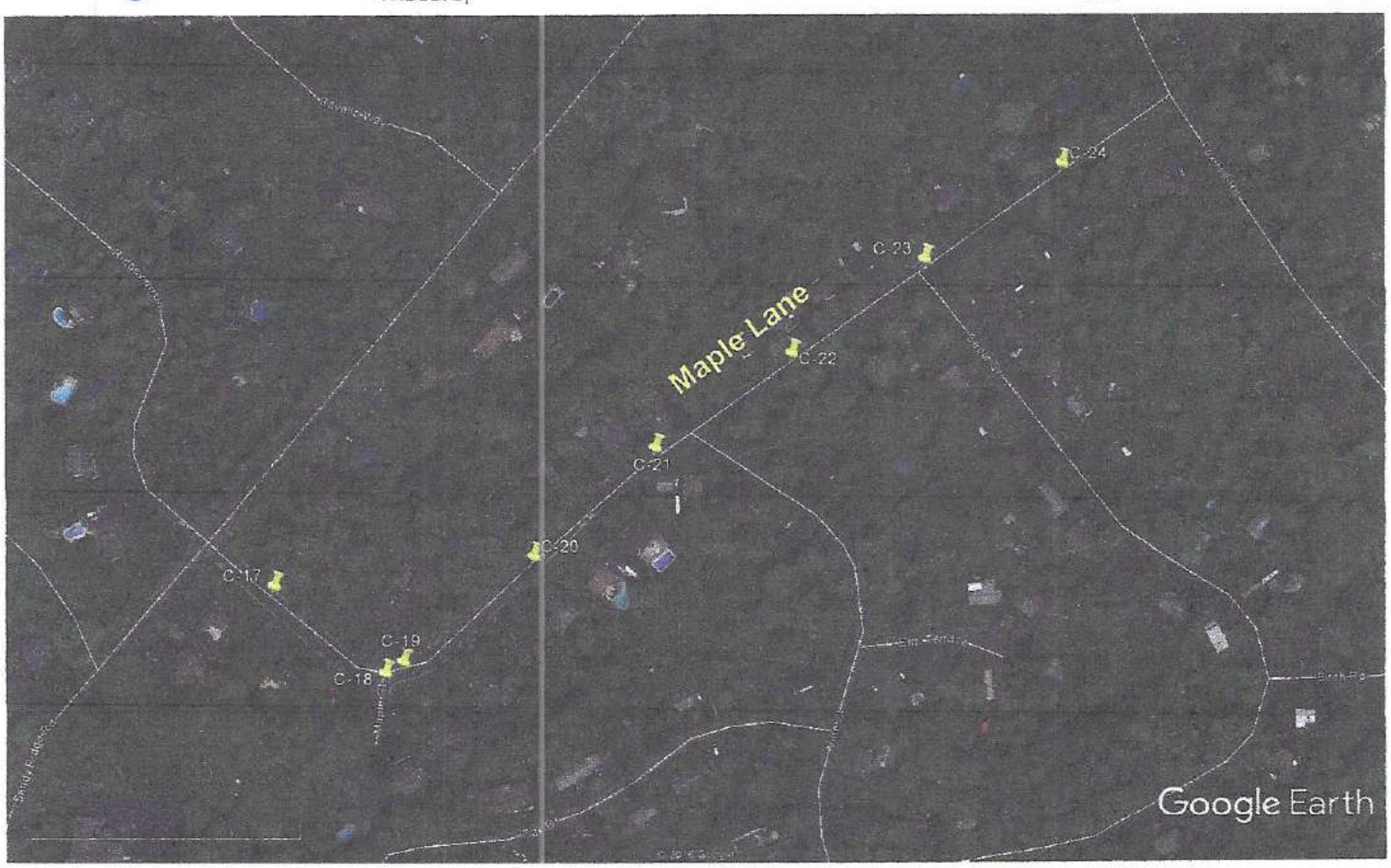
Figure 1 - Coring Location Sketches

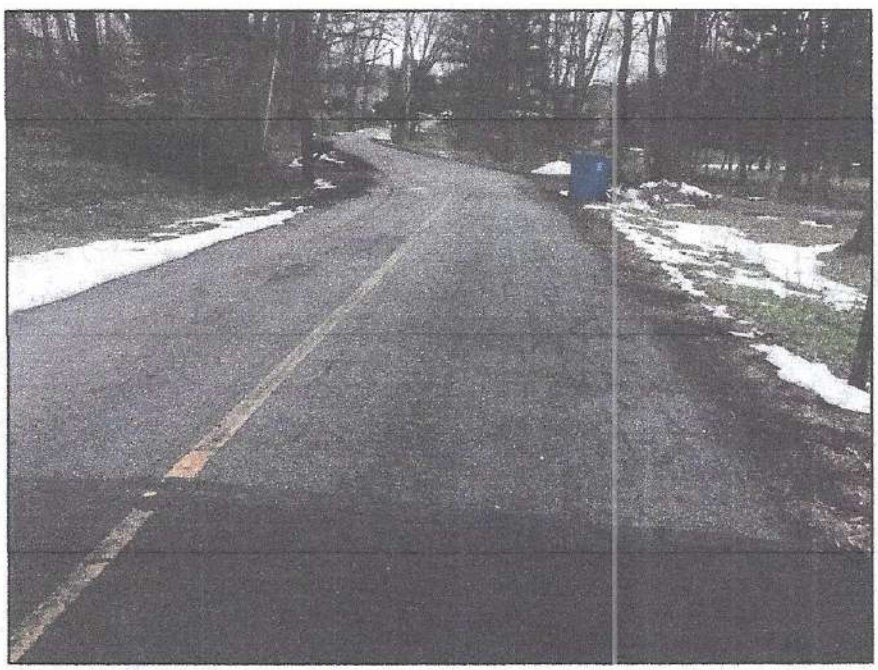
Google Earth feet 1000 meters 500



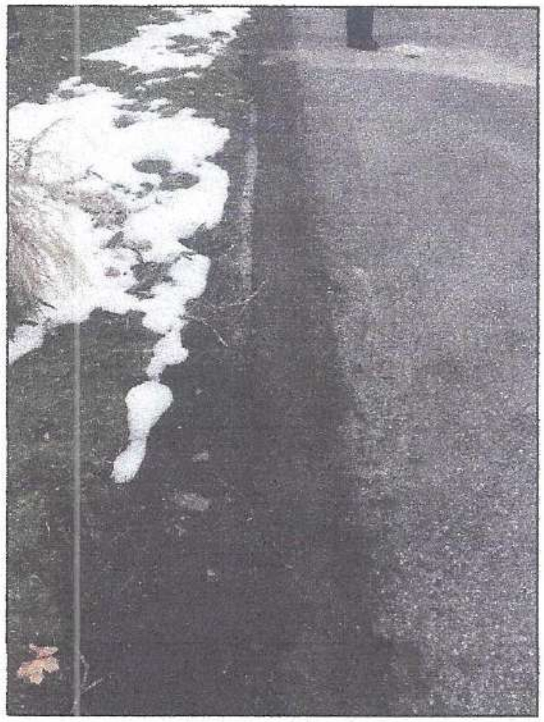
Google Earth feet 1000 meters 400

Photo Report

1) Aarons Avenue – Medium severity block cracking



2) Aarons Avenue – Low to medium severity longitudinal and edge cracking, low severity raveling

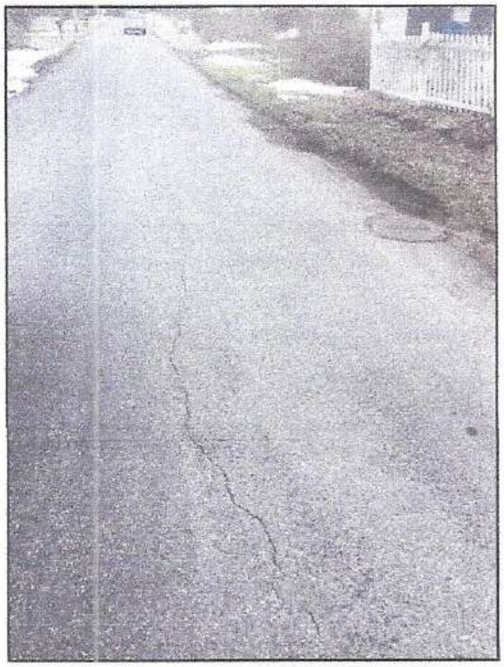


3) Aarons Avenue –Medium severity edge cracking

4) Mathews Avenue – Medium severity edge cracking, high severity pothole. Distress concentrated at edges of road due to poor drainage.

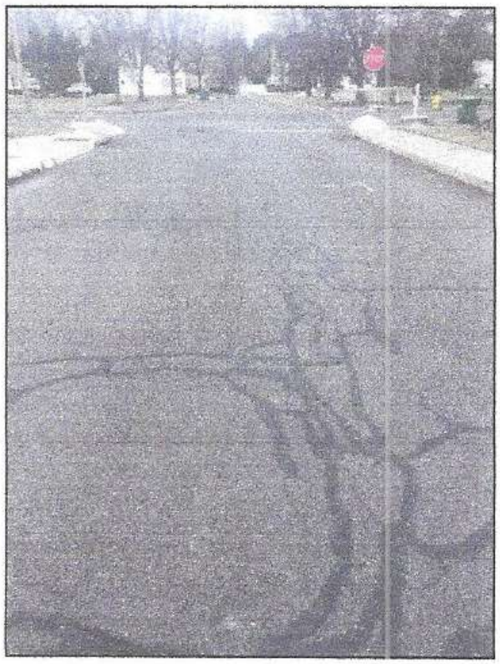
5) Mathews Avenue – Medium severity patching/utility cut, medium severity edge cracking

6) Mathews Avenue –High severity patching, medium severity raveling, medium severity edge cracking, low severity longitudinal cracking/block cracking

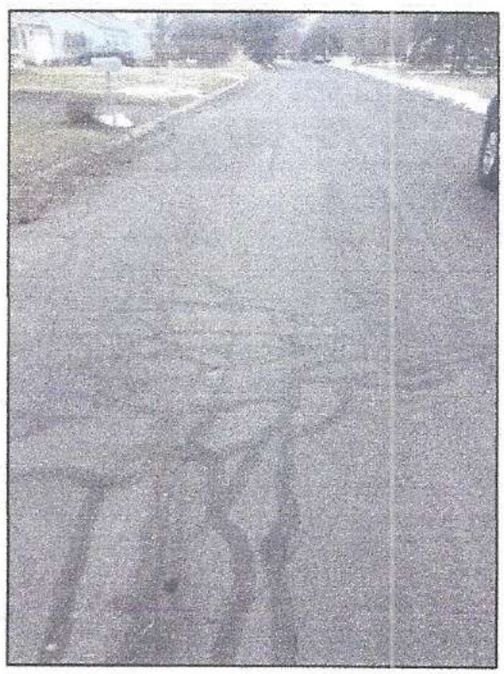


7) Mathews Avenue – Low severity longitudinal/transverse cracking

8) Mathews Avenue – Medium severity patching, low severity longitudinal cracking, and medium severity edge cracking. Repeat pavement failures due to poor drainage along edge of the road.



9) Maple Lane – Medium severity alligator cracking, low severity longitudinal/transverse cracking



10) Maple Lane – Medium severity alligator cracking, medium severity utility patching

11) Maple Lane –Low to medium severity raveling

12) Maple Lane – Low severity longitudinal/transverse cracking

13) Maple Lane – Medium severity alligator cracking, low severity longitudinal/transverse cracking.

14) Maple Lane –High severity alligator cracking, high severity potholes, medium to high severity raveling. High degree of pavement distress correlated to poor drainage.

Project # 17-03034
New Britain Borough Paving Program

Core Table
Date: 3/24/17

Core No.	Location	Material Type	Thickness	Total	Notes
C-1	Aarons Ave	Tar & Chip	1.75"		
		Wearing Course	1.25"		Severe Voids
		Binder Course	2.0"	5.0" Asphalt	Deteriorated
		Subbase	*	-	Ballast Stone
C-2	Aarons Ave	Tar & Chip	1.75"		
		Binder Course	2"	3.75" Asphalt	Moderate Voids
		Subbase	6.0"	9.75" Asphalt & Stone	Ballast Stone
C-3	Aarons Ave	Tar & Chip	0.25"		
		Wearing Course	2.0"		Moderate Voids
		Binder Course	0.75"		Moderate Voids
		Wearing Course	1.5"		Separated from other course
		Binder Course	1.75"	6.25" Asphalt	
		Subbase	*	-	Ballast Stone
C-4	Aarons Ave	Tar & Chip	0.5"		
		Wearing Course	1.5"		Minimal Voids
		Binder Course	1.25"		Minimal Voids
		Wearing Course	2.0"		
		Binder Course	3.75"	9.0" Asphalt	
		Subbase	*	-	Ballast Stone
C-5	Aarons Ave	Tar & Chip	0.5"		
		Wearing Course	0.75"		Moderate Voids
		Binder Course	1.5"	2.75" Asphalt	Deteriorated
		Subbase	-	-	Ballast Stone
C-6	Aarons Ave	Tar & Chip	0.5"		
		Wearing Course	1.5"		Moderate Voids
		Wearing Course	1.25"		Moderate Voids
		Base Course	4.0"	7.25" Asphalt	Moderate Voids
		Subbase	*	-	Ballast Stone

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New Britain Borough Paving Program

Core Table
Date: 3/24/17

Core No.	Location	Material Type	Thickness	Total	Notes
C-7	Aarons Ave	Tar & Chip	0.75"		
		Binder Course	4.25"	5.0" Asphalt	Courses Separated
		Subbase	*	-	Ballast Stone
C-8	Aarons Ave	Tar & Chip	0.5"		
		Binder Course	3.5"	4.0" Asphalt	Severe Voids
		Subbase	*	-	Ballast Stone
C-9	Mathews Ave	Tar & Chip	0.5"		
		Binder Course	3.5"	4" Asphalt	Moderate Voids
		Subbase	*	-	Ballast Stone
C-10	Mathews Ave	Tar & Chip	1.0"		
		Binder Course	2.5"	3.5" Asphalt	Moderate Voids
		Subbase	*	-	Ballast Stone
C-11	Mathews Ave	Tar & Chip	0.5"		Course Separated
		Binder Course	1.75"	2.25" Asphalt	Deteriorated
		Subbase	*	-	Ballast Stone
C-12	Mathews Ave	Tar & Chip	0.25"		
		Tar & Chip	0.25"		
		Wearing Course	0.5"		
		Wearing Course	0.75"		Minimal Voids
		Binder Course	1.75"	3.5" Asphalt	Moderate Voids
		Subbase	*	-	Ballast Stone
C-13	Mathews Ave	Tar & Chip	0.25"		
		Tar & Chip	0.25"		
		Wearing Course	0.5"		
		Binder Course	2.0"	3" Asphalt	Moderate Voids
		Subbase	*	-	Ballast Stone
C-14	Mathews Ave	Tar & Chip	0.25"		
		Tar & Chip	0.25"		
		Binder Course	2.0"	2.5" Asphalt	Deteriorated
		Subbase	*	-	Ballast Stone
C-15	Mathews Ave	Tar & Chip	0.5"		
		Binder Course	4.5"	5" Asphalt	Minimal Voids
		Subbase	*	-	Ballast Stone

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Core Table
Date: 3/24/17

Core No.	Location	Material Type	Thickness	Total	Notes
C-16	Mathews Ave	Wearing Course	0.5"		
		Binder Course	2.25"		Moderate Voids
		Base Course	2.5"	5.25" Asphalt	Course Separated
		Subbase	*	-	Ballast Stone
C-17	Maple Lane	Tar & Chip	.25"		
		Wearing Course	1"		Moderate Voids
		Binder Course	1.5"	2.75" Asphalt	Moderate Voids
		Subbase	*		Ballast Stone
C-18	Maple Lane	Tar & Chip	0.175"		
		Tar & Chip	0.175"		
		Wearing Course	1"		Serve Voids
		Binder Course	2.5"	3.75" Asphalt	Deteriorated
		Subbase	*	-	Ballast Stone
C-19	Maple Lane	Tar & Chip	0.175"		
		Wearing Course	1.5"		Moderate Voids
		Binder Course	1.5"	3.175" Asphalt	Moderate Voids
		Subbase	*	-	Ballast Stone
C-20	Maple Lane	Tar & Chip	.175"		
		Wearing Course	1.5"		Moderate Voids
		Binder Course	2.75"	4.375" Asphalt	Moderate Voids
		Subbase	*	-	Ballast Stone
C-21	Maple Lane	Tar & Chip	0.175"		
		Binder Course	4.175"	4.25" Asphalt	Minimal Voids
		Subbase	*	-	Ballast Stone
C-22	Maple Lane	Tar & Chip	0.25"		
		Wearing Course	1.25"		Moderate Voids
		Binder Course	3.0"	4.5" Asphalt	Moderate Voids
		Subbase	*	-	Ballast Stone
C-23	Maple Lane	Tar & Chip	0.25"		
		Binder Course	2.25"	2.5" Asphalt	Deteriorated
		Subbase	*	-	Concrete

Project # 17-03034
New Britain Borough Paving Program

Core Table
Date: 3/24/17

Core No.	Location	Material Type	Thickness	Total	Notes
C-24	Maple Lane	Tar & Chip	0.25"		
		Wearing Course	1.0"		Minimal Voids
		Binder Course	3.0"	4.25" Asphalt	Deteriorated
		Subbase	*	-	Ballast Stone

*Thickness of subbase could not be determined using hand operated equipment.