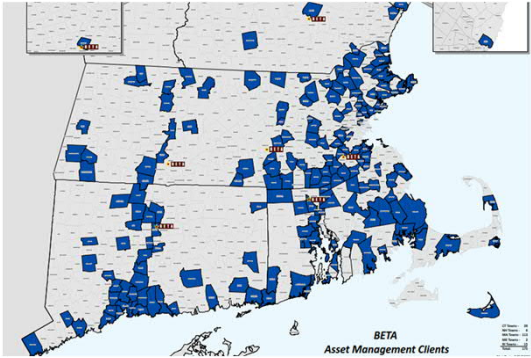


Presented by:




1





BETA  
Asset Management Clients

Full-service engineering firm with offices throughout New England. Our division was founded over 20 years ago and has grown to a group of the largest such group in the region.

- Specialize in Municipal Asset Management (170+ Communities)
  - Pavement Management
  - ADA Evaluations for ROW assets
  - Sign Inventories and Management Plans
  - Utility Infrastructure Mapping
    - Stormwater
    - Water/Sewer

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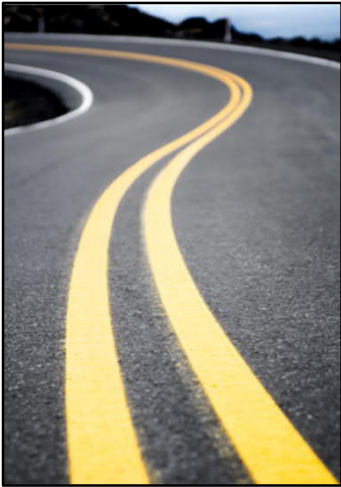


2



3

# Pavement Management



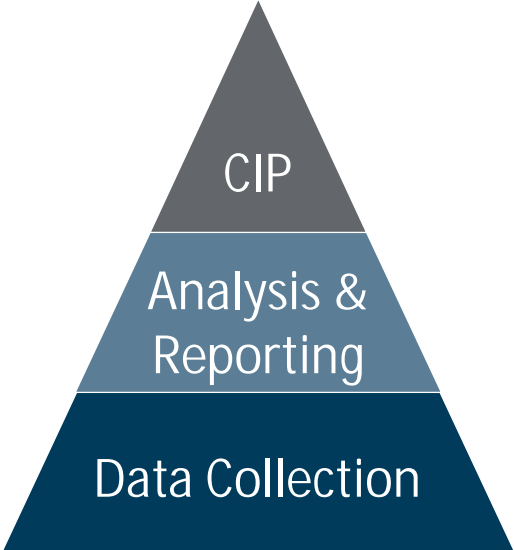
- The practice of planning for pavement maintenance and rehabilitation with the goal of maximizing the value and life of a pavement network

A pavement management program provides a tool to make informed infrastructure decisions.




4

# Typical Project Process



## 3-Step Approach

1. Data Collection
2. Analysis & Reporting
3. Capital Planning and Action Plan



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# Data Collection Methods



Windshield Survey



Automated



Artificial Intelligence (AI)



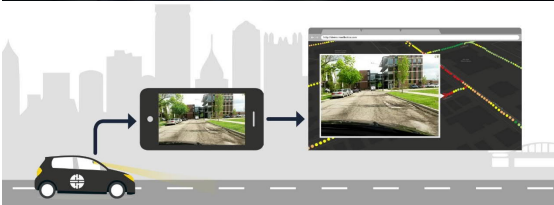
6

# Data Collection Methods

- Evolving Technology
- Artificial intelligence using Machine-Learning Technology to
- Non-biased
- Extracts information every 10'
  - Non-Biased
  - Extremely cost effective
  - High Resolution photographs



Allows for social distancing to be maintained



Data Collection



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# Reporting and Analysis

- Assign Classifications
- Roadways are rated based on exiting conditions on a scale (0-100, 1-5, etc..)
  - Roadways are categorized into maintenance categories based on a rating



Analysis & Reporting

Data Collection



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# Reporting and Analysis

## Reporting

- Quickly develop/understand costs associated with repairs
- Segment-level analysis to break jobs based on available budgets/needs

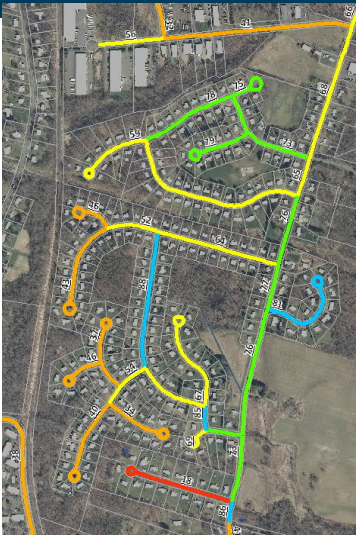
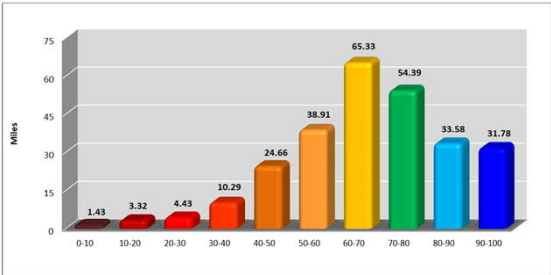
Name	From	To	Width	Length (Feet)	Square Yards	Avg. Reveal	RSR	Repair	Repair Cost
BEN ABBEY ROAD 0.15 Miles									
BEN ABBEY RD-01	SANDWICH RD	CEMETERY	30	244.06	813.52	6	69.70	Rehabilitation	\$11,989.26
BEN ABBEY RD-02	CEMETERY	CRANBERRY HWY	30	543.65	1,812.17	6	65.70	Rehabilitation	\$25,170.17
			30 Avg.	787.71	2,625.69	6	66.94	Rehabilitation	\$36,759.63
BENEDICT ROAD 0.24 Miles									
BENEDICT RD-01	PRESIDENT RD	BRYANT RD	18	926.90	1,853.79	0	95.67	Defer Maintenance	\$0.00
BENEDICT RD-02	BRYANT RD	DEAD END	18	364.50	729.00	0	95.67	Defer Maintenance	\$0.00
			18 Avg.	1,291.40	2,582.79	0	95.67	Defer Maintenance	\$0.00
BENNETTS NECK DRIVE 0.80 Miles									
BENNETTS NECK DR-01	ENTERPRIS RD	MILL WHEEL LN	20	291.00	646.67	6	75.65	Preventative Maintenance	\$3,080.00
BENNETTS NECK DR-02	MILL WHEEL LN	BENNETTS NECK DR	20	705.14	1,566.98	6	68.65	Rehabilitation	\$21,937.66
BENNETTS NECK DR-03	BENNETTS NECK DR	COUNTY RD	20	813.33	1,807.39	6	78.65	Preventative Maintenance	\$10,844.35
BENNETTS NECK DR-04	BENNETTS NECK DR	CIRCLE LN	20	702.95	1,562.11	6	68.66	Rehabilitation	\$21,869.49
BENNETTS NECK DR-05	CIRCLE LN	MILL WHEEL LN	20	790.44	1,641.41	6	68.65	Rehabilitation	\$9,035.78
BENNETTS NECK DR-06	MILL WHEEL LN	PAULINDA RD	20	385.23	811.63	4	66.65	Rehabilitation	\$11,362.86
BENNETTS NECK DR-07	PAULINDA RD	PAULINDA RD	20	390.02	866.72	6	80.65	Routine Maintenance	\$433.36
BENNETTS NECK DR-08	PAULINDA RD	PENINSULAR CIR	20	463.12	1,029.16	6	68.65	Rehabilitation	\$14,408.20
BENNETTS NECK DR-09	PENINSULAR CIR	SHORE RD	20	102.06	426.80	6	76.65	Preventative Maintenance	\$2,560.29
			20 Avg.	4,213.29	9,362.86	6	72.37	Preventative Maintenance	\$56,177.14
BIRCH STREET 0.11 Miles									
BIRCH ST	EDITH AVE	MAPLE ST	19	564.16	1,191.00	2	60.69	Rehabilitation	\$16,674.04
			19 Avg.	564.16	1,191.00	2	60.69	Rehabilitation	\$16,674.04
BLUEBERRY ROAD 0.16 Miles									
BLUEBERRY RD-01	ALDENBERRY RD	BAYBERRY RD	20	205.72	457.17	5	77.69	Preventative Maintenance	\$2,743.00
BLUEBERRY RD-02	RAYBERRY RD	CRANBERRY RD	20	235.61	523.57	5	67.69	Rehabilitation	\$7,326.95
BLUEBERRY RD-03	CRANBERRY RD	DEAD END	20	400.91	890.90	5	70.69	Preventative Maintenance	\$5,345.42
			20 Avg.	842.24	1,871.64	5	71.56	Preventative Maintenance	\$11,229.82
BLUFF ROAD 0.24 Miles									
BLUFF RD-01	CRANBERRY HWY	HILLTOP DR	21	255.06	595.19	4	75.70	Preventative Maintenance	\$3,571.13
BLUFF RD-02	HILLTOP DR	HILLTOP DR	21	1,006.06	2,147.48	6	70.70	Preventative Maintenance	\$14,084.85
			21 Avg.	1,261.14	2,942.66	5	71.71	Preventative Maintenance	\$17,655.98
BOB WHITE LANE 0.11 Miles									
BOB WHITE LN	SCRAGGY NECK RD	CUX DE SAC	20	563.88	1,253.07	4	85.64	Routine Maintenance	\$626.53
			20 Avg.	563.88	1,253.07	4	85.64	Routine Maintenance	\$626.53
BOURNE NECK DRIVE 0.25 Miles									
BETA Group, Inc. This Report is Intended For General Planning and Informational Purposes Only 1/31/2018 Page 4 of 40									

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# Reporting and Analysis

City of Providence - Backlog Summary				
Repair Method	Length (Miles)	Square Yards	Percent Repair	Estimated Cost
Major Rehabilitation	15.03	231,851	3.71%	\$12,751,816.60
Minor Rehabilitation	129.96	2,043,221	32.12%	\$81,728,867.22
Preventative Maintenance	134.9	2,255,515	33.34%	\$13,533,093.10
Routine Maintenance	88.66	1,550,804	21.91%	\$1,550,804.46
No Maintenance Required	36.1	620,729	8.92%	\$0.00
Total	404.65	6,702,120	100.00%	\$109,564,581.38
Network PCI:	71.43			

Summary Analysis



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# Why develop a PMP?...

- 1. Capture Information
- 2. Justify Your Work
- 3. Market Your Needs

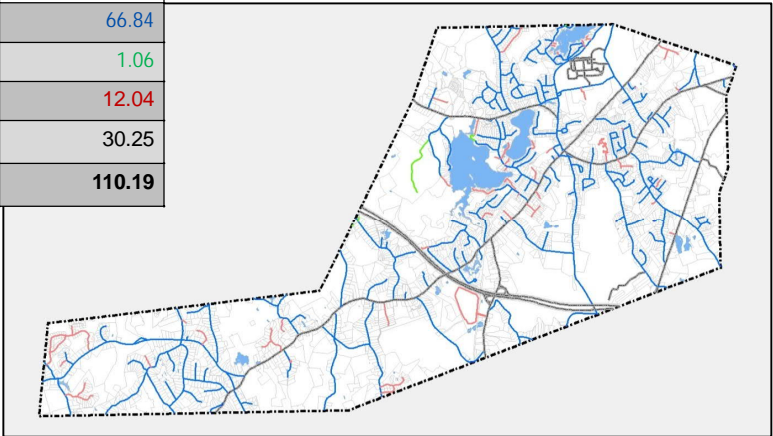


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# Compile your Roadway Inventory File

Type	Miles
Accepted	66.84
Unaccepted	1.06
Private	12.04
State	30.25
Total	110.19

Chapter 90 funding is affected by your accepted road mileage...



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# Collect Additional Roadway Information

Such as....

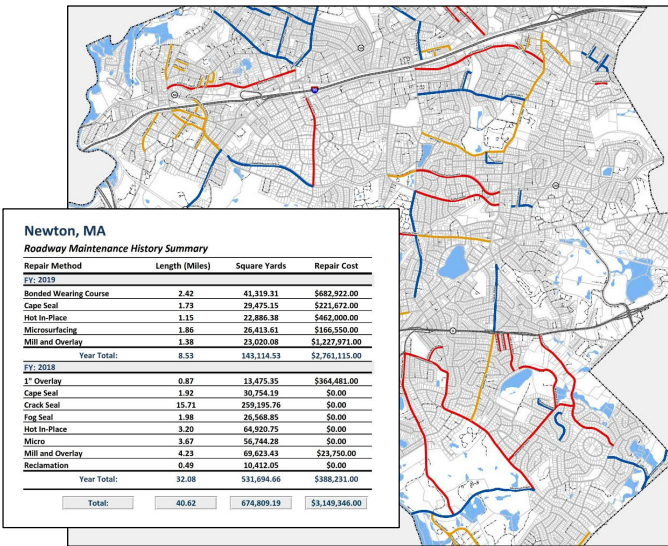
- Width/Length (Square Yardage)
- Sidewalks
- Curbing
- Striping
- Photographs
- Other Roadway Assets

Create a clearinghouse for roadway information!



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# Record Construction History



## Roadway History

- Archive historical information, if not for you, then for your predecessor!
- Map/Report on work completed to distribute information to necessary stakeholders

Take credit for your progress!!



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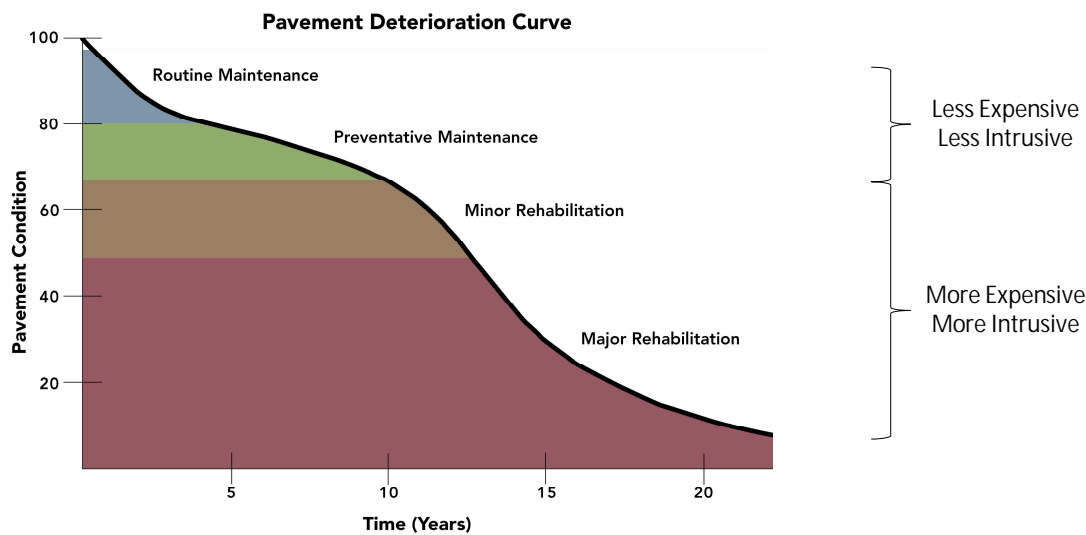
# What can a PMP do for me?...

- 1. Accumulate and Capture Information
- 2. Justify Your Actions
- 3. Market Your Needs



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# Justify your actions....



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What can a PMP do for me...

Allows users to become

PROACTIVE

rather than

REACTIVE





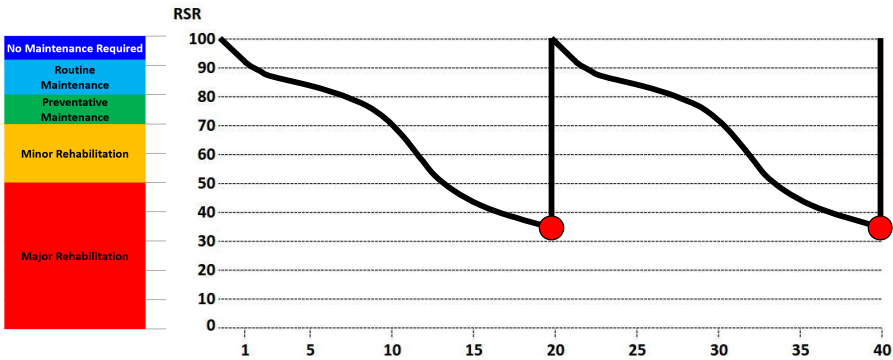
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What can a PMP do for me...

PROACTIVE

VS.


REACTIVE



Year	Proactive RSR	Reactive RSR
0	100	100
5	85	100
10	70	100
15	50	100
20	35	100
25	35	90
30	35	75
35	35	50
40	35	35

Repairs performed twice over 40 years...

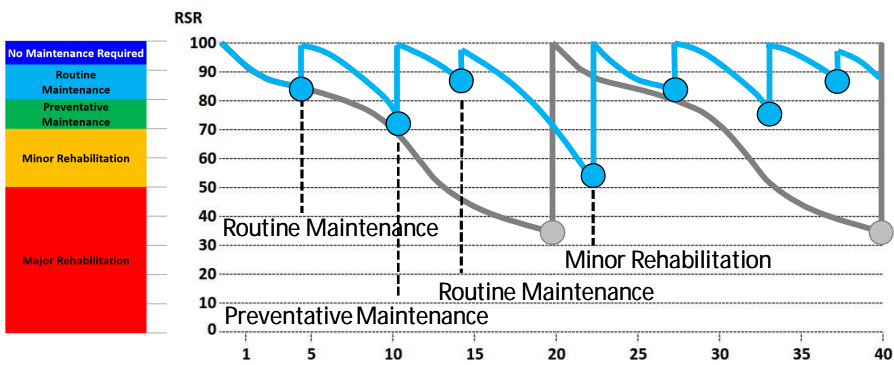
\$48 sy - \$60 sy over a 40 year period



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# What can a PMP do for me?...

PROACTIVE vs. REACTIVE

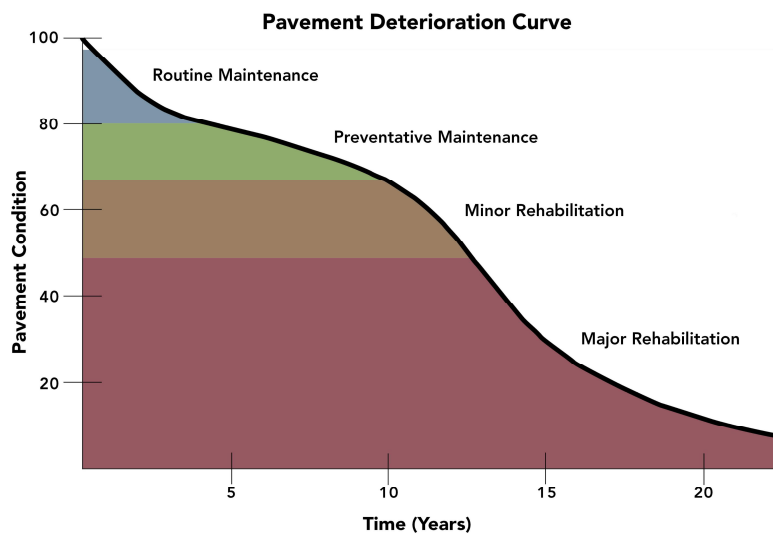


Maintenance and repairs 7 times over 40 years...  
Approximately \$30 SY



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# Justify your actions....



- Pavement Tool-Box**
- Routine Maintenance**
    - Fog Seal
    - Crack Seal
  - Preventative Maintenance**
    - Microsurfacing
    - Chip Seal
    - Rubber Chip Seal
    - Bonded Wearing Course
    - HMA Overlay
  - Minor Rehabilitation**
    - Hot In-Place Recycling
    - Mill and Overlay
    - Cold In-Place Recycling
  - Major Rehabilitation**
    - FDR
    - Reconstruction



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## What can a PMP do for me?...

1. Accumulate and Capture Information
2. Justify Your Actions
3. Market Your Needs



SBETA

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## Marketing/justifying your needs...

What Options do I have?

- City/Town Funding
- Grants
- State Funding (STIP)

Depending on Situation.....

- Bonds/Borrowing
- Additional Town/City Funding



SBETA

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# Public Outreach and Education



## Steps to Success

- ✓ Present existing conditions results in public forums
- ✓ Educating City/County staff and decision makers for consensus building
- ✓ Explanation/education of program initiatives and goals
- ✓ Performance Measuring



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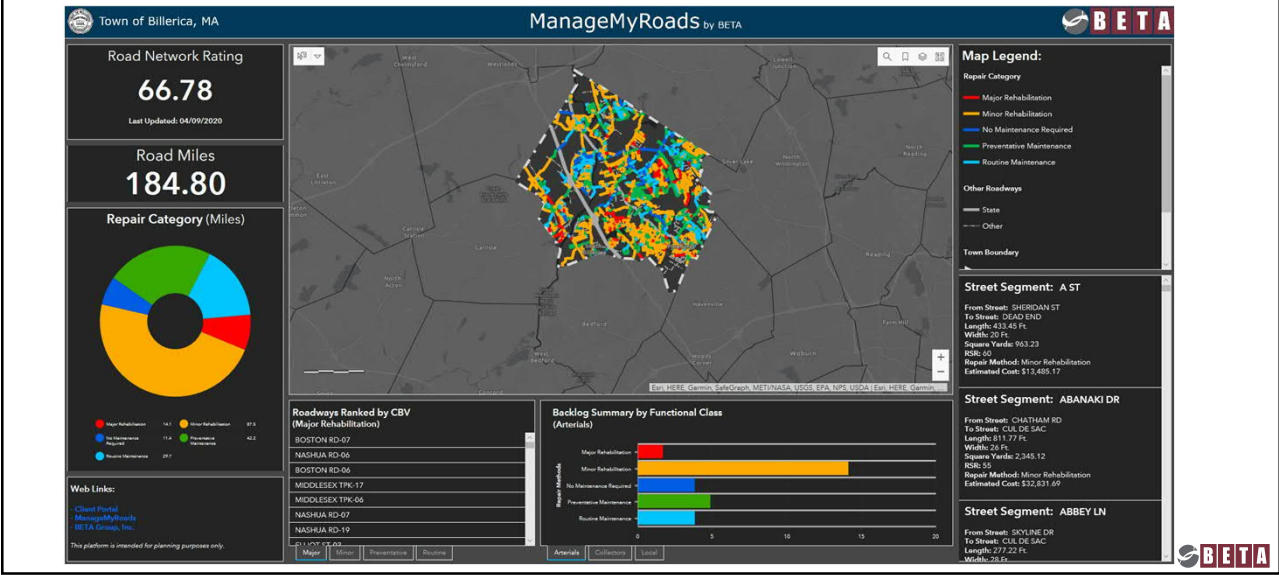
## Pavement Management Tools

1. GIS Mapping
2. Cost-Benefit Value (CBV)
3. Forecast Modeling



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# GIS Mapping – Desktop Tools



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# Cost-Benefit Value (CBV)

Data driven guide to prioritize your repairs

Variables:

- Functional Classification (or ADT)
- Life Improvement
- Unit Cost
- Pavement Condition Rating (0-100) (Banding)

Street Name	Length (Miles)	RSR	Repair Method	Est. Cost	CBV
Squaw Lane	0.65	80	Surface Treatment	\$73,379	119.17
Long Hill Road	6.19	76	Surface Treatment	\$690,469	118.63
Old Sachems Head Road	0.82	72	Surface Treatment	\$92,663	117.45
Colonial Road	1.22	72	Surface Treatment	\$129,124	89.04
Falcon Road	0.49	73	Surface Treatment	\$43,417	81.14
Clapboard Hill Road	1.62	61	Mill and Overlay	\$365,595	51.79

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Cost Benefit Value Analysis: Roadways Sorted By CBV with Cumulative Totals									
<div> <div></div> <div>* Does not include the maintenance of existing roads. Maintenance is included only for those roads that are replaced.</div> </div>									
Name	Length (Miles)	Square Yards	BSR	Class	CBV	Repair	% Repair	Repair Cost	Cumulative Total
City/County	Accepted								
<b>Billerica, MA</b>									
<div> <div></div> <div>* Does not include the maintenance of existing roads. Maintenance is included only for those roads that are replaced.</div> </div>									
Name	Length (Miles)	Square Yards	BSR	Class	CBV	Repair	% Repair	Repair Cost	Cumulative Total
City/County	Accepted								
HYPER STREET	1.00	4,073.57	79.38	AR	133.65	Preventative Maintenance	100%	\$189,749.71	\$189,749.71
COLSON STREET	0.96	3,698.33	79.93	CD	125.67	Preventative Maintenance	68%	\$246,008.01	\$435,757.72
PATTON ROAD	0.96	3,638.98	79.93	AR	125.67	Preventative Maintenance	100%	\$246,008.01	\$681,765.73
BRIDGE STREET	0.90	3,082.26	79.63	AR	75.20	Preventative Maintenance	100%	\$162,541.54	\$844,307.27
CUMMINGS STREET	1.00	3,808.00	77.25	AR	75.20	Preventative Maintenance	100%	\$162,541.54	\$1,006,848.81
WILSON STREET	0.91	3,431.72	79.22	AR	75.20	Preventative Maintenance	100%	\$162,541.54	\$1,169,390.35
FAIRBANKS STREET	0.91	3,405.15	80.67	AR	79.28	Preventative Maintenance	57%	\$131,491.48	\$1,300,881.84
WILSON STREET EXTENSION	0.90	3,388.00	79.22	AR	75.20	Preventative Maintenance	100%	\$162,541.54	\$1,463,423.38
CONCORD ROAD	2.29	15,641.16	113.88	AR	47.85	Preventative Maintenance	100%	\$1,331,987.38	\$2,795,410.76
COOK STREET	1.01	2,281.91	77.36	CD	100.86	Preventative Maintenance	93%	\$160,970.75	\$2,956,381.51
WILSON STREET	0.91	3,405.15	80.67	AR	79.28	Preventative Maintenance	100%	\$162,541.54	\$3,118,923.05
AUSTIN ROAD EXTENSION	0.91	3,405.15	80.67	AR	79.28	Preventative Maintenance	100%	\$162,541.54	\$3,281,464.59
WILSON STREET	0.91	3,405.15	80.67	AR	79.28	Preventative Maintenance	100%	\$162,541.54	\$3,444,006.13
GEORGE BROWN STREET	0.98	3,676.32	68.98	AR	33.80	Preventative Maintenance	52%	\$447,941.02	\$3,891,947.15
SHIMONS FARM ROAD	0.55	2,026.48	79.35	CD	125.67	Preventative Maintenance	36%	\$103,819.80	\$3,995,766.95
WILSON STREET	0.91	3,405.15	80.67	AR	79.28	Preventative Maintenance	100%	\$162,541.54	\$4,158,308.49
CONCORD SPRING ROAD	0.71	2,652.80	78.73	CD	21.25	Preventative Maintenance	43%	\$150,848.17	\$4,309,156.66
BAKERS ROAD	1.24	5,011.71	115.18	CD	23.25	Preventative Maintenance	48%	\$170,760.26	\$4,479,916.92
BAKERS ROAD	0.28	1,064.97	79.25	CD	20.75	Preventative Maintenance	48%	\$67,880.13	\$4,547,797.05
CAPORASIO AVENUE	0.26	2,298.09	79.36	CD	17.88	Preventative Maintenance	53%	\$420,196.16	\$4,967,993.21
WILSON STREET	0.91	3,405.15	80.67	AR	79.28	Preventative Maintenance	100%	\$162,541.54	\$5,130,534.75
MOOREY STREET	0.26	1,008.88	117.06	CD	16.72	Preventative Maintenance	23%	\$103,709.78	\$5,234,244.52
EDGEMONT STREET	0.91	3,405.15	80.67	AR	10.48	Preventative Maintenance	9%	\$16,008.43	\$5,250,252.95
WILSON STREET	0.91	3,405.15	80.67	AR	10.48	Preventative Maintenance	9%	\$16,008.43	\$5,266,261.38
BRADSTREET STREET	0.24	933.03	117.87	CD	15.88	Preventative Maintenance	10%	\$15,778.08	\$5,282,039.46
CORNING AVENUE	0.20	800.67	71.08	CD	15.84	Preventative Maintenance	9%	\$15,496.05	\$5,297,535.51
SHIMONS FARM ROAD	0.11	2,173.75	77.87	CD	11.87	Preventative Maintenance	6%	\$12,728.11	\$5,310,263.62
WILSON STREET	0.91	3,405.15	80.67	AR	9.97	Preventative Maintenance	31%	\$19,016.49	\$5,329,280.11
WILSON STREET	0.91	3,405.15	80.67	AR	9.97	Preventative Maintenance	31%	\$19,016.49	\$5,348,296.60
WILLOWDALE AVENUE	0.29	1,050.41	77.59	CD	9.01	Preventative Maintenance	87%	\$12,018.66	\$5,360,315.26

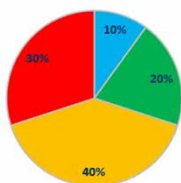
## Cost-Benefit Value Heat Maps



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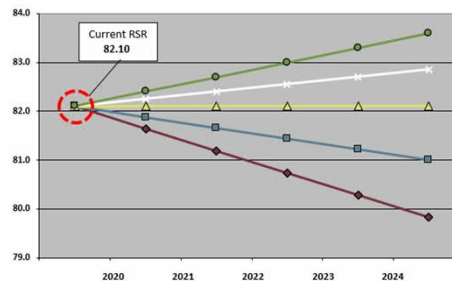
## Roadway Forecast Model Sudbury, MA

### Funding Distribution by Repair Type



- Routine Maintenance
- Preventative Maintenance
- Minor Rehabilitation
- Major Rehabilitation

Road Miles =	138.45
Ch. 90 Allotment =	\$733,026



### Funding Scenarios

<b>Scenario 1*</b>	<b>\$733,026</b>
<b>Scenario 2</b>	<b>\$1,050,000</b>
<b>Scenario 3</b>	<b>\$1,350,000</b>
<b>Scenario 4</b>	<b>\$1,550,000</b>
<b>Scenario 5</b>	<b>\$1,750,000</b>

\*Approximate FY2020 Ch. 90 Allotment



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