

# CHAPTER 9

## PAVEMENT

### A. PAVEMENT MANAGEMENT SYSTEM

A Pavement Management System (PMS) is a systematic process that collects and analyzes roadway pavement information for use in selecting cost-effective strategies for providing and maintaining pavements in a serviceable condition. The role of PMS is to provide an opportunity to improve roadway conditions and make cost-effective decisions on maintenance priorities and schedules.

#### 1. Regional Efforts and Process

The Pioneer Valley Planning Commission's (PVPC) regional PMS involves a comprehensive process for establishing the network inventory and project histories, collecting and storing the pavement distress data, analyzing the data, identifying the network maintenance activities and needs and integrating the PMS information in the metropolitan and statewide planning processes. The Pioneer Valley region covers approximately 1,200 square miles, roughly the same size as the state of Rhode Island. The roadway network covered by the regional PMS includes all urban and rural Federal-Aid highways of the 43 cities and towns in the region. The Pioneer Valley region consists of approximately 1,400 miles of Federal-Aid eligible roadways. In October 2009, the Federal Highway Administration (FHWA) mandated that the Regional Planning Agencies (RPA) undertake a study to establish the cost of maintaining the Federal-Aid roadways that make up their regions with the expectation that the results of these studies will be incorporated in every update of the Regional Transportation Plan (RTP) thereafter. The PVPC's regional PMS efforts have been ongoing since 1995 at which time the RPAs were complying with the requirements of the Intermodal Surface Transportation Efficiency Act (ISTEA) of 1991. In an effort to continue to be in federal compliance, the PVPC has continued the regional PMS efforts. Staff have collected and analyzed pavement distress data for all 43 cities and towns in the Pioneer Valley Region.

The PVPC utilizes the prepackaged Pavement Management software program "The PAVEMENT *View*" developed by Cartegraph Systems. The PAVEMENT *View* uses a Road Condition Index (RCI) as a measurement of roadway serviceability and as a method to establish performance criteria. Since the PVPC only collects pavement distress information, the Overall Condition Index (OCI) produced by PAVEMENT *View* was used for analysis purposes.

An OCI was generated for each inventoried roadway segment in the region using the pavement distress data collected by the PVPC staff. Deduct values assigned to

each type of distress based on severity and extent, were applied to generate an OCI for each roadway segment. OCI is measured from 0 to 100, with 100 being an excellent or perfect condition and zero being failure or impassable condition. The OCI values generated are grouped into OCI category ranges which are defined depending on the type and functional class of each segment. These OCI categories along with other factors, such as a Base Index, Average Curb Reveal, Functional Class and Pavement Type are used to assign a Repair Strategy for each of the defined segments.

The PVPC incorporates 6 default repair categories:

1. Reconstruction of Collectors and Arterial Streets
2. Reconstruction of Local Roads (not used in regional efforts)
3. Rehabilitation
4. Preventive Maintenance
5. Routine Maintenance
6. No Action

Reconstruction involves the complete removal and replacement of a failed pavement section which includes reclamation. For the most part, the cost per square yard differs for local roads as opposed to collectors and arterials. The rehabilitation of pavements includes the work necessary to restore the pavement to a condition that will allow it to perform satisfactorily for several years. Preventative maintenance activities are those which are performed at planned intervals to protect and seal the pavement. Routine maintenance activities are those which are taken to correct a specific pavement failure or area distress.

The following summarizes the findings of the region's surveyed federal-aid eligible roadways and recommends appropriate maintenance activities. A documented guideline of project priority, cost and recommended maintenance activity may be produced in a systematic and coordinated manner for the entire region. Project level analysis is conducted and highway maintenance projects are developed, the results of which are an integral part of the RTP and Transportation Improvement Program (TIP).

## **2. Existing Conditions**

The PVPC staff surveyed approximately 1,280 miles of federal-aid eligible roadways in the Pioneer Valley region which was divided into 2,473 roadway segments. Pavement distress data was collected for the entire Surface Transportation Program (STP) roadway network and select National Highway System (NHS) roadways. The average OCI for the surveyed roadways in the region is rated at 64, which indicates

that majority of the roadways are in a moderately good condition. The average OCI information by community is depicted in Table 9-1.

**Table 9-1 – Average OCI by Community**

<b>Community</b>	<b>Arterial Miles</b>	<b>Collector Miles</b>	<b>Fed Aid Miles</b>	<b>Average OCI 2015</b>	<b>Average OCI 2011</b>
Agawam	24.47	26.18	50.65	67	66
Amherst	16.32	34.15	50.47	58	70
Belchertown	26.22	21.27	47.49	74	80
Blandford	8.56	8.41	16.97	68	68
Brimfield	11.58	13.26	24.84	57	83
Chester	8.058	0	8.058	73	84
Chesterfield	7.713	9.96	17.673	79	81
Chicopee	17.84	42.94	60.78	74	81
Cummington	12.95	8.05	21	71	71
East Longmeadow	8.43	23.304	31.734	73	73
Easthampton	4.25	25.723	29.973	68	68
Goshen	5.401	3.7058	9.1068	71	71
Granby	7.7155	14.117	21.8325	67	85
Granville	8.803	6.452	15.255	76	76
Hadley	17.996	21.439	39.435	85	85
Hampden	0	12.65	12.65	84	84
Hatfield	0	14.687	14.687	83	83
Holland	0	7.279	7.279	35	77
Holyoke	16.25	46.97	63.22	54	82
Huntington	11.227	4.846	16.073	72	72
Longmeadow	3.26	15.79	19.05	74	61
Ludlow	24.46	9.689	34.149	68	83
Monson	8.64	25.484	34.124	54	83
Montgomery	0	5.197	5.197	74	83
Northampton	50.81	15.7	66.51	68	73
Palmer	16.603	30.572	47.175	56	87
Pelham	5.795	10.155	15.95	49	71
Plainfield	0	11.893	11.893	39	74
Russell	9.45	5.084	14.534	60	78
South Hadley	15.39	13.84	29.23	65	74
Southampton	0	17.17	17.17	58	88
Southwick	14.14	20.34	34.48	77	77
Springfield	42.7	117.42	160.12	62	78
Tolland	5.66	0	5.66	77	77
Wales	0	9.66	9.66	44	73
Ware	13.36	19.77	33.13	66	85
West Springfield	7.51	28.64	36.15	60	72
Westfield	19.14	48.72	67.86	62	78
Westhampton	0	21.08	21.08	71	71
Wilbraham	5.79	28.22	34.01	71	85
Williamsburg	7.87	11.2	19.07	74	74
Worthington	11.07	6.76	17.83	52	84
			<b>Average OCI</b>	<b>71.1</b>	<b>77.6</b>

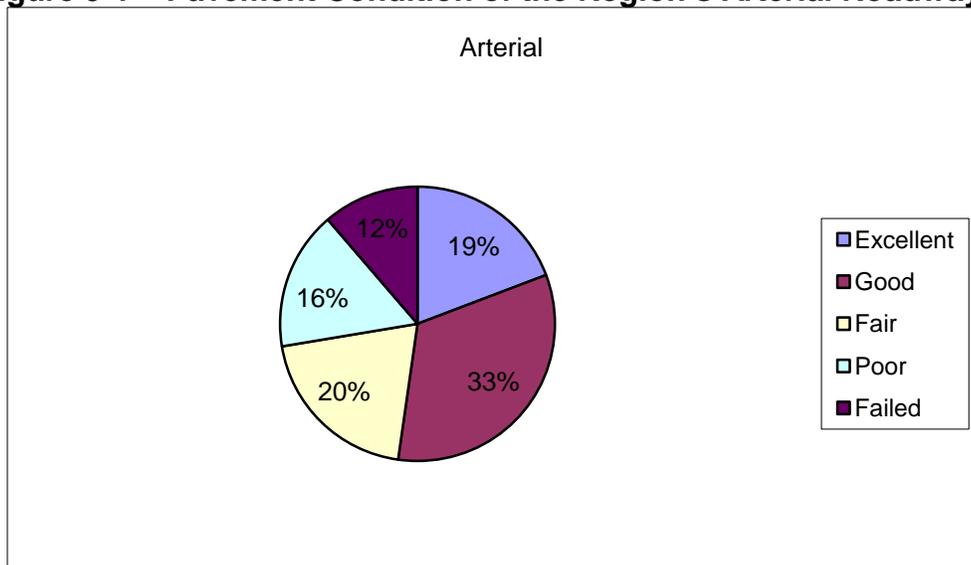
The OCI generated by PAVEMENT View was used to establish pavement condition categories of “Excellent”, “Good”, “Fair”, “Poor”, and “Failed” with OCI ranges provided in Table 9-2.

**Table 9-2 – Pavement Condition Range by Functional Class**

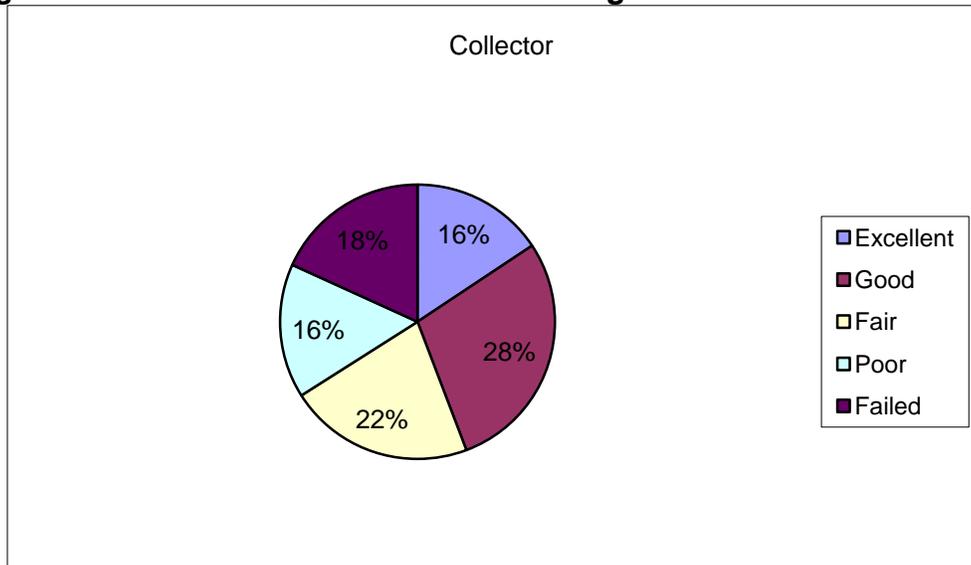
	<u>Excellent</u>	<u>Good</u>	<u>Fair</u>	<u>Poor</u>	<u>Failed</u>
<b>Arterial</b>	>89.5	>69.5 and <=89.5	>48.5 and <=69.5	>25.5 and <=48.5	<=26.5
<b>Collector</b>	>88.5	>68.5 and <=88.5	>47.5 and <=68.5	>23.5 and <=47.5	<=24.5

The results indicate that most of the region’s surveyed federal-aid eligible roadways are in good condition. Figures 9-1 and 9-2 depict the region’s pavement condition graphically by functional class. As shown, the region’s arterial and collector roadways follow a similar pattern with regards to pavement condition. The region’s surveyed federal-aid roadways consist of 459 miles of arterial and 820 miles of collector roadways. The percentages are 36% and 64% respectively.

**Figure 9-1 – Pavement Condition of the Region’s Arterial Roadways**

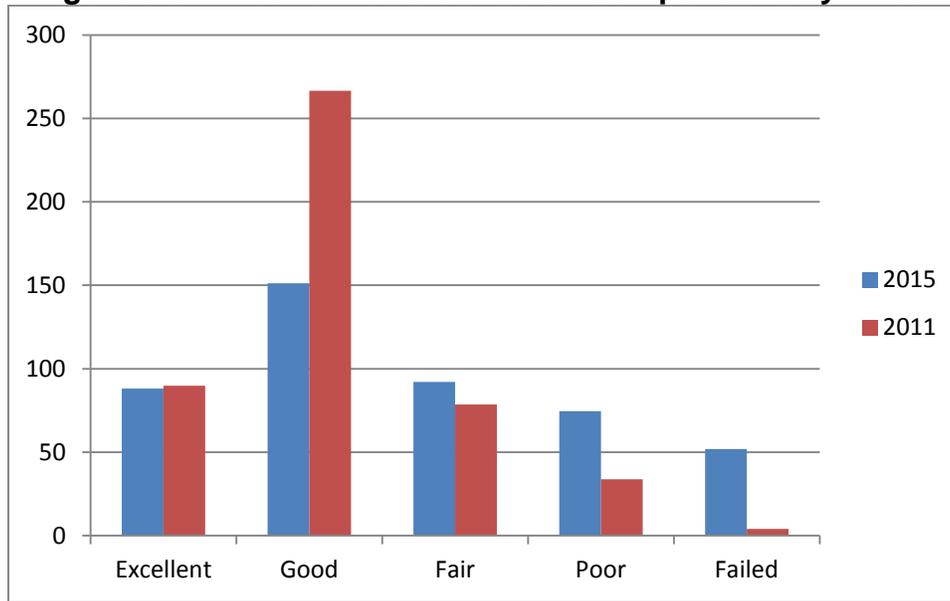


**Figure 9-2 – Pavement Condition of the Region’s Collector Roadways**

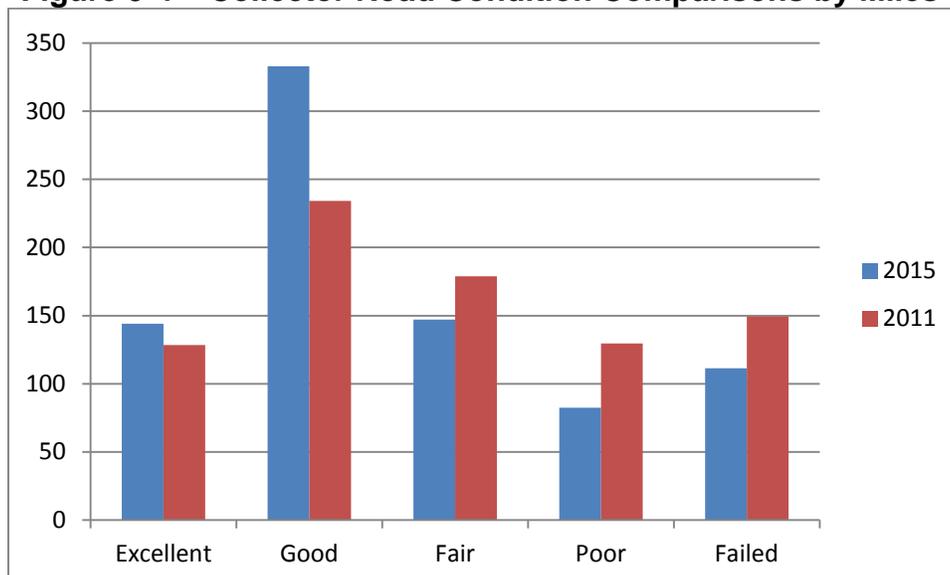


Figures 9-3 and 9-4 show a comparison of the number of miles of existing surveyed roadways by pavement condition to the last time the RTP was updated for the arterial and collector roadways respectively. Figure 9-3 is indicative of pavement repair action taken on the arterial roadway segments which require major rehabilitation and whose condition cannot deteriorate much further. The trend is reversed as far as the region's collector roadways are concerned. Figure 9-4 is indicative of application of improvement funds to be directed towards the cost effective repairs that improve and/or maintain the segments which are salvageable.

**Figure 9-3 – Arterial Road Condition Comparisons by Miles**



**Figure 9-4 – Collector Road Condition Comparisons by Miles**



### 3. Regional Roadway Improvement Needs

The budgeting process of the PAVEMENT *View* can be used to calculate the backlog of repair work for the region by assigning 100% of roadway segments within the best OCI range. The backlog is defined as the cost of bringing all roads up to a near perfect condition within one year.

The backlog represents how far behind the roadway network is in terms of its present physical condition and measures the cost of performing all desirable repairs to achieve the best OCI range. At the end of the year 2015 the backlog repair work for the Pioneer Valley Region was \$491,410,099. This cost estimate is useful in identifying the pavement condition of the system at the end of the year 2015 and in comparing to future and/or past year's backlogs.

After the backlog of improvement needs have been determined, the recommended maintenance actions for roadway segments may be ranked by priority. The priority of segment improvement is determined based on its calculated Network Priority Ranking (NPR). NPR is a function of vehicle volume, roadway length, estimated life of repair, improvement cost, and OCI, and it is a measurement of the benefit/cost ratio for each segment improvement recommendation. NPR is used to rank roadway projects based on a priority scale. The projects with a higher NPR are assigned a higher priority and projects with a lower NPR are assigned a lower priority. The higher the NPR, the higher the project priority. The roadway segments with the same NPR are assigned the same priority ranking and segments with no NPR are not assigned a priority ranking.

Table 9-3 summarizes the region's backlog of Federal-Aid eligible roadway repair work by community. The table also provides information on how far behind each community is as far as backlogs of reconstruction and resurfacing work are concerned. It is important to note that the region's total reconstruction cost is almost double of the resurfacing needs.

**Table 9-3 – Backlog of Repair Work by Community**

<b>Community</b>	<b>Backlog</b>	<b>Reconstruction</b>	<b>Resurfacing</b>
Agawam	\$16,224,260.00	\$10,678,599.00	\$3,318,244.00
Amherst	\$16,465,268.00	\$9,564,698.00	\$5,013,537.00
Belchertown	\$12,471,340.00	\$9,278,184.00	\$2,195,919.00
Blandford	\$2,202,833.00	\$1,522,460.00	\$115,664.00
Brimfield	\$6,803,075.00	\$0.00	\$5,339,046.00
Chester	\$1,096,330.00	\$0.00	\$0.00
Chesterfield	\$495,630.00	\$0.00	\$0.00
Chicopee	\$19,413,757.00	\$9,261,579.00	\$5,006,645.00
Cummington	\$1,685,082.00	\$0.00	\$940,469.00
East Longmeadow	\$4,157,136.00	\$154,539.00	\$2,055,656.00
Easthampton	\$5,133,550.00	\$1,000,955.00	\$2,357,653.00
Goshen	\$824,652.00	\$0.00	\$0.00
Granby	\$2,790,316.00	\$551,413.00	\$1,330,244.00
Granville	\$408,334.00	\$0.00	\$0.00
Hadley	\$1,044,712.00	\$0.00	\$0.00
Hampden	\$157,351.00	\$0.00	\$0.00
Hatfield	\$734,532.00	\$0.00	\$34,532.00
Holland	\$5,537,211.00	\$5,534,553.00	\$0.00
Holyoke	\$45,506,335.00	\$36,489,463.00	\$5,958,641.00
Huntington	\$927,743.00	\$0.00	\$671,051.00
Longmeadow	\$4,386,832.00	\$1,820,405.00	\$1,946,578.00
Ludlow	\$13,933,099.00	\$8,967,153.00	\$2,449,756.00
Monson	\$12,260,843.00	\$8,892,545.00	\$2,263,021.00
Montgomery	\$267,677.00	\$0.00	\$0.00
Northampton	\$29,748,336.00	\$18,615,035.00	\$7,555,272.00
Palmer	\$19,530,349.00	\$9,810,988.00	\$7,130,820.00
Pelham	\$4,688,337.00	\$4,578,590.00	\$25,973.00
Plainfield	\$7,455,723.00	\$7,216,279.00	\$206,891.00
Russell	\$3,023,725.00	\$0.00	\$2,513,856.00
South Hadley	\$8,896,811.00	\$4,165,058.00	\$3,680,120.00
Southampton	\$5,113,496.00	\$593,736.00	\$4,051,855.00
Southwick	\$3,413,098.00	\$0.00	\$2,413,172.00
Springfield	\$82,325,101.00	\$55,735,779.00	\$19,380,323.00
Tolland	\$349,425.00	\$0.00	\$0.00
Wales	\$3,011,218.00	\$2,174,126.00	\$0.00
Ware	\$6,106,834.00	\$1,284,186.00	\$2,079,357.00
West Springfield	\$23,752,869.00	\$16,926,189.00	\$5,245,773.00
Westfield	\$28,809,173.00	\$15,578,118.00	\$9,504,696.00
Westhampton	\$15,368,747.00	\$15,368,747.00	\$0.00
Wilbraham	\$6,593,550.00	\$1,761,417.00	\$2,480,844.00
Williamsburg	\$12,881,174.00	\$12,881,174.00	\$0.00
Worthington	\$3,609,078.00	\$0.00	\$2,073,076.00
<b>Total</b>	<b>\$439,604,942.00</b>	<b>\$270,405,968.00</b>	<b>\$109,338,684.00</b>