



INFRASTRUCTURE

Within the transportation system, the infrastructure that makes up and serves the roadway network is critical to its effectiveness and efficiency. Poorly maintained bridges, and pavement impact all aspects of movement, from commuting and recreation to freight and emergency services.

Bridges

Throughout the Montachusett region, many of its roads travel over numerous brooks, rivers and water bodies. Within the 22 communities of the Montachusett planning area, some 326 bridges are identified and rated by MassDOT as part of their inventory system. MassDOT regularly provides MRPC access to its bridge inventory which includes data such as the community where the bridge is located, the road name that the bridge is located on, the bridge identification number, functional classification of the road, year built, historical significance, rebuilt date (if applicable), AASHTO (American Association of State Highway and Transportation Officials) rating, and the deficiency status of each bridge, i.e. structurally deficient.

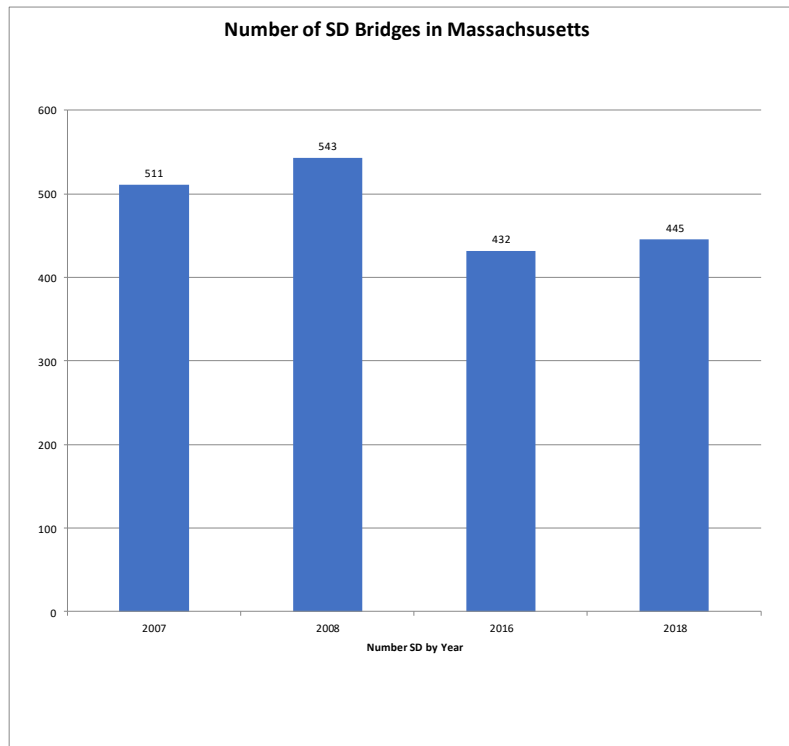
Structurally deficient bridges are a main concern in terms of repair priorities. A Structurally deficient bridge is not necessarily unsafe but is deteriorated to a point where it must be closely monitored and inspected or repaired. Structurally deficient bridges can result in bridge closings and weight restrictions which alter traffic patterns by forcing vehicles to find alternate routes frequently leading through residential streets. The result is increased congestion and pollution, potential loss of business, the potential for more accidents and failure of the emergency response times and planning process.



Accelerated Bridge Program

The Accelerated Bridge Program (ABP) was initiated by the MassDOT in 2008 as an effort to reduce the number of bridges rated as structurally deficient. On February 1, 2007, there were 511 structurally deficient (SD) bridges statewide. This number increased to 543 by July 1, 2008 when the ABP Program was initiated. Without the program, the number of SD bridges was expected to rise to 697 by October 1, 2016. The goal of the program was to reduce the number of SD bridges to fewer than 450 by October 1, 2016. That goal was reached with 432 ABP-eligible structurally deficient bridges as of October 1, 2016. The number of ABP-eligible structurally deficient bridges as of September 1, 2018 was 445.

Figure 4-37: Number of Structurally Deficient Bridges in Massachusetts



Montachusett Bridges – Current & Historical

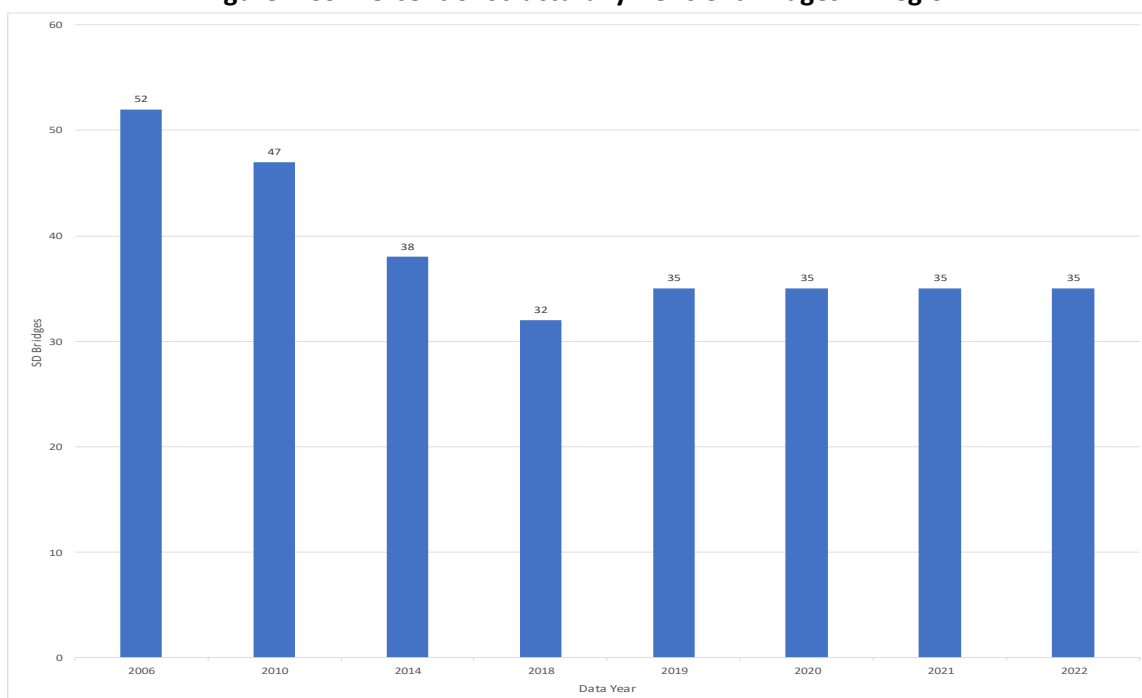
The following table and graph provide a breakdown of the total bridge numbers regionwide as well as the number of SD bridges in each community from bridge inventories over the years.



Table 4-13: Structurally Deficient Bridge Changes

Structurally Deficient Bridges Regionwide							
2006	2010	2014	2018	2019	2020	2021	2022
52	47	38	32	35	35	35	35

Figure 4-39: Percent of Structurally Deficient Bridges in Region



Within the Montachusett Region, the 2019 bridge inventory lists 35 bridges as SD. This represents approximately 11% (35 of 326) of the Region's total bridges. Of particular note is that bridge inventories from 2006 and 2010 report structurally deficient bridges being around 15% of the total in the region. A major reason for the decrease in both number and percentage of SD bridges throughout the region in the following decade is due to major investments made from the Accelerated Bridge Funding Program. As this funding program has ended, recent inventories show a plateau trend in which the number and percentage of bridges rated as SD are leveling off, or even increasing.



In order to maintain an efficient movement of goods and people, a responsive and adequately funded bridge maintenance program is essential. It is important to discourage the previous trend of increasing percentage of bridges being rated as structurally deficient. These percentages will be monitored in future inventories to determine where current trends are heading.

Pavement

The *Pavement Management Program* at MRPC consists of surveying all federal aid eligible roadways in the region for the purpose of collecting, maintaining and evaluating pavement condition data for use in transportation plan and project decision making.

There are approximately 667 miles of federal aid eligible roads in the Montachusett region, of which 222 miles are National Highway System (NHS) roads, and 445 miles are Surface Transportation Block Grant (STBG) roads. NHS roadways represent all Interstate roadways such as I-190, and I-495 along with a systematic network of principal arterials such as Route 2 and parts of Routes 12, 140 and 2A; NHS roads are regularly surveyed by MassDOT. STBG roadways, which include all other numbered routes as well as all urban arterials, urban collectors and rural arterials, are surveyed mostly by the MRPC, MassDOT also regularly collects data on all numbered routes.

The Roadway System

Of the approximately 2,124 miles of roads in the Montachusett region, approximately 445 miles are Surface Transportation Block Grant (STBG) eligible roadways and 222 miles are National Highway System (NHS) eligible roadways. This represents 31% of the region's road miles. The remaining 1457 miles (69%) are state and local aid eligible roads.

They are defined as follows:

National Highway System (NHS) – all interstate roadways and a systematic network of principal arterials spanning the state. In addition, roads connecting the NHS roadways to military bases



(known as the Strategic Highway Network) are also considered part of the NHS network. NHS passenger and freight terminals are connected by roadways called NHS connectors.

Surface Transportation Block Grant (STBG) – comprised of any functionally classified roadway not part of the NHS network. STBG funded roadways include all urban arterials, urban collectors and rural arterials. According to previous funding legislation, rural collectors are STBG eligible, but have a limitation on the STBG funding amount.

State and Local Aid – includes Chapter 90 and other non-Federal Aid categories. Roadways that fall under this category are comprised of roads functionally classified as local roads.

The following table provides a breakdown of roads by community by their aid eligibility, NHS, STBG or State Aid/Local.

**Table 4-14: Regional Centerline Miles**

Community	NHS	STP	Total Fed-Aid	State and Local	Total
Ashburnham	9.60	10.70	20.30	77.30	97.60
Ashby	6.69	7.52	14.21	50.04	64.25
Athol	13.10	19.31	32.41	82.41	114.82
Ayer	6.96	9.75	16.71	36.82	53.53
Clinton	4.96	13.11	18.07	35.16	53.23
Fitchburg	18.45	47.13	65.58	137.01	202.59
Gardner	10.89	30.72	41.61	75.53	117.14
Groton	13.15	20.84	33.99	80.29	114.28
Harvard	13.70	5.22	18.92	60.98	79.90
Hubbardston	8.18	13.13	21.31	64.32	85.63
Lancaster	14.29	17.15	31.44	43.61	75.05
Leominster	19.28	42.64	61.92	121.12	183.04
Lunenburg	10.26	23.59	33.85	58.41	92.26
Petersham	12.55	7.07	19.62	59.63	79.25
Phillipston	2.97	8.23	11.20	41.94	53.14
Royalston	0.00	20.99	20.99	52.35	73.34
Shirley	3.56	16.38	19.94	31.82	51.76
Sterling	14.92	28.81	43.73	62.73	106.46
Templeton	5.68	35.15	40.83	63.97	104.80
Townsend	9.03	16.32	25.35	68.91	94.26
Westminster	13.65	29.53	43.18	67.19	110.37
Winchendon	10.44	21.23	31.67	85.99	117.66
	222.31	444.52	666.83	1457.53	2124.36

Regional Pavement Conditions

The structural conditions of the majority of the Federal Aid eligible roads are determined by MassDOT and MRPC pavement surveys. The condition is expressed by assigning either a Pavement Serviceability Index (PSI) number from 0 to 5 or a Pavement Condition Index number from 0 – 100 (PCI) to segments along the roadway. PSI (MassDOT method) and PCI (MRPC method) is an overall rating of the pavements condition. Conditions are rated as Excellent, Good, Fair and Poor. The following table shows a general correlation between PSI and PCI, condition, repair strategies and associated cost. This average cost has been determined from consultation with MassDOT and other Regional Planning Agencies throughout the State.

Pavement Condition – Cost Breakdown



PSI	PCI	Condition	Associated Repair	Repair Cost Per. Sq. Yard
0 - 2.29	0 - 64	Poor	Reconstruction	\$45
2.3 - 2.79	65 - 84	Fair	Rehabilitation (Mill/Overlay)	\$18
2.8 - 3.49	85 - 94	Good	Preventative Maintenance	\$8.50
3.5 - 5	95 - 100	Excellent	Routine Maintenance	\$0.75

Utilizing this information, a general condition of the Montachusett Region's federal aid eligible roadway network can be developed. The following lists pavement condition on federal aid eligible roads by town in the region. These federal aid miles are further broken down by local and state jurisdiction. Please note that due to the time frame between data collection and report preparation, conditions of the roadways may change. Additionally, mileage listed in the following charts may not reflect mileage listed on the "Total Fed-Aid Miles" column of the Centerline Miles table as a small percentage of roads not eligible for federal aid are included. Therefore, this information should be viewed in general terms regarding needs and condition.

Table 4-16: 2022 Regionwide Conditions

2022 REGIONWIDE	Condition	State			Local			Combined			
		Miles	Sq. Yards	Cost	Miles	Sq. Yards	Cost	Repair Category	Miles	Sq. Yards	Total
	Excellent	87.48	1231774	\$923,830	137.16	1931232	\$1,448,424	Routine Maintenance	224.65	3163006	\$2,372,254
	Good	92.32	1299862	\$11,048,830	94.41	1329253	\$11,298,654	Preventative Maintenance	186.73	2629116	\$22,347,484
	Fair	50.92	716941	\$12,904,936	81.22	1143605	\$20,584,898	Rehabilitation	132.14	1860546	\$33,489,834
	Poor	11.13	156711	\$7,052,015	156.53	2203943	\$99,177,455	Reconstruction	167.66	2360655	\$106,229,469
	Total	241.85		\$31,929,611	469.32		\$132,509,432	Total	711.17		\$164,439,042

In comparing current regionwide network conditions to those from 2017, it would appear that the overall condition of federal aid eligible roads has shifted over the years. As highlighted at the conclusion of this report, MRPC has stated a Goal in its 2016 Regional Transportation Plan to 'Improve System Preservation and Maintenance of All Modes'. To monitor progress of that Goal, a Performance Measure was set to 'Increase the percent of categorized "good" to "excellent" federal aid eligible roadway miles within the region over a 10-year period'. The 2022 condition change charts below would indicate that this performance measure is currently being met. These conditions will continue to be monitored and reported on, on an annual basis.

It should be noted that the mileage of state jurisdiction roads has increased significantly since 2017. The reason for this is that divided highways have been accounted for in only one direction in earlier surveys in this analysis, but will now be considering both ways. For example, Route 2 is a divided highway in the Montachusett region. Previous surveys only reflected condition data on one direction of the highway, current practice is to count both east and west directions. It is also normal to have a small difference in surveyed roads year to year due to the surveys available from either MRPC or MassDOT in a given year.

2022 and 2017 Regionwide Percentage Comparisons



2022	Condition	State		Local		Combined	
		Miles	%	Miles	%	Miles	%
	Excellent	87.48	36%	137.16	29%	224.65	32%
	Good	92.32	38%	94.41	20%	186.73	26%
	Fair	50.92	21%	81.22	17%	132.14	19%
	Poor	11.13	5%	156.53	33%	167.66	24%
	Total	241.85		469.32		711.17	

2017	Condition	State		Local		Combined	
		Miles	%	Miles	%	Miles	%
	Excellent	80.24	42%	75.06	16%	155.30	23%
	Good	52.72	27%	93.84	19%	146.56	22%
	Fair	32.36	17%	155.03	32%	187.39	28%
	Poor	27.11	14%	158.84	33%	185.95	28%
	Total	192.43		482.77		675.20	

2017 - 2022 Condition Percentage Change

% Change 2017 - 2022	Condition	State	Local	Combined
		% Change	% Change	% Change
	Excellent	-6%	14%	9%
	Good	11%	1%	5%
	Fair	4%	-15%	-9%
	Poor	-9%	0%	-4%

As with the condition of bridges, the regionwide pavement conditions are in danger of deteriorating. It is important to continue to monitor these conditions and consider trends in the decision-making process.



Trends

Analysis of roads and bridges in the Montachusett region demonstrate a network that is relatively stable, however, in danger of deterioration if proper investments are not maintained. It is important to prioritize maintenance and repair of these existing infrastructures to be able to maximize public funds and allow additional investments for improvements and expansion.

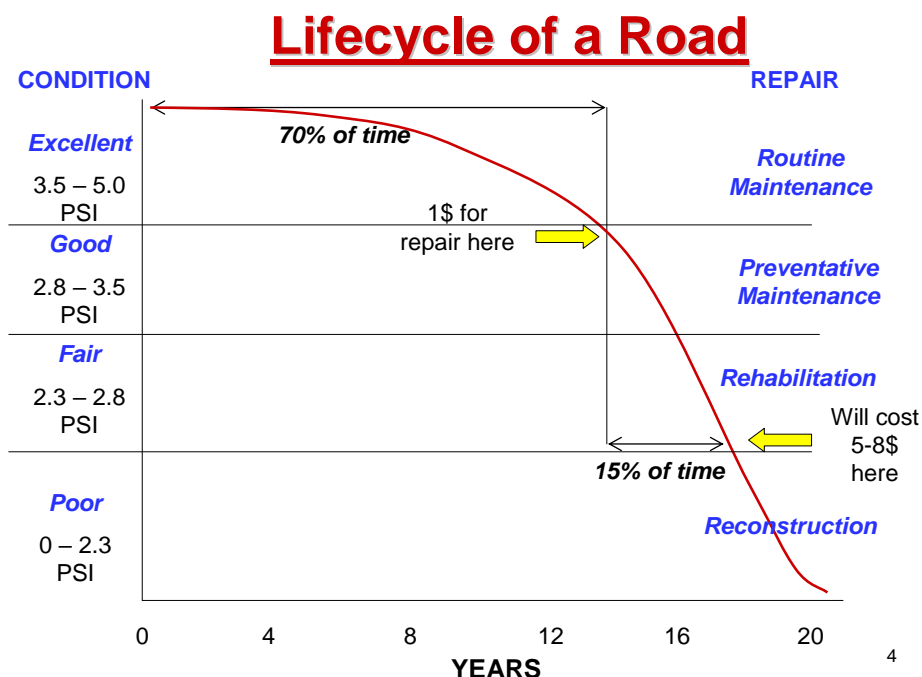
Recommendations

The transportation system in the Montachusett region largely consists of roads and bridges. Maintaining these assets are a challenge, however, we must understand the importance of a properly functioning and safe system. Maintaining a state of good repair should be a main priority and in our best interest in order to stretch our investments to the greatest benefits. Ultimately, it is recommended that investments are guided by proven asset management practices and the proper amount of investment is made to assure these assets do not deteriorate.

The figure below displays the concept of pavement lifecycle cost. A pavements lifecycle is the time between reconstruction periods. Lifecycle cost is the total cost spent on maintenance and repairs for a particular pavement section during its lifecycle. One of the main focuses of pavement management is to keep lifecycle cost low to stretch the dollar in what is commonly an ever-decreasing maintenance budget.



Figure 4-40: Lifecycle of a Road



Due to the rising cost of improvements and the declining funds for preserving existing infrastructure it is challenging to make improvements to the pavement network. Building a historical and measurable database of conditions in the Montachusett region allows for a snapshot of overall conditions which will allow us to determine how the network changes over time. Maintaining historical databases of bridge and pavement data paired with applying proven methods of asset management is recommended.

Network conditions over the last four years show an increase in percentage of roads in “poor” condition and decrease in percentage of “excellent” condition. This indicates that the current funding level of road maintenance projects is inadequate to keep up with the rate of deterioration. An overall increase in pavement repair projects along with investing in roads before they require full depth reconstruction is recommended. Furthermore, conditions should be closely monitored due to the threat of a deteriorating network.