

TOWN OF LELAND

**PAVEMENT CONDITION AND PAVEMENT
MARKINGS CONDITION ASSESSMENT**



**BRUNSWICK ENGINEERING COMPANY
LICENSE NO. F-1380**

JANUARY 17, 2023

TABLE OF CONTENTS

SECTION	PAGES
EXECUTIVE SUMMARY	2
1. PAVEMENT CONDITION RATING SYSTEM	3-9
2. STREET INVENTORY	10-12
3. STREET LENGTHS	13
4. STREET PAVEMENT CROSS SECTION DESIGNS	14-15
5. CONDITION OF EXISTING PAVEMENT	16-19
6. REPAIR RECOMMENDATIONS	20
7. CONDITION OF PAVEMENT MARKINGS WITH INSTALLATION AND/OR REINSTALLATION RECOMMENDATIONS	21-25
8. PAVEMENT REPAIR OPINION OF PROBABLE COST	26-27
9. PAVEMENT MANAGEMENT POLICY RECOMMENDATIONS	28
 APPENDIX	
1. ALPHABETICAL LISTING OF ALL STREETS	1-1 to 1-10
2. COLLECTOR STREETS RANKED BY PCR	2-1 to 2-2
3. LOCAL STREETS RANKED BY PCR	3-1 to 3-10
4. INDIVIDUAL COLLECTOR STREET PAVEMENT MARKINGS	4-1 to 4-18
5. COLLECTOR STREET OPINIONS OF PROBABLE COST	5-1 to 5-5
6. LOCAL STREET OPINIONS OF PROBABLE COST	6-1 to 6-10
7. RESIDENTIAL STREET PAVEMENT MARKINGS	7-1 to 7-3

EXECUTIVE SUMMARY

An effective Pavement Management System (PMS) depends on having reliable, accurate and complete information available. Having quality and recent pavement condition assessment data available is directly linked to the ability of the PMS to contribute to the development of reasonable and reliable recommendations and decisions regarding the Town's Street network.

The Town has over 96 miles of streets in its street network. Those streets were divided into 514 separate lengths of streets or street rating blocks for the purpose of this condition assessment with the longer streets being divided into multiple rating blocks. The Town has recently inspected a number of streets prior to accepting them for maintenance responsibility. Also, the Town has a street resurfacing program and a street paving program underway. A total of 39 street blocks were not inspected as a part of this contract as the Town staff had recently inspected the streets. However, these streets were included in the overall street rating system. Those streets were given a rating score of 100 as they will be or have been brought up to Town standards. As result, a total of 466 street blocks were inspected and rated. The lowest rated Collector Streets and Local Streets as determined by the Pavement Condition Ratings (PCR) are as follows:

LOWEST RATED COLLECTOR STREETS

STREET	FROM	TO	PCR
GRANDIFLORA DR.	ALBA LN.	GREYMOSS LN.	64
WESPORT DR.	RIVER RD.	ISLAND CT.	65
BRUNSWICK FOREST PKWY.	DRUIDS GLEN DR.	LOW COUNTRY BLVD.	67
PINE HARVEST DR.	PEMBERTON DR.	END OF MAGNOLIA GREENS	69
ENTERPRISE DR.	CITY LIMITS	PINE HARBOR WAY	72

LOWEST RATED LOCAL STREETS

STREET	FROM	TO	PCR
CAROLINA AVE.	OLD FAYETTEVILLE RD.	VILLAGE RD.	54
OAK LN.	OLD FAYETTEVILLE RD	DEAD END	61
PARKMORE CT.	WINDING TRAIL DR.	CUL-DE-SAC	63
MT. PLEASANT CIR.	LOW COUNTRY BLVD.	MOSSVALE LN.	64
WINDING TRAILDR.	PINE HARVEST DR.	CLOVERFIELD CT.	64
EMBERWOOD DR.	MALLORY CREEK DR.	DEAD END	65
CRYSTAL STONE CT.	STONEY CREEK LN.	CUL-DE-SAC	66
GREENSVIEW CIR.	SUNSET DR.	GREENSVIEW CIR.	66
HOLLY HILLS DRIVE.	TURN OUT	CUL-DE-SAC	66
LANVALE HILLS CIRCLE.	ORCHARD LOOP RD.	CUL-DE-SAC	67

Also, the condition of the pavement markings on the Collector streets was also evaluated. A total of 60,241 feet of centerline has been installed. 24,756 feet of centerlines need to be installed on six collector streets. A total of 158 stop bars have been installed; however, 59 stop bars need to be installed on eleven collector streets. A total of 89 crosswalks have been installed and 98 crosswalks need to be installed on ten collector streets.

SECTION 1

PAVEMENT CONDITION RATING SYSTEM

To accurately and fairly rate the condition of all streets maintained by the Town of Leland-, a Pavement Condition Rating System was developed. The Pavement Condition Rating System was based upon the NC DOT Pavement Condition Survey System and the FHWA Practical Guide for Quality Management of Pavement Condition Data Collection. The rating system was amended slightly to reflect the urban nature of the streets that the Town is responsible for maintaining.

Each street was assessed and rated using the following eight criteria:

1. Alligator Cracking
2. Transverse Cracking
3. Raveling /Pavement Slippage
4. Pavement Oxidation
5. Asphalt Bleeding
6. Ride Quality
7. Existing Patches in the street
8. Depressions in the Existing Pavement

Definitions and pictorial examples of the rating criteria are provided on the following pages.

1. ALLIGATOR CRACKING

Alligator cracking is a series of interconnecting cracks caused by the failure of the base or subbase under traffic loading. The failure of the base or subbase results in cracks that connect, forming many sided, sharp angled pieces that develop a pattern similar to the skin of an alligator i.e., alligator cracking. Alligator cracking if left unrepaired could result in roadway failure and a potential increase in accidents due to pothole formation and loss of pavement.



2. TRANSVERSE CRACKING

Transverse cracks extend across the pavement at right angles to the pavement centerline. These cracks are generally caused by differential base settlement or poor pavement construction techniques.



3. RAVELING/PAVEMENT SLIPPAGE

Raveling is the wearing away of the pavement surface caused by the dislodging of aggregate particles or loss of asphalt binder. Raveling can be caused by moisture getting between the riding surface course and the base course of asphalt.

Pavement slippage is caused by the failure of the tack coat or prime coat to adhere to the riding surface. The resultant failure is generally crescent shaped and can occur at any time after the road has been paved or repaved.



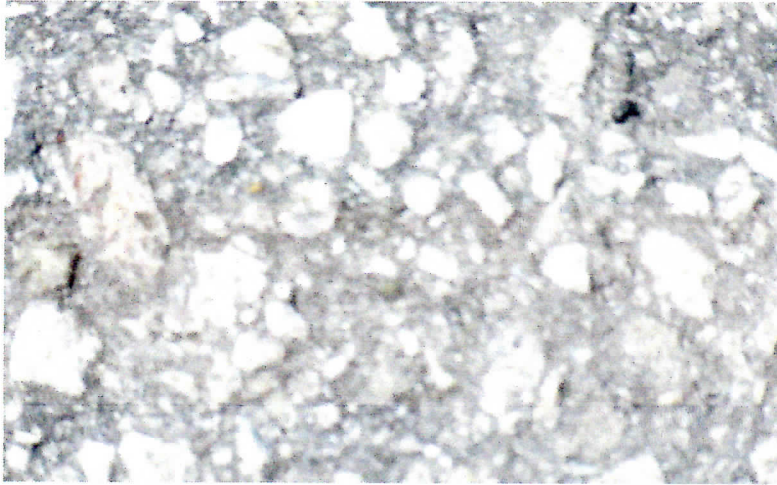
RAVELING



PAVEMENT SLIPPAGE

4. PAVEMENT OXIDATION

Pavement oxidation is the hardening and aging of the asphalt riding surface. The surface layer of asphalt has worn away or oxidized due to the sun's ultra violet radiation to expose the coarse aggregate. Pavement Oxidation usually covers the entire roadway surface.



SEVERE PAVEMENT OXIDATION



NO PAVEMENT OXIDATION

5. ASPHALT BLEEDING

Asphalt bleeding is a film of bituminous material on the pavement surface that creates shiny tar-like surface. Bleeding occurs during the hot summer months and is caused by excessive asphalt in the pavement mix, excessive tack coat, and/or low air void content.



6. RIDE QUALITY

Ride quality is related to the surface condition of the road. It is a measure of how smooth or rough the surface is and is impacted by raveling, depressions, pavement patching, alligator cracking, and other pavement defects.



7. EXISTING UTILITY REPAIR PATCHES

An existing utility repair patch is an area of pavement that has been replaced with new material to repair the existing pavement. A patch is considered a defect no matter how well it has been repaired as it is more likely to fail than the surrounding original pavement.



8. PAVEMENT DEPRESSIONS

Depressions are localized pavement sections where the pavement is lower than the surrounding pavement. Light depressions are called bird baths since they form after rainfall events. Deeper depressions can be a driving hazard. Depressions are caused by settlement of the base and subbase or improper construction. Depressions are often located at storm drainage or utility service pipe crossings where the dirt settles around the pipe.



WEIGHTING OF RATING SYSTEM FACTORS

After determining the rating criteria, a weighting system was developed to reflect the impact of the pavement deficiency on the short term and long-term viability of the roadway. For example, alligator cracking was determined to be the criteria with the highest short-term and long-term impact on the roadway. The weighting criteria used was as follows:

1. Alligator Cracking	0-25
2. Transverse Cracking	0-15
3. Raveling	0-10
4. Pavement Oxidation	0-10
5. Asphalt Bleeding	0-10
6. Ride Quality	0-10
7. Existing Patches in the Street	0-15
8. Depressions in the Existing Pavement	0-10

The rating system allowed a maximum of 100 points for a roadway in perfect condition. Points were deducted for each type of deficiency found within a street block. A copy of the data collection forms used in determining the Pavement Condition Rating for each street block is included in the Appendices attached to this report.

While two of the rating criteria (ride quality and pavement oxidation) were subjective, all of the remaining criteria were quantifiable. The field crew measured the size of the alligator cracking, length of the transverse cracking, number and size of the patches in the street, the number and size of the depressions in the street, the width and length of the edge raveling and the width and length of any asphalt bleeding. All of the data gathered in the field was used in the development of the Pavement Condition Rating for each street block. Copies of all of the completed field data sheets for each street have been provided to Town staff under a separate cover.

SECTION 2 STREET INVENTORY

The list of streets included in the Pavement Condition Assessment was based upon the 2021 Powell Bill Map and associated list of streets submitted to the NC DOT by the Town. The Powell Bill maps and associated street list showed 402 separate named streets that are Town-maintained. The Town had recently inspected some of the streets on the Powell Bill list and those streets were excluded from the list of streets to be assessed. The Town or developers have also recently awarded contracts to upgrade several streets and those streets were also excluded from the Pavement Condition Assessment. All of the Town-maintained streets were included in the overall list but the recently inspected and recently upgraded streets were shown as needing no repair. The Pavement Condition Assessment was based upon this corrected list of streets that are maintained by the Town.

To accurately reflect the conditions on longer streets, these streets were divided into smaller street blocks to account for varying pavement conditions. Streets with a length of greater than 2,000 feet were examined to determine if pavement conditions varied enough to merit dividing the street into multiple street blocks. If pavement conditions varied, the street was divided into logical street blocks that went from intersection to intersection. For example, Grandiflora Drive has an overall length of 14,018 feet and some sections have been previously resurfaced and some sections are still the original pavement. Based upon the varying pavement conditions, Grandiflora Drive was divided into 8 separate street blocks

Based upon the initial evaluation of all Town-maintained streets, 470 street blocks were identified for inclusion in the contract for evaluation. 42 streets were not assessed as they were recently inspected by the Town staff or a contract for the street's upgrade was awarded by the Town or developer. The resultant Pavement Condition Assessment Ranking includes 512 streets or street block segments.

For the purpose of this report, the streets were classified as Collector Streets or Local Streets. They are defined as follows:

Collector Street is a street that meets at least one of the following criteria:

- Has at least two lanes in each direction
- Has street pavement width greater than 30 feet for its entire length and at least six connecting streets, *OR* has a 30-foot pavement width for its entire length and a traffic volume that exceeds 1,000 vpd (vehicles per day)
- Connects two subdivisions with at least 500 lots in each subdivision

Local Street is any street not defined as a Collector Street.

TOWN OF LELAND 2023 PAVEMENT CONDITION ASSESSMENT

FORM NUMBER 1

DATE 10/17/22

STREET NAME BELVEDERE

PAVEMENT WIDTH FT

FROM CUL DE SAC

TO FAIRVIEW

BLOCK LENGTH 1191 FT

CURB AND GUTTER

PAVEMENT CONDITION ISSUES

	RATING RANGE	RATING SCORE
ALLIGATOR CRACKING	0 TO 25	<u> 20 </u>
TRANSVERSE CRACKING	0 TO 15	<u> 15 </u>
RAVELING	0 TO 10	<u> 7 </u>
PAVEMENT OXIDATION	0 TO 10	<u> 7 </u>
ASPHALT BLEEDING	0 TO 5	<u> 5 </u>
RIDE QUALITY	0 TO 10	<u> 7 </u>
EXISTING PATCHES	0 TO 15	<u> 13 </u>
PAVEMENT DEPRESSIONS	0 TO 10	<u> 10 </u>
TOTAL SCORE		<u> 84 </u>

RECOMMENDED MAINTENANCE REPAIR ALLIGATOR CRACKING

LOCATION OF PAVEMENT CONDITION ISSUES

BELVEDERE CT

TYPE OF PAVEMENT DISTRESS	BEGIN STA	END STA	WIDTH
ALLIGATOR CRACKING	0+06	0+24	3
ALLIGATOR CRACKING	0+27	0+39	4
ALLIGATOR CRACKING	0+40	0+60	4
RAVELING	0+64	1+48	3
RAVELING	1+02	1+38	1
PATCH	2+33	2+39	3
RAVELING	2+39	2+59	
OXIDATION LEVEL	MODERATE		

SECTION 3 STREET LENGTHS

The street lengths and street widths were not measured as a part of this contract. The measurements of the riding surface widths and street block lengths found in the spreadsheets included in the pages 3-1 to 3-7 of the Appendix are based upon measurement made in the FY18 Pavement Condition Assessment or the pavement lengths reflected in the Powell Bill list of streets.

The shortest Town-maintained street is Warwick Court, which is only 78 feet long. The longest Town-maintained street is Low Country Blvd., which is 14,577 ft. or 2.76 miles in length. The average street length is 1,276 feet. A summary of the total street lengths by major subdivision as shown on the Powell Bill list of streets is as follows:

TABLE 1

SUBDIVISION	TOTAL LENGTH OF STREETS (MILES)
Streets not in a Community	47.92
Brunswick Forest	25.87
Mallory Creek	8.25
Windsor Park	5.43
Westport	3.82
Grayson Park	2.86
Harrington Village	1.05
Hearthstone	0.66
Dabney Park	0.52
Colbert Place	0.32
Skylars Cove	0.26
Ibis	0.21

SECTION 4 STREET PAVEMENT CROSS SECTION DESIGNS

Four different types of street pavement cross section designs have been used in the construction of Town-maintained streets. They are:

1. Gravel Road with roadside ditches
2. Rural Road cross section with roadside ditches
3. Curb and gutter
4. Combination of curb and gutter and rural road section

The gravel roads and rural road cross section with ditches are located in the older section of the Town and were constructed prior to the adoption of the current subdivision ordinance. All streets that have been constructed since the adoption of the current subdivision ordinance have been constructed with concrete curb and gutter. Pictures of the various types of pavement cross sections shown below.

Table 2 shows the distribution of these street pavement cross sections within in the Town Figures 1-4 show examples of each type of Pavement Cross-Section.

TABLE 2

TYPE OF PAVEMENT CROSS SECTION	PERCENTAGE OF TOTAL STREETS
CURB AND GUTTER	83.59%
RURAL ROAD	15.48%
GRAVEL	0.01%
COMBINATION OF RURAL ROAD AND CURB AND GUTTER	0.57%



Figure 1 Standard Curb and Gutter



Figure 2 Rollover Curb and Gutter



Figure 3 Rural Road Section



Figure 4 Gravel Road Section

SECTION 5 CONDITION OF EXISTING PAVEMENT

Using the methodology outlined in Section 1 of this report, the Brunswick Engineering field crews inspected all 472 street blocks. An alphabetical listing of all of the street blocks that were evaluated is contained in the Appendix.

Overall, the Town-maintained streets are in good condition. Sixty-Six percent of the street blocks were found to be in average, good or excellent condition and did not currently need any repairs. Only 34% of street blocks were found to be in fair or poor condition and need work to improve the ride quality, traffic safety, and long-term structural integrity of the street. While most of the streets that are in good or excellent condition have been constructed within the last 10 years and show little signs of pavement distress, some streets that have been constructed within the past ten years have significant pavement failure and require repair.

Pavement Condition Rating Score for each street block was calculated based upon the pavement defects observed in that street block and the weighting system described in Section 1. Pavement Condition Rating Scores ranged from 0 being the lowest possible score to 100 being the highest score. A summary of the Pavement Condition Rating Scores for the 512 street blocks are shown in Table 3.

**TABLE 3
PAVEMENT CONDITION RATING SCORES**

Pavement Condition Rating (PCR)	Number of Streets	Percentage of All Paved Streets
50-59	1	0.20%
60-69	15	2.93%
70-74	25	4.88%
75-79	30	5.86%
80-84	71	13.87%
85-89	111	21.68%
90-94	125	24.41%
95-100	134	26.17%

A list of the collector streets and local streets with the lowest Pavement Condition Ratings (PCR) are shown in Tables 4 and 5.

**TABLE 4
LOWEST RATED COLLECTOR STREETS**

STREET	FROM	TO	PCR
Grandiflora Dr.	Alba Ln.	Greymoss Ln.	64
Westport Dr.	River Rd.	Island Ct.	65
Brunswick Forest Pkwy.	Druids Glen Dr.	Low Country Blvd.	67
Pine Harvest Dr.	Pemberton Dr.	End of Magnolia Greens	69
Enterprise Dr.	City Limits	Pine Harbor Way	72

**TABLE 5
LOWEST RATED LOCAL STREETS**

STREET	FROM	TO	PCR
Carolina Ave.	Old Fayetteville Rd.	Village Rd.	54
Oak Ln.	Old Fayetteville Rd.	Dead End	61
Parkmore Ct.	Winding Trail Dr.	Cul-De-Sac	63
Mt. Pleasant Cir.	Low Country Blvd.	Mossvale Ln.	64
Winding Trail Dr.	Pine Harvest Dr.	Cloverfield Ct.	64
Emberwood Dr.	Mallory Creek Dr.	Dead End	65
Crystal Stone Ct.	Stoney Creek Ln.	Cul-De-Sac	66
Greensview Cir.	Sunset Dr.	Greensview Cir.	66
Holly Hills Dr.	Turn Out	Cul-De-Sac	66
Lanvale Hills Cir.	Orchard Loop Rd.	Cul-De-Sac	67

The most common type of pavement failure was alligator cracking which normally is the result of poor subbase condition and/or high ground water conditions. Alligator cracking was found on 35% of the street blocks. In many cases, the alligator cracking was minor and isolated to a small area. In 106 of the street blocks, the alligator cracking impacted the ride quality or structural integrity of the street and needs repair.

Many streets contained multiple patches that ranged in size from 2 square feet to full pavement width patches. 32 streets contained areas where the original pavement was cut for some purpose and asphalt was reinstalled in the damaged area. Patches on these streets had settled and resulted in a depression that needed to be repaired. The sunken patch is the result of improper construction such as insufficient compaction in the patching process.

Transverse cracking was found on 26 streets. The width of the transverse crack had to be at least 1/2" wide and at least 50 feet long to be included as a pavement deficiency. Most of the transverse cracks occurred on the seam between the between the two sections of asphalt installed when the street was originally paved.

Pavement or edge raveling was found on 4% of the street blocks. Edge raveling was not confined to rural road sections as raveling was also found on streets with a curb and gutter pavement design.

Settlements and sinkholes were also found on 4% of the street blocks. In many cases, there was an obvious source of the settlement or sinkhole such as a leaking stormwater catch basin or settlement of the ground around a sewer manhole or sewer service. Some sinkholes and settlement had no obvious cause of the settlement and will require further study to determine the cause. The number of settlements around catch basins increase dramatically from the previous pavement condition assessment.

Severe pavement oxidation was found on thirteen street blocks. This is a significant increase from the previous pavement condition assessment. Most streets had light to moderate pavement oxidation. This was to be expected as most of the Town-maintained streets were paved within the last 15 years.

Other pavement deficiencies that were found include pavement construction issues such as improper rolling of the asphalt, pavement slippage after installation, and improper thickness of asphalt installation resulting in pavement failure. A number of cases of where the asphalt was installed lower than gutter was observed. This results in water standing on the pavement after rainfall events which could lead to pavement failure in cold conditions. We also found one location where the sewer manhole was significantly lower than the surrounding asphalt creating a potential traffic hazard.

A summary of the major pavement distresses, the cause of the pavement distress and the recommended repairs for the type of pavement distress are contained in Table 6. The table is based upon information from the Asphalt Institute.

**TABLE 6
PAVEMENT DISTRESS SUMMARY**

DISTRESS	POSSIBLE CAUSE	REPAIR RECOMMENDATION
Alligator Cracking	<ol style="list-style-type: none"> 1. Weak surface, base or subgrade 2. Thin surface or base 3. Poor drainage 4. Pavement too thin (PTT) 	Remove all distressed area to a depth of firm material and replace with the proper asphalt mix allowing 25% times the depth of the patch for compaction.
Transverse Cracking	<ol style="list-style-type: none"> 1. Poor rolling at seam 2. Asphalt too cold when rolled 	Pour with ASTM 2405 joint material.
Edge Raveling	<ol style="list-style-type: none"> 1. Wetting and drying beneath shoulder surface 2. Water standing on pavement 	Improve drainage and repair broken pavement. Redirect adjacent irrigation.
Pavement Oxidation	<ol style="list-style-type: none"> 1. Ultraviolet ray damage 	Seal pavement or overlay with asphaltic concrete.
Asphalt Bleeding	<ol style="list-style-type: none"> 1. Excess asphalt 2. Excess prime or tack coat 	Apply chip surface treatment or overlay with asphaltic concrete.
Ride Quality	<ol style="list-style-type: none"> 1. Poor rolling 2. Other pavement distresses 	Repair pavement distress that cause poor ride quality.
Patches	<ol style="list-style-type: none"> 1. Utility Cuts 2. Pavement Distress Repair 	Use proper patching techniques including use of compaction and proper patching materials.
Depressions	<ol style="list-style-type: none"> 1. Improper compaction of utility main trenches 2. Leakage into manhole or catch basin 3. Decomposing Organic Material 	Cut out depressed area, repair manhole or catch basin, remove organic material, and patch.
Pavement Slippage	<ol style="list-style-type: none"> 1. Lack of adhesion of riding to tack or prime coat 	Cut out area and repave

SECTION 6 PAVEMENT REPAIR RECOMMENDATIONS

After evaluation of all 472 street blocks, repair recommendations were made for 164 street blocks or 34.7% of the total number street blocks. The repair recommendations ranged from minor repairs such as sealing transverse cracks to major repair such as repairing all alligator cracking in the street block and overlaying the entire street block with 1" of asphaltic concrete. No repairs were recommended for the remaining 308 streets blocks at this time.

Table 7 contains a breakdown of all repair recommendations for all 472 street blocks.

**TABLE 7
PAVEMENT REPAIR RECOMMENDATIONS**

TYPE OF PAVEMENT REPAIR	NUMBER OF STREETS	% OF STREET BLOCKS
NO REPAIR	311	60.0%
REPAIR ALLIGATOR CRACKS	62	12.0%
REPAIR ALLIGATOR CRACKS AND OVERLAY	42	8.1%
SEAL TRANSVERSE CRACKS	26	5.0%
REPAIR SETTLEMENT	24	4.6%
REPAIR SUNKEN PATCH	22	4.2%
REPAIR ALLIGATOR CRACKS AND SUNKEN PATCH	6	1.2%
REPAIR RAVELING	5	1.0%
SEAL PAVEMENT	5	1.0%
REPAIR ALLIGATOR CRACKS AND SEAL TRANSVERSE CRACKS	4	0.8%
REPAIR ALLIGATOR CRACKS AND SEAL PAVEMENT	3	0.6%
REPAIR ALLIGATOR CRACKS AND SETTLEMENT	3	0.6%
REPAIR ALLIGATOR CRACKS AND SUNKEN PATCH	1	0.2%
RAISE MANHOLE	1	0.2%
LOWER MANHOLE	1	0.2%
REPAIR ALLIGATOR CRACKS AND PAVEMENT SLIPPAGE	1	0.2%
REPAIR POTHOLE	1	0.2%

In some cases, the repair does not include the entire street but a portion of a street. For example, Carolina Avenue, which is the lowest rated street, is 1,344 feet in length. 544 feet of the street is in good condition and does not need any repairs while 950 feet of the street was in very poor condition and needs major reconstruction. For streets where only the repair of alligator cracking was recommended, typically only 2% to 10% of the total street block area needs to be repaired.

SECTION 7

CONDITION OF PAVEMENT MARKINGS WITH INSTALLATION AND/OR REINSTALLATION RECOMMENDATIONS

Pavement markings are an important part of any roadway system as they are used to convey messages to roadway users. They indicate which part of the road to use and provide information about conditions ahead, regulatory information, and safety information. The Manual on Uniform Traffic Control Devices (MUTCD) recommends that critical pavement markings be installed on streets with higher traffic volumes. For the purpose of this analysis, Collector streets were determined to be the streets with higher traffic volumes. Arrows indicating allowable turning directions were not included in this evaluation.

The maintenance of pavement markings is also a Town responsibility on Town-maintained collector streets. The following critical pavement markings were included in this report for evaluation:

1. Street Centerlines (solid and dashed)
2. Stop Bars at Intersections
3. Pedestrian Cross Walks

PAVEMENT MARKING RATING SYSTEM

The pavement markings on the collector streets and non-collector streets were rated from poor to excellent condition. A definition of the rating criteria along with pictorial examples of the rating criteria are as follows:

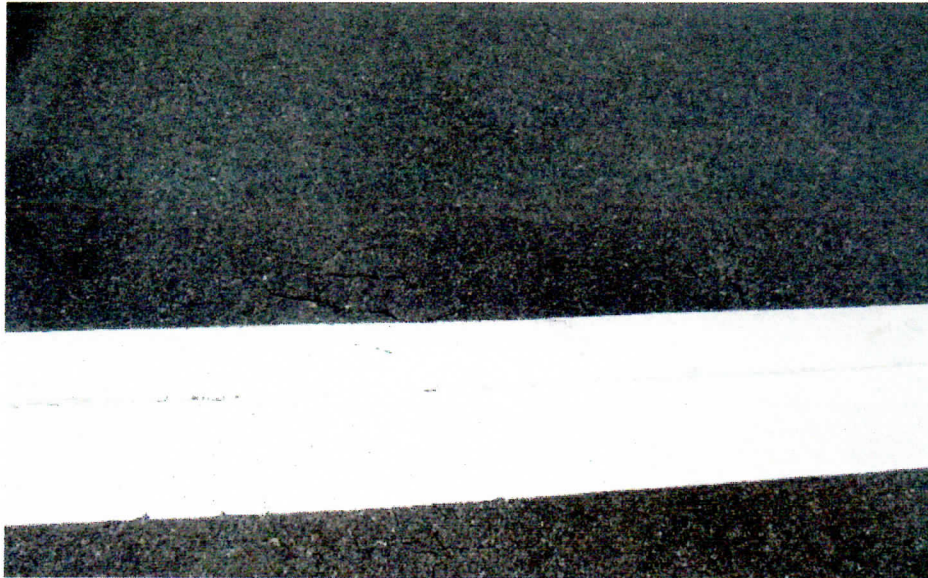
1. EXCELLENT CONDITION

A pavement marking in excellent condition is one that is clearly visible to the motoring public with no wear or distortion. All pavement markings in excellent condition are constructed with a permanent material such as thermoplastic materials.



2. GOOD CONDITION

A pavement marking in good condition is one that is clearly visible to the motoring public that has some wear or distortion. All pavement markings in good condition are constructed with a permanent material or have recently been installed with a traffic paint.



3. FAIR CONDITION

A pavement marking in fair condition is one that is visible to the motoring public that has significant wear or distortion. The motoring public can still see the pavement marking but it has lost its reflectivity and its purpose may not be evident.



4. POOR CONDITION

A pavement marking in poor condition is one that is no longer visible to the motoring public that has significant wear or distortion. The motoring public cannot see the pavement marking, it has lost its reflectivity and its purpose cannot be determined by looking at it.



CURRENT CONDITION AND LOCATION OF PAVEMENT MARKINGS

Table 8 shows the footage and condition of the existing centerline pavement markings on the existing collector streets. It also shows the footage required to be installed on collector streets without centerline pavement markings.

TABLE 8 CENTERLINES

STREET	NOT INSTALLED (FT)	INSTALLED (FT)	CONDITION
WESTGATE DR.	3,420	2,652	Excellent
GRANDIFLORA DR.	10,594	3,506	Excellent
PALM RIDGE DR.		2,323	Excellent
PINE HARVEST DR.		5,385	Excellent/Fair
OLDE WATERFORD WAY		1,637	Excellent
WESTPORT DR.	3,380		
BRUNSWICK FOREST PKWY.		11,088	Good
LOW COUNTRY BLVD.		14,784	Excellent
MALLORY CREEK DR..		9,873	Good
OCEAN GATE PLAZA		1,636	Excellent
RICE GATE WAY	1,248	1,764	Good
GRAYSON PKWY.	4,648		
NORTHGATE DR.		1,162	Excellent
TOWN HALL DR.		1,320	Excellent
NEW POINTE BLVD.		1,900	Excellent/Fair
GATEWAY BLVD.		1,214	Good
OLDE VILLAGE CIR.		One Way	Not Applicable
ENTERPRISE DR.	1,426		

Six collector streets require centerlines to be installed. The total amount of centerline markings to be installed is approximately 24, 716 feet. Fourteen collector streets had centerline pavement markings installed on all or a part of the street. The total amount of centerline pavement markings installed is approximately 60,241 feet. The condition of the pavement markings ranged from excellent for recently installed centerlines to fair for centerlines that were installed several years ago. A more detailed street by street assessment of the pavement markings is included in the Appendix.

TABLE 9 STOP BARS

STREET	# NOT INSTALLED LOCATIONS	# INSTALLED LOCATIONS	CONDITION
WESTGATE DR.	4	11	Excellent
GRANDIFLORA DR.	5	25	Fair
PALM RIDGE DR.	0	5	Excellent
PINE HARVEST DR.	0	17	Excellent/Fair
OLDE WATERFORD WAY	0	14	Excellent
WESTPORT DR.	10	5	Poor
BRUNSWICK FOREST PKWY.	8	15	Good
LOW COUNTRY BLVD.	2	27	Good
MALLORY CREEK DR.	3	10	Good
OCEAN GATE PLAZA	0	5	Poor
RICE GATE WAY	2	2	Fair/Poor
GRAYSON PKWY	12	0	
NORTHGATE DR.	2	0	
TOWN HALL DR.	0	4	Excellent
NEW POINTE BLVD.	2	12	Fair/Poor
GATEWAY BLVD.	0	2	Good
OLDE VILLAGE CIR.	0	4	Excellent
ENTERPRISE DR.	9	0	

Eleven collector streets require stop bars to be installed at street intersections. The total amount of stop bars to be installed is approximately 59. Sixteen collector streets had stop bars installed at all or some street intersections. The total amount of stop bars installed is approximately 158. The condition of the stop bar pavement markings ranged from excellent for recently installed centerlines to poor for centerlines that were installed several years ago with paint instead of thermos plastic pavement marking materials. A more detailed street by street assessment of the pavement markings is included in the Appendix.

TABLE 10 CROSSWALKS

STREET	# NOT INSTALLED LOCATIONS	# INSTALLED LOCATIONS	CONDITION
WESTGATE DR.	4	7	Excellent/Poor
GRANDIFLORA DR.	22	2	Fair
PALM RIDGE DR.	0	2	Excellent
PINE HARVEST DR.	0	14	Excellent/Fair
OLDE WATERFORD WAY	0	7	Excellent
WESTPORT DR.	13	1	Good
BRUNSWICK FOREST PKWY.	6	13	Good
LOW COUNTRY BLVD.	0	24	Good
MALLORY CREEK DR.	8	1	Fair
OCEAN GATE PLAZA	0	1	Excellent
RICE GATE WAY	3	1	Good
GRAYSON PKWY.	21	0	
NORTHGATE DR.	1		
TOWN HALL DR.	0	3	Excellent
NEW POINTE BLVD.	5	7	Fair
GATEWAY BLVD.	0	2	Good
OLDE VILLAGE CIR.	0	4	Excellent
ENTERPRISE DR.	13	0	

Ten collector streets require pedestrian crosswalks to be installed at street intersections and mid-block locations. The total number of crosswalks that need to be installed is approximately 96. Sixteen collector streets had crosswalks installed at all or some street intersections. The total number of crosswalks installed is approximately 89. The condition of the crosswalk pavement markings ranged from excellent for recently installed crosswalks to poor for crosswalks that were installed several years ago with paint instead of thermoplastic pavement marking materials. A more detailed street by street assessment of the pavement markings is included in the Appendix.

SECTION 8

PAVEMENT REPAIR OPINION OF PROBABLE COST

PAVEMENT REPAIR OPINION OF PROBABLE COSTS

Based upon the Pavement Condition Ratings (PCR) determined in the Pavement Condition Assessment Report, the street blocks were ranked from the lowest rated streets to the highest rated streets. The rankings were further divided into Local Streets and Collector Streets. To facilitate capital improvement planning, the Town has requested that an Opinion of Probable Costs (OPC) be developed for the 10 lowest rated Local Street Blocks and 5 lowest rated Collector Street Blocks.

METHODOLOGY

The Brunswick Engineering field crew revisited each of the 10 lowest rated Local Street Blocks and 5 lowest rated Collector Street Blocks. Field data such as pavement width and pavement length were confirmed. Also, the field crew determined other items that would need to be included in the estimate such as manholes, water valves, and curb and gutter replacement needs. The field data was added to the previously gathered data to develop a list of material quantities such as tons of asphalt and alligator crack repair needed was estimated. A spreadsheet was developed for each street showing the list of the type of materials and quantity of materials that would be included in the repair of the street block.

The estimated cost of each of the items included in the Opinion of Probable Cost is based upon pricing information from recently bid projects in the Town of Leland, and by the NC DOT in Brunswick County.

The unit prices will be based upon the following assumptions:

1. The unit prices represent costs in 2022 and do not represent future costs.
2. The unit prices assume that the contract amount will be at least \$1,000,000 to assure better competition among the limited number of asphalt contractors.
3. The pavement on curb and gutter streets will be ground to the same level of new riding surface on street block to prevent mounding over the curb and gutter.
4. Streets without curb and gutter will not be ground but the shoulder will be rebuilt to match the newly repaved street pavement height.
5. Pavement markings will be installed as a part of the contract on Collector Street Blocks.

OPINION OF PROBABLE COST

FIVE LOWEST RATED COLLECTOR STREET BLOCKS

STREET	FROM	TO	REPAIR COST
Grandiflora Dr.	Alba Ln.	Greymoss Ln.	\$228,885
Westport Dr.	River Rd.	Island Cove Ct.	\$147,373
Brunswick Forest Pkwy.	Druids Glen Dr.	Low Country Blvd.	\$181,599
Pine Harvest Dr.	Pemberton Dr.	Redfield Dr.	\$265,365
Enterprise Dr.	City Limits	Pine Harbor Way	\$240,741

10 LOWEST RATED LOCAL STREET BLOCKS

STREET	FROM	TO	REPAIR COST
Carolina Ave.	Village Rd.	Old Fayetteville Rd.	\$113,064
Oak Ln.	Old Fayetteville Rd.	Dead End	\$ 111,903
Parkmore Ct.	Winding Trail Dr.	Cul-De-Sac	\$ 80,762
Mt. Pleasant Cir.	Low Country Blvd.	Mossvale Ln.	\$102,201
Winding Trail Dr.	Pine Harvest Dr.	Cloverfield Ct.	\$121,374
Emberwood Dr.	Mallory Creek Dr.	Dead End	\$241,258
Crystal Stone Ct.	Stoney Creek Ln.	Cul-De-Sac	\$ 64,691
Greensview Cir.	Sunset Dr.	Greensview Circle	\$98,274
Holly Hills Dr.	Turn Out	Cul-De-Sac	\$118,239
Lanvale Hills Cir.	Orchard Loop Rd.	Cul-De-Sac	\$145,107

An Opinion of Probable Cost was prepared for each of the Top 5 Collector Street Blocks and each of the Top 10 Local Street Blocks and has been included in the Appendix.

SECTION 9

PAVEMENT MANAGEMENT POLICY RECOMMENDATIONS

The cost of pavement management is expected to continue to increase. To minimize future maintenance costs, the Town should take proactive steps now to make sure that the street maintenance performed results in the expected pavement life and that the streets accepted for Town maintenance meet the Town's standards.

The following recommendations are designed to assist the Town in improving the pavement management within the Town and thereby, reduce future maintenance costs.

1. Develop pavement patching standards and develop enforcement procedures for outside agencies that damage Town-maintained streets. This could include a 1-year warranty on all patches done by outside agencies.
2. Develop standards for compaction at catch basins to prevent future settlement
3. Develop a program to seal low traffic volume streets with severe pavement oxidation but no other major defects to extend the useful life of the street.
4. Improve pavement acceptance procedures for new streets. This should include requiring a 1-year warranty from the developer or the developer's contractor. A number of streets that have not been accepted by the Town serve a number of occupied homes and have significant pavement damage. This must be repaired before the Town accepts the street into their system for maintenance.
5. Continue the existing pavement maintenance program. Priority should be given to a number of streets where pavement damage worsened because no repair was completed in the period between pavement condition assessments.
6. At a minimum, crosswalk pavement markings and signage should be installed at crossings of the collector streets where no markings are presently installed.