

2013 PAVEMENT CONDITION SURVEY

Prepared For:



Town of Pittsboro

December 2013

US Infrastructure of Carolina, Inc.
Consulting Engineers
125 South Elm Street, Suite 510
Greensboro, North Carolina 27401



***Town of Pittsboro
2013 Pavement Condition Survey***

***Final Report
December 2013***

N.C. License # C-1950

Prepared by:

Ron Cross, Senior Field Technician,

And

John D. Fersner, III, P.E., Project Manager



Town of Pittsboro
2013 Pavement Condition Survey

TABLE OF CONTENTS

	<u>Page</u>
I. INTRODUCTION	1
II. FINDINGS	1
III. SUMMARY OF 2013 PAVEMENT CONDITION SURVEY	3
A. Procedures	3
B. Pavement Condition	3
C. Priorities	3
D. Pavement Condition Survey and Management System	5
E. Use of Survey Results	5
F. Acknowledgement	6
IV. BASIC STREET INVENTORY DATA	7
V. FINDINGS AND SUPPORTING DATA	8
A. Results	8
VI. MAINTENANCE RECOMMENDATIONS	13
A. Maintenance Activities	13
B. Unit Costs for Maintenance Activities	14
C. Maintenance Needs	14
D. Routine Maintenance	19
E. Resurfacing	20
APPENDIX	
A. Distress Type Classifications	A1
B. Street Listings (Alphabetical, Rating (PCR), and Priority (High, Medium, and Low))*	B1

*Note: The Street Listings are provided under separate cover.

Town of Pittsboro, North Carolina

2013 Pavement Condition Survey

I. INTRODUCTION

US Infrastructure of Carolina, Inc. (USI) is a consulting engineering firm with offices in Greensboro and Charlotte, North Carolina. **USI** specializes in serving public agency clients and offers a full range of municipal engineering services in transportation, infrastructure management, stormwater management, water and sewer, neighborhood improvements, and construction administration disciplines.

USI was retained by the Town of Pittsboro (Town) to perform a pavement condition assessment of the Town street system. **USI** identified approximately 24.22 miles of Town maintained asphalt roadway (See Table 2 on page 7 for pavement surface type length totals). A visual pavement condition survey of these streets was conducted by **USI**. These street segments were rated by driving each segment on a block to block basis and observing eight common pavement surface distresses and their corresponding severity levels.

The data from the observations on the rated streets was entered into an automated pavement management software program which generated a Pavement Condition Rating (PCR) for each street segment (see Table 7 on page 10 for methodology). In addition, the pavement management program generated recommended maintenance activities to address the deficiency on each street segment. Recommended secondary, third and fourth maintenance activities and costs, when applicable, were also calculated by the software and entered into the final database. Costs for the recommended maintenance activities were calculated using current local unit maintenance costs provided by **USI** and approved by Pittsboro (See Table 10, page 14).

Streets are listed based on Pavement Condition Ratings (PCRs) assigned as the “Rating” attribute within the database. Streets were categorized by the municipality as either low volume (Class A) or high volume (Class B) streets. Certain low volume or high volume streets may have higher or lower importance for the municipality based upon the number of dwelling units served, commercial traffic, or projected land development and traffic growth.

II. FINDINGS

The Town of Pittsboro’s street system is in “Good” condition with an overall weighted average PCR value of 82.2. This overall condition rating is above average when compared to other municipalities. To put this figure in perspective, the estimated weighted PCR value for NC municipalities is approximately 80.

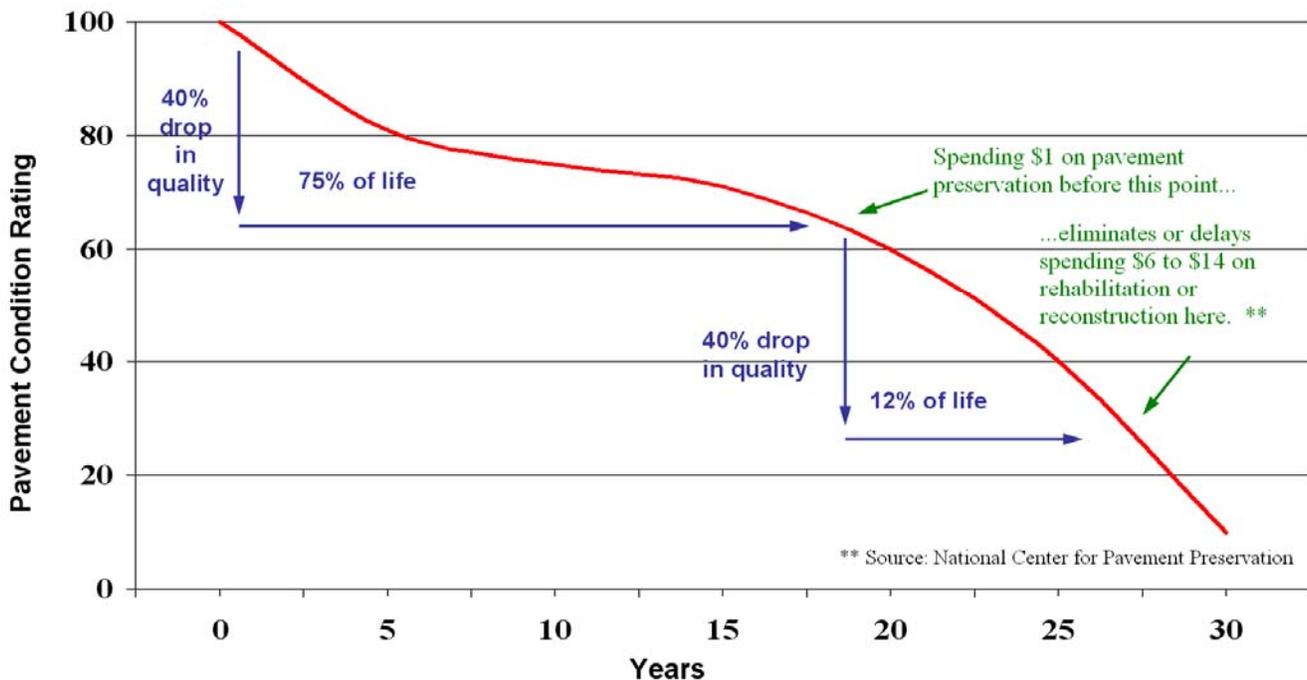
The primary maintenance needs are patching and resurfacing to correct a small amount of moderate to severe alligator cracking, moderate raveling, and severe patching. Based upon the results of this survey, approximately 2.4 miles of streets or about 10.0% of the rated street system is recommended for resurfacing within the next year. Resurfacing as well as other maintenance needs are determined based on the pavement distress, its severity level, and the traffic volume (low or high) of the street.

Recommended maintenance activities for each pavement distress are detailed in Table 8 on page 13. Once these immediate needs are addressed, **USI** recommends that Pittsboro resurface approximately 1.6 miles of street segments per year. This rate would provide the generally accepted optimum 15 year paving cycle. See Typical Pavement Deterioration Curve below. Such a cycle will allow the Town to maximize the effectiveness of its maintenance funds by providing for timely resurfacing of streets before they deteriorate to a point where more expensive rehabilitation or reconstruction is needed. It is **USI**'s recommendation that this year's street maintenance funds be allocated to include resurfacing and high priority routine maintenance, primarily crack sealing, joint repair, skin patching, full-depth patching, and short overlay.

Approximately 44.3% (10.7 of 24.2 miles) of the rated streets in the Town of Pittsboro need some level of routine maintenance or resurfacing. This figure is slightly better than the average for North Carolina municipalities, which is approximately 47%. This survey indicated a total estimated maintenance need for crack sealing, joint repair, skin patching, full-depth patching, short overlay, and plant mix resurfacing of approximately \$700,935. This represents an average estimated expenditure of \$28,940 per mile for the entire rated Town street system. It should be noted that **this cost estimate is for pavement repair only**. Additional costs of 25-40% can be incurred for drainage improvements, administration, milling (prior to resurfacing), utility adjustments, work zone traffic control, and other items.

Without a continued financial commitment and dedicated funding for street maintenance and resurfacing efforts, pavement ratings will decrease. Ultimately, postponing recommended maintenance activities typically leads to pavement failures and subsequently costly major rehabilitation or reconstruction. As can be seen from the Typical Pavement Deterioration Curve below, spending \$1 on pavement preservation prior to a pavement condition rating of roughly 60 will eliminate or delay spending \$6 to \$14 on rehabilitation or reconstruction at a later date.

Typical Pavement Deterioration Curve



III. SUMMARY OF 2013 PAVEMENT CONDITION SURVEY

A. Procedures

The procedures used for this survey include:

- An inventory of the physical characteristics of selected segments of the municipality's streets. These characteristics include block number, length, number of lanes, width, type of pavement, location of sidewalk and curb and gutter existence per street segment side, and asphalt height above gutter.
- Evaluation of the surface pavement distresses on selected street segments. Alligator cracking, block/transverse cracking, reflective cracking, rutting, raveling, bleeding, ride quality, and patching are measured according to well-defined severity levels. Alligator cracking is measured in detail by the percentage in increments of ten percent (10%) of the segment having each severity level (Light, Moderate, or Severe) of this distress. The other distresses are measured as an overall condition and categorized as light, moderate, or severe in distress level.
- Categorizing of the type of traffic volume on each segment. The municipality assigns all streets as either low volume or high volume streets. Low volume streets are typically lightly traveled residential streets. High volume streets are more heavily traveled arterial collector streets and typically receive a higher level of maintenance and repair than low volume streets.
- Entering and compilation of the collected field and post processing information into a usable database management system. This Microsoft™ Access application **USI** Total Pavement Access (**USI-TPA**) enables the user to sort and query the Town street system database by street name, high or low volume class, priority (high, medium, or low), rating (PCR), maintenance activity, and distress type to access estimated cost information of selected query data.

B. Pavement Condition

The predominant distress types that require maintenance are alligator cracking (the most critical pavement distress), block/transverse cracking, and raveling. Approximately 17.0% of the rated street system was noted as having some level of alligator cracking and approximately 24.1% of the rated street system exhibited some level of block cracking. Raveling was noted on approximately 39.1% of the rated streets; most of this (33.0%) is in the form of light raveling (surface wear). Some sections of severe patching and moderate raveling were also noted which require maintenance in the form of an asphalt overlay.

C. Priorities

Although all recommended maintenance activities are needed right away, for most public agencies there are typically more maintenance needs than funds available. Therefore, the suggested types of maintenance should be prioritized. High Priority maintenance should include crack sealing, joint repair, skin patching, full-depth patching, short overlay, and resurfacing of alligator cracking and rutting. Medium Priority maintenance includes resurfacing of severe reflective cracking, severe raveling, and severe bleeding. Low Priority maintenance typically consists of resurfacing of

moderate block/transverse cracking, moderate reflective cracking, moderate raveling, rough ride quality, moderate to severe patching, and ride quality. See Table 1 below.

Pittsboro should continue to dedicate its maintenance funding towards preventive maintenance practices and structural repair. This emphasis would reduce the rate of deterioration on pavements that exhibit light distress levels and it would extend the economic life of these streets by delaying the need for more costly maintenance or rehabilitation methods. Studies and empirical evidence from many agencies have shown that timely use of preventive maintenance practices is the most economically sound use of limited funds. Preventive maintenance and structural repair should also further reduce the maintenance cost per mile in future years. **Maintaining an aggressive crack sealing, patching, and resurfacing program should be a high priority for the Town of Pittsboro in tandem with allocating adequate funds and resources to accomplish this task.** Ultimately, postponing recommended maintenance activities typically leads to pavement failures and subsequently costly major rehabilitation or reconstruction.

In summary, **USI** recommends an increase in current street maintenance funding. Pittsboro has current needs of approximately \$700,935, which does not include preparatory activities and administrative costs. This includes recommended resurfacing 2.4 miles of street segments at a cost of approximately \$405,108. It is recommended that once the immediate resurfacing needs are met, the Town budget for annual resurfacing of about 1.6 miles of street segments per year in order to achieve a desired 15 year resurfacing cycle. This will require nearly \$267,840 annually at today’s unit prices including preparatory patching. It is **USI**’s recommendation that this year’s and future street maintenance funds be distributed to include resurfacing and high priority routine maintenance. The Town currently has a need for routine maintenance measures of approximately \$295,827. It would be desirable to achieve sufficient funding to achieve the maintenance schedule recommended above. The Town should consider reviewing the budget for these measures annually in order to assure adequate funding for the optimum economic life of its street system.

Table 1
PRIORITY BY TYPE OF MAINTENANCE FOR THE TOWN OF PITTSBORO

PRIORITIES	Total Miles	Total Cost	Cost Per Mile	Percentage of Cost
<u>HIGH PRIORITY</u> : Routine Maintenance, Resurfacing of Alligator Cracking and Rutting	10.58	\$691,822	\$59,982	98.7
<u>MEDIUM PRIORITY</u> : Resurfacing of Severe Block/Transverse Cracking, Severe Reflective Cracking, Severe Raveling, and Severe Bleeding	0.00	\$0	\$0	0.0
<u>LOW PRIORITY</u> : Resurfacing of Moderate Block or Reflective Cracking and Raveling, Resurfacing of Severe Ride Quality and Patching	0.15	\$9,113	\$79,543	1.3
Total Repairs	10.73	\$700,935	\$61,623	100.0

D. Pavement Condition Survey and Management System

Information provided to the Town by our Pavement Condition Survey and Management System includes:

- An updated basic inventory of bituminous paved streets with block number, length, number of lanes, width, type of pavement, location of sidewalk and curb and gutter existence per street segment side, and asphalt height above gutter.
- Pavement distresses, by type and magnitude, along with the PCRs for each street segment.
- Recommended maintenance activities (primary and secondary) and anticipated repair costs.
- Digital copies of all data, reports, and charts.
- **USI's** Total Pavement Access (**USI-TPA**) application that enables the user to sort the Town database by street name, rating (PCR), maintenance activity, collected attributes and distress type. This program also allows the user to generate query summaries and alphabetical and rating (PCR) listings which can be printed to hard copy.
- One hard copy list of street sections that includes field inventory data, distress ratings and estimated repair function and cost data into an alphabetical listing and a listing of the street sections sorted by PCR from lowest to highest.
- One hard copy list of street sections that includes field inventory data, distress ratings and estimated repair function and cost data for the high, medium, and low priorities highlighted in Table 1 on the previous page.

This information is advantageous for municipalities because:

- The survey is an objective evaluation of eight types of surface pavement distresses. Commonly accepted cost-effective maintenance practices are then recommended for repairing those pavement distresses.
- The survey permits the municipality to use its limited funds more cost efficiently for maintenance and resurfacing by prioritizing these activities.
- Streets with critical pavement distress are easily identified for further engineering investigation, testing, or pavement reconstruction.
- The computerized approach permits the municipality to vary the types of maintenance activities to allow budget planning for different levels of maintenance service.

E. Use of Survey Results

USI's Pavement Condition Survey is an objective evaluation of the amount and severity of eight types of pavement distresses. The inventory and analysis methods used for this project have been used for NCDOT and agencies throughout North Carolina and have proven to be valuable aids to street maintenance programs.

Municipal pavements are in a continuous state of deterioration. This deterioration rate depends upon many factors. Inadequate pavement thickness, unanticipated truckloads, and poor drainage accelerate deterioration. Therefore, it is reasonable and prudent to conduct these surveys periodically (every 2 to 3 years) to monitor the condition of the street system.

Such periodic surveys not only indicate the rate of deterioration of the street system, but also provide the Town with a means to gauge the effectiveness of existing resurfacing programs and street maintenance activities. Additionally, these periodic surveys make it possible to build a history of all maintenance activities to assist in planning for more cost-effective maintenance procedures.

The results of the survey should never be used arbitrarily. There is no substitute for in-the-field engineering judgment and experience by Town personnel in determining the specific types of maintenance activities needed. The street ratings and recommended maintenance practices should be used as a guide for planning and scheduling maintenance activities.

It is the intent of this report to emphasize the importance of maintaining the Town roadway assets. Based on current industry pricing, it is estimated that the Town maintained streets, which are comprised of approximately 293,367 square yards of asphalt pavement, have an estimated value of \$9 million. To be a good steward of the Town street system, it is prudent that preventative maintenance practices continue and that a sustained financial investment be made to maintain these roadway assets. “There is no more fundamental transportation capital investment than system preservation – keeping existing infrastructure in good condition. If preservation investment is deferred, costs increase dramatically, leading to the saying ‘pay me now or pay me more – lots more – later.’” - Washington Department of Transportation 2007 – 2026 Highway System Plan. For more information on roadway asset management, please visit www.usi-eng.com and click on the Client Resources toolbox for the AASHTO report: *Rough Roads Ahead*.

In an effort to further Pittsboro’s preventative maintenance practices, the Town could look at adding the following maintenance activities:

<u>Maintenance Activities</u>	<u>Distress</u>	<u>Pavement Age</u>	<u>Benefit</u>
Fog Seal Coating Fog Seal Rejuvenator	Light Oxidation	1 to 5 years	Replenishes asphalt chemicals; extends Pavement life
Slurry Seal Microsurfacing	Moderate Ravel	5 to 10 years	Seals pavement; Extends pavement life
BST Cape Seal	Severe Block Cracking	10 to 15 years	Seals cracks; Extends pavement life

The key to preventive maintenance is to use the right maintenance activity for the right pavement at the right time. When this is accomplished, maintenance funding is used to its fullest potential.

F. Acknowledgment

USI appreciates the Town of Pittsboro’s cooperation during the pavement survey. John Poteat was very helpful and instrumental in working with **USI** in supplying field data collection support and information required for preparation of this report.

IV. BASIC STREET INVENTORY DATA

Pittsboro has a total of 26.74 miles of Town maintained roadway that were identified by **USI**. This report addresses the 24.22 miles of paved asphalt roadway (Pavement Type = “P”) and Bituminous Surface Treatment (Pavement Type = “B”) that were rated. Table 2 lists the breakdown of surface types for all Town maintained streets, while tables 3 through 5 below list the basic inventory data for rated Town maintained street segments.

Table 2
PAVEMENT

Surface Type	Miles	Percent of System
Plant Mix Asphalt (P)	23.80	89.0
Bituminous Surface Treatment (B)	0.42	1.6
Concrete (C)	0.00	0.0
Unpaved (U)	2.52	9.4
Total	26.74	100.0

Table 3
SIDEWALK

Location	Length (linear mi)
Left Side	4.6
Right Side	5.9
Total	10.5

Table 4
CURB AND GUTTER

Location	Length (linear mi)
Left Side	8.9
Right Side	9.1
Total	18.0

Table 5
LOW AND HIGH VOLUME STREET BREAKDOWN

Volume	% Miles	Miles	Lane Miles	Avg Rating	Cost Per Mile	Total Cost	% Cost
Low	79.9	19.36	38.49	82.0	\$27,566	\$533,685	76.1
High	20.1	4.86	9.98	83.0	\$34,414	\$167,250	23.9
Total	100.0	24.22	48.46	82.2	\$28,940	\$700,935	100.0

V. FINDINGS AND SUPPORTING DATA

A. Results

The Pavement Condition Survey provides an objective evaluation by visual observation of eight types of pavement distress and the relative amount and severity of each type of distress. A pavement distress summary conducted for the Town of Pittsboro is shown in Table 6 on page 9. The following are some observations from the survey:

- Approximately 44.3% of the rated streets in Pittsboro are in need of some type of maintenance. The overall estimated cost for repairing these streets is \$700,935 or \$28,940 per mile system wide.
- The most predominant distress was found to be raveling (surface wear). Approximately 33.0% of the surveyed street system exhibits light raveling and 6.1% exhibited moderate raveling. None of the streets exhibited severe raveling.
- The most structurally damaging and costliest distress to repair is alligator cracking. Approximately 17.0% of the rated street system exhibits some level of alligator cracking. About 2.2 miles (8.9%) of roadway exhibit a severe level requiring full depth patching and about 0.5 miles (2.1%) of roadway are at a moderate level requiring skin patching. Alligator cracking is a high priority distress and is the most serious pavement distress because it results from a structural pavement failure. Unless corrected, it will progress to the point of requiring complete pavement reconstruction.
- Many of the streets in Pittsboro exhibit block cracking. Approximately 24.1% of the surveyed street system exhibits some level of block cracking. Approximately 0.3 miles (1.1%) exhibit moderate block cracking which require crack sealing. There are no streets that exhibit severe block cracking.

Table 6**PAVEMENT CONDITION SURVEY DISTRESS SUMMARY FOR RATED STREETS**

Distress Items	Miles Low Volume	Miles High Volume	Total Miles	% Miles
1. Alligator Cracking				
None	15.98	4.13	20.10	83.0
Light	1.13	0.32	1.45	6.0
Moderate	0.34	0.16	0.50	2.1
Severe	1.91	0.25	2.16	8.9
2. Block Cracking				
None	15.60	2.78	18.37	75.9
Light	3.59	1.97	5.56	23.0
Moderate	0.17	0.11	0.28	1.1
Severe	0.00	0.00	0.00	0.0
3. Reflective Cracking				
None	19.35	4.86	24.21	100.0
Light	0.00	0.00	0.00	0.0
Moderate	0.00	0.00	0.00	0.0
Severe	0.00	0.00	0.00	0.0
4. Rutting				
None	15.88	3.60	19.48	80.4
Light	2.87	1.13	4.00	16.5
Moderate	0.60	0.13	0.73	3.0
Severe	0.00	0.00	0.00	0.0
5. Raveling				
None	12.28	2.47	14.75	60.9
Light	5.70	2.29	8.00	33.0
Moderate	1.37	0.10	1.47	6.1
Severe	0.00	0.00	0.00	0.0
6. Bleeding				
None	18.94	4.86	23.80	98.3
Light	0.42	0.00	0.42	1.7
Moderate	0.00	0.00	0.00	0.0
Severe	0.00	0.00	0.00	0.0
7. Ride Quality				
Average	19.23	4.54	23.77	98.2
Slightly Rough	0.13	0.31	0.44	1.8
Rough	0.00	0.00	0.00	0.0
8. Patching				
None	18.44	4.54	22.98	94.9
Light	0.49	0.10	0.59	2.4
Moderate	0.30	0.00	0.30	1.3
Severe	0.13	0.22	0.34	1.4
Total	19.36	4.86	24.22	100.0

Note: Columns may not add up exactly due to rounding.

The type of distress that was observed on each street segment is shown in the final database, the Access database application (**USI-TPA**), and hard copy street listings provided in Appendix B.

The type and amount of distress that was observed on each street segment was used to obtain a Pavement Condition Rating (PCR). This rating has a scale between 0 and 100 and a basic description of each category is as follows:

<u>Rating</u>	<u>General Condition</u>
91-100	Very Good
81-90	Good
66-80	Fair
51-65	Poor
0-50	Very Poor

Each street segment begins with a rating of 100 and points are deducted from this rating based on the type and severity of distress. Deductions are the same for Class A (low volume) and B (high volume) streets. Deduct values for the severity levels of each distress are given below in Table 7.

Table 7
DEDUCT VALUES

PAVEMENT DISTRESS	SEVERITY			
	None (N)	Light (L)	Moderate (M)	Severe (S)
Alligator Cracking (AL, AM, AS) (Multiplied by percent)	0	25	60	99
Block/Trans Cracking (BK)	0	5	20	35
Reflective Cracking (RF)	0	5	10	20
Rutting (RT)	0	5	15	25
Raveling (RV)	0	5	25	35
Bleeding (BL)	0	5	15	25
Ride Quality (RQ)	-	0	10	25
Patching (PA)	0	5	10	15

As an example, presume a street segment has the following pavement distresses: 20% Light Alligator Cracking (AL), Moderate Rutting (RT), Light Patching (PA), and no other pavement distresses. The Pavement Condition Rating would be:

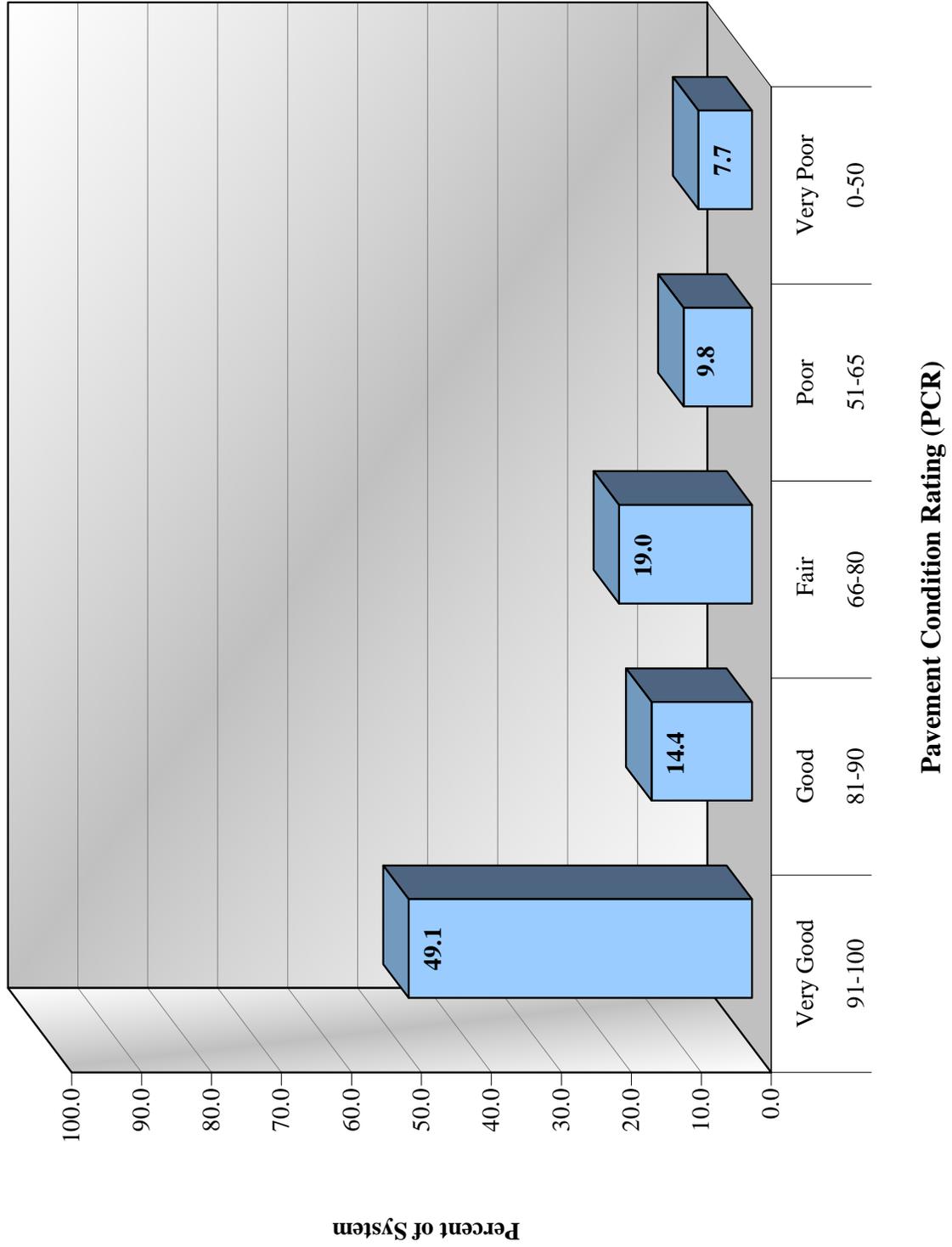
$$\begin{aligned} \text{PCR} &= 100 - (\text{AL}) - (\text{RT}) - (\text{PA}) \\ \text{PCR} &= 100 - (0.2 \times 25) - (15) - (5) = 75 \end{aligned}$$

Please note that the Pavement Condition Rating (PCR) does not differentiate between low volume and high volume streets. The same criteria is used to rate each street. However, the Town staff may want to separate these streets for analysis purposes. In regards to recommended maintenance activities, low volume and high volume streets are evaluated independently as shown in Table 8 on page 13. Depending on the street volume along with the pavement distress, the recommended maintenance activity may vary as shown in Table 8. Additionally, Table 9 on page 13 indicates how low volume and high volume streets are handled differently in regards to resurfacing needs when there is a high percentage of alligator cracking present and moderate or severe rutting.

The bar graph shown on the next page in Figure 1 illustrates the percentage of rated streets in the Town of Pittsboro that have PCRs in each condition category. As the bar graph illustrates, a high percentage of the rated street system is presently in good or very good condition. Approximately 63.5% of the rated streets in the Town of Pittsboro have a PCR that is considered in good or very good condition (PCR = 81-100), while approximately 17.5% of the rated street system was found to be in poor or very poor condition (PCR = 0-65). **USI** recommends that the Town set a goal of reducing the percentage of streets in very poor and poor condition to less than 10% within the next two years. Although the matter of reducing the streets in poor and very poor condition is important, the Town should also concentrate on streets in “Fair” condition, which includes 19.0% of the street system, (PCR = 66-80) where the cost of maintenance is more cost-effective.

If proper repairs and maintenance are not performed, a comparison of a street segment’s rating over time will indicate the rate of pavement deterioration. The effects of maintenance practices may also be reflected in a comparison of PCR values. For instance, a street segment’s PCR will increase after resurfacing or a declining PCR may be stabilized with patching or crack sealing.

Figure 1 - Breakdown of Streets into PCR Categories for 2013



VI. MAINTENANCE RECOMMENDATIONS

A. Maintenance Activities

The types of maintenance activities used in the Pavement Condition Survey analysis are listed below in Table 8. These activities are commonly accepted for cost-effective minimum levels of maintenance service. They include crack sealing, joint repair, skin patching, full-depth patching, short overlay, and complete resurfacing of a street segment with a 1", 1.5", and 2" plant mix (PM) asphalt.

Table 8
MAINTENANCE ACTIVITIES

PAVEMENT DISTRESS	LOW VOLUME STREETS			HIGH VOLUME STREETS		
	Light (L)	Moderate (M)	Severe (S)	Light (L)	Moderate (M)	Severe (S)
Alligator Cracking (AL, AM, AS)	None	4' Wide Skin Patch	4' Wide Full-Depth Patch	None	8' Wide Skin Patch	8' Wide Full-Depth Patch
Block/Transverse Cracking (BK)	None	Crack Sealing	4' Wide Full-Depth Patch	None	1.5" PM Resurfacing	8' Wide Full-Depth Patch
Reflective Cracking (RF)	None	Crack Sealing	Joint Repair	None	1.5" PM Resurfacing	Joint Repair
Rutting (RT)	None	None	1" PM Resurfacing	None	Short Overlay	1.5" PM Resurfacing
Raveling (RV)	None	1" PM Resurfacing	1" PM Resurfacing	None	1.5" PM Resurfacing	1.5" PM Resurfacing
Bleeding (BL)	None	None	1" PM Resurfacing	None	None	1.5" PM Resurfacing
Ride Quality (RQ)	None	None	1" PM Resurfacing	None	None	1.5" PM Resurfacing
Patching (PA)	None	None	Short Overlay	None	None	1.5" PM Resurfacing

If a high percentage of the pavement surface has alligator cracking, resurfacing is recommended as shown below in Table 9. All severe alligator cracking should be repaired with full-depth patching prior to resurfacing.

Table 9
MAINTENANCE FOR A HIGH PERCENTAGE OF ALLIGATOR CRACKING

VOLUME	CONDITION	RESURFACING
Low	AM & AS \geq 50%	1" PM Resurfacing
	AM & AS \geq 50% and M or S Rutting	2" PM Resurfacing
High	AM & AS \geq 30%	1" PM Resurfacing
	AM & AS \geq 30% and M or S Rutting	2" PM Resurfacing

B. Unit Costs for Maintenance Activities

The unit costs for maintenance activities are shown below in Table 10. These unit costs were provided by **USI**.

Table 10
UNIT COSTS FOR MAINTENANCE ACTIVITIES

ACTIVITY	COST (PER SQUARE YARD)
Crack Sealing	\$0.65
Skin Patching	\$15.00
Joint Repair	\$0.85
Full-Depth Patch	\$43.20
Short Overlay	\$6.00
1" Plant Mix Resurfacing	\$5.21
1.5" Plant Mix Resurfacing	\$7.82
2" Plant Mix Resurfacing	\$10.42

C. Maintenance Needs

A comparative table with a summary of maintenance needs for 2013 is shown on the next page in Table 11. These activities are based on objective descriptions of conditions existing at the time of the survey. Although the computer analysis determines the primary and secondary maintenance activities for these conditions, there may be isolated distresses that are not evident in the results. The secondary maintenance activities and costs included, when applicable, in the database and the **USI-TPA** Access application are subject to the primary totals.

Alligator cracking is a high priority distress and it accounts for approximately 41.5% of the recommended repair cost in the form of full-depth or skin patching.

Figure 2, on page 16, illustrates how the total mileage is distributed among the various recommended maintenance activities. Approximately 28.9% of the system's rated streets are recommended for full depth patching and about 10.0% of the system's rated streets are recommended for resurfacing, primarily due to alligator cracking and raveling.

Figure 3, on page 17, illustrates how the total cost is distributed among the various recommended maintenance activities. Approximately 57.8% of the system's cost is for maintenance in the form of resurfacing, as a primary maintenance activity that includes all necessary patching.

Figure 4, on page 18, illustrates how the total recommended repair cost is distributed between routine maintenance and resurfacing activities. Routine maintenance activities account for approximately 42.2% (\$295,827) of the estimated maintenance while resurfacing activities account for 57.8% (\$405,108) of the estimated maintenance needs.

Table 11**SUMMARY TABLE OF SUGGESTED PRIMARY MAINTENANCE ACTIVITIES FOR RATED STREETS**

PRIMARY ACTIVITY	MILES LO VOL	COST LO VOL	MILES HI VOL	COST HI VOL	TOTAL MILES	% MILES	TOTAL COST	COST/ MILE	% COST
Crack Sealing	0.00	\$0	0.00	\$0	0	0.0	\$0	\$0	0.0
Joint Repair	0.00	\$0	0.00	\$0	0	0.0	\$0	\$0	0.0
Skin Patching	0.77	\$6,075	0.40	\$8,205	1.17	4.8	\$14,280	\$12,205	2.0
Full-Depth Patching	5.58	\$203,093	1.43	\$73,786	7.01	28.9	\$276,879	\$39,498	39.5
Short Overlay	0.00	\$0	0.13	\$4,668	0.13	0.6	\$4,668	\$35,908	0.7
RM* Total	6.35	\$209,168	1.96	\$86,659	8.31	34.3	\$295,827	\$35,599	42.2
1" PM	1.90	\$293,986	0.11	\$20,895	2.01	8.3	\$314,881	\$156,657	44.9
1.5" PM	0.00	\$0	0.32	\$59,696	0.32	1.3	\$59,696	\$186,550	8.5
2" PM	0.09	\$30,531	0.00	\$0	0.09	0.4	\$30,531	\$339,233	4.4
Resurface Total	1.99	\$324,517	0.43	\$80,591	2.42	10.0	\$405,108	\$167,400	57.8
Total Repair	8.34	\$533,685	2.39	\$167,250	10.73	44.3	\$700,935	\$65,325	100.0
No Repair	11.02	\$0	2.47	\$0	13.49	55.7	\$0	\$0	0.0
Total System	19.36	\$533,685	4.86	\$167,250	24.22	100.0	\$700,935	\$28,940	100.0

* RM is routine maintenance

Note: Columns may not add up exactly due to rounding.

The results of the Pavement Condition Survey in the provided database and street listings have a code symbol in the 'Activity' column defining the controlling or primary maintenance activity for each street section. It should also be noted that a secondary maintenance activity has been incorporated into the database, when applicable, in the "Activity 2" field with associated cost data. A third and fourth activity and associated cost, when applicable, are also incorporated within the database as structured above. The code symbols are as follows:

CS	= Crack Sealing	PM1	= 1" Plant Mix
JR	= Joint Repair	PM1.5	= 1.5" Plant Mix
SKP	= Skin Patching	PM2	= 2" Plant Mix
FDP	= Full-Depth Patching		
SO	= Short Overlay		

These maintenance activities can be categorized as either routine maintenance or resurfacing. Routine maintenance limits the detrimental effects of traffic loads and weather conditions. For the Town of Pittsboro routine maintenance includes crack sealing, joint repair, skin patching, full-depth patching, and short overlay. Resurfacing adds a new layer to the pavement's structure and improves its load carrying capacity.

Figure 2 - Distribution of Maintenance Needs by Primary Repair Type
Percentage of Total Miles
Total Miles: 24.22

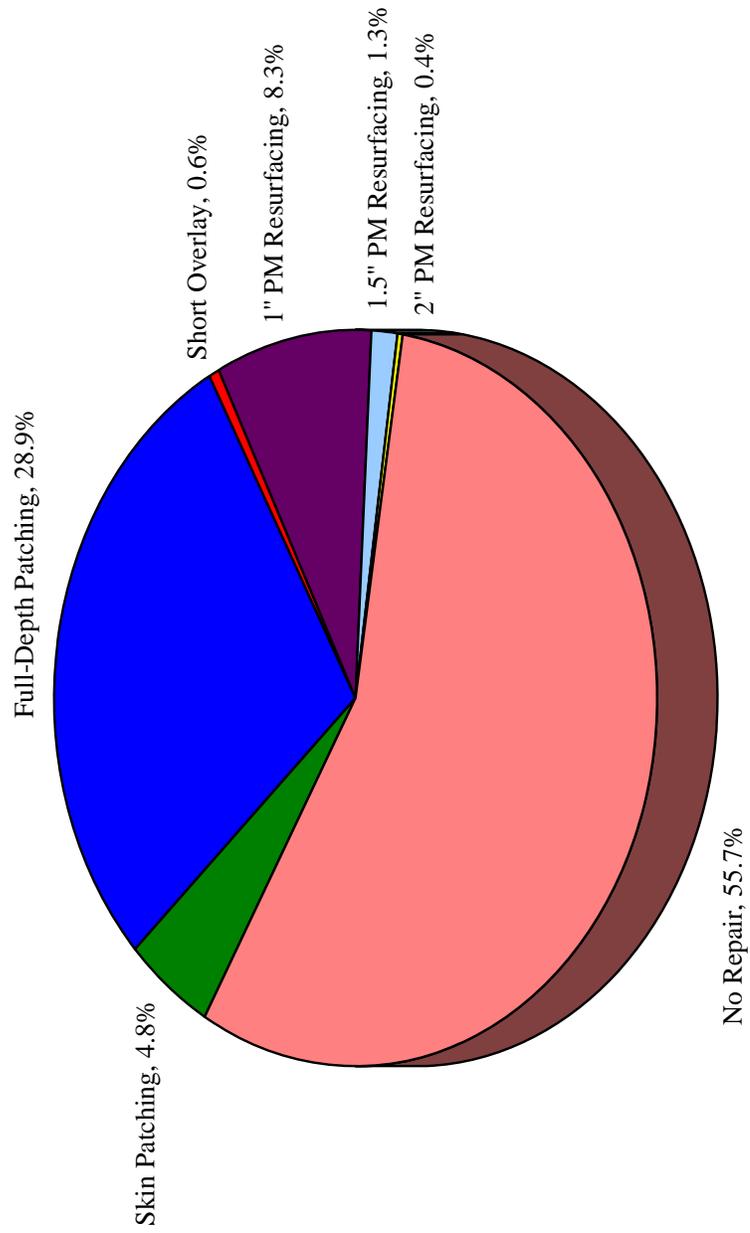


Figure 3 - Distribution of Maintenance Costs by Primary Repair Type
Percentage of Total Cost
Total Cost: \$700,935

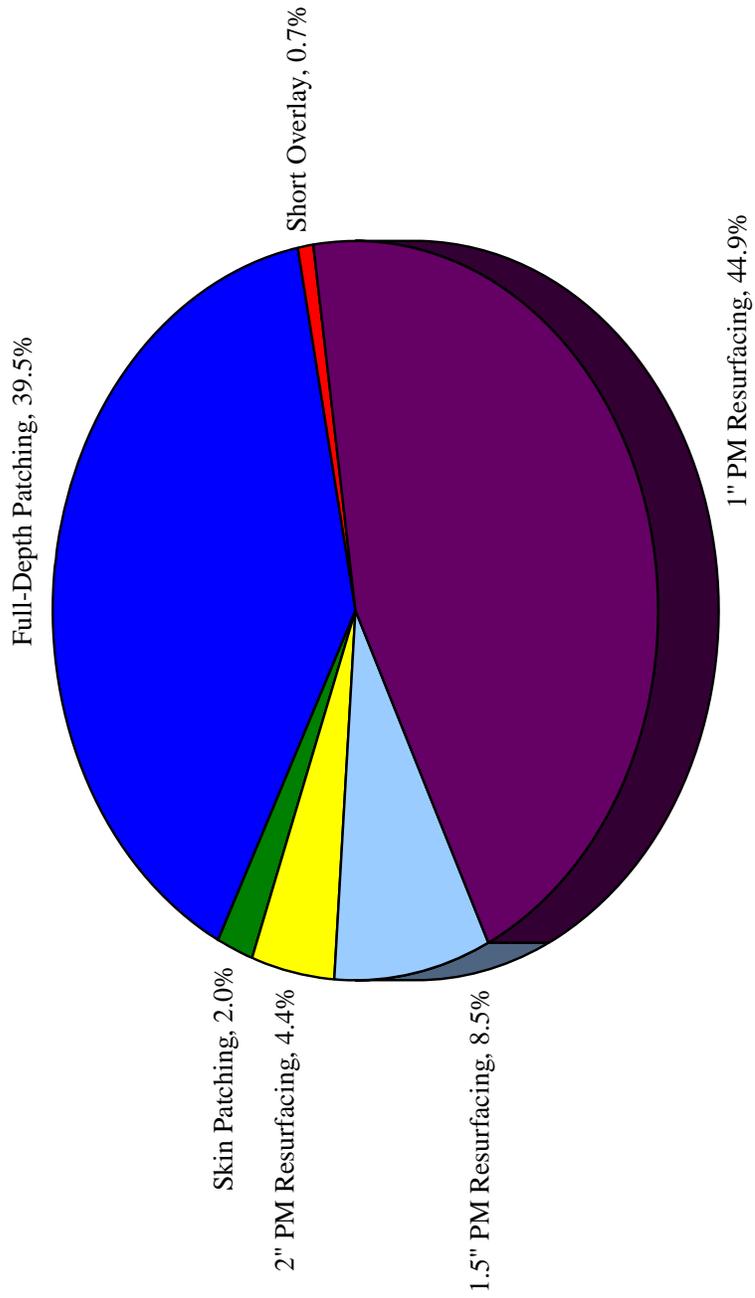
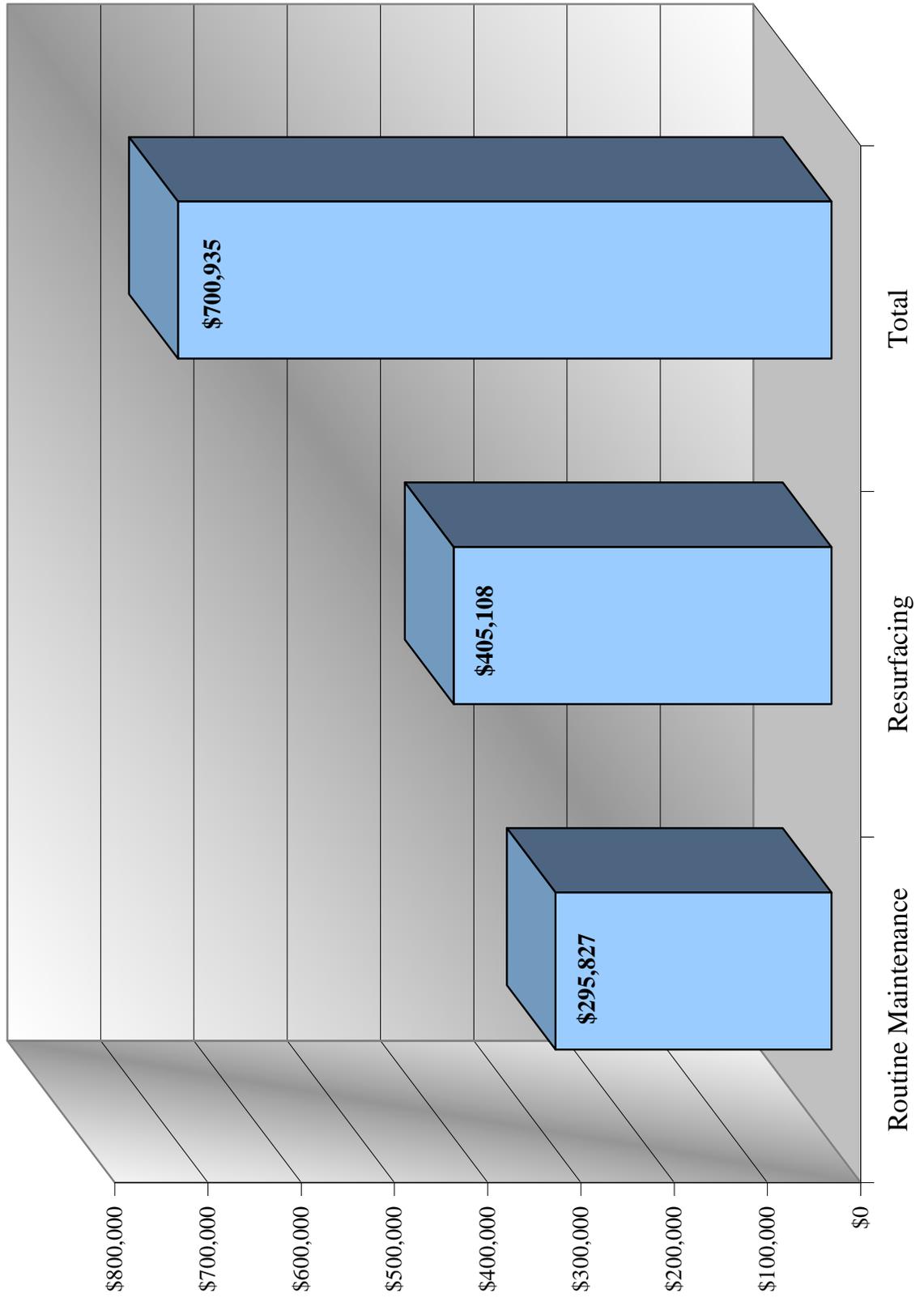


Figure 4 - Routine Maintenance vs. Resurfacing Cost



D. Routine Maintenance

These important maintenance activities are included where surface pavement distresses are not present in sufficient magnitude to warrant complete plant mix resurfacing. Routine maintenance includes crack sealing, joint repair, skin patching, full-depth patching, and short overlay.

The Pavement Condition Survey indicates that there are approximately 8.3 miles of streets requiring routine maintenance. The estimated cost of this work is \$295,827 or \$35,599 per mile, accounting for roughly 42.2% of the estimated total street maintenance cost need.

The following sections define the routine maintenance for the Town of Pittsboro.

- **Crack Sealing**

Crack sealing is needed for moderate block/transverse cracking and moderate reflective cracking on low volume streets. Block cracking is not a structural failure and does not usually progress rapidly. Cracks are generally caused by shrinkage of the asphalt and daily temperature cycling. Traffic loads can increase the severity of block cracking if water is allowed to penetrate into the cracks. Therefore, it is very important to seal these cracks to prevent water penetration into the base materials. The definition of moderate block/transverse cracking includes cracks that have been sealed previously but are beginning to open back up. **Although crack sealing is generally an effective preventive maintenance measure, it should not be used in place of patching to seal moderate to severe alligator cracking.** There are no street segments requiring crack sealing as a primary maintenance at this time. However, crack sealing is recommended as a secondary maintenance activity for 0.3 miles of street segments.

Even though it will result in a higher initial cost, the use of a rubberized asphalt crack sealant is recommended. Because cracks must be resealed periodically, a continuing crack sealing program is required. Crack sealing can be a very cost-effective expenditure of funds.

- **Joint Repair**

Joint Repair is recommended for severe reflective cracking. Reflective cracking occurs when cracking at the joints of an old concrete pavement reflects to the surface of an asphalt overlay. Often repairs must be made to the Portland cement concrete pavement below the surface. Resealing or repairing of the concrete joints, either by crack pouring or major reconstruction of the old joint might be required. Slab stabilization may also be required if pumping is present. There are no street segments that exhibit severe reflective cracking.

- **Skin Patch**

Skin patching is recommended for the repair of isolated locations of moderate alligator cracking. It seals the surface and slows the rate of deterioration. Alligator cracking is a structural failure of the pavement and can deteriorate rapidly if appropriate maintenance is not performed.

Similar to full-depth patching, skin patching (where required) is included in the primary resurfacing activities. There are approximately 2,748 square yards of recommended skin patching. Approximately 952 square yards (12 street segments) are recommended as a primary maintenance activity at an estimated cost of \$14,280 with the remaining 1,796 square yards to be performed as a secondary activity to resurfacing.

- **Full-Depth Patch**

Full-depth patching is required to repair severe alligator cracking. The Town also uses full-depth patching to repair severe block cracking. It involves the removal of the surface course, base course, and sub-grade, if necessary. New material should be placed in compacted lifts. Often, a full-depth asphalt repair can be used.

There is an estimated 11,204 square yards of full-depth patching needed in Pittsboro. Approximately 5,785 square yards (55 street segments) are recommended as a primary maintenance activity at an estimated cost of \$276,879 with the remaining 5,419 square yards recommended as a secondary activity. Where resurfacing is recommended, the cost of full-depth patching is included in the total resurfacing cost. Those repairs must be done prior to any resurfacing activity.

It is recommended that the Town of Pittsboro maintain an aggressive patching program. This type of maintenance is very cost-effective in extending the useful life of pavements. Delaying this type of maintenance will cause pavements to fail at a much faster rate. Many streets requiring patching may need resurfacing in the near future. However, timely and thorough patching can postpone the need for resurfacing.

- **Short Overlays**

Short overlays, or resurfacing portions of a street, are recommended on streets with severe patching and on high volume streets with moderate rutting.

E. Resurfacing

Plant mix resurfacing is a major maintenance activity. Plant mix resurfacing, combined with full-depth patching is used to repair structural damage. It is recommended for a variety of pavement distresses, as severity and magnitude increase, and some distress types require more immediate attention than others. Because the funds available for street resurfacing are typically limited, resurfacing activities need to be addressed by the type of pavement distress that causes the need. This section will address resurfacing activities by the type of distress that requires it.

The Pavement Condition Survey indicates that there are approximately 2.4 miles of streets requiring resurfacing. The estimated cost of this work is \$405,108 or \$167,400 per mile, accounting for roughly 57.8% of the estimated total street maintenance cost need.

- **Alligator Cracking**

Alligator cracking is the most serious pavement distress. It is a structural pavement failure that may be caused by traffic overload, inadequate design thickness, base or sub-grade

failure, poor drainage, or a combination of these factors. It should be given top priority for proper repair. It is a progressive failure, and unless corrected it may progress to the point that the street may require complete pavement reconstruction.

The Pavement Management program is set to determine the need for resurfacing when 30% of a segment on Class B (high volume) streets and 50% of a segment on Class A (low volume) streets has moderate and/or severe alligator cracking. The cost of full-depth patching is also included, where required, in the cost estimate of resurfacing. When light or no rutting exists with alligator cracking, a 1" plant mix resurfacing is recommended for low and high volume streets.

When moderate or severe rutting exists with alligator cracking, a 2" plant mix resurfacing is recommended. These streets are in very poor structural condition and may require reconstruction. Possibly, some engineering testing is needed to determine if there are subsurface problems.

- **Block/Transverse Cracking**

Block/Transverse cracking is not load associated but is caused by the shrinkage of asphalt and temperature fluctuations. The severity can increase if water penetrates into the cracks. Therefore, it is important to seal the block/transverse cracks to prevent water penetration into the pavement's base materials. Unless remedied, alligator cracking may develop. Pittsboro utilizes full-depth patching to repair severe block/transverse cracking.

- **Reflective Cracking**

Reflective cracking is generally not load associated but occurs on asphalt concrete which has been overlaid on old jointed concrete pavement. Reflective cracking is characterized by bulged joints above the riding surface and caused by movement of the concrete slab beneath the roadway surface. Where there is severe reflective cracking, a 1" or 1.5" plant mix resurfacing is recommended for low and high volume streets respectively. There are no roads in the Pittsboro street system that exhibit severe reflective cracking at this time.

- **Rutting**

Rutting is a surface depression that typically occurs in the wheel path(s) or at the edge of the pavement. It occurs when the pavement layers or sub-grade consolidate due to traffic loads. Rutting represents a structural failure and often occurs in conjunction with alligator cracking. To repair severe rutting, plant mix resurfacing is recommended.

- **Raveling**

Raveling typically occurs on, but not limited to, bituminous surface treated (BST) streets, sometimes referred to as "tar-and-gravel". Raveling is identified by the loss of aggregate particles from the pavement surface. The inability of the liquid asphalt to hold the aggregate in place causes raveling. Resurfacing is needed to seal the pavement and provide a new wearing surface. Resurfacing is recommended for both the moderate and severe conditions.

- **Ride Quality**

Ride quality is a relative indication of roughness and how the street rides to the public. Any number of factors including rutting, cracking, utility cuts, localized dips, or poor patching can cause rough ride quality. Improving rough ride quality requires a plant mix resurfacing, but other repairs may also be required.

- **Patching**

Patching is only an indication of the amount of surface area that has received some type of maintenance repair. The quality or condition of the patch is not considered in the evaluation. Severe patching indicates that a large amount of patching exists on the pavement. Resurfacing is recommended when patching covers more than 30% of a pavement's surface area. Where there is severe patching on high volume streets, a 1.5" plant mix resurfacing is suggested.