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meet Chittenden County's transportation needs

CHITTENDEN COUNTY METROPOLITAN PLANNING ORGANIZATION

CITY OF SOUTH BURLINGTON
PAVEMENT MANAGEMENT STUDY

DRAFT Report

August 2004

CCMPO
30 Kimball Ave, Suite 206, South Burlington, Vermont 05403
(802) 660-4071 / (802) 660-4079 *Fax*
www.ccmpo.org

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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 City of South Burlington has approximately 80 miles of locally-maintained paved 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 combined health of the road network. To assist the town in planning for maintenance needs, the Chittenden County Metropolitan Planning Organization has prepared this pavement 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 creating 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 five funded projects chosen by MicroPaver, and six unfunded projects that the CCMPO has selected on the basis of MicroPaver's calculations for major repairs over the next three years:

Table 1: MicroPaver Immediate Repair Priority Roads

Funded Major M&R Suggestions

Year	Section	From	To	Current PCI	Est. cost
2004	Adams Ct	Brownell	Brownell	59	$24,924.14
2004	Harbor Ridge	Pheasant Way	Cul-de Sac	55	$97,592.97
2004	Fairmont	Holt Street	Proctor Ave	70	$21,125.90
2005	Swift Street	Dorset Street	Pvmt Change	57	$91,791.78
2006	Scotsdale	Yandow	Green Dolphin	55	$146,169.01
				TOTAL	$381,603.80

Table 2: MicroPaver Additional UnFunded Repair Possibilities

Unfunded Major M&R Suggestions

Section	From	To	Current PCI	Est. cost
Airport Parkway	Kirby	White St	32	$37,374.37
Brookwood Dr	Dorset	Oakwood	19	$115,647.00
Airport Rd	Williston	Airport Dr	34	$167,707.86
Swift St C	Spear St	Dorset St	35	$362,297.42
National Guard B	Chng Pvmt	Falcon St	27	$178,921.95
Shamrock Rd	Lime Kiln Rd	End	20	$154,569.35
			TOTAL	$1,016,517.96

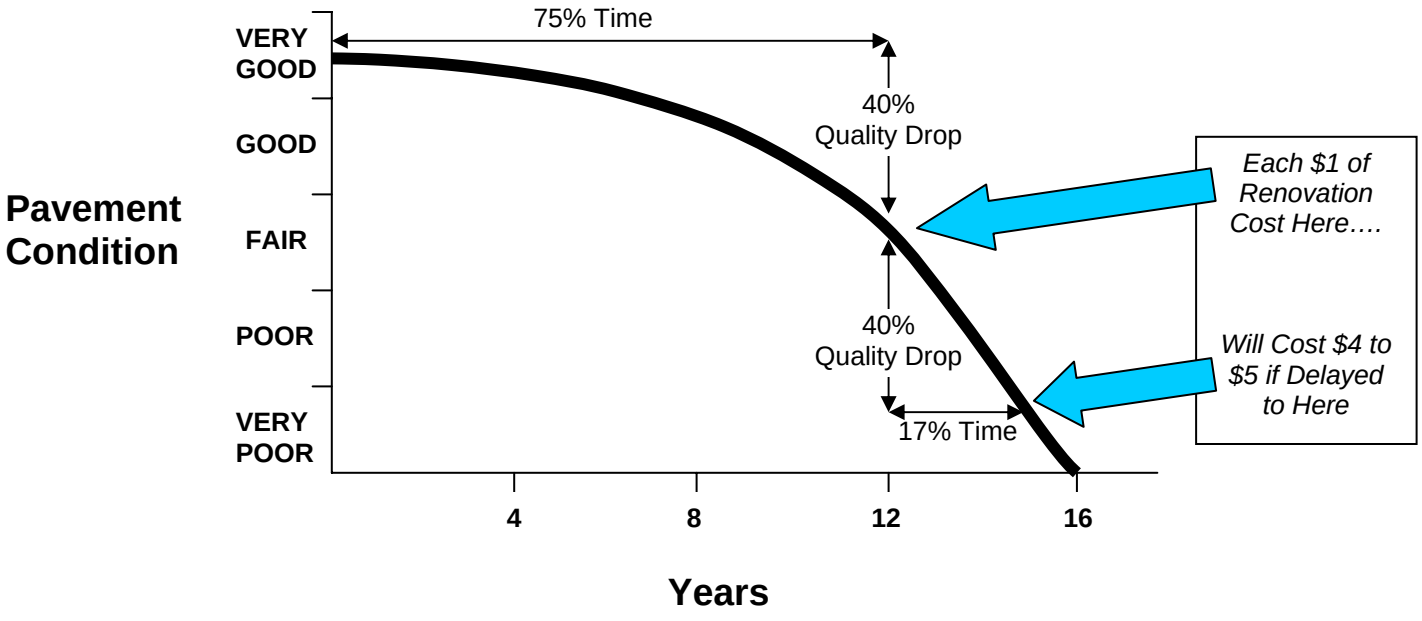
All of these projects are the result of only giving MicroPaver the option of major maintenance and rehabilitation, and a complete list of both these, and the recommendations of the program when preventative maintenance is considered as well can be found in Appendix A. The difference between what MicroPaver chooses as funded or unfunded is that all of the funded suggestions are still at least a little bit above the critical PCI value of 55. All of the roads designated as unfunded are already below that value, but since these suggestions are for major maintenance and repair, the projects below critical PCI may be of more importance to the town, as the ones above the critical PCI can still be maintained with less costly preventative strategies. The CCMPO has therefore chosen a few of the unfunded projects to display as well, although the estimated cost to repair all six of these with major M&R would be over budget even over a three year length of time. It is therefore up to the city of South Burlington to decide how many of these major projects it will pursue while still hopefully accomplishing some of the more minor preventative maintenance projects. This will prevent further degeneration of the rest of the roads which tend to be in satisfactory shape.

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 public works officials, 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.

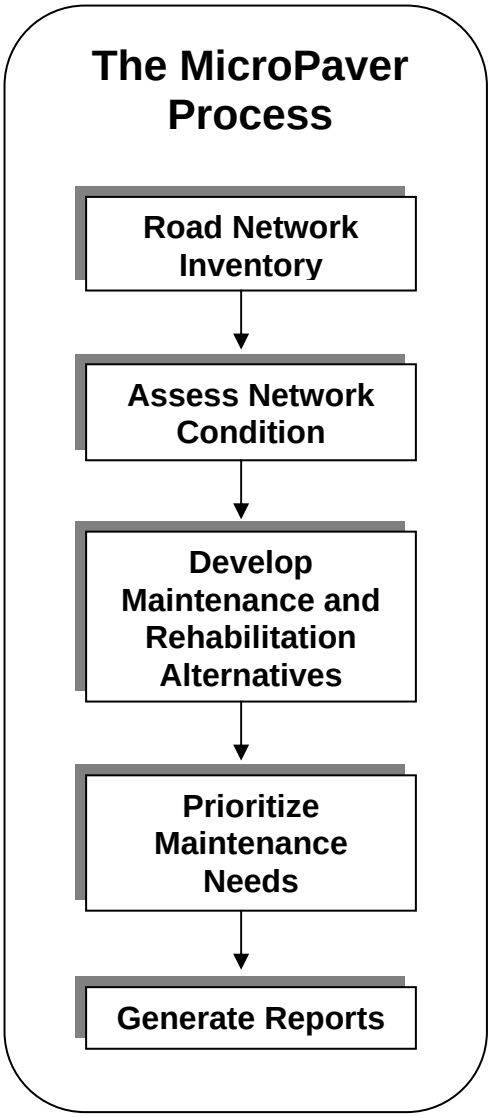
FIGURE 1: Pavement Deterioration/Rehabilitation Relationship



MICROPAVER SOFTWARE

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

FIGURE 2



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

Evaluating a Section

Once all the public roads within South Burlington were surveyed, the data from the inspection sheets were 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 section in South Burlington was Kindness Court A, which had a PCI of 10.

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 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.

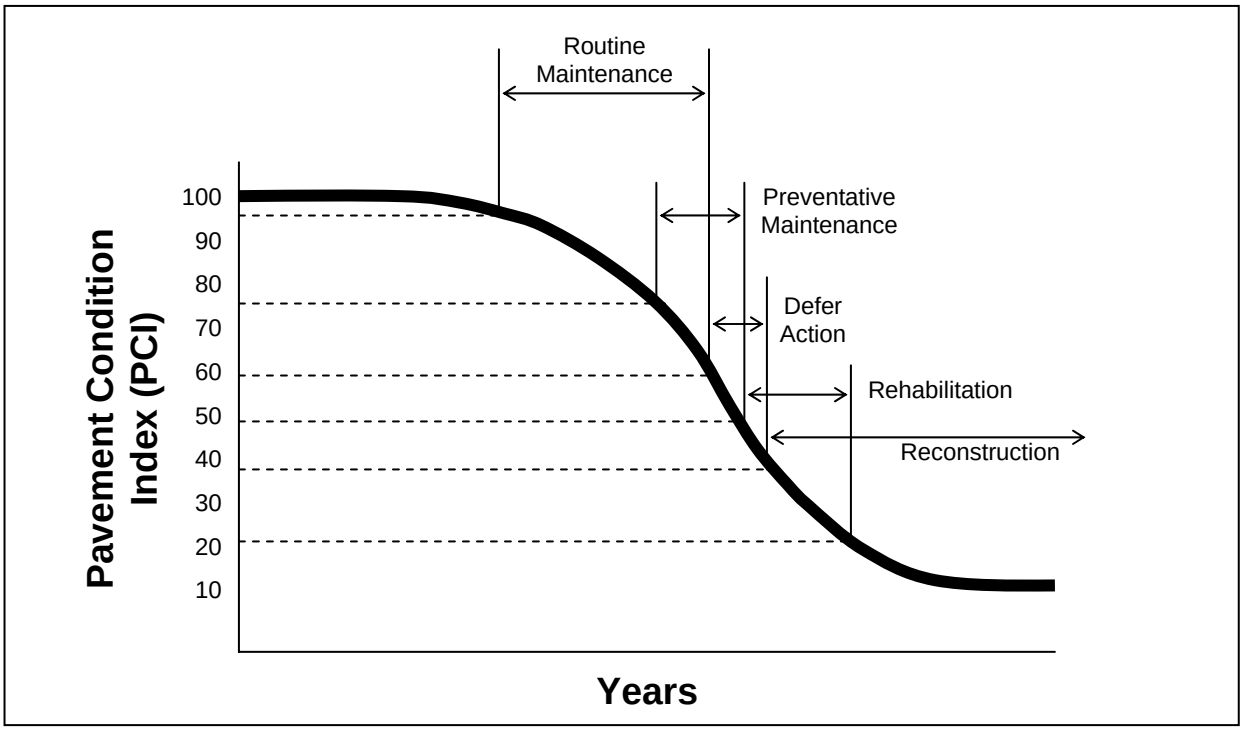
Major Maintenance & Rehabilitation

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. That 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 city 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 250,000 dollars for each of three years, and allowing the software to suggest only repair strategies that are already in use in South Burlington, the program computed a repair strategy and this is shown in the excel spreadsheets in the Appendix. The GIS maps were created using the PCI value that MicroPaver computed for each road section, and importing this data into ArcView. The grading system is a general standard, and the maps are meant to give a good overall illustration of the road conditions.

2.0 SUMMARY OF FINDINGS

2.1 MAINTENANCE AND REPAIR ALTERNATIVES

The Town of South Burlington 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. MicroPaver has analyzed the roadway conditions along with the budget of $250,000 that South Burlington has available for roadway maintenance and has generated a maintenance schedule coinciding with the South Burlington repair strategies. This report also includes what condition the roads will be in after the proper maintenance and repairs are performed.

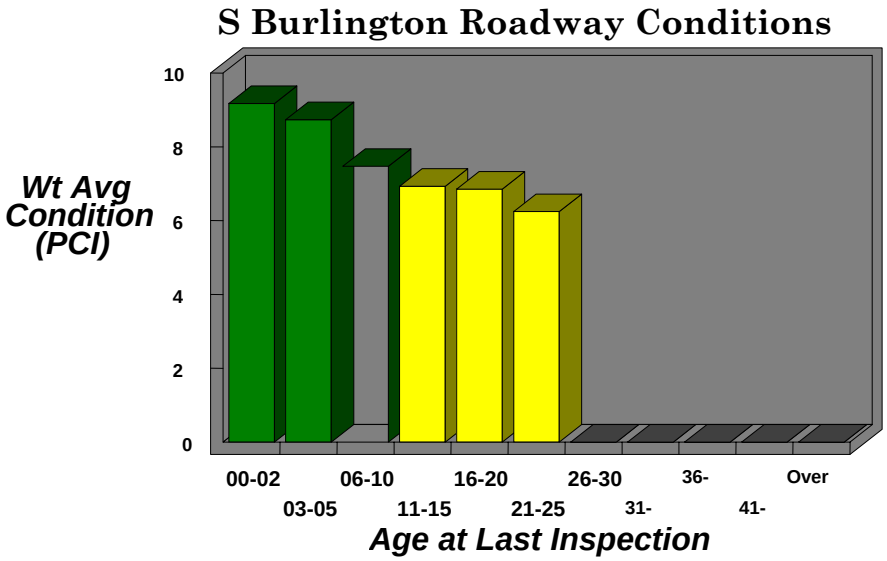
Table 4: South Burlington Repair Strategies in MicroPaver Maintenance Options

Code	Name	Cost /Unit
CS-AC	Crack Sealing - AC	$.19 / Ft
O-1.5-AC	1.5" Overlay	$0.37 / SqFt
PA-AL	Patching - AC Leveling	$22 / SqFt
RB-AC	Rebuild	$80 / SqFt
RC-AC	Reclaim 1.5" base, 1.5" top	$0.47 / SqFt

2.2 OVERALL SOUTH BURLINGTON ROADWAY CONDITIONS

The average PCI of all the roads came out to 71.64, which is in the range of satisfactory condition, and is where both routine and preventative maintenance should be used in order to prevent the roads from going into a rapid decline, as 71.64 is at the upper level of where the cost to repair the roads will begin to increase rapidly. Below is a graph of average weighted pavement condition index versus age, which gives a good visual of how well South Burlington's roadways are holding up over years of both loading and climate related distresses. It must be noted though that not all the correct construction data was available at the time of this report, and therefore any roads with unknown dates were listed as being built on 7/1/1985, or in the 21-25 year old section.

Figure 4: MicroPaver Average Roadway Condition by Age



The primary distresses for the paved roads in South Burlington were the various types of cracking associated with asphalt pavement, such as: alligator, block, edge, and longitudinal/transverse.

3.0 CONCLUSION

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

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

Micro Paver; 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

Plan Parameters

Name	Description
Date Executed	Date plan was created
Time Executed	Time plan was created
Selection Criteria	Criteria Used
Sort Order	None
Condition Method	Method used to rate roadways
First Plan Year	First year for plan to take effect
Years in Plan	Total years plan is for
Cost by Condition Table	Table Used to develop cost projections
Consequence Model Report	Not Used
Limit to Budget Report	Was plan executed with a limited budget
Budget Table	Budget table used
Budget Scale Factor	Factor applied to budget table, depending on town budget
Priority Table	Priority Table Used
Local Preventative Policy	Policy Table used
Local Prev Cost Table	Cost Table Applied
Minimum Condition Report	Was a minimum condition report generated
First Year for Major M&R	First year Major M&R to be applied
Apply Inflation	Yes or no
Inflation Rate	Rate applied if yes
Require Work	Yes or No
Inventory Items Considered	Number of sections analyzed

Applied Policy for 2004

Name	Description
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
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
Section	Section Name
Last PCI	PCI value as of last inspection
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 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
Branch Name	Full Branch Name that section belongs to
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
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 (Not fully Accurate)
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

Unfunded M&R Suggestions

Name	Description
Plan Year	Year M&R is suggested
Section	Name of roadway section to be repaired
PCI	Pavement Condition Index
Category	PCI Category Section is classified as
Major Under Critical PCI Value Unfunded	Dollar amount needed to repair section with major M&R. None of these would fall into the funded category. The table is included in case the town would like to pursue more major repair projects.