

**Town of Cumberland
Pavement Management
Cumberland, Maine**

Index

<i>Description</i>	<i>Page</i>
Introduction	2
Data Collection	3
Field Inventory	3
Pavement Condition Ratings	4
Existing Condition of Streets	4-5
Forecasted Condition of Streets	6
Summary of Existing and Future Conditions	7-8
Treatment Alternatives	9-10
Conclusions	10

Appendix A

Table 1	Pavement Condition Ratings – All Roads Combined (Alphabetical)
Table 2A	Pavement Condition Ratings – State Roads (Alphabetical)
Table 2B	Pavement Condition Ratings – Town Roads (Alphabetical)
Table 3A	Pavement Condition Ratings – State Roads (PCR - Lowest to Highest)
Table 3B	Pavement Condition Ratings – Town Roads (PCR - Lowest to Highest)
Table 4	Segments with PCRs that Increased

Appendix B

Field Data

Field Notes

Appendix C

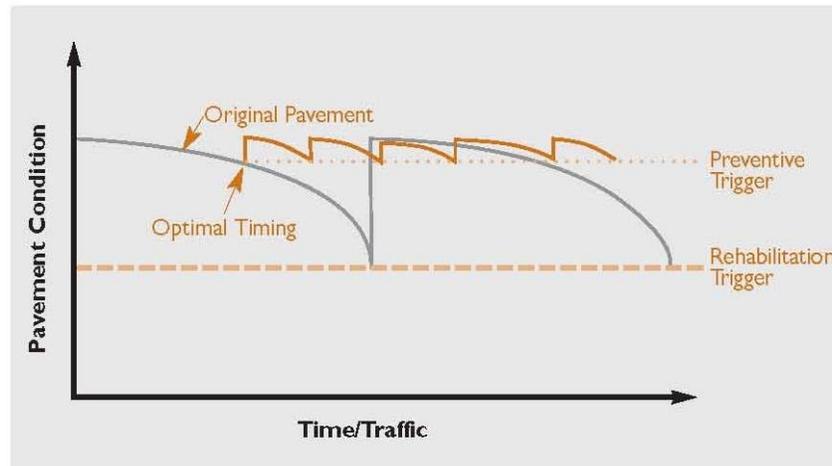
Generic Preliminary Opinions of Probable Construction Costs provided by the Town

Introduction

Gorrill-Palmer Consulting Engineers Inc. was retained by the Town of Cumberland to conduct pavement condition ratings for all Town maintained roadways as well as the state roadways as provided to us by the Town.

The purpose of the study was to assess the pavement condition and inventory the existing roadways in order to determine the appropriate maintenance/improvement strategy and to develop an appropriate timeline for a long-term capital improvement program based on a prioritization of the roadways considering their condition. By continuing to complete these pavement evaluations on a regular basis, it is possible for the Town to better gauge how quickly roadways are deteriorating and, consequently, how best to allocate resources.

The following graph illustrates the ideal timing to complete preventive maintenance before the pavement condition reaches a point where pavement rehabilitation is required. This is due to the fact that it is significantly less expensive to complete an overlay on a roadway than to rehabilitate or reconstruct a roadway. Rehabilitation of a roadway involves reclaiming the pavement and typically some minor areas of reconstruction, and costs at least three times the amount it costs to complete a light overlay; reconstruction of a roadway costs at least six times the amount to complete an overlay. Therefore it is important to complete preventive maintenance to maintain the roadways so they do not reach the point where they require rehabilitation or reconstruction.



*Graph from TRNews 228

The pavement conditions were evaluated using the Visual Condition Survey for Flexible Pavements methodology, developed by the Maine Department of Transportation (MaineDOT) Pavement Management Division. The pavement condition rating methodology is summarized on the following pages.

Data Collection

A listing of the town and state maintained roadways was obtained from the Town to determine which roadways would be surveyed.

Field Inventory

The pavement condition data was collected using a pavement distress survey approach developed by the MaineDOT. The survey is completed by systematic sampling on each of the inventory segments, which are homogenous in regard to pavement age and lane and shoulder width.

Inventory segments that are less than one mile in length are inventoried every $\frac{1}{4}$ mile, while segments that are greater than a mile in length are surveyed every $\frac{1}{2}$ mile. Segments were identified by street name as well as beginning and end points and distance. To ease in the repetition of this study at a future date, and to increase accuracy, inventory samples were aligned with a physical landmark which does not change from year to year.

Each inventory point examines the roadway pavement section which is 100 feet in length and 12 feet in width. The 12 feet shall be in the predominate lane of travel, generally closest to the centerline of the road. Inventory samples are staggered, with the first rating always performed on the right side, the second on the left, and so forth. If an inventory segment was not longer than 400 feet, it was not possible to get two samples, and the sample was taken in the center of the segment.

The distress survey records the extent and the severity of commonly occurring Maine pavement distresses. These distresses are cracking, including transverse, longitudinal, edge and load associated cracking; distortion and patching. A description of each of the distresses is below:

- Transverse Cracks: Transverse cracks are typically perpendicular to the roadway centerline.
- Longitudinal Cracks: Longitudinal cracks are typically parallel to the roadway centerline.
- Edge Cracking: Cracks begin parallel to and within 12 inches of the pavement edge. Cracking is either a fairly continuous straight crack or crescent-shaped cracks in wave-formation.
- Load Cracking: Load cracking is found in the wheel paths and is often accompanied by rutting.
- Distortion: Distortion is a deviation of the transverse profile from its original shape. Distortion includes rutting, excessive crown and local bumps.
- Patching: Patching is a temporary correction to damaged pavement or an area in obvious need of correction.

Each distress is given a rating from 0 to 3, 3 being a severe rating. For example, Transverse Cracks has a severity of “1” if the total transverse cracking is less than 1 lane width (12’) in the sample area, a severity of “2” if there are between one and five cracks across the sample area, and “3” if there were more than five.

To assist us in the completion of the survey we marked out the 100 foot survey sites with white paint, which on lower volume roads, may be visible the next time the survey is completed. During the completion of the survey it did rain on some days and the paint did not take. Great care was taken to try to duplicate the inventory locations used in previous studies; however, this was not possible in all locations. This was generally due to improvements performed in the segment, or a lack of landmark reference in the previous studies. Since all of the ratings were not exactly in the same location as the previous study there are some roadway segments that have a slightly higher pavement condition than in the previous study. For this reason, each sample was taken using a physical landmark such as a utility pole. This will help increase the accuracy of historical data in the future.

Each street was identified with a beginning point, and landmarks were recorded at the location of the survey sites. There were approximately 185 streets or street sections resulting in 72.9 miles of rated roads.

In addition to completing the pavement distress survey, roadway widths, shoulder types and total roadway lengths were collected. This data will assist in the preparation of preliminary opinions of probable construction cost for future projects.

Pavement Condition Ratings

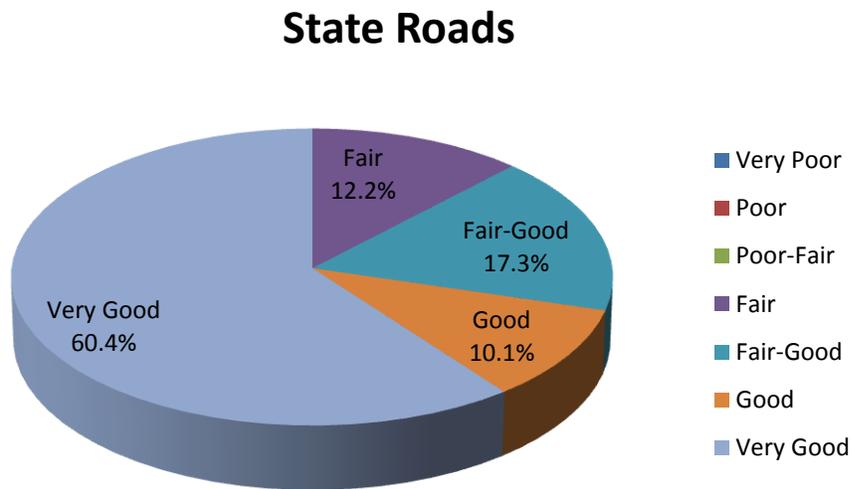
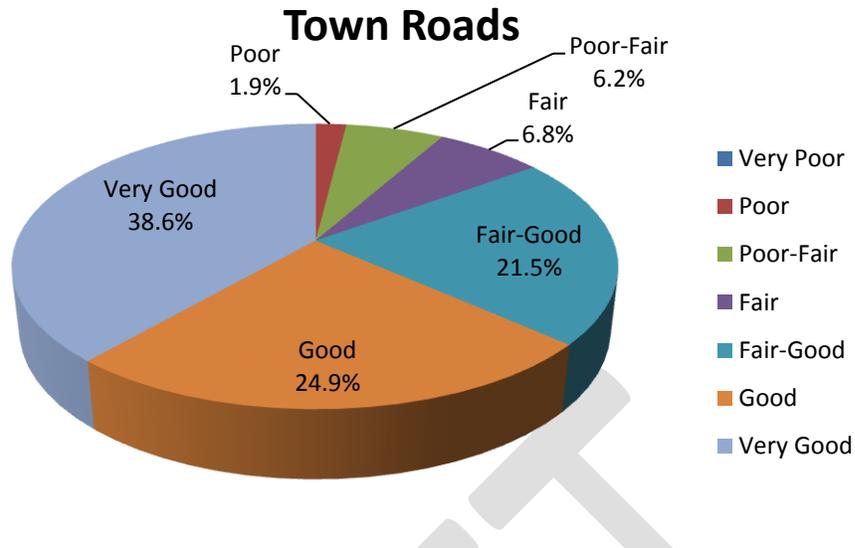
The raw pavement survey distresses collected in the field were reduced to Pavement Condition Ratings (PCRs). The PCR is a scale from 0 to 5 with a 5 being a newly paved roadway. The pavement condition ratings were produced using a spreadsheet that transforms all the field data into a PCR. There two separate listings of the PCRs for the Town Roadway and the State Roadways which are organized alphabetically as well as from the lowest to the highest PCR. In addition there is a combined listing which contains projected PCRs calculated using a standard rate of deterioration based on the current condition of each road.

Existing Condition of Streets

Several of the roadways in Cumberland, are maintained by both the State and the Town, depending on the season and type of maintenance. For this reason, the overall road network is separated into two categories, State Roads and Town Roads. The state roadways include:

Black Strap Road	Blanchard Road
King’s Highway	Route 1
Route 100	Route 88
Route 9	Skillin Road
Tuttle Road	Winn Road

The current condition of the streets is summarized in the following charts, based on this distinction of roadway ownership.



As can be seen from the graphs above, the state roadways appear to be in fairly good condition. This is a result of the work that the Town has recently completed on Route 88, King’s Highway and a portion of Tuttle Road. In addition the MaineDOT has recently completed maintenance surface treatments (thin pavement overlays) on portions of Route 88, portions of Route 100, the majority of Tuttle Road, Blackstrap, and the majority of Winn Road resulting in higher pavement condition ratings. However the maintenance surface treatments will begin to experience reflective cracking very soon and the pavement condition ratings for these roadways will drop significantly over the next several years.

As with the state roadways, the Town Roadways are also in fairly good condition overall. It should be noted that in the summary tables there are some Town roadways which have a higher pavement condition rating than in 2005. This is often a result of the roadway or a section of the roadway being improved by the town. For example, in previous studies Forest Lake Rd had been surveyed as a single segment, but due to improvements near the Gray town line, it was split into two separate sections with this improved section being in Very Good condition, while the un-improved section receiving a Fair rating. Also, due to limited documentation of

previous sample locations, it was possible that the ratings were not exactly in the same location resulting in a slightly different pavement condition rating. For this reason, each sample was taken using a physical landmark such as a utility pole to help provide better accuracy the next time the pavement condition data is collected.

Forecasted Condition of Streets

A deterioration rate is the amount the pavement condition rating drops each year. The deterioration rate can be affected the many factors including the roadway base, subsurface drainage as well as the vehicle loading. To obtain the 2016 forecasted PCR a standard deterioration rate was adjusted to be in line with historical pavement condition data that was available for Cumberland. The rate of deterioration is summarized in the table below:

PCR Value	Annual Deterioration
0-2.40	0.1
2.41-3.20	0.125
3.21-3.60	0.175
3.61-4.50	0.2
4.51-5.00	0.275

Existing Condition of Cumberland's Town Roads

Range PCR	Description	1998 Mileage	2005 Mileage	2011 Mileage	Forecasted 2016 Mileage *
0.00-1.60	Very Poor	0.2	0.0	0.0	1.2
1.61-2.00	Poor	0.0	0.6	1.0	3.8
2.01-2.40	Poor-Fair	3.4	4.0	3.4	10.2
2.41-2.80	Fair	8.0	3.6	3.5	14.9
2.81-3.20	Fair-Good	5.9	7.4	11.0	12.1
3.21-3.60	Good	8.6	11.2	12.7	3.4
3.61-5.00	Very Good	22.7	23.0	19.7	5.6
Total		48.6	49.7	51.2	51.2

*Assumes no maintenance performed

Existing Condition of Cumberland's State Roads

Range PCR	Description	Mileage	Forecasted 2016 Mileage*
0.00-1.60	Very Poor	0.0	0.0
1.61-2.00	Poor	0.0	0.0
2.01-2.40	Poor-Fair	0.0	5.7
2.41-2.80	Fair	2.6	1.9
2.81-3.20	Fair-Good	3.8	3.7
3.21-3.60	Good	2.2	0.9
3.61-5.00	Very Good	13.1	9.4
Total		21.7	14.83

*Assumes no maintenance performed

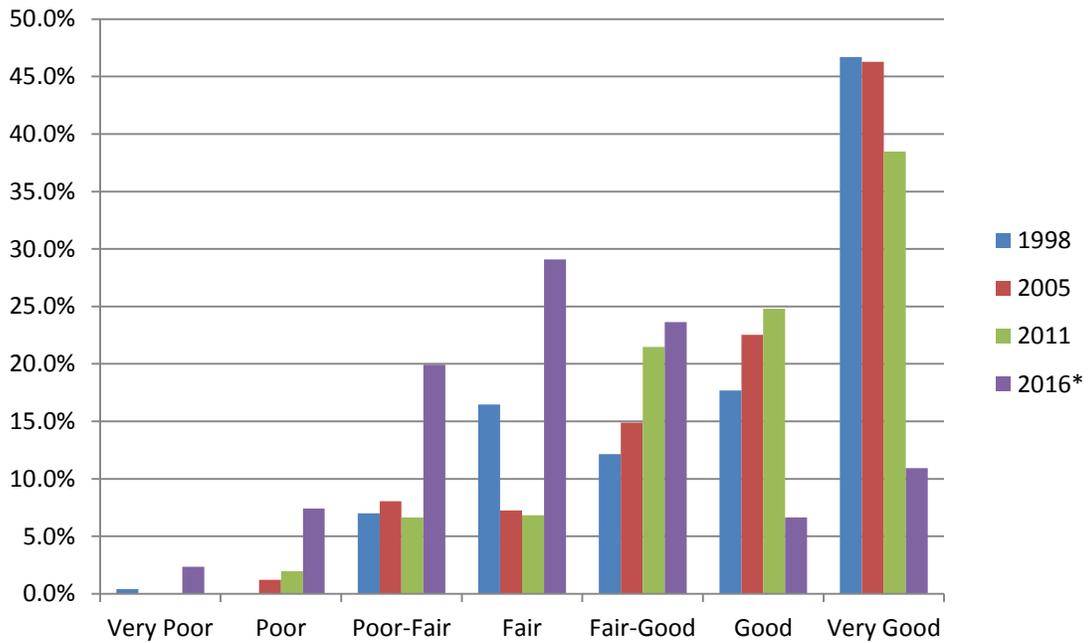
Summary of Existing and Future Conditions

The existing condition tables show that approximately 64% of all Town streets are currently in good to very good condition, with the remaining 36% being in very poor to fair-good condition and in need of maintenance. In 2005 approximately 69% of all Town streets are currently in good to very good condition, with the remaining 31% being in very poor to fair-good condition and in need of maintenance. This indicates that overall the condition of the Town roadways has dropped slightly between 2005 and 2009. However it should be noted that the Town has recently made significant improvements to several Town Roadways including Range Road, Town Landing Road, Sea Cove Road as well as others.

The table also shows that if no maintenance were performed, the percentage of Town roads in good to very good condition would fall to 18% in just five years, while the roads in very poor to very poor to poor-fair condition would rise to 82% in the same time period. This dramatic drop in the quality of the Town's roadways illustrates the importance of maintaining an aggressive maintenance schedule. Once a roadway has deteriorated below a 2.40, the structural stability of the roadway has been compromised, and repair costs are many times greater.

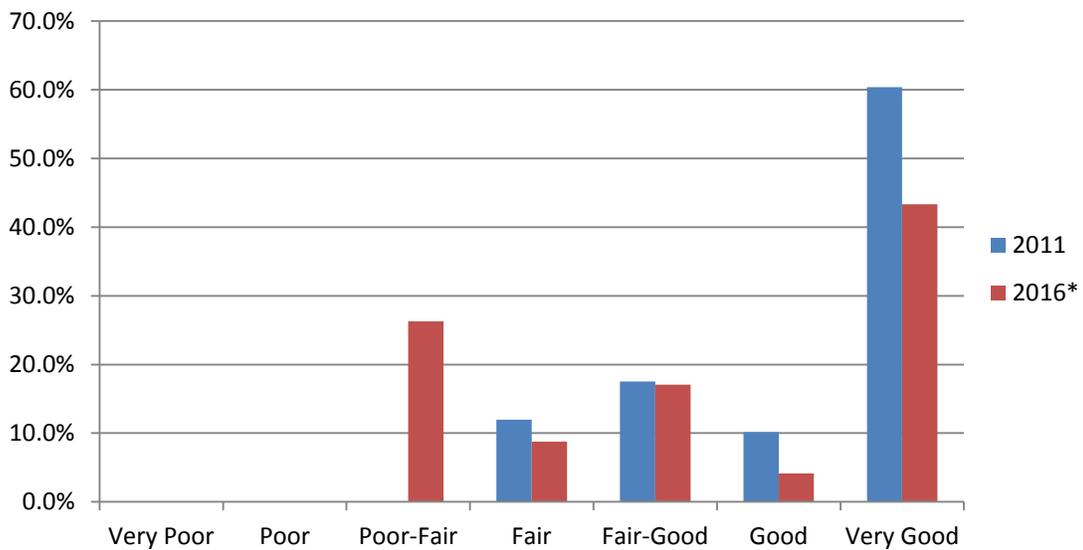
As previously discussed there has been a significant amount of work completed recently on the state roadways resulting in 70% of the roadways falling into the good and very good categories. However a significant amount of the work performed consisted of maintenance surface treatments which we expect will begin to experience reflective cracking very soon and the pavement condition ratings for these roadways will drop significantly over the next several years.

Condition of Town Roads



*Forecasted PCR assuming no maintenance performed

Condition of State Roads



*Forecasted PCR assuming no maintenance performed

Treatment Alternatives

The Town anticipates utilizing three treatments in its maintenance program. In order to maintain the town's roadways in the most economical way, it is imperative to utilize the appropriate treatment at the appropriate time. The treatment options are listed below:

- **Future Overlay:** This treatment alternative consists of a 3/4" shim course of pavement and a 1" surface course of pavement. The shim course is applied to the existing pavement to smooth out any distortion (rutting, small depressions, etc.) prior to the surface course. The shim allows for a more uniform roadway and for a more evenly compacted surface layer, which extends the pavement life and ride quality. It is listed as a future treatment to allow the town to budget for future maintenance, as well as existing needs.
- **Overlay:** This treatment alternative consists of a 3/4" shim course of pavement and a 1.25" surface course of pavement. The shim course is applied to the existing pavement to smooth out any distortion (rutting, small depressions, ect.) prior to the surface course. The shim allows for a more uniform roadway and for a more evenly compacted surface layer, which extends the pavement life and ride quality. This treatment is similar to the treatment above, however it represents an existing need.
- **Rehab:** A full depth reclamation treatment pulverizes the existing pavement and mixes it with some of the existing base material in place. The material is then re-graded and prepared for a 2" base course and 2" surface course pavement.

The following table presents treatment alternatives based upon the PCR values. The pavement condition ratings are an average PCR for the length of the roadway, so it is possible that one survey site has a much lower pavement condition rating compared to the remainder of the roadway segment. Before any construction is scheduled for any roadway improvements, a site visit should be completed to determine the exact scope of work. For instance, the Town may need to include scope items beyond just overlaying the roadway such as catch basin repair or ditching in the scope of work, which would also increase the cost of the improvements. The tables in Appendix A include a generic preliminary opinion of probable construction cost per square foot of roadway surface, based on information provided by the town, for the various pavement treatment alternatives for the existing roadway width and length. These costs do not include drainage or curb improvements. The actual cost to complete the improvements will vary depending on several factors, including project length, scope of work, and other variables.

A summary of the generic opinion of the opinion of probable construction costs for the pavement treatments is presented in the table below, and the breakdown of these opinions of probable construction costs per square foot provided by the Town can be found in Appendix C. As the condition of roadways declines, the cost to repair the roadways increases, therefore it is more cost effective to overlay roadways, within the timeframes noted, before they reach a point where they need to be reclaimed or reconstructed. The following tables contain the recommended treatments for the respective PCR ratings, while the tables in Appendix A list the recommended treatments for the individual roads.

Treatment Alternatives

<u>Town Roads</u>					
PCR Range	Description	Treatment	Recommended Completion Date	Mileage	2011 Opinion of Construction Cost**
0.00-1.60	Very Poor	Rehab	When Funding is Available	0.0	
1.61-2.00	Poor	Rehab	When Funding is Available	1.0	\$375,000**
2.01-2.40	Poor – Fair	Rehab	When Funding is Available	3.4	\$1,331,000**
2.41-2.80	Fair	Overlay	2011-2012	3.5	\$548,000
2.81-3.20	Fair – Good	Overlay	2012-2013	11.0	\$1,685,000
3.21-3.60	Good	Future Overlay	Next 5-8 years	12.7	\$1,447,000
3.61-5.00	Very Good	Future Overlay	Next 8-10 years	19.7	\$2,242,000
TOTAL				51.2	\$7,628,000

**Does not include curb/drainage costs

<u>State Roads</u>					
PCR Range	Description	Treatment	Recommended Completion Date	Mileage	2011 Opinion of Construction Cost**
0.00-1.60	Very Poor	Rehab	When Funding is Available	0.0	
1.61-2.00	Poor	Rehab	When Funding is Available	0.0	
2.01-2.40	Poor – Fair	Rehab	When Funding is Available	0.0	
2.41-2.80	Fair	Overlay	2011-2012	2.6	\$464,000
2.81-3.20	Fair – Good	Overlay	2012-2013	3.8	\$1,094,000
3.21-3.60	Good	Future Overlay	Next 5-8 years	2.2	\$265,000
3.61-5.00	Very Good	Future Overlay	Next 8-10 years	13.1	\$1,970,000
TOTAL				21.7	\$3,793,000

**Does not include curb/drainage costs

Conclusions

As can be seen in the previous tables the majority of the Town's roadways are currently in good to very good condition (64%). However, of roads in this category, many will require maintenance in the near term, and if this maintenance is not performed, the town can expect the percentage of good to very good roads to drop to 18% by 2016. This report is meant to assist the Town with their long-range planning for street resurfacing and reconstruction as well as to provide a current snapshot of the existing roadway conditions.

We recommend the Town continue to inventory pavement condition ratings every three years. This will allow for the development of historical pavement condition data which will reveal potential deficiencies with the roadway subgrade or drainage. We also recommend that the Town keep a file with improvement history for the roadways so that any treatments can be identified since the last pavement condition rating was completed.