Communities working together to
meet Chittenden County's transportation needs

CHITTENDEN COUNTY METROPOLITAN PLANNING ORGANIZATION

TOWN OF JERICHO
ROADWAY SURFACE MANAGEMENT STUDY

August 2004

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EXECUTIVE SUMMARY

> *It is generally most cost effective to spend your money keeping the good roads good than it is to put all your funds in to fixing the worst roads. This idea may be exactly opposite to what personal tendencies would be, but it is basically correct. Keep the good roads good and plan ahead for the extra money you will need to gradually rebuild the poor roads. [adapted from RSMS 98 documentation]*

The Town of Jericho has approximately 57 miles of town-maintained roads. Overall, these roads are in satisfactory condition. Regular maintenance of these roads at timely intervals is the most cost-effective way to ensure the health of the road network. To assist the town in planning for maintenance needs, the Chittenden County Metropolitan Planning Organization has prepared this roadway surface management study.

For a quick overview of the status of town roads and maintenance priorities please refer to the maps on the following pages. These maps were generated with information from ArcView and MicroPaver software. Tabular listings of the data used in generating these maps are available in the appendices if more detailed information is desired.

MicroPaver's planning capabilities were used to generate a three year plan for roadway maintenance and rehabilitation. Below are six projects that MicroPaver recommends for immediate repair:

Table 1: MicroPaver Immediate Repair Priority Roads

Section	From	To	Current PCI	Est. cost
Browns Trace	Packard Rd.	Orr Rd.	52	31,443.10
Browns Trace	Nashville Rd.	Barber Farm	54	2,868.95
West View Dr	Foothills	Meadow	30	21,587.75
Arcadia	West View Dr	End	26	11,878.09
Meadow Dr.	Foothills	Foothills	40	7,598.38
Snowflake Dr.	Griswold St.	Ross Ln.	36	7,137.46
			TOTAL	*$82,513.73*

All of these projects are considered stop gaps and the town may want to further examine these to decide if they are cost effective. It may be realistic to perform major repairs on one or two of these roads listed above. It should also be brought to the town's attention that the majority of un-paved roads require re-shaping and additional gravel. The proposal above leaves nearly $17,500 of the total budget available for unpaved roads. The gravel roads we recommend for prompt service can be found below.

Table 2: Gravel Road Priority Maintenance Areas

| Section	From	To	Current PCI	Est. Cost
Cilley Hill	Hanley Lane	Town Line	81	130.66
Skunk Hollow	Entire Unpaved Section		75	5,566
Orr Road	Packard	Lee River	53	1,712.20
Tarbox Rd	Barber Farm	Governor Peck	65	1,576.09
			TOTAL	*$8,984.95*

The listing of all MicroPaver suggestions for a three year Maintenance & Rehabilitation plan can be found in Appendix A.

1.0 PAVEMENT MANAGEMENT SYSTEM OVERVIEW

A Pavement Management System (PMS) is a tool designed to assist agencies charged with maintaining and constructing roadways. This tool provides a means to collect, store, and analyze information on pavement conditions, and determine maintenance needs to make optimal use of road maintenance funds. Pavement management systems do not replace the expertise of local road foremen, but they can be a valuable tool to help them plan for future maintenance needs.

Through a systematic analysis of pavement life cycles, a PMS can determine the most cost-effective means to keep pavements functioning at a desirable condition level. Figure 1 below illustrates the need for a road "wellness" program. The figure shows early investments in maintaining the integrity of roads will pay off over time – each dollar spent on maintaining roads in fair condition will forego the need to spend four to five dollars on rehabilitating/reconstructing a road in very poor condition.
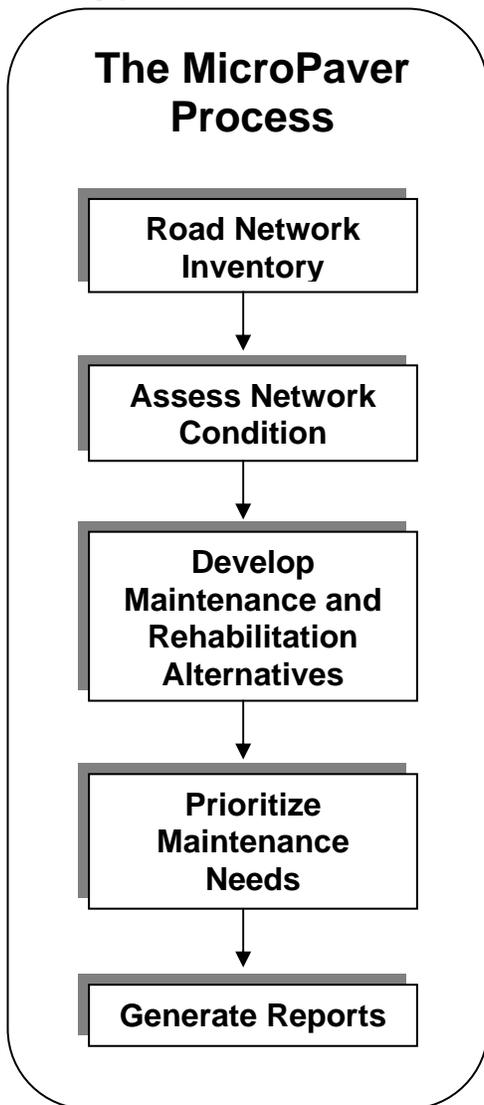
FIGURE 1: Pavement Deterioration/Rehabilitation Relationship
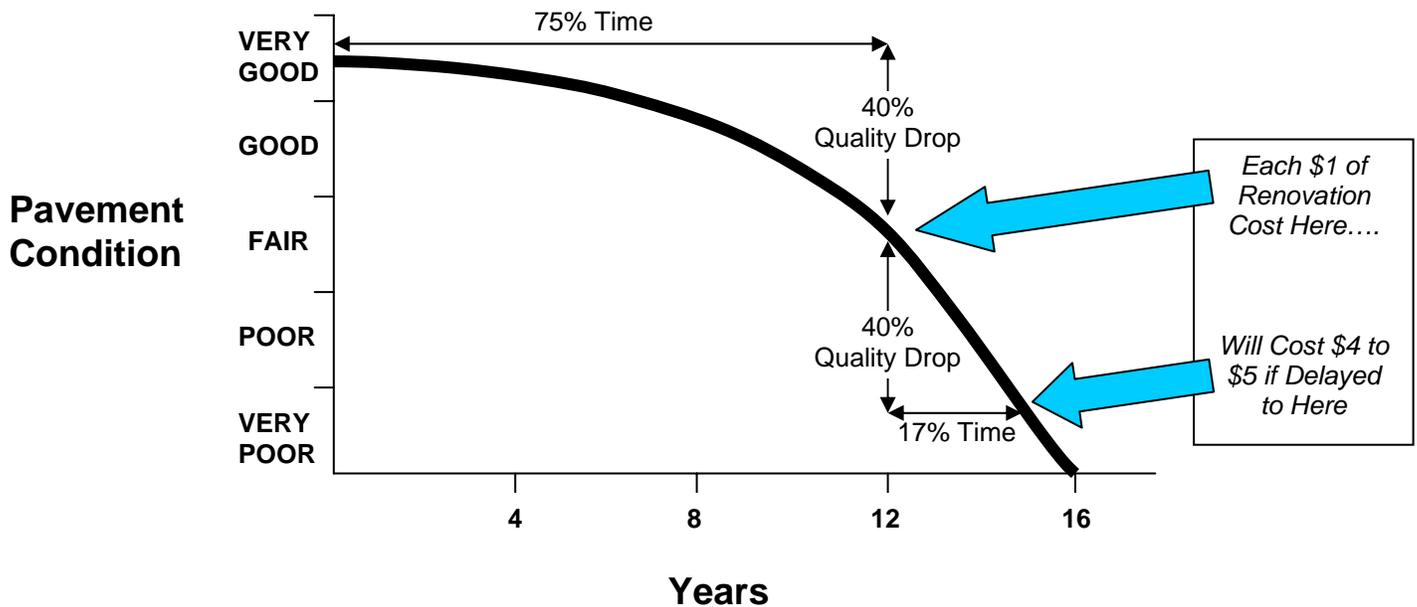
1.1 MICROPAVER SOFTWARE

The Chittenden County MPO used MicroPaver software in conjunction with ArcView GIS mapping in order to evaluate the road conditions in Jericho.

FIGURE 2

The MicroPaver Process

- Road Network Inventory
- Assess Network Condition
- Develop Maintenance and Rehabilitation Alternatives
- Prioritize Maintenance Needs
- Generate Reports

1.1.1 Road Network Inventory and Inspection

The first step in using the MicroPaver software was to create a network of all the town-maintained roads. Next, branches were created for each road. Then, the branches were divided into sections in accordance with logical breaks and sizes of what would be repairable lengths. These were usually changes in surface type, or breaks at intersections so as to keep each section at a fairly reasonable length. Finally each section was broken into samples of approximately 100 ft each and a certain number of these samples were randomly inspected as representing the overall quality of a section. Below is a table demonstrating how many samples were inspected in accordance with how many overall samples there were for a section.

Table 3: MicroPaver Recommended Sampling Method

Number of 100 foot sample units in Section	*Number of sample units to be inspected*
1	1
2-4	2
5-20	3
Over 20	4

1.1.2 Evaluating a Section

Once all the public roads within Jericho were surveyed, the data from the inspection sheets was entered into the MicroPaver Software. The MicroPaver inspection process details the type and extent of different distresses for paved and gravel roads. The software uses this information to calculate deduct values for each type of defect. The program then calculates an overall Pavement Condition Index (PCI) for each section using the deduct values and also the age of the road. These PCI values describe the condition of the road and are the main value taken into account when evaluating necessary strategies to maintain the roads. A PCI score of 100 denotes perfect condition and a score of zero is the worst possible score. The lowest scoring road in Jericho had a PCI of 20.

1.1.3 Maintenance Recommendations

The third step in applying MicroPaver is the development of a Maintenance and Rehabilitation (M&R) plan. MicroPaver has a function allowing the user to enter in possible maintenance activities for each type of local and global deficiency along with the cost of each activity. It then integrates all of the gathered information and computes a maintenance and rehabilitation plan for a specified length of time based on the available budget. This function incorporates preventative repair strategies in order to keep the overall network in optimal condition.

Local Maintenance

Preventive Maintenance - This strategy is a more expensive activity designed to stop deterioration before it becomes a serious problem. Surface seals are excellent examples of preventative maintenance. A common cause of poor performance of seals is inadequate repair of existing problems before sealing. Therefore, extensive repair work may also be included in the cost of preventive maintenance. Road repairing and sealing needs will probably have to be programmed over several years and be done in the order of their priority ranking because of the cost involved in doing considerable mileage. Routine maintenance should be performed on those sections that are not programmed for preventive maintenance during the current budget year.

Stop-Gap - The road sections which fall into this category necessitate certain minimal repairs to prevent immediate failure, and will require major M&R in the near future. For instance, it may be necessary to take care of any severe problems (deep potholes, washouts, etc.) with temporary repairs to keep the road passable for traffic.

Major Maintenance & Rehabilitation

Roadway Rehabilitation - Rehabilitation usually includes overlays or extensive recycling. Recycling is a process where a layer of existing pavement is ripped up and reconstituted by special equipment. This technique provides results comparable to laying down new pavement and saves costs for raw materials and transportation of new pavement. Funding for completion of rehabilitation projects depends on long range planning. Staged construction may require several years to complete an entire project. Established priorities should be followed when possible. Sections falling into this category that are not programmed for the current budget year will fall into the deferred action strategy.

Roadway Reconstruction - Reconstruction projects are similar to rehabilitation, with the primary distinction between the two being the cost difference. Reconstruction involves complete removal and replacement of a failed pavement and might also involve other features such as widening, improved alignment, grade changes, guard rail, and major drainage work. Lead times of several years may be required because of the more costly nature of full reconstruction and the time required to develop a complete plan of action, to secure required permits, and establish special funding needs. The is the most costly type of maintenance activity.

The MicroPaver software determines a repair strategy for each segment of road based on the PCI. The Pavement Condition Index (PCI) is a composite figure number found through an analysis of the various pavement distresses observed in the roadway surveys.

FIGURE 3: Maintenance Strategies Based on Pavement Condition
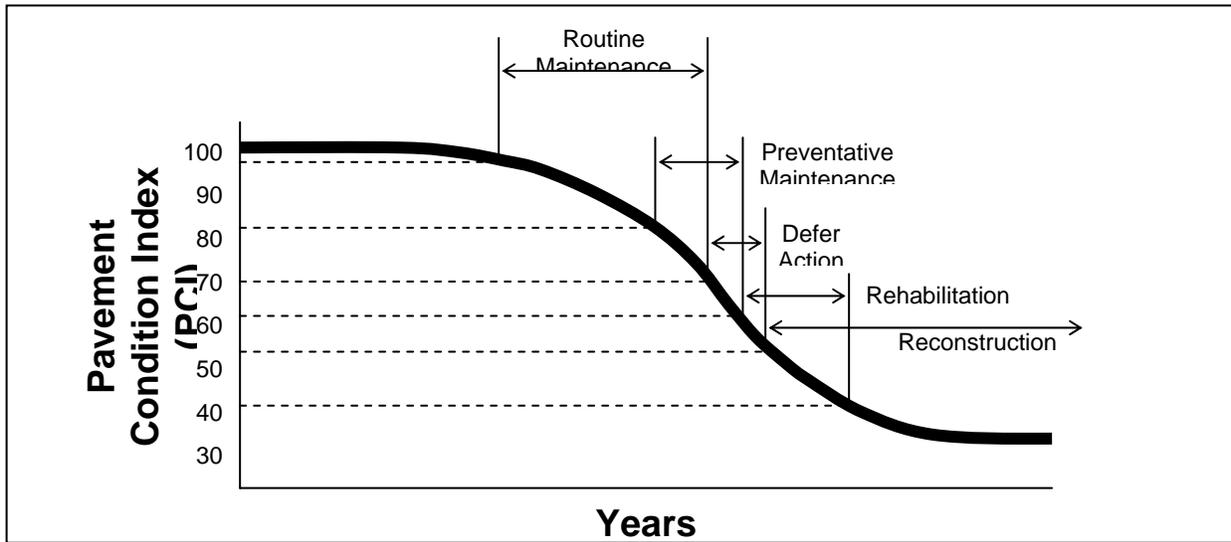
1.1.4 Prioritization of Maintenance Needs

Once maintenance alternatives are generated, the software creates a prioritized listing of road projects based on the structural condition of the pavement. The software does make suggestions as to exactly where to spend the funds, but it does not take into account traffic counts. Therefore the township should use the MicroPaver report as general guidelines to follow to ensure adequate consideration of any issues that the software does not account for.

1.1.5 Report Generation

The final MicroPaver step involves generating reports to communicate the results of the analysis. These reports were generated using MicroPaver's M&R planning resources. Using a budget of 100,000 dollars for each of three years, and allowing the software to suggest only repair strategies that are already in use in Jericho, the program computed a repair strategy and this is shown in the excel spreadsheets in the Appendix. The GIS maps were created by importing the PCI values MicroPaver computed for each road section into ArcView. The grading system is a general standard, and the maps are intended to give a good overall illustration of the road conditions.

2.0 SUMMARY OF FINDINGS

2.1 MAINTENANCE AND REPAIR ALTERNATIVES

The Town of Jericho has a few regularly used repair strategies that have been entered into the MicroPaver program and are the only strategies considered in the maintenance planning process. Paver has analyzed the roadway conditions along with the budget of $100,000 that Jericho has available for roadway maintenance and has generated a maintenance schedule coinciding with the Jericho repair strategies. This report also includes what condition the roads will be in after the proper maintenance and repairs are performed.

**Table 4: Jericho Repair Strategies in MicroPaver Maintenance Options**

Code	Name	_Domain Units
AG-G	Add Gravel- gravel	Work._Area
AG-RA	Add Gravel-reclaimed asphalt	Work._Area
CS-AC	Crack Sealing - AC	Work._Linear
CS-O-AC	Crack Sealing w/ 1.5"Overlay	Work._Area
O-1.5-AC	1.5" Overlay	Work._Area
PA-AL	Patching - AC Leveling	Work._Area
RB-AC	Rebuild	Work._Linear
RC-AC	Reclaim 1.5" base, 1.5" top	Work._Area
RS-UP	Reshape- Blading, Draging - UP	Work._Area

2.2 OVERALL JERICHO ROADWAY CONDITIONS

MicroPaver calculated an average PCI of 66.7 for all the roads in Jericho, which is in the range of fair condition. Pavements in fair condition warrant both routine and preventative maintenance to keep the network in optimal condition, as a PCI of 66.7 is near the "drop-off" in pavement life occurs without preventative maintenance. Without routine maintenance, the cost to repair the roads will begin to increase rapidly. When broken down by surface type, the average PCI for the paved roads was found to be 58.8, and the average PCI for the gravel roads was 78.3.

Although the average PCI for gravel roads was higher according to MicroPaver, it should be noted the gravel roads were held to a lower standard by the program. The result of this is that many gravel roads also need maintenance as well, even though they have a higher PCI value. The main problems observed on gravel roads were improper drainage and the need for more gravel to maintain the wearing surface of the roadway. The primary distresses for the paved roads in Jericho were the various types of cracking associated with asphalt pavement, such as: alligator, block, edge, and longitudinal/transverse cracking.

Figure 4: MicroPaver Average Roadway Condition by Surface Type
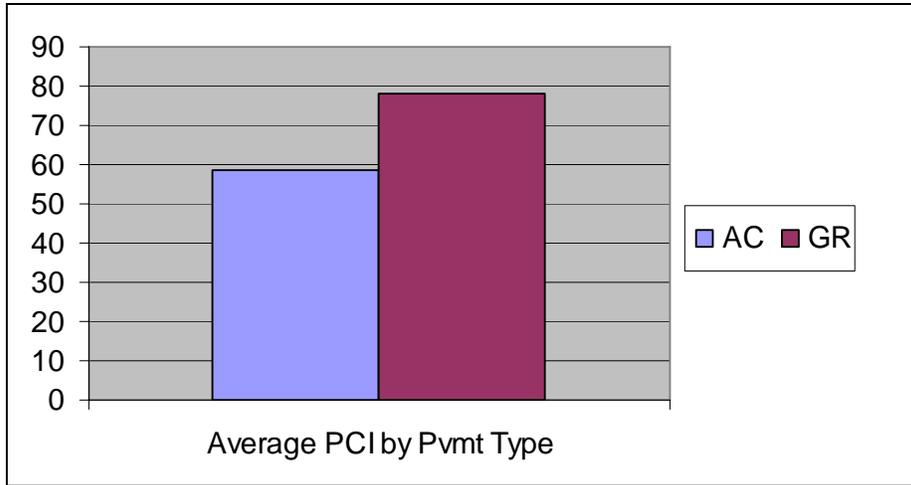
AC – Asphalt Concrete; GR - Gravel

3.0 CONCLUSION

In general, town highways in Jericho are in good condition. The Town should continue to prioritize routine maintenance activities in favor of roadway reconstruction when possible to continue maximizing the use of town highway funds. The various appendices attached to this report include detailed reports on each section of town highway.

CCMPO staff is available to assist town staff in setting up and using the MicroPaver software, or the MPO will continue providing service to the community as requested and as our community technical assistance budget allows.

REFERENCES

MicroPaver; US Army Corps of Engineers, Version 5.2

Shahin, M.Y. Pavement Management for Airports, Roads, and Parking Lots. Kluwer Academic Publishers: Boston. 1994.

Appendices

Applied Policy for 2004

Name	Description
Year Applied	Year Repair Strategy is to be Applied
Section	Name of roadway section to be repaired
Description	Type of Distress
Severity	Either Low, Medium, or High
Distress Qty	Amount of Distress present in the section
Unit	Unit of Distress. Either Ft or SqFt
% Distress	Percent of section having particular distress
Work Description	Name of work to be applied
Work Qty	How much of repair strategy to be applied
Unit	Either Ft or SqFt
Unit Cost	Cost per unit or work applied
Work Cost	Total cost of repair
Funded	Either Yes or No, depending on if it can be fixed within the range of the set budget.

3 Year Section Summary

Name	Description
Network/Branch/Section	Name of Network, Branch Number, and Section Name
Section Area	Area in SqFt
Jul 2004	Repair Strategy to be Applied and PCI value before and after repair strategy for
Jul 2005	Repair Strategy to be Applied and PCI value before and after repair strategy for
Jul 2006	Repair Strategy to be Applied and PCI value before and after repair strategy for

Work Plan

Name	Description
Plan Year	Year Repair Strategy is to be Applied
Branch	Branch Number as assigned by MicroPaver
Section	Section Name
Section Area	In SqFt
Last PCI	PCI value as of last inspection
Stop Gap Funded	Cost of stop gap repair on the section, funded
Stop Gap Unfunded	Cost of stop gap repair that should be performed on the section, but is unfunded due to low budget
Preventative Funded	Cost of preventative repair on the section, funded
Preventative Unfunded	Cost of preventative repair that should be performed on the section, but is unfunded due to low budget
Major Under Critical PCI: Unfunded	Cost of major repair that should be performed on the section, but is unfunded due to low budget. The section is already below critical PCI value

|	
Major Above Critical Unfunded	Cost of major repair that should be performed on the section, but is unfunded due to low budget. The section is still above critical PCI value
Maintenance Type	Either preventative, stop gap, or major
Local Funded	Either Yes or No, depending on if it can be fixed within the range of the set budget.
Category After	Condition of road section after repairs, ranging from Excellent to Failing.

Summary

Name	Description
Plan Year	Year of Plan from 2004-2006
Sum Of Stop Gap Funded	Total cost of stop gap repairs on roads that will be funded under current budget
Sum Of Stop Gap Unfunded	Total cost of stop gap repairs on roads that won't be funded
Sum Of Preventative Funded	Total cost of preventative repairs on roads that will be funded under current budget
Sum Of Preventative Unfunded	Total cost of preventative repairs on roads that won't be funded
Sum Of Major Under Critical PCI Unfunded	Total cost of major repairs on roads below critical PCI value that won't be funded
Sum Of Major Above Critical PCI Unfunded	Total cost of major repairs on roads above critical PCI value that won't be funded
Total	Total cost for funded projects
Unfunded	Total cost for Unfunded projects
Budget	Budget
Avg Of Condition Before	Average roadway PCI value for the whole town before repairs
Avg Of Condition After	Average roadway PCI value for the whole town after repairs

Inspection Data

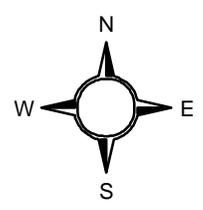| Name	Description
BranchID	Branch Identification Number
SectionID	Section Identification Name
Rank	Roadway rank, either P, S, or T
Surface	Surface type, either AC- Asphalt or GR-
Branch Area SqFt	Total Branch Area
BranchName	Full Branch Name that section belongs to
Sections	Number of sections in the branch
From	Where section starts
To	Where section ends
Length Ft	Length of section
Width Ft	Roadway Width
Area SqFt	Total section area in SqFt
Const_Date	Construction Date of section
Road Name	Six digit roadway number
Condition	Section PCI Value
Pct Load	Percent of distress caused by loading
Climate/Durability	Percent of distress caused by climate
Other	Percent of distress caused by other factors

Jericho Town Highways
MicroPaver PCI Calculations
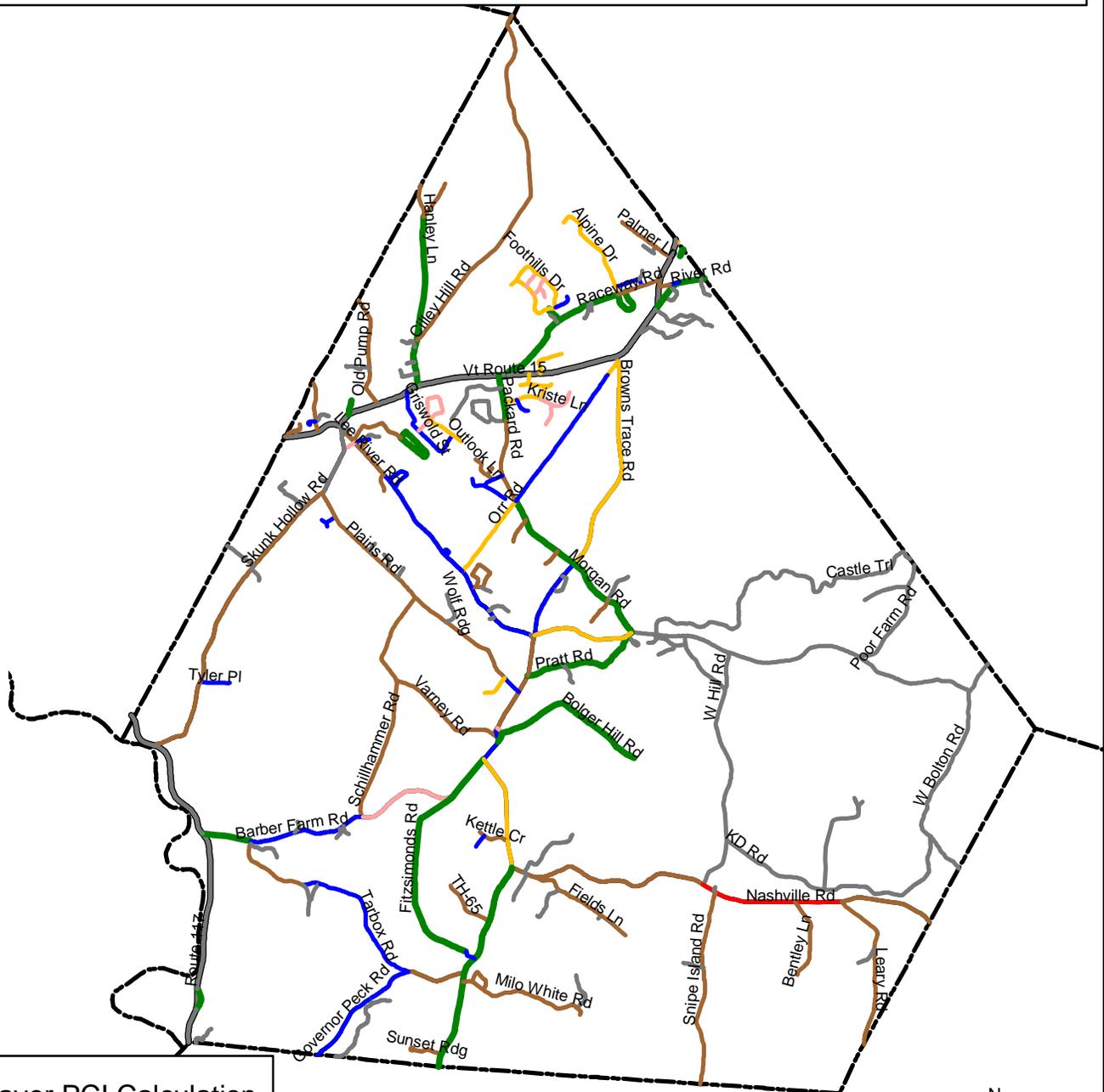
MicroPaver PCI Calculation
- Good (85-100)
- Satisfactory (70-85)
- Fair (55-70)
- Poor (40-55)
- Very Poor (25-40)
- Serious (10-25)
- Failed (0-10)
- Not Surveyed

1 0 1 2 Miles

N
W E
S

Hanley Ln, Foothills Dr, Alpine Dr, Palmer Ln, Olley Hill Rd, Old Pump Rd, Raceway Rd, River Rd, Vt Route 15, Kriste Ln, Browns Trace Rd, Packard Rd, Griswold St, Outlook Ln, Lee River Rd, Orr Rd, Skunk Hollow Rd, Plains Rd, Wolf Rdg, Morgan Rd, Castle Trl, Poor Farm Rd, Pratt Rd, Tyler Pl, Varney Rd, Bolder Hill Rd, W Hill Rd, Schillhammer Rd, Fitzsimonds Rd, Kettle Cr, KD Rd, Nashville Rd, W Bolton Rd, Barber Farm Rd, Tarbox Rd, TH-65, Fields Ln, Snipe Island Rd, Bentley Ln, Leavy Rd, Route 117, Governor Peck Rd, Milo White Rd, Sunset Rdg