

# 5

## Road and Bridge Infrastructure



2016 Regional Transportation Plan

# 5 Roadway and Bridge Infrastructure

Franklin County has a diverse collection of transportation resources, including scenic roadways and covered bridges. A safe and efficient transportation network depends on the quality and integrity of the transportation infrastructure in the county, including roads and bridges. This chapter examines the condition of these road and bridge resources and includes an analysis of the roadway network (mileage and functional classification), traffic volumes, bridge ratings, pavement management analysis, congestion and traffic operations. The goal of this chapter is to identify existing concerns and future needs based on this analysis and public input received during the development of this plan.

## Existing Conditions

Franklin County consists of over 1,700 centerline miles. The majority of these miles, 79 percent, are maintained by the Towns, while MassDOT owns and maintains 11 percent of the roads. The remaining 10 percent of the roads are owned by various other entities or classified as unaccepted. Table 5-1 details the breakdown of roadway jurisdiction within each of the municipalities.

**Table 5-1: Roadway Centerline Mileage by Functional Class**

Functional Classification	Total Centerline Mileage	Percentage of Total
Urban Interstate	8.9	0.52%
Rural Interstate	14.9	0.87%
Urban Principal Arterial	37.8	2.22%
Rural Principal Arterial	29.4	1.73%
Urban Minor Arterial	55.0	3.23%
Rural Minor Arterial	53.5	3.14%
Rural Major Collector	219.3	12.87%
Urban Collector	28.8	1.69%
Rural Minor Collector	113.2	6.65%
Rural Local Road	955.4	56.07%
Urban Local Road	187.3	11.00%
<b>Total</b>	<b>1703.9</b>	<b>100%</b>

Source: Massachusetts Department of Transportation, Road Inventory Year-End Report and Road Inventory File, 2013.

## Functional Classification

Functional classification is the categorization of highways and roadways in terms of the service that the roads provide within the regional network. Additionally, functional class has both rural and urban designations based on the U.S. Census population figures. The urban boundaries are based on population figures available from the 2010 U.S. Census. All the urban areas in Franklin County are defined as large urban clusters (Census block groups with a population density of 5,000 to 50,000).

**Table 5-2: Roadway Centerline Mileage by Maintenance Authority**

Town	Maintenance Authority							Town Totals
	MassDOT	Town	State Forest or Park	DCR*	State Institutional	State College	Un-accepted**	
Ashfield	10.9	71.5	0.3	0	0	0	0.3	83.1
Bernardston	16.8	41.9	0	0	0	0	0.2	59.0
Buckland	6.0	43.1	0	0	0	0	1.1	50.3
Charlemont	12.0	42.7	1.6	0	0	0	0.4	56.8
Colrain	4.0	78.7	1.1	0	0	0	4.1	88.0
Conway	6.5	64.3	0	0	0	0	0.3	71.1
Deerfield	20.4	77.7	1.1	0	0	0	1.3	100.6
Erving	13.5	17.3	6.2	0	0	0	1.1	38.3
Gill	3.9	34.6	0.1	0	0	0	1.9	40.6
Greenfield	21.5	102.1	0	0	0.6	1.5	9.3	135.2
Hawley	0	44.8	3.4	0	0	0	0.2	48.5
Heath	0	52.2	1.5	0	0	0	5.8	59.5
Leverett	5.4	34.6	0	0	0	0	3.1	43.1
Leyden	0	35.5	0	0	0	0	2.5	38.1
Monroe	0	16.7	1.6	0	0	0	0.0	18.4
Montague	5.7	103.6	0.5	0	0	0	3.5	113.4
New Salem	11.9	35.7	0.2	53.8	0	0	2.2	103.9
Northfield	11.1	65.8	0.0	0	0	0	6.9	84.0
Orange	15.6	87.2	0.5	0	0	0	3.5	106.9
Rowe	0	36.0	0	0	0	0	0.3	36.4
Shelburne	9.3	49.8	0	0	0	0	0.08	59.2
Shutesbury	3.1	30.8	0	5.1	0	0	2.6	41.7
Sunderland	4.3	39.0	2.9	0	0	0	0.0	46.3
Warwick	0.01	56.0	6.6	0	0	0	1.6	64.3
Wendell	0.3	46.4	16.7	2.0	0	0	1.2	66.7
Whately	9.8	31.2	0	0	0	0	8.4	49.5
TOTAL	192.8	1340.1	45.0	61.0	0.6	1.5	62.7	1703.9

Centerline Miles refer to the linear length of a road segment. For divided highways, only the length of one side of the roadway has been counted. Source: MassDOT, Road Inventory Year-End Report 2013.

\*Department of Conservation and Recreation. State parks and forests are also under the jurisdiction of DCR.

\*\*Unaccepted Roadways consist of roads open to public travel but not formally accepted by a city or town, as well as some private ways.

The majority of roadway mileage in Franklin County, 81 percent, is categorized as rural, with the remaining 19 percent defined as urban. The breakdown of road miles in Franklin County according to functional classification is summarized in Table 5-2. A map of the roadways in the county, along with the functional classification of each roadway is located at the end of this chapter.

Funds are available for improvements and maintenance based on roadway functional classification. All interstates and arterials are eligible for federal funds; all urban collectors and rural major collectors are also eligible; rural minor collectors and local roads are not eligible for federal funds. Approximately 26 percent of the roads in Franklin County's road network are eligible for federal funds per roadway functional classification. The remaining 74 percent of the county's roads are rural minor collectors or local roads and depend on local funds and Chapter 90 funding from the State for improvements and maintenance.

### **Traffic Volumes and Growth Trends**

In Franklin County, traffic volume data has been collected at almost 800 different locations since 1991, the majority of which have been collected by the FRCOG and MassDOT. The FRCOG maintains a database of this traffic volume data and makes it available online through MassDOT's Transportation Data Management System.

Traffic volumes on Franklin County's roadways vary from over 25,000 vehicles per day on sections of Interstate 91 to less than 100 vehicles per day on a number of local roadways. The most heavily traveled roadway in Franklin County is Interstate 91 where Average Annual Daily Traffic (AADT) volumes range from approximately 32,000 vehicles per day in Whately to less than 18,000 vehicles per day through Bernardston. Along Route 2, AADT volumes vary between 17,000 vehicles per day near the Greenfield Rotary to less than 1,300 vehicles per day through parts of Charlemont. Other high volume corridors include Route 116 in Sunderland and Route 5/10 in Whately, with traffic volumes near 15,000 vehicles per day.

Using a sampling of data collected between 2011 and 2014 at 20 locations throughout the county, annual traffic growth was examined and an average growth rate (AGR) for traffic was estimated. There was significant variation in volume growth by location, with some locations showing increased traffic and some showing reduction in traffic volume over the same 4 year period. The overall AGR for the sample showed a decrease in traffic volume of 2.7 percent.

### **Bridges**

Bridges are a critical component of the Franklin County roadway network. Maintaining the safety and functionality of bridges in Franklin County is a top priority. The majority of bridges

located on high volume roadways are predominantly under the domain of the State and are inspected by MassDOT and ranked according to standards established by the American Association of State Highway and Transportation Officials (AASHTO). The purpose of the AASHTO rating is to provide a standard to compare the status of bridges in a region and across the country. Many factors are considered when developing the rating of a bridge, such as its structural integrity, the road's functional classification, the designed purpose of the bridge, etc. The AASHTO rating may allow some generalized assumptions, however, because so many factors are rating determinants it is important to research each bridge individually for specific information. Bridges may be further classified as *structurally deficient (SD)* or *functionally obsolete (FO)*. Each of these classifications can increase the priority of repair or replacement of the bridge. According to federal aid Bridge Program guidelines, for a bridge to be eligible for rehabilitation it must both be deficient and have an AASHTO rating of 80 or less; and for a bridge to be eligible for replacement it must have an AASHTO rating of less than 50.

MassDOT maintains a listing of all bridges that meet the National Bridge Inventory (NBI) criteria set by FHWA. This criteria identifies bridges that are publicly owned highway bridges longer than twenty feet located on public roads. Railroad and pedestrian bridges are not included in the NBI, nor are bridges that have been closed for more than 10 years. Bridges that are not listed in the NBI are not eligible to receive Federal bridge replacement funding<sup>1</sup>. This bridge listing includes the year the bridge was built or rebuilt, the AASHTO rating from the most recent bridge inspection, and whether the bridge is structurally deficient or functionally obsolete. Information on Franklin County bridges and their current classification are shown in a map at the end of this chapter.

Bridges are considered structurally deficient if they fall below specific thresholds. These bridges may span a range of conditions, from requiring a minor, but vital, repair to a more complete rehabilitation. As with all bridges in the Commonwealth, safety concerns are paramount. If a bridge is in need of significant repair to maintain current traffic volumes and vehicular weight, then that bridge should be high on the priority list. Statewide, priority for funding is given to structurally deficient bridges.

Bridges may also become functionally obsolete. Functionally obsolete refers to a bridge's inability to fully support the roads they serve due to variables such as limited width or height even though the bridge itself is structurally sound. Such a determination is based on the current operating capacity of the bridge. This bridge classification helps identify areas where

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<sup>1</sup> <http://www.fhwa.dot.gov/bridge/nbis/#10>

mobility may be decreased as a result of the bridge. For example, if a four-lane roadway leads into a two-lane bridge, some level of congestion is expected as a result of the decreased capacity. While the bridge may be structurally sound, the issue lies in the capacity of the bridge to carry traffic. Functionally obsolete bridges may not present a safety hazard, but may contribute to overall congestion. This bridge classification category can be used to identify problem areas in the transportation network.

There are a total of 298 bridges in Franklin County that are on the NBI, according to the 2014 MassDOT Bridge Inventory. In order for a bridge to be eligible for rehabilitation it must be deficient and have an AASHTO rating of 80 or less. There are 83 bridges (28 percent of total) in Franklin County that are eligible for rehabilitation according to this threshold. Furthermore, 38

**Table 5-3: NBIS Bridge Condition, per Town**

Town	Bridge Condition			Total Bridges
	Functional	Functionally Obsolete	Structurally Deficient	
Ashfield	10	1	0	11
Bernardston	12	0	3	15
Buckland	12	2	4	18
Charlemont	23	3	3	29
Colrain	20	1	3	24
Conway	13	4	2	19
Deerfield	9	2	5	16
Erving	6	2	2	10
Gill	2	0	2	4
Greenfield	32	10	5	47
Hawley	9	0	1	10
Heath	2	0	3	5
Leverett	4	3	3	10
Leyden	1	0	0	1
Monroe	2	0	2	4
Montague	9	5	4	18
New Salem	1	0	1	2
Northfield	11	1	0	12
Orange	12	0	3	15
Rowe	3	1	0	4
Shelburne	3	0	1	4
Shutesbury	0	0	0	0
Sunderland	1	0	0	1
Warwick	3	0	0	3
Wendell	1	0	0	1
Whately	14	1	0	15
<b>County Totals</b>	<b>215</b>	<b>36</b>	<b>47</b>	<b>298</b>

bridges (13 percent of total) meet the requirements for replacement with an AASHTO rating of less than 50. A total of 47 bridges in the county are formally classified as structurally deficient and an additional 36 bridges are formally classified as functionally obsolete. Table

5-3 presents an overview of the bridge condition for NBI bridges in Franklin County, by municipality.

Several other types of bridges are located throughout the county in addition to those bridges listed on the NBI. The jurisdiction of these bridges ranges from private ownership to being municipally owned. Additional bridge categories include bridges such as pedestrian bridges, culverts and railroad bridges. While MassDOT is responsible for the inspection of all NBI bridges only, MassDOT also maintains an inventory of all other bridges in the state.

In addition to data provided by MassDOT, the FRCOG also collected qualitative data from Franklin County residents as part of the Regional Transportation Plan Update. When asked to indicate their transportation concerns for their community and for the County, 87.5% of survey respondents indicated that road and bridge conditions and maintenance were of high or medium concern. Additional comments from the respondents indicate that bridge conditions are the primary concern.

### **Pavement Management Analysis**

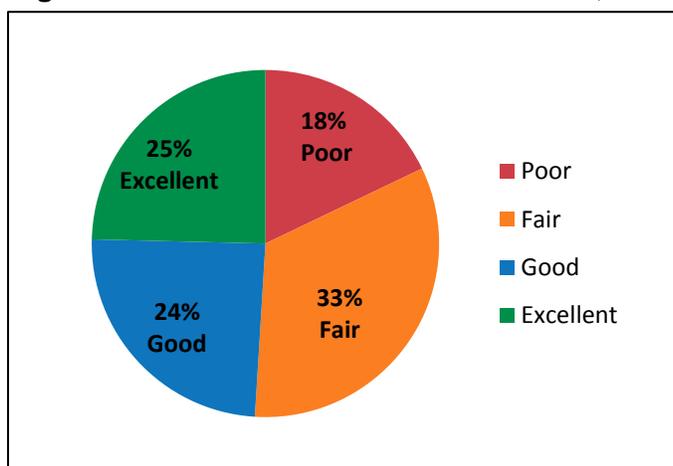
A Pavement Management System (PMS) is a planning tool that collects and monitors information on current pavement conditions, evaluates and prioritizes alternative maintenance, rehabilitation and reconstruction (repair) strategies, according to the Federal Highway Administration (FHWA). In Franklin County, it is important to develop a PMS for the region because pavement is such a significant capital investment and a critical component of our transportation infrastructure.

MassDOT and the FRCOG each have a history of conducting pavement management analyses throughout the county. Franklin County has a total of 447.88 miles of roadway that are eligible for federal funding. Of the federal-aid eligible roadways, 58 percent are under town jurisdiction, with the remaining 42 percent maintained by MassDOT. Pavement condition data has been collected by MassDOT for 54 percent of the federal-aid eligible roadways in the county using specialized data collection equipment. A special testing vehicle, the Automatic Road Analyzer (ARAN) collects pavement condition data and rates the pavement condition according to the Pavement Serviceability Index (PSI) on a 5 point scale. Based on this scale, roadway conditions are classified as poor, fair, good, or excellent.<sup>2</sup> From the roadways that have been surveyed by MassDOT, pavement condition has been estimated for the region and is shown in Figure 5-1.

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<sup>2</sup> MassDOT. FFY 2011 – 2015 Capital Investment Plan. September 2010.

**Figure 5-1: Pavement Condition Estimates, 2013**



As shown in Figure 5-1, the majority of roadways surveyed are assessed as in good or excellent condition (25% excellent, 24% good). Approximately 33 percent of roadways are in fair condition and 18 percent of roadways are in poor condition.

In order to calculate the anticipated costs of repair and maintenance to bring roadways up to an excellent rating, the

data collected by MassDOT on a sample of federal aid roadways in the county was analyzed using cost estimates derived by neighboring regional planning agencies, including Pioneer Valley Planning Commission, Berkshire Regional Planning Commission, and Montachusett Regional Planning Commission. Estimated maintenance and repair costs are shown in Table 5-5 for three maintenance strategies. These costs are approximate as they are based on an estimated condition of the regional pavement system as well as projected cost estimate figures.

It is unrealistic, due to limited financial and physical resources, to bring all roadways in the county to excellent condition at one time. Furthermore, it is important to note that even as roadways reach excellent condition, they will still need to be maintained in order to prevent deterioration. It is necessary to prioritize pavement management needs throughout the county and balance this with cost and safety considerations. This is further complicated by the fact that the relationship between pavement condition and cost is not linear. For example, the strategy that often seems the most logical (repair the worst roads first), is actually the least cost effective. Research has shown that it is far less expensive to keep a road in good condition than it is to repair once it has deteriorated. As roadway conditions worsen, the costs of repairs increase significantly. A roadway that has in poor condition has already reached a point where it cannot be repaired using low-cost treatments, while a roadway in good condition can be maintained that way. Table 5-5 shows that the most cost-effective maintenance strategy is “A: Stop Further Deterioration.” This strategy proposes maintaining roadways that are currently in

<b>Table 5-5: Pavement Management Repair Cost Estimates – Existing Conditions</b>			
<b>Maintenance Strategy</b>	<b>Years</b>	<b>Description</b>	<b>Estimated Cost</b>
A: Stop further deterioration	1-5	Bring roadways in good and fair condition to excellent condition; maintain roadways in excellent condition.	\$24,225,955
	6-10	Bring roadways in poor condition to excellent condition; maintain roadways already in excellent condition.	\$28,762,115
	Total		\$52,988,070
B: Repair the best roadways first	1-5	Bring roadways in good condition to excellent condition; maintain roadways in excellent condition.	\$6,941,793
	6-10	Bring roadways in poor and fair condition to excellent condition; maintain roadways already in excellent condition.	\$50,301,325
	Total		\$57,243,118
C: Repair the worst roads first	1-5	Bring roadways in poor and fair condition to excellent condition.	\$40,364,351
	6-10	Bring roadways which have deteriorated to good and fair condition to excellent condition; maintain roadways already in excellent condition.	\$23,898,519
	Total		\$64,262,870

excellent and good condition and try to also prevent further deterioration of roadways in fair condition and bring those up to excellent condition as soon as possible.

The FRCOG continues to work on implementing a PMS for Franklin County. Pavement condition surveying has begun and several software analysis tools have been tested. The selected software tools will be in place late in 2015. Federal aid eligible roadways in Franklin County will be continually monitored and surveyed on a three-year rotating basis. A database with the results of the surveying will be maintained and a regional report will be regularly produced that summarizes the status of surveyed roadways. The implementation of a PMS in Franklin County is intended to help provide more accurate and detailed information that can be used to determine priority ranking and cost effective repair and maintenance strategies for roadways in the region.

## Sign Retroreflectivity

The Federal Highway Administration (FHWA) has issued federal requirements for public roads on a variety of topics, including signage. These federal requirements for sign standards are derived from the *Manual on Uniform Traffic Control Devices (MUTCD)* and apply to all public roads. These standards are in



**View of Route 63 in Montague**

place to promote the safety and efficiency of public roads by informing motorists of regulations, warning them of potential hazards, and helping ensure that motorists reach their destinations as safely and efficiently as possible.<sup>3</sup>

In 2009, the FHWA provided new sign retroreflectivity requirements for all agencies (including towns and cities) that maintain roadways open to public travel. Retroreflectivity is the property of a traffic sign to reflect light back to the driver at night. Highly retroreflective traffic signs are more legible at night. Meeting the new signage retroreflectivity requirements is the responsibility of each town or city.

These guidelines establish minimum retroreflectivity levels. If a sign falls below this minimum value, it needs to be replaced. It is in the best interest of agencies to adhere to this requirement not only due to potential federal funding implications but also with regards to liability. The FHWA states that public agencies that demonstrate a reasonable maintenance policy, as outlined in the new regulations, should be better equipped to successfully defend against tort litigation involving claims of improper sign retroreflectivity. In short, these standards aim to improve traffic safety in all cities and towns during nighttime driving conditions.

The FHWA enacted final rules regarding minimum retroreflectivity levels in 2012. All agencies were required to have a plan to maintain sign retroreflectivity at or above the minimum levels presented in the MUTCD by January 2014.

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<sup>3</sup> Federal Highway Administration (FHWA), *Sign Retroreflectivity Guidebook: For Small Agencies, Federal Land Management Agencies, and Tribal Governments*, September 2009.

The FRCOG provided assistance to multiple Franklin County towns in developing sign retroreflectivity maintenance plans, including selection of a retroreflectivity assessment method. The plans include procedures for assessment, creation of a sign inventory, a sign replacement plan, an implementation timeline, and cost estimates. Participating towns included Deerfield, Greenfield, Monroe, Montague, New Salem, Sunderland, Warwick, Wendell, and Whately.

## **Traffic Studies**

### **Deerfield Elementary School Traffic Circulation and Flow Study**

In 2013, The Town of Deerfield requested the FRCOG evaluate traffic operations at the Deerfield Elementary School and Pleasant Street (the access road to the school). The study examined pedestrian safety and traffic circulation during morning pick-up and afternoon drop-off periods and included recommendations for improvements based on best practices for traffic operations at schools.

### **STOP Sign Compliance Study**

A study was conducted in 2013 to evaluate intersections with suspected traffic control device compliance issues. The locations were identified through previous planning studies conducted in the region and by surveying local Police Departments. The report focused on four specific locations where STOP sign compliance has been identified as a safety issue and included recommendations to improve compliance with existing traffic controls.

### **Identification of the Most Hazardous Intersections in Franklin County**

Approximately every three years the FRCOG analyzes crash data from the Registry of Motor Vehicles for the twenty-six communities in Franklin County to identify intersections that have experienced a repeated occurrence of crashes. The study identifies the fifty most hazardous intersections and ranks them based on a calculated crash rate that takes into account the severity of each of the crashes, as well as the exposure to crashes based on traffic volumes. The most recent study was completed in 2012 and reviewed crash data from 2007 through 2009. This study is described more thoroughly in Chapter 13 – Transportation Safety. An update of the report, using the next set of available data, will be completed in 2016.

### **Road Safety Audits**

The Road Safety Audit (RSA) process is an effective tool for improving traffic safety at specific locations and is a measure that has been supported for many years by MassDOT and the FHWA. Since the implementation of the multi-disciplinary RSA process in Franklin County in 2010, RSAs have been conducted at nineteen locations in the region. More details about RSA activity in Franklin County are provided in Chapter 13 – Transportation Safety.

## **Planned and Completed Roadway Improvement Projects**

### **Route 2 Safety Improvements**

Since the formation of the Route 2 Task Force in 1994, the FRCOG has been working together with the communities along the Route 2 corridor from Phillipston to Greenfield to create a safer roadway. More than \$70 million has been invested in constructing safety improvements along the corridor. The first improvements included numerous upgrades such as the installation of shoulder rumble strips, new signs and lines, tree clearing for improved visibility, and the installation of variable message signs. The first major construction project was the realignment of Route 2 around the Erving Paper Mill creating a safer climate for both through travelers of the roadway and the mill's loading docks. This work was followed by the construction of a climbing lane, intersection improvements, and a truck weigh station in Athol. This work included installation of an innovative centerline treatment called "Qwick Kurb" along 13 miles of highway in Philipston and Athol. Next was the reconstruction of two bridges and lowering the profile of Route 2 in the Erving area of Erving, along with the construction of protected turn lanes, acceleration and deceleration lanes, and traffic flow improvements in the Erving side neighborhoods near the French King Bowling Alley. Improvements in Orange that included intersection and climbing lane improvements, as well as rehabilitation of the Route 122 Bridge, were completed in 2012. Improvements at the intersection of Route 2 and Route 2A in Erving are scheduled for construction in 2016 and designs for improvements in Erving Center and Farley are under development. Improvements in the Gill/Greenfield section are currently being completed as part of the rehabilitation of the Gill-Montague Bridge and additional improvements for this area are in the preliminary planning stage. More detailed information about the Route 2 Safety Improvements and the Route 2 Task Force can be found in Chapter 13 – Transportation Safety.

### **Greenfield Mountain Climbing Lane**

In the 2009 *Route 2 West Safety Study*, it was recommended that a climbing lane be added to the westbound lane of Route 2 over Greenfield Mountain approaching Shelburne. The study concluded that there is enough pavement width on the roadway to accommodate a climbing lane, but not enough to have a desirable shoulder width. MassDOT has restriped the pavement markings and added signs on this section of Route 2 to allow trucks to travel in the shoulder while climbing. FRCOG conducted a follow-up study in 2013 to determine how well these changes were functioning. The study showed that the widened shoulder is working effectively and safely as an informal "climbing lane."

### **Roundabout at Greenfield Community College (GCC) and Colrain Road**

The intersection of Colrain Road and College Drive in Greenfield is located at the entrance to Greenfield Community College (GCC) and has experienced delay and safety challenges.

MassDOT worked with the City of Greenfield to develop improvements to this intersection,

which include the creation of a roundabout. The construction of the roundabout was completed in the spring of 2015, improving safety and traffic circulation.



**Roundabout at GCC and Colrain Road in Greenfield**

### **Greenfield Road Improvements**

The reconstruction of Greenfield Road in Montague consists of roadway reclamation and minor widening of approximately 2 miles from near Sherman Road south to Hatchery Road. Major elements of the project will improve safety at the intersection of Randall Road (site of a fatal crash), will widen shoulders to improve bicycle accommodation on this segment of the Franklin County Bikeway, and will ultimately connect to a new bicycle and pedestrian bridge under design for south of Hatchery Road. The reconstruction project began in 2014 and is expected to be completed in 2016.

### **Route 2 in Charlemont**

MassDOT and the FRCOG have been working together for several years to make improvements to Route 2 in Charlemont. MassDOT identified seven culverts along this corridor that were originally constructed in the early 1900's that were approaching the end of their design life. Several of these also suffered damage from Tropical Storm Irene in 2011. Since 2010, five culverts have been replaced and two have been repaired. MassDOT also plans to replace the Trout Brook (repaired in 2012) culvert in a future project. A project to reconstruct Route 2 from Route 8A south to Route 8A north is eligible for funding in 2017. This project will also construct improvements in the village center with repair of existing

sidewalk and construction of new sidewalk, as well as traffic calming measures, including crosswalk enhancements and landscaping and signage gateway treatments.

### **Recommendations for Road and Bridge Infrastructure**

- Monitor data for roadway safety and infrastructure performance measures.
- Continue to staff the Route 2 Task Force and advocate for advancement of additional safety improvements.
- Continue to implement a Pavement Management Program.
- Update the Most Hazardous Intersections report using the next set of available data.
- Continue conducting Road Safety Audits and support projects to address safety issues in the region.



**Repaving of a Franklin County roadway.**