

# 12

## **Resiliency & Climate Change**



2024 Regional Transportation Plan

# 12 Resiliency and Climate Change

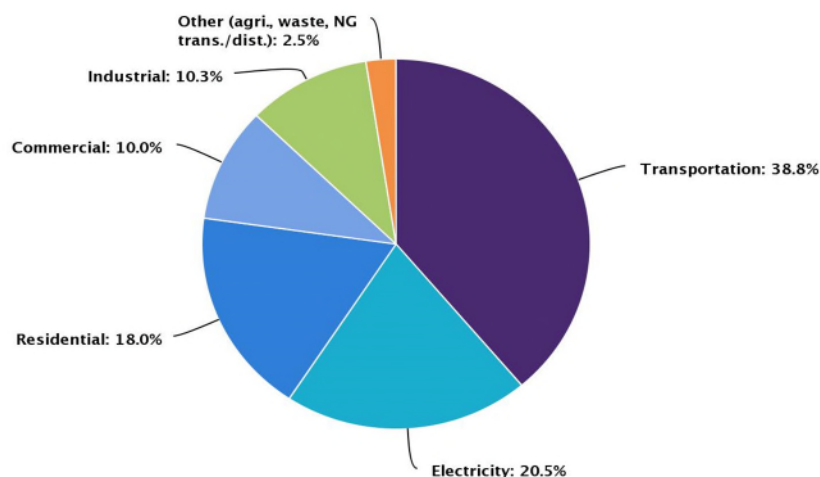
The promotion of energy efficient and sustainable transportation systems is an issue that has increasingly become a priority both regionally and nationally. Impacts of climate change and higher fuel costs have contributed to a strengthening focus on reducing the personal use of automobiles and also on using new and developing technologies that create more fuel efficient and cleaner vehicles.

Climate change is a result of global warming, which is largely caused by human activities, specifically the production of greenhouse gases (GHG) from burning fossil fuels like coal, oil, and natural gas. Almost 33 percent of all GHG emissions in the United States came from the transportation sector in 2019. In Massachusetts, almost 38 percent of GHG emissions in 2020 came from transportation (Figure 1), with nearly half of the contribution coming from passenger vehicles alone.<sup>1</sup> There has been progress in the Commonwealth to reduce GHG emissions – in 2020, total emissions were reduced to an estimated 31% below 1990 levels. The Massachusetts Clean Energy and Climate Plan for 2025 and 2030 (CEC) has set goals for the Commonwealth to be carbon neutral by 2050. Because of transportation's role in the emissions, the CEC sets an 18 percent reduction in transportation emissions by 2025 and a 34% decrease by 2030, compared to 1990 levels.

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<sup>1</sup> *Massachusetts Clean Energy and Climate Plan for 2020: 2015 Update*. Massachusetts Executive Office of Energy and Environmental Affairs, December 31, 2015; and *Choices for Stewardship: Recommendations to Meet the Transportation Future, Volume I*. Commission on the Future of Transportation in the Commonwealth, December 2018.

**Figure 1: Massachusetts GHG Emissions by Sector**



Source: *Massachusetts Clean Energy and Climate Plan for 2020: 2015 Update*. Massachusetts Executive Office of Energy and Environmental Affairs, December 31, 2015.

### **Impacts of Climate Change on Transportation Infrastructure**

Transportation-related GHG emissions contribute significantly to climate change. In turn, climate change also impacts the transportation system. Resilient MA, the Climate Change Clearinghouse for the Commonwealth, identifies the following impacts of climate change on transportation infrastructure in Massachusetts:

- Extreme heat may cause heat stress in materials like asphalt and increase the frequency of repairs and replacements;
- Flooding caused by heavier downpours may damage roads and stormwater infrastructure like undersized culverts;
- High temperatures and dense air conditions could increase runway length requirements for aircraft due to diminished performance in such conditions;
- More nuisance ponding on roads may slow commutes and commerce;
- Rapid freeze thaw cycles may cause damage to road surfaces;
- Costly damage to roads, bridges, and rail networks may occur as a result of extreme nor'easters, hurricanes, severe thunderstorms and blizzards;
- Extensive flood damage to roads and bridges could dramatically affect commerce and public health and safety especially where alternative routes aren't available;

- High winds could down power lines and poles adjacent to roads; and
- Communities and critical facilities could be cut off after storms.<sup>2</sup>

The impacts of climate change are already being felt in Franklin County, and include an increased number of very hot days, higher average rainfall and temperatures, and more severe storms. These effects also, in turn, impact the performance of our infrastructure. Incorporating climate change adaptation strategies into planned infrastructure improvements will increase our resiliency to the impacts of climate change now and in the future.

Sustainable transportation, climate change resiliency, and the reduction of GHG's is a priority for the Franklin County Transportation Planning Organization (FCTPO). This chapter will discuss ongoing and recommended initiatives that encourage sustainable transportation and the reduction of GHG emissions in the region. In addition, this chapter will examine ways in which the transportation infrastructure system can become more resilient to the changing conditions in the region as a result of climate change.

### **Guiding Policies, Programs and Plans**

The Commonwealth of Massachusetts, FRCOG, and other regional organizations have demonstrated their commitment to reducing GHG emissions. Within the past few years, the following policies and plans have been enacted to help reduce the level of GHGs.

### **Metropolitan Planning Organizations and the Global Warming Solutions Act**

The Commonwealth's Global Warming Solutions Act (GWSA) of 2008 requires statewide reductions in greenhouse gas (GHG) emissions of 25 percent below 1990 levels by the year 2020, and 80 percent below 1990 levels by 2050. On March 26, 2021, the Governor signed into law [An Act Creating A Next-Generation Roadmap for Massachusetts Climate Policy](#), which requires the EEA Secretary to set interim emissions limit and sector-specific sublimits every 5 years. The 2030 emissions limit shall be at least 50% below the 1990 baseline, the 2040 emissions limit shall be at least 75% below the 1990 level, and a 2050 emissions limit that achieves at least net zero statewide greenhouse gas emissions, provided that in no event shall the level of emissions in 2050 be higher than a level 85% below the 1990 level.

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<sup>2</sup> <http://resilientma.org/sectors/transportation>. Accessed March 3, 2023.

As part of the GWSA, the Executive Office of Energy and Environmental Affairs developed the Massachusetts Clean Energy and Climate Plan (CECP, updated in 2022), which outlines programs to attain the emissions reduction.

The Commonwealth's thirteen metropolitan planning organizations (MPOs) are integrally involved in helping to achieve greenhouse gas reductions mandated under the GWSA. The MPOs work closely with MassDOT and other involved agencies to develop common transportation goals, policies, and projects that would help to reduce GHG emission levels statewide. For example, one of the programs in the CECP is MassDOT's sustainability initiative known as GreenDOT. GreenDOT policy goals were developed in accordance with the GWSA, and are as follows:

- Reduce greenhouse gas (GHG) emissions;
- Support smart growth development; and
- Promote the healthy transportation modes of walking, bicycling, and public transit.

The FCTPO shares in these goals and is working to meet the specific requirements of the GWSA regulation – *Global Warming Solutions Act Requirements for the Transportation Sector and the Massachusetts Department of Transportation (310 CMR 60.05)*. The purpose of this regulation is to assist the Commonwealth in achieving their adopted GHG emission reduction goals by:

- Requiring MassDOT to demonstrate that its GHG reduction commitments and targets are being achieved;
- Requiring each MPO to evaluate and track the GHG emissions and impacts of its Regional Transportation Plan and Transportation Improvement Program; and
- Requiring each MPO, in consultation with MassDOT, to develop and utilize procedures to prioritize and select projects in its RTP and TIP based on factors that include GHG emissions and impacts.

Meeting the requirements of this regulation will be achieved through the transportation goals and policies contained in the 2024 Regional Transportation Plans, the major projects planned in the RTPs, and the mix of new transportation projects that are programmed and implemented through the Transportation Improvement Program. The GHG tracking and evaluation processes enable the MPOs to identify the anticipated GHG impacts of the planned and programmed projects, and also to use GHG impacts as a criterion in prioritizing transportation projects. This approach by the MPO is consistent with the greenhouse gas reduction policies of promoting healthy transportation modes through prioritizing and programming an appropriate balance of roadway, transit, bicycle and pedestrian

investments; as well as supporting smart growth development patterns through the creation of a balanced multi-modal transportation system.

All of the MPOs and MassDOT are working toward reducing greenhouse gas emissions with plans, actions, and strategies that include (but are not limited to):

- Reducing emissions from construction and operations;
- Using more fuel-efficient fleets;
- Implementing and expanding travel demand management programs;
- Encouraging eco-driving;
- Providing mitigation for development projects;
- Improving pedestrian, bicycle, and public transit infrastructure and operations (healthy transportation); and
- Investing in higher density, mixed use, and transit-oriented developments (smart growth).

#### Regional GHG Tracking and Evaluation in RTPs

MassDOT coordinated with MPOs and regional planning agency (RPA) staff on the implementation of GHG tracking and evaluation in development of each MPO's 2012 RTPs. This collaboration has continued for the MPOs through subsequent RTPs including this update. MassDOT, using its statewide travel demand model, provides the FCTPO with statewide estimates of CO<sub>2</sub> emissions resulting from the collective list of all recommended significant projects in all the Massachusetts RTPs combined (and supplemented by CO<sub>2</sub> emission reduction results for smaller, "off-model" projects supplied by the MPOs). The results of this modeling can be found in Chapter 14: Air Quality Conformity Determination.

Working closely with MassDOT, the FCTPO continues to make efforts toward progress through planning activities to meet the GHG reductions targets and comply with the requirements of the GWSA. Potential TIP projects are subjected to an evaluation process using Transportation Evaluation Criteria (TEC). The TEC scores are currently compiled by looking at six different topic areas: condition, mobility, safety, community effects, land use & economic development, and environmental effects. The last criterion, environmental effects, specifically examines a project's potential impact on air quality and climate. The TEC are currently being revised and will have expanded metrics for GHG and climate metrics.

In addition to minimizing the GHG impacts from proposed projects, the FRCOG staff has sought public input on how to further reduce GHGs in the region. This topic received some of the most attention during the public outreach for the development of this RTP, only preceded by the need for more public transit. The results from the public outreach surveys

distributed for this update show that the availability of cleaner forms of transportation (walking, bicycling, and transit) should be a major priority for the region.

### **Municipal Vulnerability Preparedness (MVP) Program**

The Municipal Vulnerability Preparedness grant program (MVP) provides support for cities and towns in Massachusetts to begin the process of planning for climate change resiliency and implementing priority projects. The state awards communities with funding to complete vulnerability assessments and develop action-oriented resiliency plans. Communities who complete the MVP program become certified as an MVP community and are eligible for MVP Action grant funding and other opportunities. Action grants can fund a wide range of projects including those that increase transportation resiliency to impacts from climate change. To date, seven Franklin County towns are certified as MVP communities. The FRCOG is a certified provider under the MVP program and can assist towns with completing the assessment and resiliency plan. Many of the recommendations from the Franklin County MVP plans include transportation-related action items - specifically around the issues of failing culverts, localized flooding, and rail freight incidents.

### **Multi-Hazard Mitigation Planning**

The *State Hazard Mitigation and Climate Adaptation Plan* (SHMCAP) for the Commonwealth was adopted on September 17, 2018, and is effective through September 18, 2023, in fulfillment of Governor Baker's Executive Order 569 on climate change. This plan is the first of its kind to comprehensively integrate climate change impacts and adaptation strategies with hazard mitigation planning. The FRCOG is utilizing the State's plan as a model for town hazard mitigation plan updates that will be developed over the next several years. Multi-Hazard Mitigation Plans assess a town's vulnerability to various natural and man-made hazards and identifies action items to mitigate these risks. Current and future impacts from climate change will be integrated into the plan updates. Vulnerability assessments include evaluating impacts of flooding, severe storms, extreme heat, and man-made hazards on a town's transportation infrastructure. Towns with approved plans are eligible to apply for mitigation grants from the Massachusetts Emergency Management Agency (MEMA). The SHMCAP update to be released in Fall of 2023 will integrate the data, information and findings of the [MA Climate Change Assessment](#).

### **Green Communities Program**

In 2008, Massachusetts created the Green Communities Program, which uses funding from auctions of carbon emissions permits under the Regional Greenhouse Gas Initiative (RGGI), to reward communities that achieve Green Communities designation by meeting five clean energy benchmarks:



1. Adopting local zoning bylaws or ordinances that allow “as-of-right siting” for renewable and/or alternative energy research & development, manufacturing, or generation facilities;
2. Adopting an expedited permitting process related to the as-of-right facilities;
3. Establishing a municipal energy use baseline and a program to reduce energy use by 20 percent within five years;
4. Purchasing only fuel-efficient vehicles for municipal use; and
5. Requiring all new residential construction over 3,000 square feet and all new commercial and industrial real estate construction to reduce lifecycle energy costs (i.e., adoption of an energy-saving building “stretch code”).

Currently, 25 towns in Franklin County are officially designated as Green Communities and are eligible to apply for grants to fund municipal energy efficiency and renewable energy projects. Transportation-related projects that have been eligible for funding in recent Green Community grant rounds include: vehicular efficiency measures, such as idle reduction equipment and after-market hybrid retrofit kits; incremental costs of hybrid vehicles, plug-in hybrid or fully electric vehicles; and publicly accessible electric vehicle charging station equipment.

### **UMass Clean Energy Extension**

The UMass Clean Energy Extension was established with funds from the MA Department of Energy Resources (DOER) and provides a resource dedicated to reducing market barriers and accelerating the adoption of clean energy for Massachusetts cities and towns, businesses, institutions, farms, low income and other multi-unit housing, and others. The UMass Clean Energy Extension provides technical support and advice upon request, and proactively seeks opportunities to promote clean energy projects.

In order to help municipalities cut costs and achieve greater fuel efficiency, UMass CEE’s Greening Municipal Fleets initiative is researching the obstacles to fuel use reduction and compiling information regarding how to overcome these challenges, with a focus on small, rural communities where vehicle fuel usage can account for 35% or more of municipal energy usage.

### **Sustainable Franklin County: A Regional Plan for Sustainable Development**

In 2010, the U.S. Department of Housing and Urban Development (HUD) announced the Sustainable Communities Planning Grant Program. In the 2010 Budget, Congress provided a total of \$150 million to HUD for the Sustainable Communities Initiative to improve regional



planning efforts that integrate housing and transportation decisions and increase the capacity to improve land use and zoning. In the Fall of 2010, a consortium, with the FRCOG as lead partner, received a \$425,000 grant under this program for Franklin County. Through this grant, the FRCOG created *Sustainable Franklin County: a Regional Plan for Sustainable Development*. The goals and recommendations in the plan were identified through an extensive public outreach process and focus on sustainable development within the context of a rural region. It not only examines issues associated with transportation, but also comprehensively looks at the effects of land use, housing, economic development, natural and cultural resources, and infrastructure on sustainability. The top sustainable transportation goals identified in the public outreach process for the plan were:

- 1) Increase availability and use of public transit;
- 2) Restore passenger rail service; and
- 3) Increase bicycle/pedestrian facilities and promote walking and bicycling.

### **Current Planning Activities**

The FRCOG recognizes the rural nature of the Franklin County region and acknowledges that traveling by automobile is often the most convenient or only option. However, with an aging population and more attention being focused on environmental issues, it is important to discuss options for reducing dependence on the single-occupied vehicle and increasing alternative transportation options. The Franklin County region and the FRCOG have been working on bringing sustainable transportation to the area and mitigating GHGs. This section highlights the many planning activities that have recently been completed or are ongoing in this topic area.



**Park & Ride in Erving**

## **Electric Vehicle Charging Infrastructure**

Electrifying transportation is one way to reduce GHG emissions and transportation's contribution to climate change. According to the Commission on the Future of Transportation, electric vehicles (EVs) “emit far less than conventional vehicles, especially when grids rely on renewable energy rather than carbon-based fuels to power them. In terms of emissions impact, an EV in New England is equivalent to achieving a fuel economy of 103 miles per gallon in a conventional vehicle, and national research shows that midsize EVs are estimated to reduce GHG emissions by 51% compared to midsize gasoline-powered vehicles.”<sup>3</sup> Massachusetts has committed to electrifying all vehicles by 2050, and together with seven other states, has pledged to have 3.3 million electric vehicles on the road by 2025. However, “only through a robust charging network will consumers have the necessary confidence in reliability for wide-scale EV adoption.”<sup>4</sup>

In 2022, FRCOG staff assessed the demand for electric vehicle charging stations in the region with the goal of determining if the existing infrastructure is adequate or if additional charging stations are needed. The study found that many of the existing public charging stations in Franklin County are well used and additional stations are needed throughout the region. FRCOG staff are continuing to explore opportunities to install public charging stations throughout Franklin County and to advocate for additional assistance and support to the towns if they install stations.

As part of this 2022 electric vehicle charging station assessment, the FRCOG found that municipal experience with recently installed charging stations to be generally negative. Many Franklin County towns have discovered that the operating and maintenance costs of the stations far exceed the revenue from user fees. This unexpected high ongoing cost, especially for small towns with very limited budgets, is causing town administrators to reconsider installing additional stations unless there is financial assistance to assist with these costs until demand is sufficient to cover the expenses.

## **Park and Ride Lots**

Park and ride lots provide an opportunity to those who do not live on or within walking distance of public transit routes to travel to an intermediary location and take public transportation or carpool with other commuters. There are currently several park and ride lots in Franklin County. They include:

- Charlemont Park & Ride (Route 2 between North River Road and 112)

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<sup>3</sup> *Choices for Stewardship: Recommendations to Meet the Transportation Future, Volume I*. Commission on the Future of Transportation in the Commonwealth, March 2023. Pages 24-25.

<sup>4</sup> *Ibid.* Page 52.

- Whately Park & Ride (Route 116/5/10)
- Greenfield Registry of Motor Vehicles/Visitors Center Park & Ride
- Sunderland Park & Ride (Route 47)
- Erving Park & Ride (Route 2)

In 2018, FRCOG Staff evaluated the existing park and ride facilities in Franklin County to determine how well they are being utilized. In addition, FRCOG Staff conducted surveys of the park and ride facility users to better understand where they were coming from and how they were using the lots. The study shows that the use of the Whately and Sunderland park and ride lots continue to increase and that many users of the Sunderland lot are parking there in order to access public transit. The study recommends marketing of park and ride lots in the region, increased transit service to park and ride lots, and the installation of adequate bike racks and EV charging stations at all lots.

In 2021, FRCOG staff examined the feasibility of additional park and rides in the eastern portion of the county, where there had been a lack of facilities. This study identified several potential locations in Erving and Orange. Then the FRCOG and the Town of Erving worked with MassDOT to have a facility designated on Route 2 in Erving Center.

## **Ridesharing**

As mentioned in Chapter 9: Transit, ridesharing using private Transportation Network Companies (TNC), such as Uber or Lyft, has become even more popular since the last RTP update in 2020. These TNC vehicles are readily available just to the south of Franklin County, particularly in the Hampshire County towns of Amherst and Northampton. However, their availability in Franklin County still remains limited. It is possible for users to receive rides to return to Franklin County (e.g., Greenfield) from Hampshire County, but it is still difficult for users to book a ride to be picked up in much of Franklin County. The FRCOG will be investigating ways to increase the TNC presence in the region as a way to provide choices in transportation.

## **Shared Vehicle Program**

Car sharing is defined as the joint access and/or ownership of a car. For individuals who do not need a car every day, it is a way to have a car when you really need one while relying on alternatives for most trips. Zipcar is a national vehicle sharing program that is available in Massachusetts. This service allows users to pay a fixed rate for the use of a vehicle that they are able to reserve when they need it. Members can reserve cars for time periods ranging from just hours to many days. These reservations include the cost of fuel, insurance, and reserved parking. Presently, the Zipcar options in western Massachusetts

are more limited than the eastern part of the state. The closest options are in Amherst, with eleven cars, and Northampton, with two cars. There are no Zipcars sited in Franklin County.

### **Promote Walking and Bicycling**

Franklin County residents greatly support increased walking and bicycling options in the region. Shifting to these transportation modes can result in a significant decrease in transportation-related GHG emissions, while promoting the health of residents. In Franklin County, several reports and studies have examined the safety and security of the pedestrian and bicyclist transportation network and efforts have sought to increase the quality and quantity of these facilities. These include the Franklin County Bikeway Plan and maps (the maps were updated most recently in 2017); a bicycle parking purchase program that resulted in the purchase and installation of 54 bike racks in 11 towns and 3 school districts; Walk Franklin County maps, updated in 2018, for all towns in Franklin County that depict one to two mile walking routes in town centers; and an annual bike breakfast at the JWO Transit Center during Baystate Bike Week. Chapter 10 summarizes in more detail the efforts to encourage bicycling and walking in the region.

### **Complete Streets**

The Complete Streets Funding Program is a state funding program that provides technical assistance and construction funding to eligible municipalities for construction, reconstruction, and some rehabilitation and resurfacing projects that increase safety and accessibility for all travel modes including walking, biking, transit, and vehicles, and for people of all ages and abilities. Eligible municipalities must pass a Complete Streets Policy and develop a Prioritization Plan. Since the program began, FRCOG staff have assisted eight towns with developing Prioritization Plans. The City of Greenfield and the Town of Deerfield also completed their own Plans. Towns become eligible to apply for funding to construct the improvements that are identified in the Prioritization Plans through the Massachusetts Complete Streets Funding Program. Chapter 10 provides more details about Complete Streets efforts in the region.

### **Increase Use of the Public Transit System**

In Franklin County, several reports and studies have examined the demand for public transit in the region. The following studies and reports have focused on transit service and include: *Alternative Transportation Plan*, *West County Transit Study*, *North County Transit Study*, *East County Transit Study*, a *Survey of Select Populations Regarding Transit Service*, and the FRTA's *Regional Transit Plan*. The major strength of the transit system is that most of the major population centers within Franklin County are currently being served by public transit. Another beneficial aspect of the public transit system is the inclusion of bicycle racks on all

of the buses. This coordination between various modes of transportation can help decrease dependence upon the single occupant motor vehicle and help mitigate GHG emissions. On the other hand, these studies and public outreach has shown that a weakness with the current status of transportation options within Franklin County is the limited service of public transit. This is primarily due to the high cost of providing transit service to such a rural population. See Chapter 9: Transit, for recommendations on how to improve the public transit system in Franklin County.

In addition to improving the transit system in Franklin County, over the next several decades, the transit fleet will need to transition to more efficient and cleaner vehicles for Massachusetts to meet its Global Warming Solutions Act (GWSA) 2050 goals. FRTA has already made strides in reducing GHG emissions of its transit fleet by purchasing a hybrid-electric bus. However, according to the Commission on the Future of Transportation, “Achieving the Commonwealth’s 2050 GWSA mandate will require the near-complete transition of our vehicle fleet (cars, trucks, and buses) to electric vehicles or other zero-emission vehicle (ZEV) technology.”<sup>5</sup> Due to higher up-front costs of purchasing battery electric buses compared to diesel buses, and the associated charging infrastructure, financial incentives will be needed to help regional transit agencies make this transition. The FRTA is currently working with MassDOT on a transition plan for an electric fleet.

### **Passenger Rail in the Region**

In 2014, passenger rail returned to Franklin County with the Amtrak “Vermont” service stopping at the new rail station constructed at the John W. Olver Transit Center. This service, running on the recently improved tracks known historically as the Connecticut River Main Line, connects Washington D.C. and White River Junction, VT with stops including New York City and Springfield, Holyoke, Northampton, and Greenfield in Massachusetts. The service has two runs per day – one northbound and one southbound. In the Fall of 2019, a pilot service, the “Valley Flyer,” began with expanded service between Greenfield and New York City. The Valley Flyer provides four additional roundtrips per day during the work week, and one additional roundtrip per day on the holidays and weekends. In Fall of 2022, this pilot service was declared permanent based on its high ridership numbers. FRCOG staff are currently working with chambers of commerce and other regional partners on a marketing campaign to promote travel by rail in the region. See Chapter 7: Passenger Rail, for more information on passenger rail in the region.

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<sup>5</sup> *Choices for Stewardship: Recommendations to Meet the Transportation Future, Volume I*. Commission on the Future of Transportation in the Commonwealth, March 2023. Page 52.

## **Telecommunications**

Telecommuting can help decrease GHG emissions by allowing workers to eliminate some daily commutes and work from home instead. It is anticipated that the number of employees telecommuting in Franklin County will continue to increase in the future, particularly after the recent expansion of the telecommunications infrastructure and high-speed internet services throughout the region. Chapter 4 includes more information on broadband internet expansion efforts in the region.

## **Improve Traffic Operations**

### Reduce Congestion and Travel Time

The time vehicles spend idling in traffic congestion is a direct contributor to GHG emissions. In order to prevent idling and decrease time spent in traffic, the efficiency of the transportation network needs to be examined. Constructing roundabouts at intersections are an effective way to decrease emissions. Ensuring effective signal timing at intersections also improve traffic flow and reduce delays. In the Fall of 2023, a project on Route 2 near the Big Y shopping center in Greenfield will increase safety and traffic congestion by adding a signal and improving the signal timings, among other enhancements.

### Improve Communication and Notification

Technology can help improve the efficiency of the transportation network through driver communication and advanced notice of incidents to users of the transportation network. Improvements in communication may include better and more frequent use of variable message signs to notify drivers of upcoming construction schedules or delays. Another form of notification is the Massachusetts Travel Advisory System which is a free service provided for the Commonwealth in which a motorist can call 511 to see if a select number of major roadways are experiencing congestion. This service includes Interstate 91 and Route 2 in western Massachusetts. Motorists who are aware of an incident can take an alternate route, which will result in an avoidance of the congestion and a decreased travel time.

## **Transportation Resiliency**

The following strategies are aimed at preparing for the impacts of climate change on the future of the transportation system and the incorporation of climate resiliency into planning practices.

## **Nature-Based Solutions**

Nature-based solutions (NBS) are actions that conserve, create, restore, and employ natural resources to enhance climate resilience. NBS use natural systems, mimic natural processes,

or work in tandem with engineering to address natural hazards like flooding and erosion. The terms Green Infrastructure and Low Impact Development fall under the category of nature-based solutions.

Green infrastructure treats stormwater as a resource rather than a waste product, and can complement or replace traditional pipe and pond, or “gray” stormwater infrastructure, which utilizes extensive underground systems. In many communities, existing stormwater infrastructure is aging, expensive to maintain, and inadequate to handle the heavier rainfalls our region is experiencing due to climate change. This leads to localized flooding and negative impacts to roads, bridges, property, and water quality. At the same time, many local roads and other public facilities are in need of upgrades. Integrating green infrastructure into public projects now and in the future can result in cost savings and provide a host of other public benefits.

In 2017, FRCOG staff prepared a Green Infrastructure Guide for Public Works Projects to introduce different Green Infrastructure stormwater management techniques and how they might be applied in a transportation project. The guide includes information on design and maintenance, benefits, limitations, and cost of different techniques, as well as links to additional resources. Case studies from the region are highlighted within the guide.

MassDOT has a Roads & Rivers training program designed for Highway Departments and other municipal staff to help them better understand river processes, aquatic habitat, and how transportation infrastructure affects and is affected by river stability. In addition, the program will provide information as to how to design, construct, and maintain transportation infrastructure that accommodates river channel stability. This is important for both paved and unpaved roads within Franklin County.

The FRCOG has completed a demonstration project in the Town of Buckland that promotes the use of green infrastructure stormwater management techniques and the integration of these techniques into various upcoming road projects identified by the town. In addition, the FRCOG has completed a Sustainable Stormwater Management Plan for Franklin County, which identified opportunities to incorporate sustainable, climate resilient stormwater management techniques, including green infrastructure, as part of planned and funded road projects. As part of this Plan, nine case studies throughout the county were selected to illustrate how the techniques could be used to manage stormwater runoff from paved and unpaved roads.



A helpful resource to planners, town officials, and DPWs is the Resilient MA website.<sup>6</sup> This website provides the most up-to-date climate change science and decision support tools for Massachusetts. This includes information on the impacts of climate change on infrastructure and transportation.

### **High Risk Stream Crossings**

In 2018, FRCOG staff completed a series of reports and maps for each town in the Deerfield River Watershed that identify high risk stream crossings in each community. The information in the reports and maps is from a pilot project completed by MassDOT and UMass Amherst that assessed the vulnerability of road-stream crossings to precipitation events. Roads, bridges, and culverts in the Deerfield River Watershed are particularly vulnerable to flooding, as Tropical Storm Irene demonstrated in 2011. Events like Tropical Storm Irene are projected to become more frequent due to climate change.

FRCOG planning staff compiled information on high risk culverts for each Franklin County town within the watershed to help municipal officials and public works staff prioritize bridge and culvert upgrades in their town. The reports also provide information on how to make road-stream upgrades more resilient to current and projected precipitation conditions, and lists potential funding sources for upgrading crossings. Upgrading and replacing culverts and bridges with structures that can withstand higher flows will save money over the long term, help protect critical infrastructure, and improve aquatic habitat in the watershed.

### **Culvert Assessments**

FRCOG staff have been conducting culvert assessments for Franklin County towns to identify the structural condition of culverts and their vulnerability to flooding. To date, staff have assessed all drainage structures and culverts in eleven towns and created spreadsheets and interactive online maps showing the location and condition of each culvert that was assessed. This work provides towns with valuable information to prioritize culvert replacements and repairs before a failure occurs. FRCOG staff will be continuing these evaluations for other towns in Franklin County.

### **Evacuation Planning and Mapping**

A safe transportation system protects users from hazards, including hazards resulting from climate-related stresses on the system. It is expected that more extreme weather events will lead to more precipitation and flooding. It is critical that infrastructure be planned and maintained to be able to withstand a higher frequency of these events. Tropical Storm Irene

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<sup>6</sup> Resilient MA: Climate Change Clearinghouse for the Commonwealth, <http://resilientma.org/>

in August, 2011 provided crucial information on the vulnerability of the transportation network in the event of major flooding. This event flooded and washed out many roads and bridges in the region. Such events may be more severe in the future, so a revised examination of potential flooding areas and critical infrastructure should be performed for the whole region. The FRCOG has prepared updated flood maps with evacuation routes for each municipality in order to assess changes in flooded areas as a result of climate change and its effects on emergency preparedness.

### **Pavement Management**

More prolonged heat spells and hotter days are expected with climate change, along with increased precipitation events. These effects will directly impact pavement condition. Warmer days will result in the softening of the pavement for longer periods of time and may lead to more rutting. Additional concerns regarding stormwater runoff should be examined when updating or redesigning the roadway network to accommodate the potential need for more drainage. The FRCOG conducts a Pavement Management Program for the region to monitor this critical component of the transportation infrastructure.

### **Recommendations for Resiliency and Climate Change**

The transportation sector is the largest contributor to GHG emissions, which are a primary cause of climate change. There are many steps that have already been taken in the region to help mitigate GHG emissions. The region has also taken a proactive role in preparing for the impact of climate change on the regional transportation system.

- Continue to promote a reduction in GHG emissions in the region through the mitigation strategies described in the chapter.
- Continue to promote sustainable and alternative forms of transportation to the singly-occupied motor vehicle.
- Continue to support the electrification of transportation in the region through increasing public charging infrastructure and supporting the transition of municipal and transit fleets to electric vehicles.
- Assist municipalities with assessing transportation infrastructure most at risk to climate change and planning for upgrades and replacements that are designed to handle storm events and withstand the temperature extremes predicted for Franklin County.

- Integrate nature-based solutions into transportation projects whenever feasible to increase climate change resiliency. In particular, look at ways to manage stormwater runoff and impacts of climate change.
- Continue to implement a Pavement Management System for the county.
- Increase standards for the resilience of new infrastructure, particularly for those vulnerable to flooding.
- Promote zoning that discourages development in vulnerable areas.



**Before and After Pictures of a Culvert Replaced in Colrain to Accommodate Increased Rainfall Amounts**