



MEMORANDUM

July 19, 2012

To Richard Waldo, Deputy DPW Director

Copy to

From	Nathan C. Weeks, P.E., BCEE	Tel	774-470-1633
	Alex T. Rouchaleau, EIT		774-470-1642
Subject	Pavement Management Plan for Town of Provincetown Paved Roads	Job No.	8614790

INTRODUCTION

The following memorandum summarizes the services provided by GHD for the Town-Wide Paving Plan for the Town of Provincetown. GHD was hired to develop a Town-wide paving plan with the goal of developing a long-term paving and road resurfacing plan that would evaluate the condition of the current roadways infrastructure, develop costs of maintenance and rehabilitation, and provide a tool to track repairs and expenditures.

PAVEMENT MANAGEMENT SYSTEM OVERVIEW

A Pavement Management System (PMS) is a planning tool used to aid agencies with the task of building and maintaining their roadways. A PMS provides agencies with a means to collect, store, organize, and analyse pavement condition information and help agencies plan for preventative and future maintenance. Research and experience has shown it is far less expensive to maintain a road in good condition than it is to allow a road to deteriorate before repairing it (refer to Figure 1). Pavement Management Systems place priority on maintaining these good condition roads, which over the long-term will effectively provide a higher condition roadway at a lower cost.

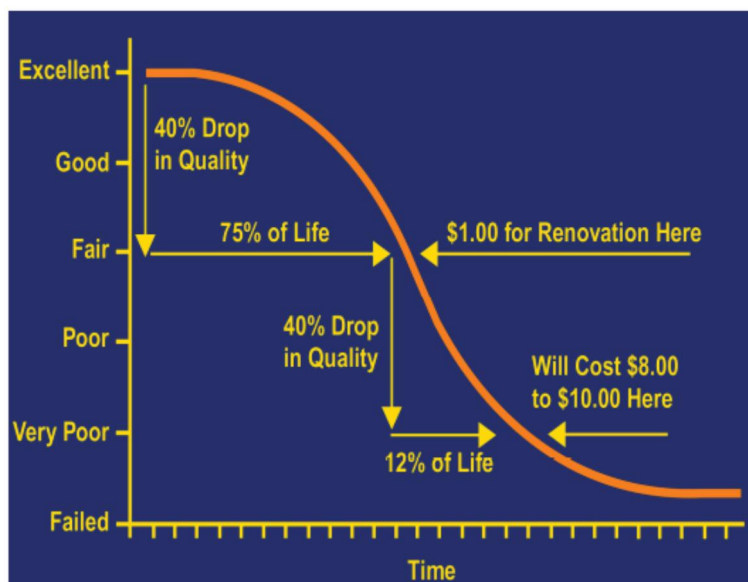


Figure 1 Pavement Deterioration Curve



Since the cost of creating and maintaining a PMS is relatively cheap compared to the cost of repairing and maintaining roadways, many smaller communities have begun to implement pavement management systems.

BACKGROUND

In order to develop a Pavement Management Plan, GHD followed these steps:

1. Obtained a street network inventory through existing GIS resources, previous Town surveying, and an inventory of public and private roadways provided by the Provincetown DPW.
2. Performed a pavement condition survey following the ASTM 6433-11 Standard Practice for Roads and Parking Lots Pavement Condition Index Surveys¹. The surveying was performed between April and June 2012 to collect visual information of the condition of the roadway infrastructure including:
 - a. Type of road (dirt, gravel, asphalt).
 - b. Dimensions, locations, and identifiable characteristics of the road.
 - c. Visual condition of the asphalt roads following the Pavement Condition Index (PCI)².
 - d. Photographs of the road section, sample unit, and defects present.

The pavement management software MircoPAVER Version 6.5.1 was used to calculate the PCI of each road section and manage the data.

3. Develop maintenance/repair alternatives and associated unit costs tailored to the Town.
4. Determine the total backlog cost of maintenance and repairs needed to bring the roadways up to "near perfect" condition.

METHODOLOGY

Surveying Procedures

In order to perform the pavement condition evaluation, the Town's roadways were broken down into a network of branches, sections, and sampling units. Branches are defined as a single entity with a distinct function. For example Commercial St was considered to be a branch. These branches were then broken into sections based on physical attributes such as traffic volume, dimensions, and maintenance. Once branches have been broken into sections, sample units of each section were then surveyed to determine the section's overall pavement condition index (PCI) based on the 20 distress types for asphalt pavement surfaces (see Appendix E). As an example, Commercial Street was divided into ten sections and sample units of each pavement section were taken to determine the PCI. The number of sample units taken for each section was adjusted to most accurately represent the section's pavement condition. It typically followed the guidelines shown on the following table. A typical sample unit size was 500 to 2500 ft².

¹ ASTM 6433-11 Standard Practice for Roads and Parking Lots Pavement Condition Index Surveys. The ASTM 6433 is the standard practice used to quantify the condition of roadways.

² The standard follows the Pavement Condition Index (PCI) to rate the condition of the roadways on a scale of 0-100, 0 being a failure and 100 being a newly paved surface free of defects.



Table 1 Sample Survey Unit Quantities

Number of Sample Units per Section	Number of Sample Units to Survey
1 to 5 sample units	1 sample unit
6 to 10 sample units	2 sample units
11 to 15 sample units	3 sample units
16 to 40 sample units	4 sample units
Over 40 sample units	10%

Software Analysis of Results Using MicroPAVER

MicroPAVER is a pavement management software program that was originally developed by the U.S. Army Corps of Engineers in the late 1970's to aid in the management of the Department of Defences' pavement inventories. The software uses the pavement condition index (PCI) and consistent inspection data to characterize the pavement's condition and predict its future maintenance and repair needs. MicroPAVER still remains one of the most widely used and supported PMP programs available and represents the standard by which all other PMP programs are judged.

The capabilities of the MicroPAVER software include the following³:

- Develop and organize the pavement inventory
- Assess the current condition of pavements
- Develop models to predict future conditions
- Report on past and future pavement performance
- Develop scenarios for maintenance and repair based on budget or condition requirements
- Plan repair and maintenance projects

The MicroPAVER software was used to analyze the data obtained from the pavement surveying and to create a pavement management plan for the Town of Provincetown.

³ Excerpt taken from MicroPAVER website - <http://www.cecer.army.mil/paver/Features.htm>



Provincetown Pavement Treatment Categories

In order to provide the Town with area-specific pavement treatment and repair alternatives the pavement condition index (PCI) was broken down into the following distribution based on typical maintenance strategies:

Table 2 Provincetown Maintenance & Repair Strategies

Maintenance & Repair Category	PCI	Condition
Base Rehabilitation	0 – 59	Failed Condition; in need of full reconstruction including base layer
Structural Improvement	60 – 72	Poor condition; in need of additional thickness to support traffic.
Preventative Maintenance	73 – 85	Fair condition; in need of surface sealing or thin overlay.
Routine Maintenance	86 – 95	Good condition; in need of crack sealing or patching.
Do Nothing	96 – 100	Excellent condition; in need of no current maintenance.

Based on the above maintenance and repair strategies the following pavement repair options and unit costs were created for Provincetown and incorporated into the MicroPAVER software:

Table 3 Provincetown Pavement Repair Options & Unit Costs

Repair Option	Unit Cost per Foot ²	PCI
Reclamation Arterial/Collector: Police, Sawcut, Reclaim, Reset Structures, Pave, Handwork, Stripe, Inspect	\$7.37	0 – 59
Reclamation Local: Police, Sawcut, Reclaim, Reset Structures, Pave, Handwork, Inspect	\$5.41	0 – 59
Mill/Overlay Arterial/Collector: Police, Sawcut, Mill, Tack, Pave, Stripe	\$2.82	60 – 72
Mill/Overlay Local: Police, Sawcut, Mill, Tack, Pave	\$2.00	60 – 72
Thin Overlay: Police, Crackseal/patch, Tack, Overlay	\$1.45	73 – 85
Chipseal: Crackseal/Patch, Chipseal	\$0.63	73 – 85
Routine Maintenance: Crackseal	\$0.01	92 – 95
Routine Maintenance: Crackseal, Patch	\$0.07	86 - 91

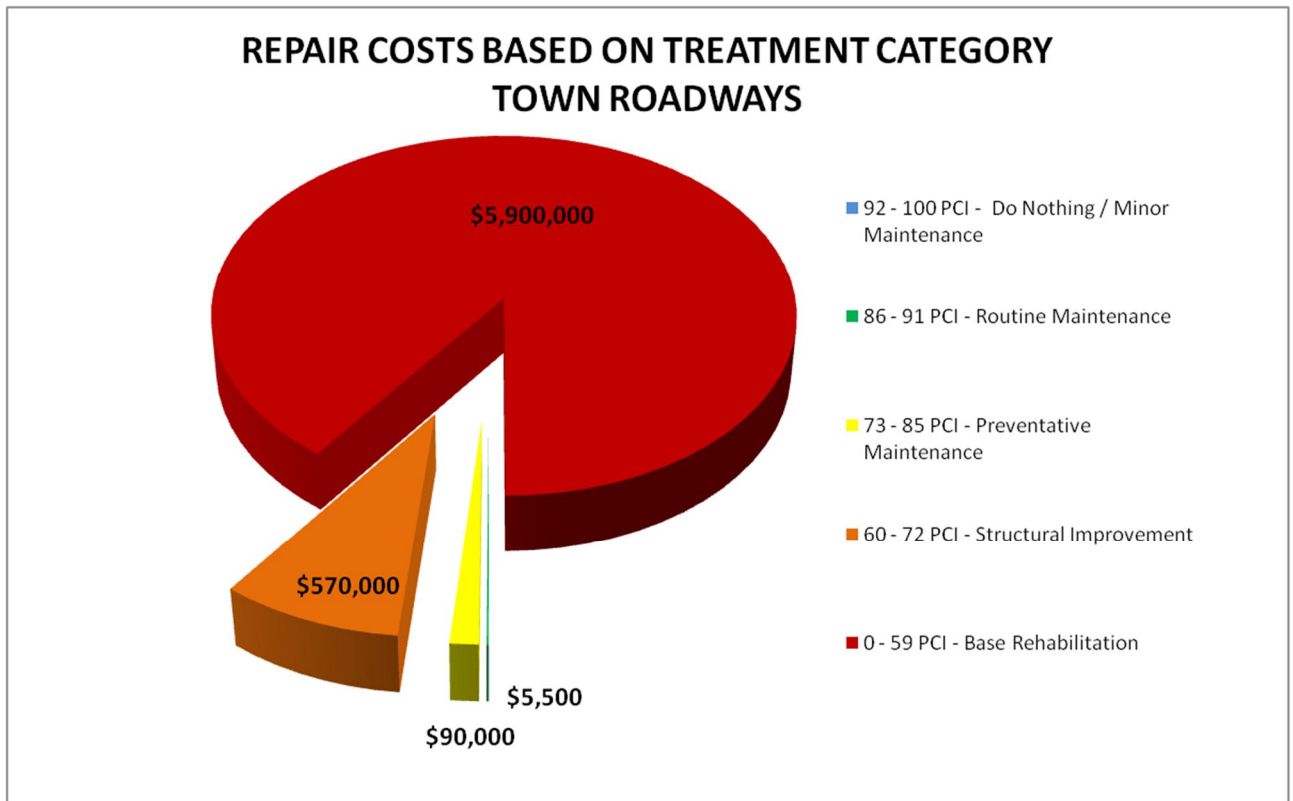


SUMMARY OF FINDINGS – TOWN ROADWAYS

Provincetown has approximately 17 miles of Town owned paved roads. Based on the maintenance strategies and repair options discussed above, town roads currently have an average PCI of 55 and a backlog of approximately \$6.6 million, the cost to bring the 17 miles of Town paved roads to a near perfect condition (a PCI of > 95 was used as “near perfect” condition). Table 4 provides a breakdown of the backlog:

Table 4 Summary of Provincetown Paved Town Road Repair Backlog

Maintenance & Repair Category	Cost	Percentage of Total Backlog	Percentage of Town Roadways
92 - 100 PCI: Do Nothing/Minor Maintenance	\$730	0	16
86 – 91 PCI: Routine Maintenance	\$5,500	0	2
73 – 85 PCI: Preventative Maintenance	\$90,000	1	8
60 – 72 PCI: Structural Improvement	\$570,000	9	14
0 – 59 PCI: Base Rehabilitation	\$5,900,000	90	59



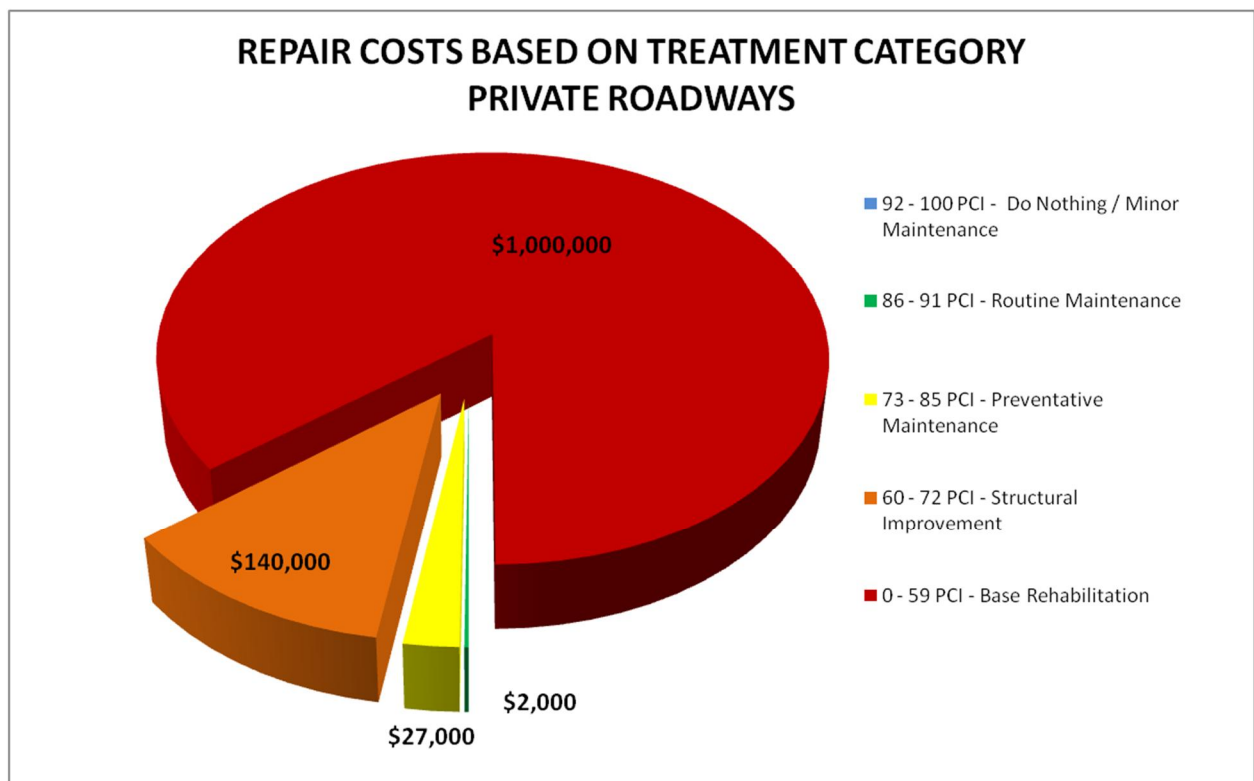


SUMMARY OF FINDINGS – PRIVATE ROADWAYS

Provincetown has approximately 4.8 miles of privately owned paved roads. Based on the maintenance strategies and repair options used, private roads currently have an average PCI of 63 and a backlog of approximately \$1.2 million, the cost to bring the 4.8 miles of privately paved roads to a near perfect condition (a PCI of >95 was used as “near perfect” condition). Table 5 provides a breakdown of the backlog:

Table 5 Summary of Provincetown Paved Private Road Repair Backlog

Maintenance & Repair Category	Cost	Percentage of Total Backlog	Percentage of Town Roadways
92 - 100 PCI: Do Nothing/Minor Maintenance	\$-	0	17
86 – 91 PCI: Routine Maintenance	\$2,000	0	7
73 – 85 PCI: Preventative Maintenance	\$27,000	2	11
60 – 72 PCI: Structural Improvement	\$140,000	12	17
0 – 59 PCI: Base Rehabilitation	\$1,000,000	86	48



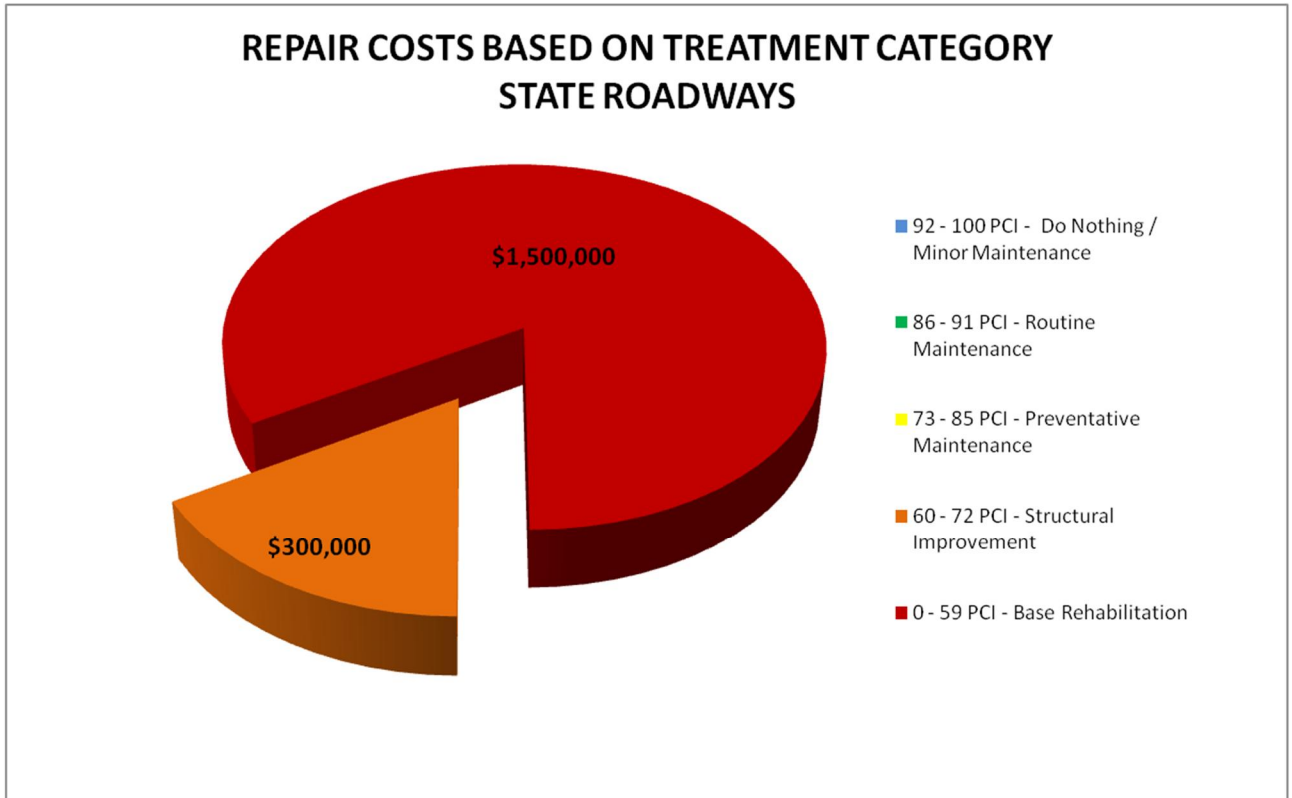


SUMMARY OF FINDINGS – STATE ROADWAYS

Provincetown has approximately 3.3 miles of state maintained paved roads. The findings do not include Route 6 as its condition was not surveyed. Based on the maintenance strategies and repair options used, state roads currently have an average PCI of 65 and a backlog of approximately \$1.8 million, the cost to bring the 3.3 miles of state maintained paved roads to a near perfect condition (a PCI of >95 was used as “near perfect” condition). Table 5 provides a breakdown of the backlog:

Table 6 Summary of Provincetown Paved State Road Repair Backlog

Maintenance & Repair Category	Cost	Percentage of Total Backlog	Percentage of Town Roadways
92 - 100 PCI: Do Nothing/Minor Maintenance	\$-	0	24
86 – 91 PCI: Routine Maintenance	\$-	0	0
73 – 85 PCI: Preventative Maintenance	\$-	0	0
60 – 72 PCI: Structural Improvement	\$300,000	16	24
0 – 59 PCI: Base Rehabilitation	\$1,500,000	84	52





EXISTING CONDITION EVALUATIONS

The following photographs show examples of Provincetown roadways that fall into the 5 maintenance repair strategies.



Bradford St. - Section No. 5

PCI = 100 (Excellent Condition, in need of nothing)



Court St. – Section No. 1

PCI = 87 (Good Condition, in need of routine maintenance)



Winslow St – Section No. 2

PCI = 73 (Satisfactory Condition, in need of preventative maintenance)



Bradford St – Section No. 2

PCI = 61 (Fair condition, in need of structural improvements)



Cemetery Rd – Section No. 1

PCI = 48 (Poor condition, in base rehabilitation)



Mechanic St.

PCI = 14 (Failed condition, in need of base rehabilitation)