Southern New Hampshire Planning Commission

Road Surface Management System

Chester, NH

August 2018

As a part of a Program with the NH Department of Transportation and UNH Technology Transfer Center, the Southern New Hampshire Planning Commission conducted a road inventory, condition assessment, and forecasting for the town of Chester, NH. Inventory and Assessments were entered into the Statewide Road Surface Management System (SRSMS) software for analysis, prioritization, and generation of repair strategies. Repair strategies and a five-year budget plan have been prepared in partnership with the town and presented within this report.

Technology Transfer Center
New Hampshire LTAP at UNH

SNHPC

New Hampshire DOT
Department of Transportation

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OVERVIEW

In the fall of 2017, SNHPC staff met with the Chester town staff to discuss the scope of work, schedule and general objectives of the project. In December 2017 and January 2018 SNHPC staff conducted a windshield survey of the roads to gather roadway surface data using an iPad and the RSMS software. Following town input into the data collection, roadway condition/location maps were produced for municipal review. In May 2018, SNHPC staff received training in pavement management scenario planning and in the use of the RSMS software to customize pavement management/capital planning strategies for the town.

TOWN OF CHESTER, NH

Chester is a rural town located in Rockingham County, occupying **26** square miles with **35** miles of local roads. SNHPC staff worked with town officials and town departments to develop local road maintenance budgeting tools to ultimately help assist the town in future road maintenance decisions.

SADES ROAD SURFACE MANAGEMENT SYSTEM

Chester agreed to work alongside the Southern New Hampshire Planning Commission to conduct a road inventory data collection, identification of pavement conditions, and operation of the statewide Road Surface Management System (SRSMS) software. This is part of a program being used by the NH Department of Transportation (DOT), in partnership with UNH T2 and the regional planning commission to assist communities in planning local road maintenance. It should be noted that this program focuses on pavement surface and not subgrades of town roads.

The following tasks were conducted using UNH T2's SRSMS data collection protocols and software:

1. Divided the town's road system into ¼-mile sections for assessment and analysis;
2. Determined and documented the conditions of the each section;
3. Worked with the Road Agent to characterize and document the relative priority and amount of traffic, and the likelihood of the road-surface heaving from frost for each road segment;
4. Reviewed maintenance or repair methods by category with the Road Agent;
5. Conducted a second analysis focused on roadway preservation.

SNHPC staff developed an inventory of road conditions for all paved, town-maintained roads based on a list of roads derived from NHDOT centerline shapefiles. The roads were assessed from December 5, 2017 through January 16, 2018. The Road Agent evaluated each road segment for the relative amount of traffic that it bears and the

relative importance to the town. SNHPC entered the data into the RSMS program, which developed a Pavement Condition Index (PCI) and a list of maintenance and repair recommendations. This information is contained in Appendices A and B. Working from SRSMS reports, town officials can prepare a detailed comprehensive long-term work and budget plan.

Based on the information entered into the SRSMS Forecasting program, the tool can:

- Calculate a Pavement Condition Index (PCI)
- Calculate a road segment priority for repairs
- Suggest maintenance/repairs
- Calculate estimated repair costs
- Develop reports

Note: the SRSMS Forecasting Program is a tool that provides an overview of the whole network, including rough estimates to allow the community information for creating a strategic maintenance and replacement plan. Additional analysis would be needed to create specific repair and replacement strategies and costs.

Sections I through III of this report describe how SRSMS was applied to Chester. Section IV provides a conclusion of the study. Appendices contain reports that summarize the data and serve as a basis for the conclusion.

SECTION I: ROAD NETWORK INVENTORY AND CONDITION SURVEY

IDENTIFICATION AND CHARACTERIZATION OF SECTIONS

Roads were segmented into roughly quarter-mile sections by NH DOT, based mainly on road geometry (designing a road to maximize efficiency and safety while minimizing cost/environmental harm. Over 100 sections were defined for the 30.3 miles of roads assessed. Segments ranged in length from 256 to 1,945 feet. The town's Road Agent reviewed each segment and characterized its local importance and the relative volume of traffic that it handles, each on a five-point scale (5 = high; road has police, hospital, school, etc.; 1 = dead end street with few houses)

PAVEMENT CONDITION RATING

Rating the condition of all paved road sections is based on a process similar to common informal practice. Local highway personnel rely heavily on visual inspections and experience to schedule maintenance activities. One problem with the informal approach is that experience is very difficult to transfer from one person to another. It also can be difficult to objectively explain maintenance decisions to local governing

bodies. SRSMS applies a comprehensive condition rating technique based on sound engineering and management practices. These techniques enable the user to draw objective, consistent, and easy-to- explain conclusions.

Researchers and practitioners have developed several pavement condition rating techniques based on visual inspection. A road section is inspected, and the severity and extent of surface distresses are recorded. The SRSMS distress characteristics for pavement include:

Road Pavement Distress

- Longitudinal/transverse cracking
- Alligator cracking
- Edge cracking
- Patching/potholes
- Drainage
- Roughness
- Rutting

Experience with SRSMS has shown that users can accurately determine conditions from a vehicle, with closer inspection where necessary. SNHPC staff used SRSMS software to enter the road condition information for each section. The condition information, along with the traffic volume and importance ratings were combined, resulting in a PCI for each segment that could range from 1 to 100 where 100 represents top condition. In Chester, segment Pavement Condition Indexes ranged from 16.5 to 100. The overall network PCI was 72.77. Figure 1 represents the pavement conditions at the time of the assessment, grouped into three broad categories.

SECTION II: APPROACHING ROAD REPAIR NEEDS

PAVEMENT PRESERVATION

With time, all roads deteriorate; the exact rate will vary based on local conditions. Pavement preservation is a program employing a network level, long-term strategy that enhances pavement performance by using an integrated, cost-effective set of practices that extend the pavement life, improve safety, and meet motorist expectations. Pavement preservation is a set of non-structural applications to preserve the surface, including minor rehabilitation as well as preventative and routine maintenance ranging from crack sealing to thin overlays.

All too frequently, municipal officials set priorities by the “worst first” approach; they give the most deteriorated roads the highest priorities. Such roads are also the most expensive to repair, which commits a large amount of town funds to only a few roads. Inadequate funds remain to accomplish the relatively inexpensive preventative and

routine maintenance. These roads have low to moderate deterioration and can have their useful lives extended significantly at a lower cost by utilizing pavement preservation strategies.

Figure 2 illustrates the smoothed curve of pavement life which shows pavement conditions over time.

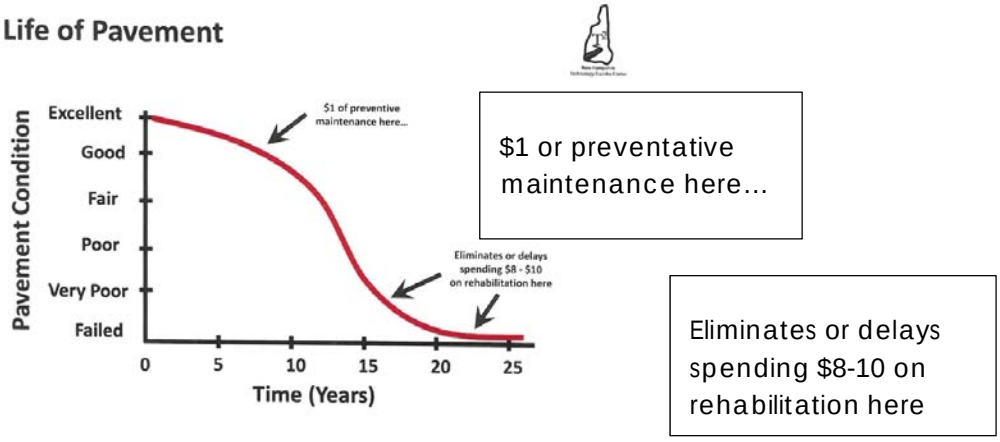


Figure 2. Life of Pavement (Pavement Condition over Time)

SECTION III: SELECTION OF MAINTENANCE AND REPAIR OPTIONS

MAINTENANCE AND REPAIR OPTIONS

In meeting with the Chester Road Agent, several potential repair strategies were discussed. Some strategies are more applicable than others based on conditions, expense, even the amount of sunshine received on site. Generally, in addition to deferred maintenance, the repairs fall into three broad types: preservation, repair and overlay, and rehabilitation and reconstruction.

The following are the available strategies for the town:

Guide to Acronyms:
FDR = Full Depth Reclamation
FDR w/CaCl2 = Full Depth Reclamation with liquid Calcium Chloride
HMA = Hot Mix Asphalt

1. **Deferred Maintenance**: No action required. The road section is in very good condition.

2. **Preservation Maintenance**: Sealing cracks and patching potholes for specific small areas; routine maintenance should include cleaning ditches and culverts. Crack sealing, patching, ditch and culvert cleaning, and mowing of shoulders and adjacent areas are essential to get the intended service life from a section of pavement. Examples include crack, fog, sand, and chips seals as well as isolated patch & shim.

Routine maintenance can usually be performed by the town's road crew, and should be included in the town's annual budget. Roads requiring routine maintenance are slowly but surely deteriorating. Adequate funds should be made available consistently across annual budgets to ensure that roads in good condition remain so.

3. **Repair and Overlay**: Coating of the surface and chip seals of thin (1½ inch) overlays are used to prevent or slow further deterioration. Hot mix asphalt (HMA) overlays and milling are examples of these types of strategies.

Repair and overlay is performed on roads that are in sufficiently good condition and require inexpensive repair to extend road life. Much of the work is within the public works department's capability.

4. **Rehabilitation and Rebuilding**: Including major repairs of the road surface such as an asphalt overlay after surface preparation or the excavation of the road base, the replacement and often the addition of aggregate, and new paved surface. The road including its sub-base has deteriorated to such an extent that the base must be replaced or stabilized. Such conditions are usually caused by too long a period of inadequate maintenance, and by poor subsurface drainage. In the latter conditions, appropriate repair and/or new construction of ditches and culverts should be included in the project. Full Depth Reclamation (FDR) projects fall into this repair type. Contractors usually perform rehabilitation repairs.

Before town officials attempt to fund these out of annual budgets, they should consider the impact on routine and preventive maintenance. It is much less expensive in the long run to keep good roads in good condition than to let them deteriorate to the point where they need rehabilitation. On the other hand, roads needing rehabilitation are rapidly deteriorating and will become much worse quickly without adequate funding.

Reconstruction is very costly and if the main focus of a road maintenance program, can absorb a large portion, if not all, of a municipality's annual budget. If this is the town's typical strategy, it would not allow an adequate budget for routine and preventative maintenance. Municipalities should consider reconstruction strategies through a Capital Improvement Program (CIP).

Figure 3 illustrates the suggested repair options along the pavement life curve.

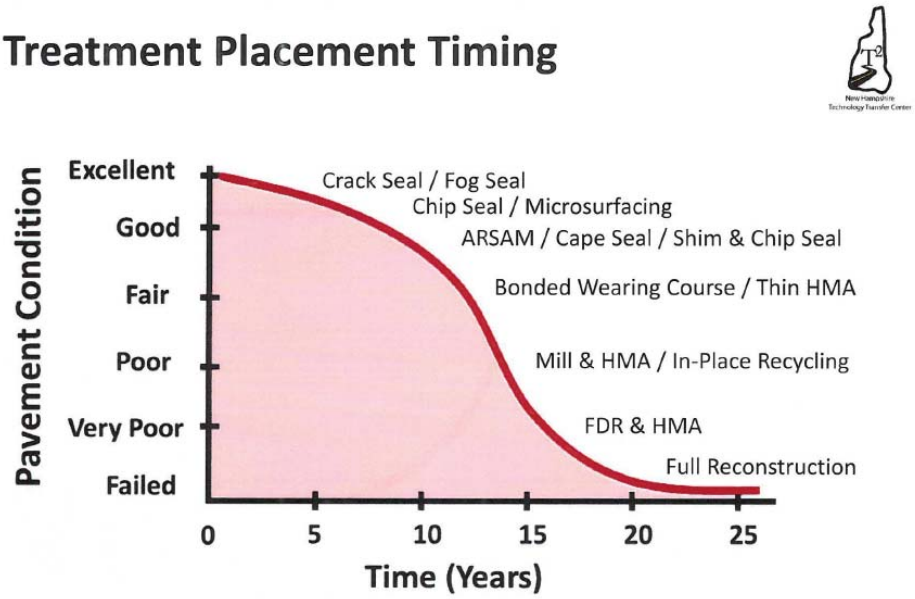
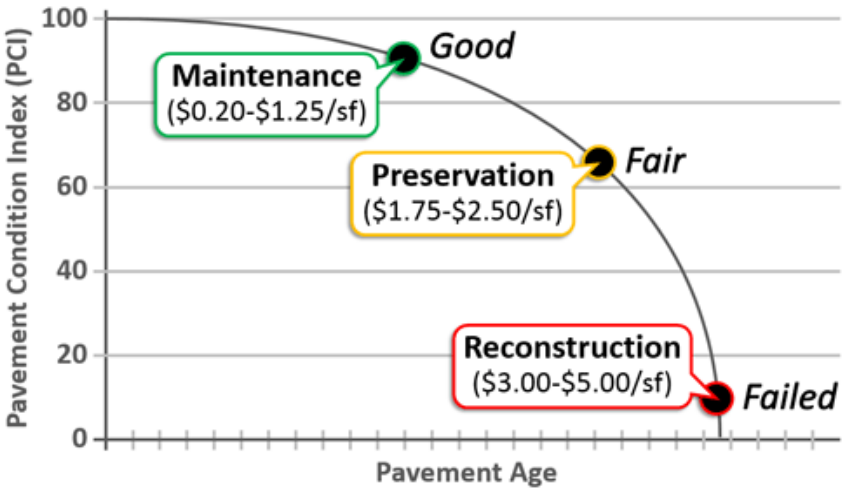


Figure 3. Treatment Placement Timing (Suggested Repairs According to Pavement Condition over Time)



Source: Washington State DOT

Figure 4. Cost to repair pavement at various condition levels

In addition to generating a PCI for each road segment, the SRSMS software forecasts what PCI could be anticipated annually if various maintenance and repair strategies (including deferred maintenance) were applied over the next nine to ten years. The software not only projects the PCI of individual segments but also the full road network.

The SRSMS program provides a set of recommended repair alternatives consistent with the repair strategy for each road section's drainage and condition. SNHPC staff reviewed these alternatives with the Road Agent and discussed potential road repairs.

Three separate scenarios were developed by SNHPC (see attachment). The first focused on bringing the town's roads up to a comprehensively high standard (90+ PCI). This was done based on the repairs recommended by the Road Agent on July 19, 2018. Hypothetically, the total cost to do this would be approximately $6.6 million in year one, with follow-up costs totaling approximately $200,000 in years 2-10.

The second made all Road Agent-recommended repairs, but only on roads where PCI fell between 70 and 80. This scenario would cost approximately $2 million in 2019, with follow-up costs totaling approximately $56,000 in years 2-10.

As these scenarios may not be palatable for Chester taxpayers, SNHPC ran a third scenario based on the approximate annual road budget of $50,000 for minor repairs (crack sealing). Looking for the greatest "bang for the buck" in this scenario, money was used to "save" roads by crack sealing them before they descend into needing significant repairs. Priority was given to roads with PCI 65-85 (primarily 70-80).

Given the Road Agent's input that actual costs are higher than those specified in the RSMS analysis, the proposed 2019 repair cost is closer to $35,000. With this amount of funding, 23 roads were able to be crack sealed, adding roughly five years to their life. Generally, in 2023-25 they would be due for a further crack seal treatment.

These segments were selected because they reflect roads that do not warrant full reconstruction.

SECTION IV: CONCLUSION

The SRSMS tool and analyses were seen as useful for planning, budgeting, and spurring discussions with town leaders about how best to maintain town roads' pavement.

The first scenario was intended to be representative of an ideal-world scenario where all repairs could be undertaken to bring the Chester road network to an excellent PCI. The second scenario was intended to show how significant investment in roads approaching failure could be save them from descending into failed condition. The third scenario was intended to illustrate how preventative maintenance can preserve the Town's existing assets, undertaking minor repairs with the $50,000 allotted budget before PCI levels dip below 65

The Town and Road Agent might want to explore whether some of the preservation treatments described in the accompanying SRSMS Repair Strategies might be suitable for some of the roads in Chester, adding additional tools for addressing maintenance of Chester's road network.

While no absolute determinations were made by the end of this program period, the SRSMS program can be a useful tool for helping to set out the planning of road pavement maintenance for the coming decade. These benefits include planning and communicating repair strategies (to both to the Selectmen and to future Road Agents) as well as the impacts of those repair strategies on pavement conditions and the need for subsequent repairs.

This project was spread out over an extended time period, in part to enable communication between the regional planning commissions, NH DOT, and UNH T2, enhancing the consistency of data collection and refinement of the analyses.

(NOTE: Due to technical delays in NH DOT and T2's development of the forecasting software, SNHPC's original completion date of June 30, 2018 was pushed back to August 31, 2018.)

While work on the Forecasting element of this project did not really begin until during the 2018 repair season, it gave a good basis for discussions about costs and the accuracy of the model for repairs occurring in 2019 and beyond. Large repair amounts can be daunting, but when existing budgets are applied to pavement sections with PCI between 65 and 85, the life of these particular roads can be extended by five years or more. Familiarity with road network PCI and the deterioration curve can guide decision makers in their constant task of making budgets stretch the farthest and preserve the network for many years of smooth driving.