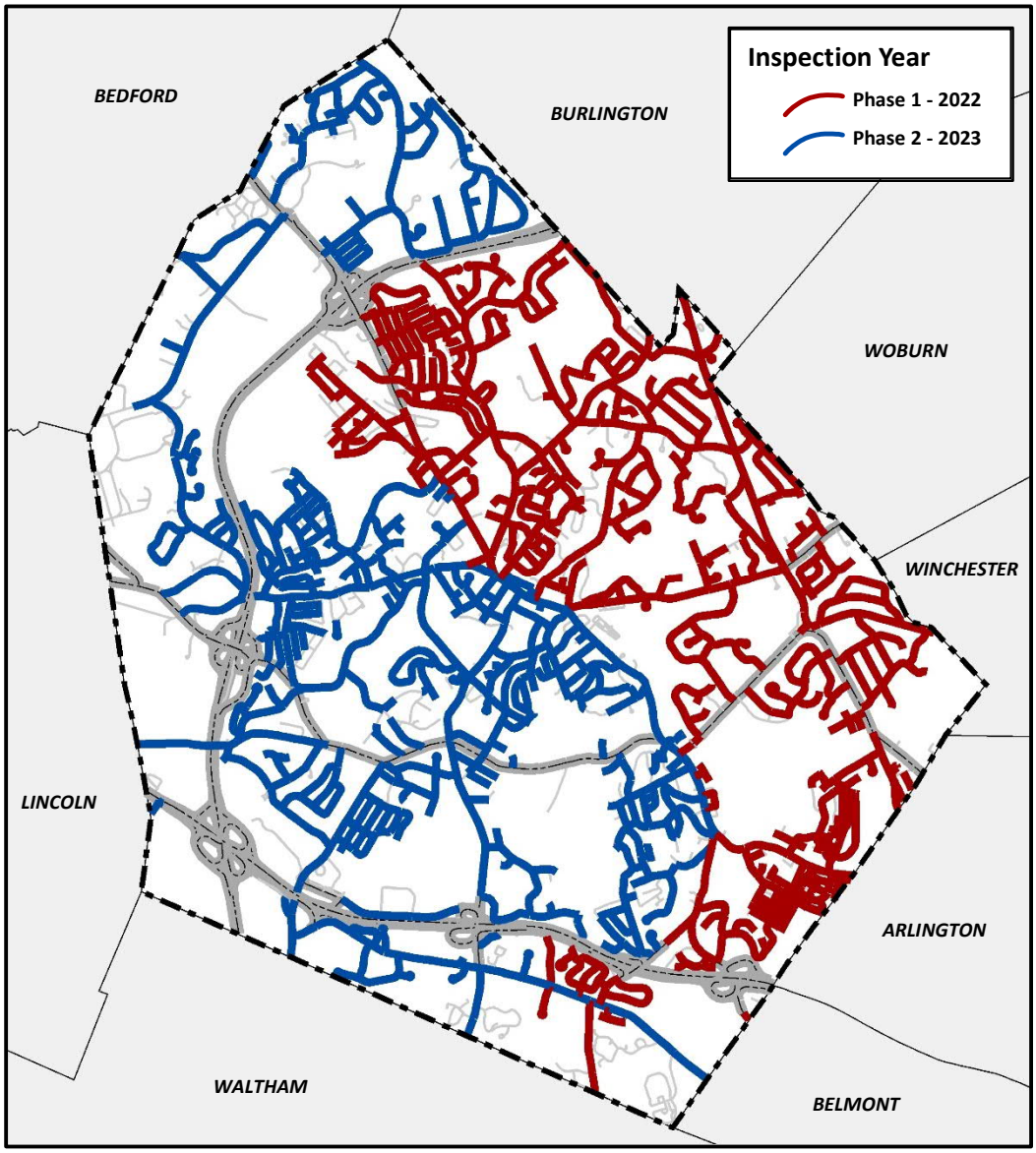
Pavement Management Summary

FY2023

DRAFT



Town of Lexington
Massachusetts

Prepared for:
John Livsey, P.E.
Town Engineer

Date: November 29, 2022

Date of Inspections:
- Phase 1: Summer 2022
- Phase 2: Summer 2023

BETA
IMPROVING COMMUNITIES TOGETHER

Introduction

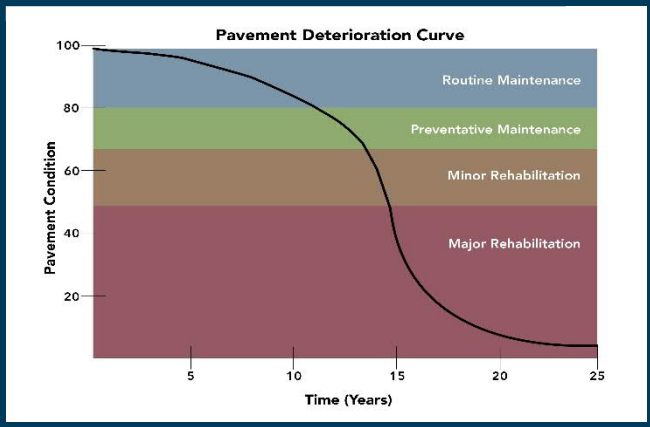
Background

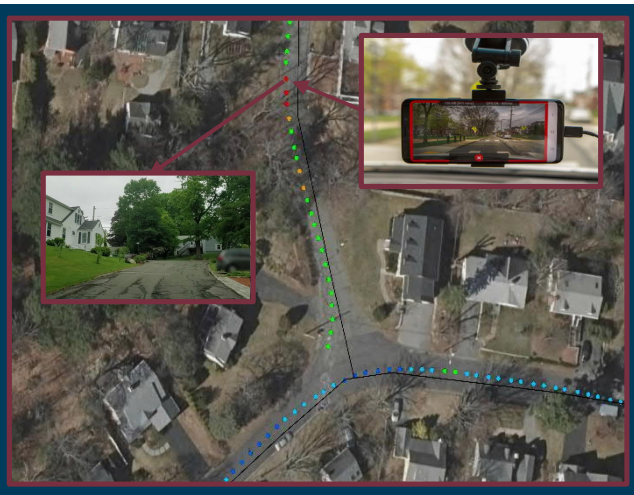
The Town of Lexington retained BETA Group, Inc. (BETA) to maintain its existing Pavement Management Program (PMP) for its Town Accepted roadways. The initial program was developed in 2017 with road inspections being conducted over 3 years from 2017-2019. BETA was then rehired by the Town to implement a recurring 2 phased approach to inspect half the roadway network annually. The first full cycle was completed from 2020-2021. Currently, BETA has completed the first phase of the second cycle (2022-2023). Of the **131.87 miles** to be inventoried, roughly 50% were inspected in the Summer of 2022 (Phase 1) with the remaining balance to be inspected in the Summer of 2023 (Phase 2).

This comprehensive study was undertaken with the goal of establishing an extensive database of roadway surface conditions in order to produce a prioritized list of improvements. The PMP is a planning tool intended to provide the foundation to manage the Town's roadway resources by combining professional engineering metrics with local institutional knowledge. These efforts assisted in the creation of a dynamic Capital Improvement Plan for the Town's roadway network.

The Town is committed to maintaining and improving its roadway network. This is achieved by preserving and maintaining the existing infrastructure to the greatest extent possible.

Pavement Deterioration Curve





Pavement Management Approach

Pavement management is based on the theory of predicting roadway deterioration over time. This theory allows pavement managers to perform timely maintenance to the roadway system, extending the roadway's life in order to avoid more costly and extensive structural repairs. A key aspect of pavement management, as illustrated by the Pavement Deterioration Curve, is the recognition that roadways deteriorate in an accelerated fashion at particular times in the roadway lifecycle. Understanding this concept allows opportune decisions that yield the most cost-effective results.

Implementing a PMP involves identification of the road network, evaluation of its surface conditions, and specification of its maintenance practices and associated repair costs. Roadway condition data is compiled to facilitate the calculation of a **Road Surface Rating (RSR)** for each street segment. This range includes a possible low value of 0 for a road characterized by a high severity of distress, and a possible maximum value of 100 for a road with no visible defects. Ultimately, the RSR value allows each roadway segment to be placed into a planning level repair category.

Roadway Survey

In Phase 1, a total of **65.38 miles** of roadway were inspected by BETA's field team. The required field inspections were performed autonomously through a smart phone application that utilizes machine-learning technology provided by RoadBotics. This proven methodology allowed for consistent data to be delivered to the Town. Images were captured every 10 ft and later used as data points to assess roadway conditions. The images were analyzed to identify pavement surface damage through algorithms which are designed to identify damages such as cracking, potholes, depressions and patching. Upon receiving the data from RoadBotics, BETA conducted a thorough QA/QC review of the pavement condition data in order to produce quality information for reporting and analysis. Additionally, all roadways improved in 2022 were updated in the system and are reflected in the summary of findings of this report.

Summary of Findings

Upon completion of Phase 1 of the 2022-2023 pavement inspection cycle, the **overall network RSR for Lexington's public roadway network was 89.90**. This is an increase of approximately 1.1 points from the results of the 2021 assessment (88.78). The network RSR represents a benchmark for performance measuring of the Town's PMP moving forward. If the overall RSR were to consistently drop in the years to come, this would be a sign that the program may need to be adjusted or funding for the program may need to be increased. However, the significant increase in the Town's network RSR over the past 3 years emphasizes the progress and commitment the Town has established in both maintaining and improving its roadway network utilizing a balanced pavement management approach.

Repair strategies and associated unit costs were defined (as shown below) to develop the Backlog Summary. This summarizes both the mileage of roadway within each suggested repair method as well as the estimated cost based on unit prices for each repair category. **The current backlog summary for the Town's roadway network is approximately $6.45 Million.** This budgetary dollar figure represents the funding necessary if the Town were to perform all required maintenance for the Town's road network within the next year.

**For roads to be inspected in Phase 2, legacy RSR scores were utilized from the previous inspection cycle to calculate the current network RSR. This accounts for predictive annual deterioration as well as any roadway improvements since the time of inspection.*

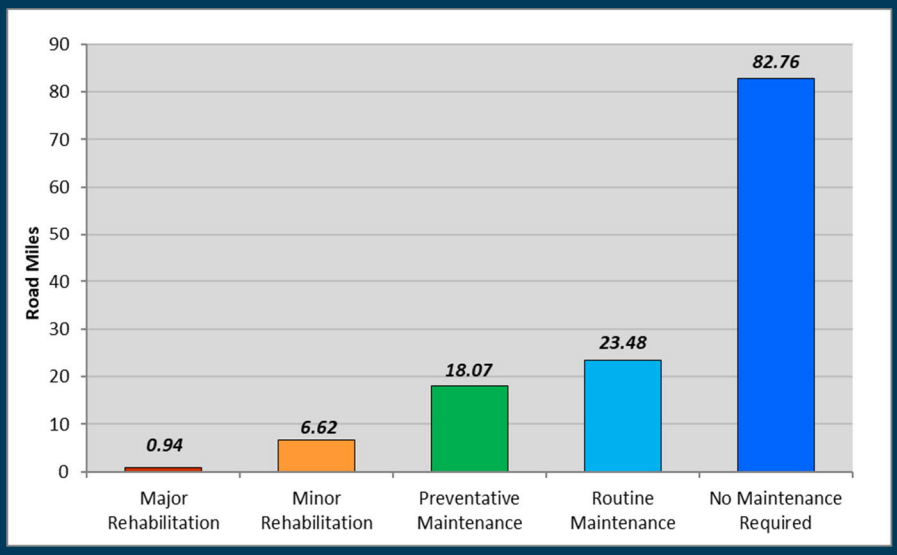
89.90

CURRENT TOWN NETWORK ROADWAY SURFACE RATING (RSR) (November 2022)

Repair Method	RSR Range	Unit Price* (sq. yd)
Major Rehabilitation	0-45	$50.00
Minor Rehabilitation	45-65	$25.00
Preventative Maintenance	65-80	$8.00
Routine Maintenance	80-94	$1.75
No Maintenance Required	94-100	$0.00

*Please Note, Unit Prices have been adjusted to reflect current price increases

RSR Breakdown by Mileage



Backlog Summary

Repair Method	Length (Miles)	Square Yards	Percent Repair	Estimated Cost
Major Rehabilitation	0.94	14,581	0.7%	$729,041
Minor Rehabilitation	6.62	114,081	5.0%	$2,803,534
Preventative Maintenance	18.07	284,447	13.7%	$2,275,573
Routine Maintenance	23.48	363,006	17.8%	$635,260
Defer Maintenance	82.76	1,252,583	62.8%	$0
Total	**131.87**	**2,028,698**	**100%**	**$6,443,408**

Capital Planning & Concluding Remarks

A series of Cost Benefit Value (CBV) analyses were generated to serve as a tool to prioritize potential roadway projects for inclusion in a multi-year Capital Improvement Plan (CIP). The development of a CIP will assist the Town in improving its network rating over time.

A 5-year forecast model was run to demonstrate how the network-level RSR for paved roadways would fluctuate over time under different funding scenarios. The current model suggests that the Town secure approximately $2.5 Million annually to maintain the current rating. If the Town were to appropriate roughly $4.0 Million annually to roads, the Network RSR would likely approach a 93.

We recommend that Lexington continue with its existing funding allocation until the volatility in pricing stabilizes and the backlog of current roadways in the rehabilitation bands is eliminated.

The PMP provides decision makers with a picture of existing roadway conditions, a cost estimate to protect those paved roadways in good condition, and a recommended strategy to meet the Town's goals and objectives.

Program Maintenance

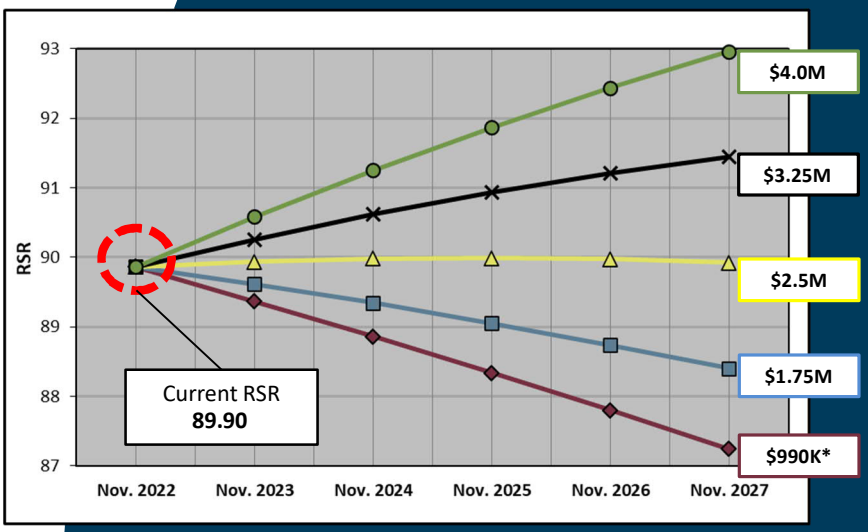
To best manage and update the Town's PMP database, the following practices are suggested:

- Continue to update all annual roadway improvements into the database. Both the pavement condition rating and repair history information should be entered.
- Add any new roadway network descriptions to the database as soon as the Town accepts the roadways.
- Update repair method unit costs annually to provide accurate work plan forecasts.
- Assign one or more individuals to oversee system upkeep and to request annual pavement condition updates.
- Undertake annual street surveys on approximately ½ of the road network. Roadways that have been repaired within the last season or roadways that fell into the reclaim category and have not been repaired can be screened from the updated total mileage.
- Review developments in pavement technology that might offer a more cost-effective alternative to pavement maintenance or rehabilitation over the pavement's life cycle.

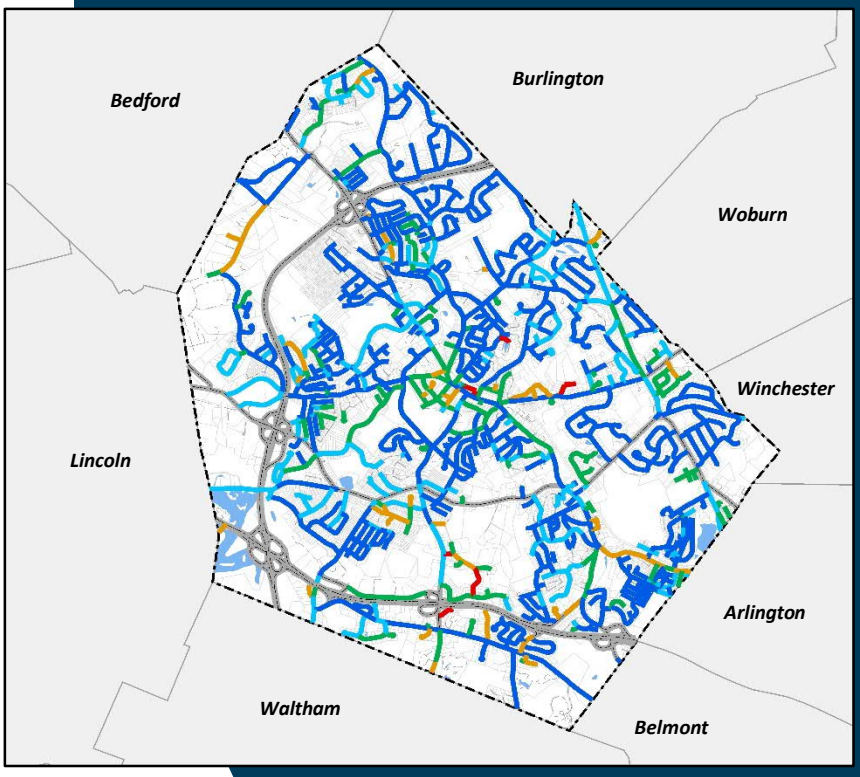
The Pavement Management Program will continue to serve as a valuable instrument to the Town and facilitate a progressive approach to managing roadway infrastructure.

Forecast Model

Projected RSR by Year



***FY23 Ch. 90 Allotment**



RSR Network Map

IMPROVING COMMUNITIES TOGETHER