TOWN OF MIDDLETOWN
350 EAST MAIN RD., MIDDLETOWN, RI 02842

Roadway Pavement Management System

March 3, 2016

Inventory and Assessment

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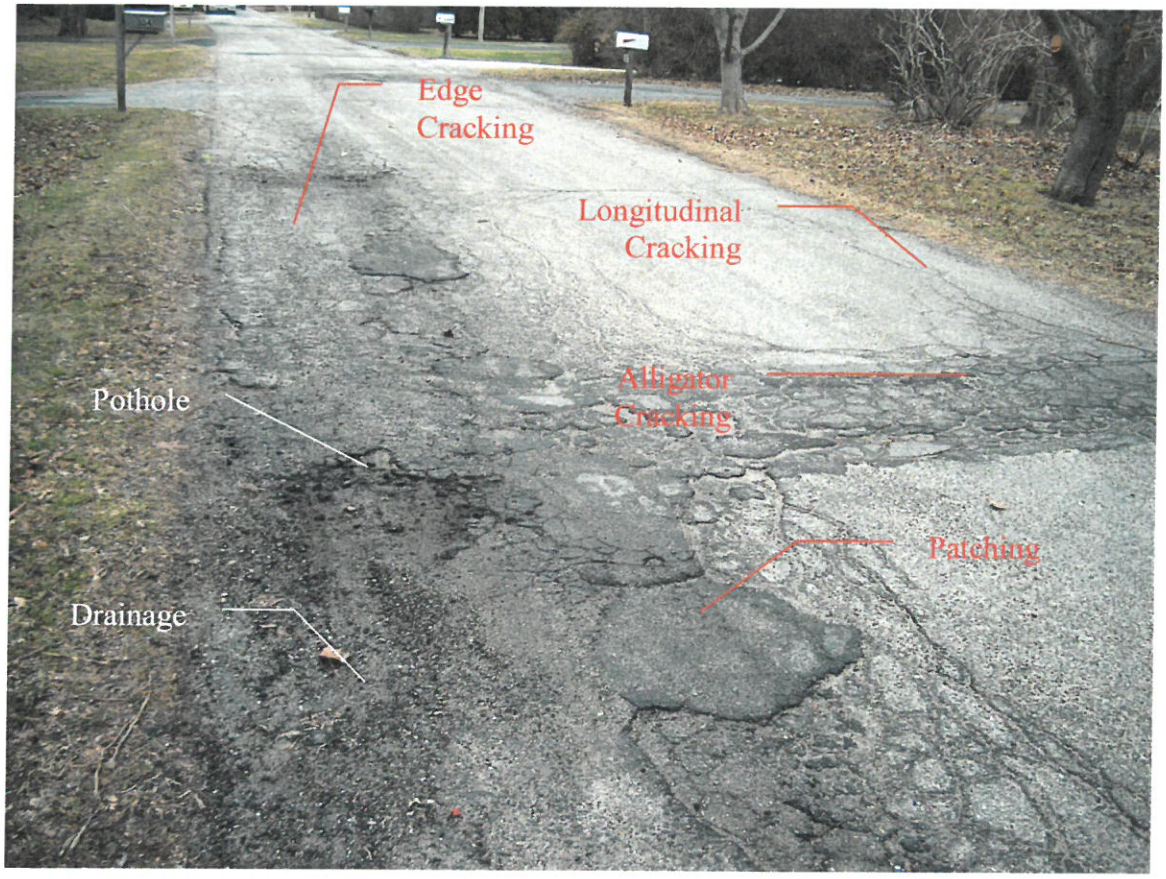


SUMMARY OF ROAD IMPROVEMENTS FOR 2012 – CURRENT DATE:

Buck Road Extension: Spring 2015, top dress existing gravel base, installed two new catch basins, cape cod berm, 6" lip berm and 4' asphalt sidewalk, signage (one way eastbound), 2" modified binder, 1-1/2" finish course scheduled for summer 2016, JAM Construction ($135,472).

JH Dwyer Drive: Spring 2015, Installed Triax Geo grid, 12" gravel (1250'), milled, reshaped, compacted 1250', installed 2-1/2" modified binder Mass Specification, slip lined sewer mains, laterals, and storm drains and re built catch basins East Coast Construction ($405,674) and National Water Main Cleaning Co.($357,126) finish course scheduled for summer 2016.

Town Wide Patching: Completed summer 2015, removed existing asphalt, add roadbase, install 2" binder and 1-1/2" surface course, total 3540 square yards ($141,770).

Easton's Point Sanitary Sewer Repairs: Project provided permanent patch at Kent Rd., Ashurst Ave., O'Donnell Way, O'Donnell Dr., Easton Ter. & Stimpson St., 2" modified binder at Shore Dr, & (Tuckerman Ter. Pending large residential project completion), 2-1/2" modified binder at Kane Ave., James St., Sunset Hill Rd., White Ter., Hoover Rd., S Crest St., mill and add 1-1/2" top at Wolcott Ave and Tuckerman Ave. (535 Tuckerman to Purgatory), repair sewer trench with geo grid, 12" gravel crowned, add drainage system to James St. Completed Spring 2015.

Forest Avenue Sewer and Drainage Project: 2-1/2" modified binder installed fall 2014, finish course 1-1/2" planned for summer 2016.

State Highway 214 Aquidneck Ave. from East Main Rd to Gaudet School entrance: Sewer replacement project, for 1-1/2" mill and overlay.

As of February 2013:

Continental Village Project: drainage system replaced and upgraded as necessary, temporary trench patch allowed to settle for 2011/2012 winter, evaluate sub base, spring 2012 peel existing asphalt, 2" binder, early fall 1-1/2" top. Roads included: Smithfield, Haymaker, Longmeadow, Winthrop, Continental Drive, Concord Drive, and Plymouth Ave.

Esplanade Drainage Project: drainage diversion project from Esp 1 outfall to Esp 2 outfall, combined two drainage watersheds into one, with an area of 200 acres, new outfall pipe added 500' offshore, water quality improvements included two aqua swirl pretreatment systems, base replaced and reinforced with Tensar Triax geo grid along Esplanade and Crest Street, 2" binder, 1-1/2" top.

Federal Stimulus Project: 12" base replacement and reinforcement with Tensar Triax geo grid along Berkeley Ave from Wyatt Rd to Wyndham Hill and Crest St from Purgatory to Tuckerman

2012 Crack Seal Project: Town wide

Introduction:

In early December 2007 the Town of Middletown through its Engineering and Public Works Department began to inventory all the Town maintained roads. In all there were 372 roadway segments inventoried. Surveyed Town road lengths total 76.62 miles, also included within the Town roads are the CIP projects. After totaling lengths and widths our total area of roads surveyed is 8,639,818 sq ft. Longer roads were broken into shorter segments and identified from cross street to cross street. Each road was rated for eight different types of distress; these are outlined in the following report. As the Town has improved and replaced roads thru projects and maintenance the road condition index is upgraded.

Purpose:

In order to better manage the existing roadway system in a cost effective manner this maintenance program was begun. It is anticipated that good roads be maintained in a good condition by crack sealing, minimum overlays, and other preventative maintenance procedures. Poor roads that require major reconstruction such as grind reclaim and full asphalt replacement and full road reconstruction including base will be managed thru a (10 year) program.

Residents will be made aware, by newspaper media and web site postings, that maintenance on good roads will be implemented possibly prior to other roads with need of greater work. Those roads that have the need for substantial work will be planned for in a program as such.

Procedure:

Grade all roads with a quantitative approach that is cost effective, repeatable, and simple. A number referred to as the Road Condition Index varies from zero, being the worst, to 100, being the best, is derived from evaluating different forms of distress.

Inventories are stored in an excel spreadsheet and the Town's GIS map. All road assessment attributes have been read into the GIS mapping and tagged to that particular road or segment by an object ID label.

A GIS map has been created using different colors to indicate roads with similar ranges of conditions.

Road Condition Index (RCI) Grading:

Best Roads:
With RCI between **100 and 75**, will be assessed every five years, potential for overlay, crack seal, edge treatments.

Good Roads:
With RCI between **74 and 50**, will be assessed every three years, potential highly likely for crack sealing, targeted area treatments, edge treatments.

Fair Roads:
With RCI between **49 and 25**, will be targeted for immediate treatment of overlay, milling and new surface installations, likely to be part of a larger project.

Poor Roads:
With RCI between **24 and 0** will be candidates for complete mill, re shape, add grid, install binder and surface course or grind / reclaim, new binder and surface treatments. As these roads are potentially parts of a larger project.

In order to rank different types of distress we need to score each type by weighted influence (degradation rate) on the overall condition of roadway.

If traffic distress factor is equal to zero the road condition index (RCI) is computed as follows:

Category	Worse Score	Best Score	Weight RTech (%)	Weight Town (%)
Long. & Trans. Cracking	9	0	10	12.5
Alligator Cracking	9	0	10	12.5
Patching & Potholes	3	0	20	25.0
Edge Cracking	9	0	10	12.5
Drainage	2	0	10	12.5
Roughness	2	0	10	12.5
Rutting	1	0	10	12.5
Total			80	100

If traffic distress factor is not equal to zero the road condition index (RCI) is computed as follows:

Category	Worse Score	Best Score	Weight RTech (%)	Weight Town (%)
Long. & Trans. Cracking	9	0	10	11.1
Alligator Cracking	9	0	10	11.1
Patching & Potholes	3	0	20	22.3
Edge Cracking	9	0	10	11.1
Drainage	2	0	10	11.1
Roughness	2	0	10	11.1
Rutting	1	0	10	11.1
Traffic	3	0	10	11.1
Total			90	100

Grading criteria:

1) Longitudinal & Transverse cracking; thermal failure, grade by size of crack and extent of road surface covered, rating based on 0 to 9.
2) Alligator cracking; fatigue failure, grade by size of crack and extent of road surface covered, rating based on 0 to 9.
3) Patching and potholes; indicator of past efforts to repair / stabilize surface, rating based on 0 to 3
4) Edge cracking; subsurface stress reflected along pavement surface within 2' of road edge, indicator of fatigue stress along edge likely to be related to poor drainage or blocked surface runoff, rating based on 0 to 9.
5) Drainage; rating based on 0 to 2
6) Roughness; rating based on 0 to 2
7) Rutting; rating based on 0 to 1
8) Traffic; indicator of truck traffic and road is used as a collector, rating based on 0 to 3

After considering the grading all numbers are adjusted to weigh in for a total of 100 possible points. Best score of 100 represents the highest quality road; score of zero represents the worst quality road.

Future considerations:

In order to provide for other conditions to be assessed the road condition index may be expanded to include a section on safety considerations such as: sight distance, rate of curvature (both horizontal & vertical), road clutter / distractions, sidewalks. Another category that may be included will be intersections with a new set of grading parameters.

As the maintenance program is implemented, roads of similar condition will be monitored after maintenance has been installed, and then graded against one that has not. This comparison will be used to forecast for future maintenance programs

As future RCI's are generated they will be loaded into the GIS mapping features and all attributes will attach / update as required.

Road facts:

Approximate Length of Roads Surveyed = 76 miles

	Length	% of Total	Area	% of Total
BEST	202,930	50.37%	4,373,686	50.62%
GOOD	83,730	20.78%	1,849,585	21.41%
FAIR	76,795	19.06%	1,625,206	18.81%
POOR	39,388	9.78%	791,341	9.16%
ALL	402,843	100.00%	8,639,818	100.00%

Attachment:

Appendix A: Condition survey and distress guidelines

Appendix B: Photographs example of distress

Appendix C: GIS map with color coded RCI

Visit Middletown website www.middletownri.com for individual road scoring sheets, under public works department.

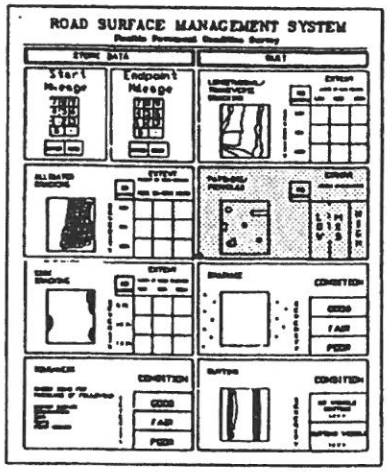
Report prepared by:

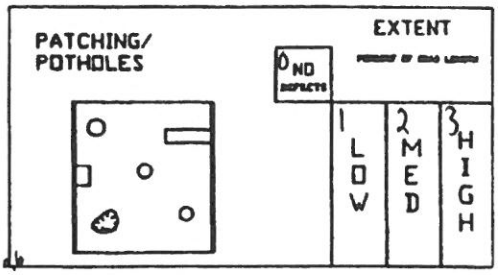
Warren Hall, PE, PLS, Town Engineer

3/3/2016

Appendix A: Condition Survey and Distress Guidelines

7.1.3 Patching/Potholes





Patching refers to areas where the original pavement has been removed and subsequently replaced but is showing deterioration. Potholes are areas where portions of the road pavement have broken and loss of pavement has resulted in a bowl-shaped depression.

NO DEFECT: No patches or potholes detected in the rated section.

EXTENT:

LOW The total area of patching is less than 10% of the total section area and/or there are fewer than 5 potholes per 100' of section length.

MEDIUM The total area of patching is between 10% and 30% of the total section area and/or there are between 5 and 10 potholes per 100' of section length.

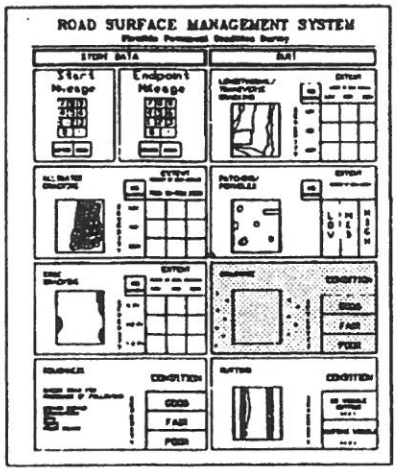
HIGH The total area of patching is greater than 30% of the total section area and/or there are more than 10 potholes per 100' of section length.

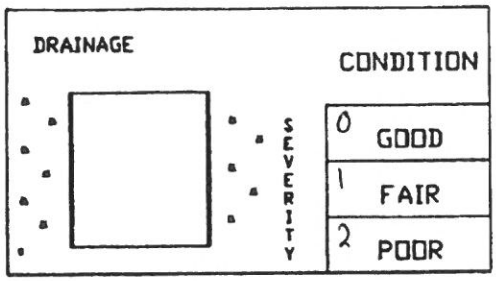
NOTES:

1. Edge cracks, spalling of longitudinal/transverse cracks, and displacement of alligator cracks are not counted as potholes.

2. Only patches that show deterioration should be evaluated. Good patches should be ignored. Frost heaves, including culverts that are protruding and rocks that are coming up through the surface, should be included. Surface area, rather than depth of deterioration, should be used to assess extent.

7.1.5 Drainage





Drainage severities are judged by the ability for run-off to flow from the paved area to a location that does not influence roadway conditions. Visual indicators of drainage problems include accumulation of debris and sand and high water marks. Evaluation during or just after a rainfall event can be extremely beneficial.

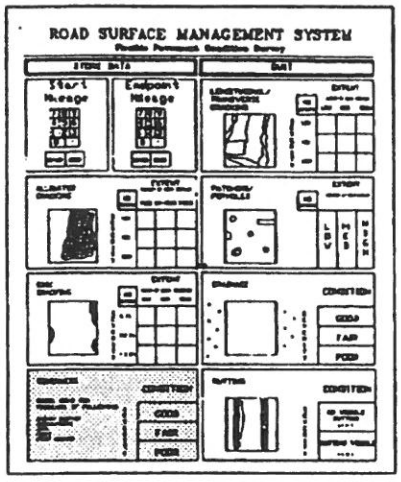
CONDITION: GOOD — There is no evidence of water accumulation on the pavement surface. Roadway has good crown. Positive drainage can be visually confirmed. Ditches, gutters, and other drainage structures are clear, clean, and functioning.

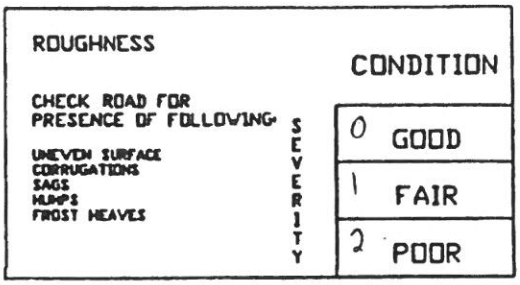
FAIR — There is evidence of occasional water accumulation on the pavement surface. Road crown is minimal. Ditches, gutters and other drainage structures are functional though probably need maintenance.

POOR — There is evidence of recurring and extensive ponding of water on the pavement\ surface. Roadway has no crown. Ditches, gutters and other drainage structures are not functioning or non-existent.

NOTES:
Sure signs of poor drainage include:
1. Road shoulders above the edge of pavement;
2. Standing water; and
3. Outwashes or accumulations of sand along the edge of the roadway.

7.1.6 Roughness





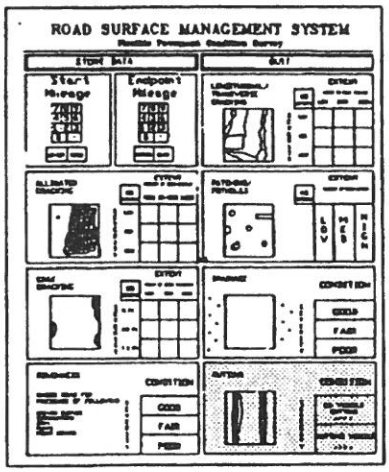
Pavement roughness is defined as irregularities in the roadway surface which adversely affect the comfort of the ride.

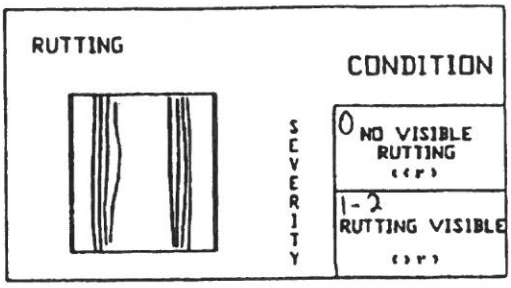
CONDITION:	**GOOD**	Road has even surface — ideal for smooth, undisturbed travel. New roads and recent resurfacing generally fall into this category. (There may be minor distortions not noticeable to the typical rider.)
	FAIR	Noticeable unevenness, but vehicle may continue safely at posted speeds. Sags, humps, and frost heaves have not yet become hazardous.
	POOR	Pavement surface is very uneven, causing a safety hazard for vehicles traveling at the posted speed limit.

NOTES:

1. Assessment of roughness should be determined while the survey vehicle is traveling at posted speeds.
2. This category is also a "catch-all" for conditions which are not included in other categories — i.e., corrugations, waves, frost heaves, settlement, etc.

7.1.7 Rutting





Rutting refers to channels in the wheel paths. Rutting causes water to drain along the road surface rather than drain to the edge of the road.

CONDITION: NO VISIBLE RUTTING: There is no visible evidence of rutting *(depth of rut is 1 less than 1").*

RUTTING VISIBLE: Road surface has visible ruts *(depth of rut is greater than 1").*

NOTE:

1. Tire path wear caused by snow tires or tires with chains is not the same as rutting, but should be recorded in the Roughness or Patching/Potholes Categories.

7.0 CONDITION SURVEY & DISTRESSES

7.1.8 Traffic

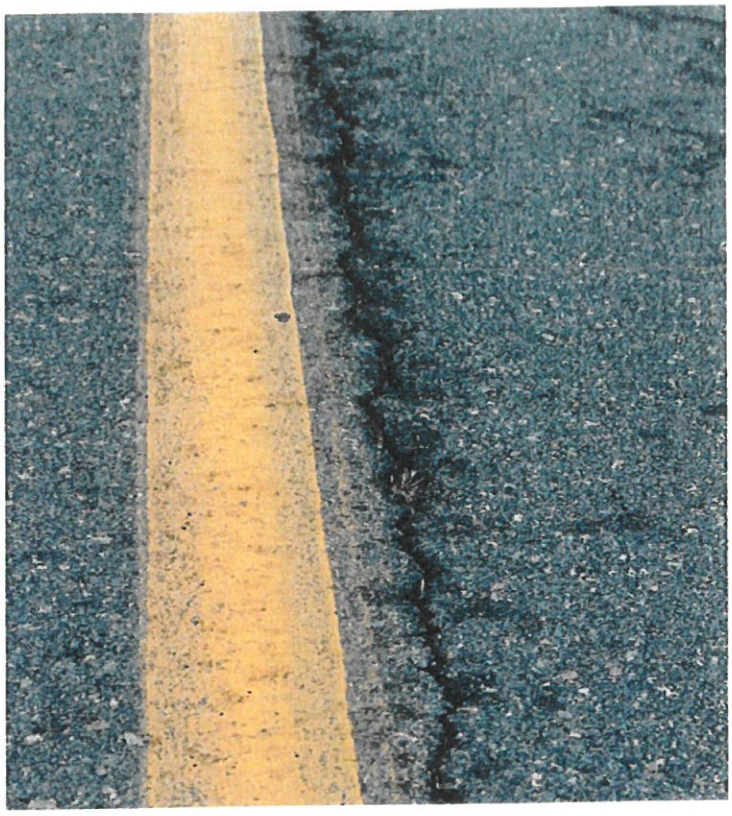
Traffic		Condition
	Severity	0 - None
		1 - Light
		2 - Medium
		3 - Heavy

Condition:

NONE	Neighborhood roads, dead ends, no regular truck traffic Ex. Francisco Dr.
LIGHT	Neighborhood collector roads Ex. Atlantic Dr.
MEDIUM	Connector of major thoroughfares Ex. High St.
HEAVY	Major artery; regular heavy truck traffic Ex. Forest Ave., Green End Ave., Oliphant Ln.

Appendix B: Photograph Examples of Distress

Longitudinal Cracking



Transverse Cracking

Alligator Cracking

Patching

Potholes

Edge Cracking

Drainage

Town of Middletown

Road Condition Survey

March 3, 2016