

A WORKING DOCUMENT • FEBRUARY 2019



AN UPDATE ON TRANSPORTATION FINANCE



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A Better City is a diverse group of business leaders united around a common goal—to enhance Boston and the region's economic health, competitiveness, vibrancy, sustainability and quality of life. By amplifying the voice of the business community through collaboration and consensus across a broad range of stakeholders, A Better City develops solutions and influences policy in three critical areas central to the Boston region's economic competitiveness and growth: transportation and infrastructure, land use and development, and energy and environment.



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INTRODUCTION



AN UPDATE AND OUTLOOK ON THE STATE OF TRANSPORTATION FINANCE IN MASSACHUSETTS


In 2016, A Better City released a comprehensive evaluation of metropolitan Boston's infrastructure—the *State of the Built Environment* report. This report examined the existing conditions of the region's transportation, energy, water, and sewerage systems, as well as the projected future needs of the region after accounting for population growth, expected changes in the labor force, housing patterns, and the impacts of climate change and sea-level rise. The report stated:

“Based on our projections, the conclusion is pretty straightforward. As a region we must find ways to expand our infrastructure, enhance the efficiency with which we use our infrastructure, and find ways to conserve energy, water, and open space in order to accommodate the population growth and expanded economic output we project through 2030. The complexity lies in determining which course to take and ultimately, how to pay for it.”

Transportation infrastructure is one of the largest and most identifiable components of the built environment, comprising our roads, bridges, tunnels, subway cars, trains, and buses. This category of

infrastructure generates the most attention from the public and requires substantial resources of public dollars. The performance of our highways, commuter rail, and subways is essential to our economy and quality of life, and the goal of a high-quality transportation system is shared by citizens, elected officials, and stakeholders.

If Massachusetts wants to maintain its reputation as a great place to live, and as a global leader with a dynamic economy, our transportation infrastructure must improve to keep pace with our growing needs. During the past decade, Massachusetts made significant changes to the management of our transportation system and reorganized some of the ways it is financed, warranting a comprehensive review of the existing transportation financing structure.



“TRANSPORTATION INFRASTRUCTURE IS ONE OF THE LARGEST AND MOST IDENTIFIABLE COMPONENTS OF THE BUILT ENVIRONMENT, COMPRISING OUR ROADS, BRIDGES, TUNNELS, SUBWAY CARS, TRAINS, AND BUSES.”

A Better City's 2016 *State of the Built Environment* report gave a warning regarding the potential growth of the region. **This follow-up evaluation examines the cost, the resources available and estimates additional resources required just to maintain our transportation system over the next ten years.**

In addition, it reviews the actions taken to address the state's transportation system since the 2007 Transportation Finance Commission reports and highlights both some challenges and some opportunities for its future.

In 2007, 13 leaders from various civic, business, and transportation organizations studied the Commonwealth's transportation policies and infrastructure, and reported their findings and recommendations in two volumes of a Transportation Finance Commission (TFC) report. Volume 1, *Transportation Finance in Massachusetts: An Unsustainable System Findings of the Massachusetts Transportation Finance Commission*, was published in March 2007. Volume 2, *Transportation Finance in Massachusetts: Building a Sustainable Transportation Financing System—Recommendations of the Massachusetts Transportation Finance Commission*, was published a few months later in September

2007. For the purposes of this report, the two volumes are treated and referred to simply as “the TFC report.”

The findings and recommendations in the TFC report became the intellectual blueprint for how to fix Massachusetts's transportation system. Ten years later, the TFC report remains an unofficial guide for elected officials, transportation stakeholders, and the general public to understanding the transportation needs of the Commonwealth. The report quantified the size of the funding gap, recommended many essential transportation reforms, and raised awareness of the scale of the challenge. The commission introduced its comprehensive work with an unambiguous warning:

“Our findings paint a dire picture. Numerous decisions were made in the past that have led us to this juncture. But this report is not about pointing fingers or assigning blame. We need to grasp the enormity of the problem that we face, recognize that ‘business as usual’ will not suffice, and work together to develop sustainable solutions for our transportation system.”

“WE NEED TO GRASP THE ENORMITY OF THE PROBLEM THAT WE FACE . . . AND WORK TOGETHER TO DEVELOP SUSTAINABLE SOLUTIONS FOR OUR TRANSPORTATION SYSTEM.”



In part as a result of this report, Massachusetts state government engaged in several legislative efforts to reform the financing and delivery of transportation services in the Commonwealth. Most of these changes, in one way or another, have their origins in the findings and recommendations of the TFC report. Thus, it is entirely appropriate and important that we take a comprehensive look back at what the TFC recommended and what has happened in the ensuing decade.

How much progress has been made in Massachusetts? Is the transportation system on a path to sustainability? Are we in better shape than we anticipated 10 years ago? What reforms are still left unaddressed? What are the new challenges? What is the current transportation finance gap for 2019 and beyond?

These are the questions this *Update on Transportation Finance* analysis will explore. By acknowledging the previous work of transportation leaders in Massachusetts, and comparing their ideas with current results and data, we will provide an update on transportation finance throughout the Commonwealth.

This 2019 analysis will advance the conversation about infrastructure by examining the funding needed to maintain our existing transportation system.

If we can close the financing gap presented here, we will have brought our system up to 20th century standards a quarter of the way through the 21st century.

While many in the Commonwealth expect a system that is resilient to climate change, decarbonized to reach our 2050 greenhouse gas emissions goals and expanded in a way that provides access and efficient mobility for a growing population and economy, these investments are not accounted for here.

This analysis should be considered the floor for the investments necessary for our system. From this we must set new goals, policies, and priorities for the future accessibility needs of Massachusetts. Most importantly, this document should be a call for action to develop a comprehensive transportation finance plan that enables Massachusetts to move forward with shaping a 21st century system.





CHAPTER 1

LOOKING BACK AT THE TRANSPORTATION FINANCE COMMISSION REPORT

“THE TRANSPORTATION FINANCE COMMISSION HAS CONCLUDED THAT OUR SYSTEM HAS BEEN NEGLECTED FOR YEARS, AND THAT THE SYSTEM WE TAKE FOR GRANTED WILL FAIL IF WE DO NOT TAKE PROMPT AND DECISIVE ACTION. . . . WE ESTIMATE THAT OVER THE NEXT 20 YEARS, THE COST JUST TO MAINTAIN OUR TRANSPORTATION SYSTEM EXCEEDS THE ANTICIPATED RESOURCES AVAILABLE BY \$15 BILLION TO \$19 BILLION. THIS DOES NOTHING TO ADDRESS NECESSARY EXPANSIONS OR ENHANCEMENTS.”¹

These are the most telling words from the TFC report, and they set the framework for every transportation debate of the past decade.

LOOKBACK AT TFC FINDINGS

Underlying this statement on a \$15–19 billion gap were the following conclusions:

- Virtually every transportation agency in the state is running structural deficits and resorting to short-term, quick fixes that hide systemic financial problems.
- The conditions of our roads, bridges, and transit systems are in broad decline.
- Available revenue has been limited across multiple sources.
- We have no money for transit or highway enhancements or expansions without further sacrificing our existing systems and exacerbating our problems.

Of the \$15–19 billion funding gap, approximately \$10.5 billion was attributed to the Commonwealth’s various highway programs, and the remainder (between a low estimate of \$4.8 billion and a high estimate of \$9 billion) was attributed to the MBTA (Massachusetts Bay Transportation Authority). Less attention was paid to other elements of the transportation system, including the Commonwealth’s Department of Conservation and Recreation’s (DCR’s) bridges and parkways (some

responsibility for which has since been transferred to the Massachusetts Department of Transportation [MassDOT]; the Massachusetts Port Authority’s (Massport’s) Tobin Bridge (subsequently transferred to MassDOT); and the Regional Transit Authorities (RTAs). Because the Registry of Motor Vehicles (RMV) was not then part of MassDOT and the Aeronautics Commission was semi-independent, neither was included in the analysis.

Many of the sub-heading in the report were particularly alarming and served as the basis for several subsequent studies and reform efforts. These findings stated:

- MBTA has a critical and growing structural funding gap
- MBTA operating costs are not controlled
- MBTA is carrying a crushing debt burden
- MBTA’s capital budget shortfalls impact its ability to achieve a State of Good Repair (SGR)
- MassHighway has adopted unsustainable business practices to compensate for inadequate financial resources
- MassHighway does not have the staff and budget to oversee and maintain the highway system adequately
- MassHighway has under-invested in the state’s road and bridge program for decades

- MassHighway has lacked a coordinated set of asset management systems to prioritize the use of limited state and federal funding
- Massachusetts owes \$1.5 billion of its future funds for projects that have already been built
- Metropolitan Highway System (MHS) is burdened by payments to the Central Artery/Tunnel (CA/T) project

In its 2007 report, the TFC outlined a series of recommendations for closing the funding gap under two broad rubrics—reform and revitalization. The report listed 22 reform recommendations intended to save \$2.4 billion. The TFC made six revitalization recommendations intended to increase revenue by \$18.7 billion.

Chapter Two of this report reviews the findings of the 2007 TFC report, as well as some developments up through early 2019; Chapter Three projects these findings out to the next 10 years (2028); Chapter Four reviews the state's future economic growth prospects and the unmet needs for transportation expansion; Chapter Five addresses potential management and funding reforms; and Chapter 6 presents the recommendations of the study.

It is apparent even from a basic overview that many changes have occurred in the governance, finance, and operation of the Commonwealth's transportation system during the decade since the TFC report. When viewed as a list, the changes over the past 10 years are extensive and impressive. A few highlights include:

- the formation of MassDOT itself, creating for the first time a unified, multimodal transportation agency responsive to the Governor's appointed Secretary of Transportation
- increases in the state sales tax (from 5 to 6.25 percent, with 1 cent dedicated to the MBTA)
- increase in the gas tax (from 21 to 24 cents)
- regular MBTA fare increases to keep pace with inflation (three increases since 2007)
- reform of the MBTA pension system
- creation of the Fiscal and Management Control Board for increased oversight of the MBTA
- additional flexibility in outsourcing and privatizing services at the MBTA

- implementation of performance-based project prioritization and asset management systems
- transfer of the Tobin Bridge and DCR bridge projects to MassDOT
- restoration of tolls on the so-called "Western Turnpike"—I-90 west of the Weston tolls—to maintain a steady revenue stream
- institution of the Accelerated Bridge Program (ABP), which significantly reduced the Commonwealth's backlog of structurally deficient bridges, and introduced innovative and accelerated methods of project delivery, such as "Fast 14," which replaced 14 bridges over I-93 in record time
- the conversion of the state's toll roads to All Electronic Tolling (AET) collection, creating the potential for a much more flexible and demand-based toll structure in the future

Nevertheless, any consumer of transportation services in the Commonwealth knows that much remains to be done to address chronic State of Good Repair (SGR) issues, growing congestion on our roadway and transit systems, and the demands of a dynamic and growing economy in parts of the state, as well as to help jump start economic growth in other parts of the state. No one who experienced the dramatic collapse of the MBTA during the record-breaking winter of 2015 will ever forget it, and there continue to be frequent disruptions and challenges to commuter rail, subway, and bus service. As stated in a 2015 issue of *MassBenchmarks*¹ (a joint publication of the University of Massachusetts Donahue Institute and the Federal Reserve Bank of Boston):

"Transportation infrastructure is the connective tissue that makes the Massachusetts economy run. The Commonwealth is home to numerous world-leading industry clusters, including life sciences, healthcare, finance, higher education, tourism, and advanced manufacturing. These set the state apart from competing regions and provide Massachusetts with a dynamic economy that innovates, produces high-wage jobs, and generates new businesses. . . . While talent and the workforce distinguish the Massachusetts economy, transportation services and infrastructure provide the foundations—access to markets and to people—that the state's industries rely on to thrive. The state's roadways, transit, ports, and airports connect workers to employers, link businesses with suppliers and markets, and foster



NOW IS THE PERFECT TIME TO DO A DETAILED ASSESSMENT OF THE PROGRESS WE HAVE MADE AND THE CHALLENGES AHEAD.

the face-to-face business and non-business interactions that an economy based on innovation needs to succeed.”

We need to look no further than the growth of metropolitan Boston’s economy in recent years to understand future success of our economy is directly related to our transportation system’s ability to effectively serve our residents, workers, and businesses, especially in the face of increased vehicular congestion and capacity concerns on our mass transit system

The TFC focused its analysis on the largest drivers of transportation costs in the Commonwealth at the time, particularly:

- MassHighway, now the Highway Division of the consolidated Massachusetts Department of Transportation or MassDOT
- the Massachusetts Turnpike Authority and its two components, the Metropolitan Highway System (MHS) in the Boston region, and the Western Turnpike, both now incorporated into the Highway Division of MassDOT

- the Massachusetts Bay Transportation Authority (MBTA), now part of MassDOT’s Rail and Transit Division

This blue-ribbon commission issued stark warnings on the condition of the transportation system in Massachusetts. The TFC looked at a 20-year period of expected needs and challenges and, as we are now past the halfway mark of their recommendations, it is an appropriate time to review this report and bring renewed clarity to the challenges still ahead. What is the condition of the state’s transportation system today? How much progress has Massachusetts made over the past decade to reform and improve our transportation system? Finally, what are the financial challenges ahead, and do we have the financial resources necessary to support our public infrastructure adequately? These questions are the central focus of this year’s work.



CHAPTER 2

TEN YEARS AFTER THE TFC REPORT: HOW MUCH HAS BEEN ACCOMPLISHED?

“THIS IS A CALL TO ACTION. THESE RECOMMENDATIONS NEED TO BE DISCUSSED AND DEBATED. WE ENCOURAGE THE CITIZENRY EITHER TO ACCEPT THESE STEPS OR TO OFFER OTHER MEASURES EQUAL TO THE TASK. THOSE ELECTED AND APPOINTED TO MANAGE OUR TRANSPORTATION SYSTEM SHOULD ACCEPT THAT BOTH REFORM MEASURES AND NEW REVENUES ARE A NECESSITY AND EQUALLY IMPORTANT. BUT, MOST IMPORTANTLY, OUR PUBLIC OFFICIALS SHOULD REALIZE THAT FAILURE TO ACT IS NOT AN OPTION, AND THAT THE TIME TO ACT IS NOW.”³

As discussed in Chapter 1, the TFC forecast a \$15–19 billion funding gap⁴ over the 20 years from 2007 to 2026, with \$8–10 billion of that occurring in the first 10 years (2007–2017). This initial 10-year period is the subject of this chapter, which examines four distinct topics:

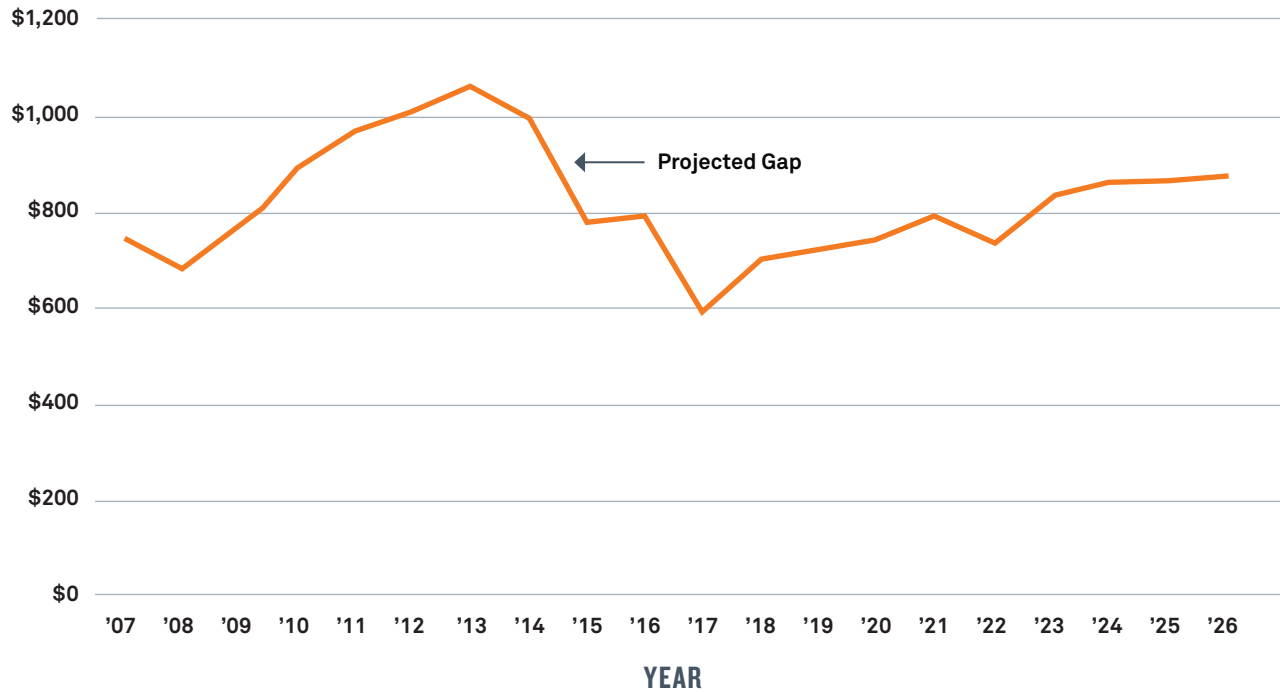
- **Funding Gap:** This represents the difference between available transportation funding vs. projected funding needed to reach a State of Good Repair (SGR). Through 2017, the TFC projected an \$8–10 billion funding gap would exist.
- **Spending Gap:** A subset of the funding gap is then delivering on the work: The spending gap evaluates how much the state needed to spend to achieve and maintain SGR status compared to how much the state actually spent in each transportation category.
- **Debt Financing:** A significant portion of the state’s efforts to increase transportation spending was done by borrowing more money.
- **Transportation Asset Conditions:** As a result of the actions taken, what was the impact on the condition of transportation infrastructure, and what areas are still in greatest need of attention?

TFC STATUS UPDATE

Over a 20-year timeframe (through 2026), the TFC projected that Massachusetts would face a cumulative \$15–19 billion funding gap and that, when the cumulative gap was broken out for each year, the state would face an immediate challenge (see Figure 2.1).

As viewed from 2007, Massachusetts faced a large hurdle: the urgent needs of DCR parkways and bridges, such as the Longfellow Bridge and Storrow Drive Tunnel, and the transportation projects required as part of a 2006 legal settlement signed by the Romney Administration. These State Implementation Plan for Air Quality—or “SIP Commitment”⁵—projects included the Green Line Extension and other MBTA transit improvements. These one-time projects and were not included in the existing transportation budgets, and thus, would result in a funding gap that would exceed \$1 billion annually. After the Green Line Extension was expected to be completed and DCR bridges rehabilitated, an annual funding gap would still remain and grow almost every year at a steady rate. On an annual basis, the TFC report projected that the annual funding gap—were existing transportation needs adequately met—would never fall below \$600 million in any given year through 2027.

FIGURE 2.1: Projected Gap by Year in TFC Report, 2007–2026



Source: Transportation Finance Commission Report, 2007

In response to the TFC report, the Commonwealth of Massachusetts took significant actions by adopting reforms, increasing capital infrastructure spending, creating new special-borrowing programs, and increasing some transportation revenue. **In total, over these 10 years, the state made progress in addressing the transportation funding gap, but never fully reached the levels recommended by the TFC report.** Table 2.1 shows the current estimated funding gap by major program category. The state appears to have reduced the gap to about \$5 billion from the \$8–10 billion gap forecast for the 10-year period of 2017–2027.

The most significant progress was made on funding gaps in the Statewide Road and Bridge Program, and in Municipal Transportation Aid (commonly known as “Chapter 90” aid). The least progress was made in the toll road funding gap (primarily the Metropolitan Highway System in the Boston metro area) and all of the MBTA funding categories. The Statewide Road and Bridge Program was the primary beneficiary of the one-time infusion of American Reinvestment and Recovery Act (ARRA) funding⁶ during and after the Great Recession of 2008–2009, and the special borrowing that financed the Accelerated Bridge Program (ABP).

To close the gap by 2027, the TFC report offered a balanced approach of policy reforms that would generate savings, and detailed specific



transportation revenue enhancements. The remainder of this section examines the progress made in implementing these recommendations. As shown, though many recommendations were implemented at least in part, they generated neither the savings nor revenues that the TFC forecast.

RECOMMENDED POLICY REFORMS TO GENERATE SAVINGS AND EFFICIENCIES

The TFC made 22 policy reform recommendations designed to close \$2.4 billion of the overall gap it forecast. A 10 year status check on these recommendations is shown in Table 2.1.⁷









TABLE 2.1: TFC Policy Recommendations

- Recommendation addressed in a meaningful way
- Recommendation only partially addressed
- Recommendation not addressed

SUMMARY	PERCENT
Reforms addressed in a meaningful way	59%
Reforms only partially addressed	31%
Reforms not addressed	9%

	TFC POLICY RECOMMENDATIONS	STATUS
1	Road and bridge investments should be selected and advanced based on rational and transparent criteria.	●
2	The Executive Office of Transportation and Public Works (EOTPW) should utilize alternative procurement methods and public private partnerships (P3)	●
3	The use of private flagmen should be allowed on road and bridge projects	●
4	Responsibility for the Department of Conservation and Recreation's (DCR) parkways and bridges should be transferred to MassHighway	●
5	Maintenance Responsibilities of I-395, I-84 and I-291 should be transferred to the Massachusetts Turnpike Authority	●
6	EOTPW should establish the position of Private Project Ombudsman	●
7	The Commonwealth should end the practice of using bonded funds for operating personnel and expenses	●
8	The Commonwealth should improve the predictability of highway funding and coordination of projects funded by multiple entities	●
9	The rate of growth of MBTA fringe benefits costs should be reduced	●
10	The unnecessary constraints on MBTA management should be removed	●
11	The MBTA needs to fully fund its state of good repair program. This goal can and should be achieved by the Commonwealth assuming the debt from Central Artery/Tunnel transit commitments	●
12	The Commonwealth should pay for all MBTA capital expansions, and before committing to a project, the MBTA should demonstrate that adequate revenues are in place to operate and maintain the expansions	●
13	Regional Transit Authorities (RTAs) should be forward-funded	●
14	The RTA's 2.5 % per year cap in operating cost growth should be eliminated	●

TABLE 2.1: TFC Policy Recommendations (continued)

15	RTAs should be allowed to borrow with the full faith and credit of the Commonwealth	
16	The Secretary of Transportation should exercise a stronger coordinating role with respect to RTAs	
17	The Secretary of Transportation should have the authority to coordinate all aspects of the Commonwealth's transportation network	
18	The CEO of each Massachusetts transportation agency should institute a rigorous performance evaluation process	
19	All Massachusetts transportation agencies should have the same \$100,000 tort liability limit as municipalities	
20	The vast majority of our funds for the foreseeable future should be devoted to maintenance and rehabilitation	
21	The Tobin Bridge should be transferred from Massport to the Metropolitan Highway System	
22	Transportation user fees must be dedicated to transportation uses	

Source: Transportation Finance Commission, 2007 Reviewed with Status Updates by Project Management team

A comparison of the TFC report and today's transportation bureaucracy shows Massachusetts has a proud record of reforms during the past 10 years. Our elected officials, transportation officials, and the TFC members deserve praise for these efforts, which have improved our transportation system.

Of the 22 TFC recommendations for reforms, we can say that 20 of these were fully or partially implemented. The two that were not addressed were not expected to generate huge savings. The TFC estimates also did not identify the amount of savings that would result from the Commonwealth assuming the debt from the Central Artery/Tunnel (CA/T) transit commitments or from allowing the Regional Transit Authorities (RTAs) to borrow with the full faith and credit of the Commonwealth.

Some financial savings—which we calculate exceed \$140 million—have already been seen by the Commonwealth, but a snapshot of the current financial savings would miss the larger point of these changes. Most transportation reforms, such as changes to the MBTA pension and retirement rules, will continue to generate increased savings over the next 10 years and beyond. For example, though the MBTA's “23

years and out” retirement policy was changed in 2009, it was applied only to new employees, meaning the savings will be realized gradually over future decades. Another example is the flagmen program, which permits flagmen, rather than uniformed police details, for certain types of construction projects along roadways. However, this cost-saving substitution is more the exception than the norm. These are just two examples of how reform ideas have been partially implemented, and have thus resulted in limited cost savings.

In addition to these 22 policy recommendations, additional noteworthy policy reforms dramatically changed the way Massachusetts manages its transportation systems. The Transportation Reform Act of 2009 eliminated the Massachusetts Turnpike Authority and created the unified MassDOT that exists today. This law also changed certain aspects of MBTA employee pension plans, and created an Office of Performance Management within MassDOT that is charged with applying data-driven approaches to analyzing system performance.

Reforms continued with 2015 legislation—motivated by the cataclysmic collapse of the MBTA's services during the severe winter of 2015—that restructured

oversight of the MBTA. The law created a new Fiscal and Management Control Board (FMCB) to oversee the MBTA, and gave the MBTA a three-year waiver of the state's so-called "Pacheco Law," which restricts how state agencies may go about privatizing services. This waiver expired in mid-2018 but not before the MBTA estimated savings of \$450 million over the next ten years, as a result of this exemption.

Overall, there is an impressive record of transportation reform initiated by the TFC findings. Legislative leaders and both the Patrick and Baker Administrations deserve praise for their attention to transportation reform during the last 10 years.

RECOMMENDED NEW REVENUE SOURCES FOR TRANSPORTATION

The TFC report made six recommendations geared to provide additional revenue and addressing the transportation financing shortfall. These items

(shown in Table 2.2) were forecast to raise \$18.7 billion in revenue over 20 years.




Of these recommendations, two were fully adopted, three were adopted in part, and one was not adopted. The two recommendations that were fully adopted were:

- the restoration of tolls on the Western Turnpike, which makes it possible for the Western Turnpike to operate on a "pay as you go" basis
- MBTA transit fare increases in fiscal years 2007, 2014, and 2017 (Fiscal Year 2017 is technically year 11 of the TFC forecast period)







Commentary on the three recommendations that were partially implemented follows here:

- The TFC report called for an 11.5 cent per gallon increase in the gas tax, indexed to inflation, starting in 2008. This exact amount was recommended because the gas tax had not been raised

TABLE 2.2: TFC Revenue Recommendations

-  Recommendation addressed in a meaningful way
-  Recommendation only partially addressed
-  Recommendation not addressed

SUMMARY	PERCENT
Revenue recommendation addressed in a meaningful way	33%
Revenue recommendation only partially addressed	50%
Revenue recommendation not addressed	17%

	TFC REVENUE RECOMMENDATIONS	STATUS
1	The gas tax should be increased by 11.5 cents and indexed to inflation	
2	The Massachusetts Turnpike should develop a balanced operating budget for the Western Turnpike that does not rely upon spending down its reserve fund	
3	Fares should remain a meaningful source of revenue for the MBTA, through regular and predictable increases to keep pace with inflation	
4	Toll increases on the Turnpike Extension and Harbor Tunnels must be carried out	
5	The Commonwealth should move to a system of direct road user fees as the principal source of transportation funding using modern technology	
6	The Commonwealth should investigate whether public private partnerships are appropriate for the development and/or funding of our transportation infrastructure	

Source: Transportation Finance Commission, 2007 Reviewed with Status Updates by Project Management team



since 1991 and 11.5 cents was the amount needed to adjust it for the inflation over those intervening years. Furthermore, indexing the rate would prevent this loss of purchasing power from occurring again in the future. The Commonwealth did not take any action on the gas tax until 2013, and then the legislature enacted only a 3 cent per gallon increase.⁸ Although the legislature included a provision for annual indexing of future gas tax increases by the rate of inflation, that portion of the 2013 law was repealed by the voters in a 2014 ballot referendum.⁹

- Tolls on the Metropolitan Highway System (MHS) in the Greater Boston area (harbor tunnels, Tobin Bridge, Massachusetts Turnpike from the Weston tolls east) were increased in 2008, as recommended by the TFC. However, a second toll increase scheduled for 2014 was not carried out. Starting in 2010, the Commonwealth has, in lieu of increasing toll rates, transferred \$100 million annually to pay debt service on transportation bonds.
- The Patrick Administration created a P3 (public-private partnership) Commission as part of the 2013 finance legislation. The commission recommended two projects for consideration as P3s—a third (tolled) bridge over the Cape Cod Canal, and a managed (toll) lane on Route 3 south. The Baker Administration declined to pursue either project, so no revenue was realized.

The one recommendation not implemented related to a Vehicle Miles Traveled (VMT) program for direct road user fees captured through modern technology:

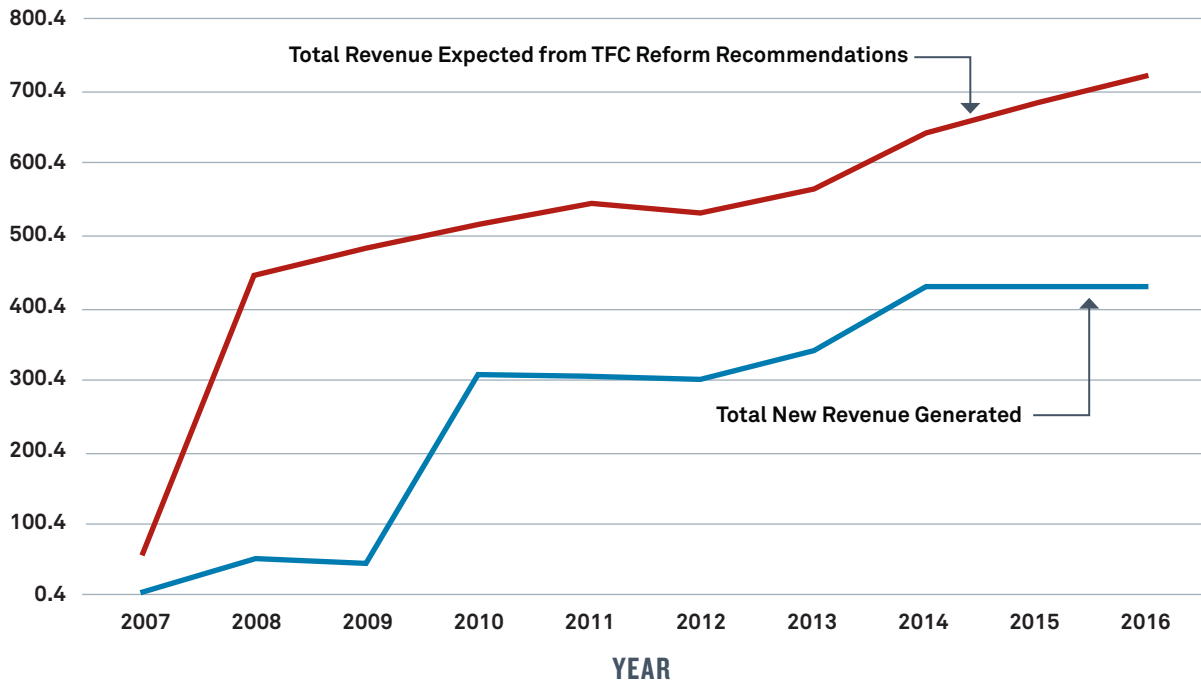
- The TFC report estimated that a VMT tax or user fee could generate \$5.5 billion between 2017 and 2026, but the state has not yet taken any steps to adopt a VMT or adjust the basic toll road structure. Toll collection continues to be limited only to the Massachusetts Turnpike, and the Boston Harbor bridges and tunnels. In 2016, the Baker Administration vetoed a study on a VMT pilot program.

The state did successfully implement an All Electronic Tolling (AET) system on all toll roads, thereby reducing congestion at toll plazas and creating the technological basis to structure the toll system more creatively, such as using time-of-day or congestion pricing. However, to date, the AET has been implemented in a revenue neutral way, which keeps in place the traditional tolling structure.

The TFC recommendations suggested that in the 10-year period of 2007–2016, Massachusetts should raise more than \$5 billion in new revenue to address the transportation funding shortfall.

We have calculated that the total amount raised through new revenue enhancements reached approximately 50 percent of this goal. (See Figure 2.3.) Unfortunately, some transportation revenue measures that were originally put in place by the Legislature have since been repealed; other revenue-raising measures not included in the TFC recommendations have been included in this analysis:

- The state sales tax was increased from 5 to 6.25 percent in 2009 to address the revenue shortfalls caused by the Great Recession. One cent of the tax was dedicated to the MBTA and \$160 million annually was used to pay down Massachusetts Turnpike debt. This was the first time the MBTA received a dedicated state revenue stream similar in concept to the gas tax for roadways.
- Since 2017, Massachusetts has imposed a small, 20 cent surcharge on rides through ride-sharing services, such as Uber and Lyft. (These companies are overseen by the Department of Public Utilities [DPU] Transportation Network Company Division.) This charge generated almost \$13 million in 2017.¹⁰

FIGURE 2.2: Projected vs. Actual Revenue from TFC Recommendations, 2007–2016

Source: Created by Project Management Team reviewing 2007 TFC report vs. MassDOT and MBTA revenue enhancements 2007–2016.

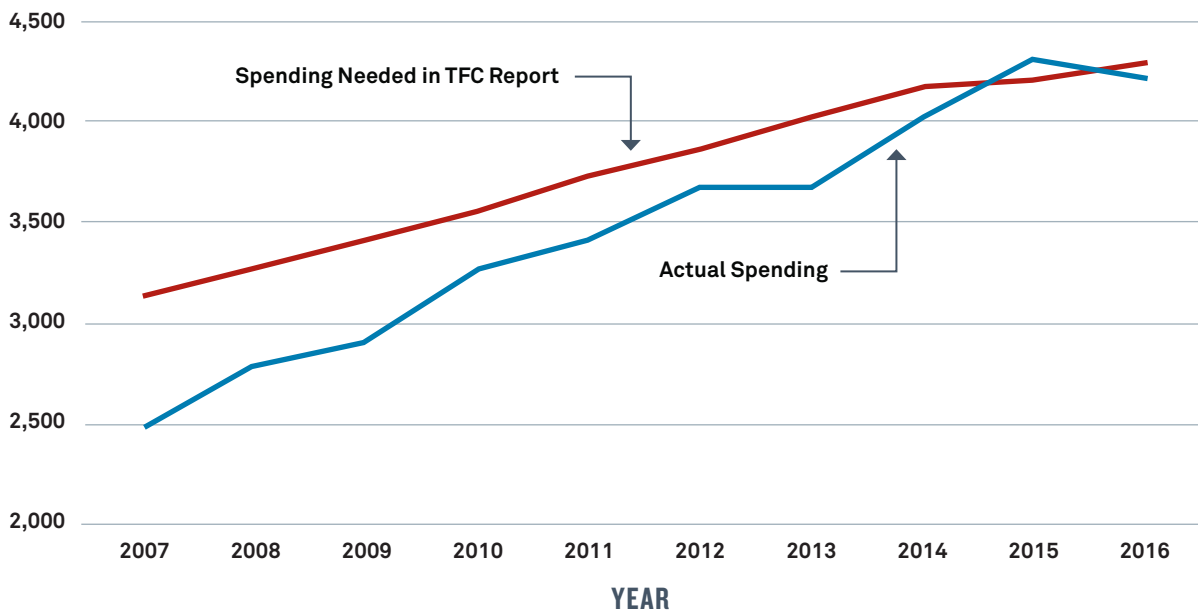
SPENDING GAP

Massachusetts did take significant steps to increase spending dramatically on transportation infrastructure during the past 10 years. Although the state may have fallen short of expectations on savings from reforms, and failed to raise the recommended transportation revenue, spending on transportation infrastructure did increase to the levels recommended by the TFC report. We are paying for this increased spending through the revenue-raising measures discussed above, as well as with one-time revenue infusions and significant increases in borrowing:

- Federal stimulus spending from the American Recovery and Reinvestment Act (ARRA), enacted in 2009 in response to the Great Recession, ended in 2013 and accounted for \$439 million in additional spending. In Massachusetts, a large portion of ARRA money was spent on “shovel-ready” roadway repaving projects.
- The Commonwealth’s Accelerated Bridge Program (ABP) was designed to fix or replace bridges rated as Structurally Deficient (SD). In 2008 there were more than 540 SD bridges in the state, and without additional funding, the

number of SD bridges was expected to reach 700 before 2016.^{11,12} The ABP initiative started in 2009 and is nearing completion, with total borrowing budget of \$3 billion. As a result of this program, the number of SD bridges decreased to 461 in 2014, but has slowly begun to increase over the past two years.¹³

The ABP program was enacted in part as a response to the collapse of the I-35W Mississippi River Bridge in Minneapolis in 2007. Similar measures were undertaken by many states at the time. The Commonwealth paid for this program through borrowing against future gas tax revenue and future federal highway aid. ABP is considered a one-time, special borrowing program that is treated as separate from the traditional, statewide, capital infrastructure “bond cap” budget of MassDOT. However, the debt service impact of this \$3 billion of borrowing is considered as part of the state’s overall annual debt-capacity analysis.¹⁴ Some examples of bridges repaired or replaced include 14 bridges over I-93 between I-95 north and downtown Boston (Fast 14 project), the Longfellow Bridge over the Charles River (connecting Boston and Cambridge), and the Whittier Bridge on I-95 in Newburyport. Many smaller, less-publicized bridges were also repaired or replaced by the ABP.

FIGURE 2.3: Total Transportation Spending Increased, 2007–2016

Source: Created by Project Management Team with data from the 2007 TFC report vs. MassDOT budget and CIP Data 2007–2016.

THE RATE OF SPENDING INCREASES VARIED CONSIDERABLY BETWEEN ROAD AND BRIDGE SPENDING, AND MBTA SPENDING.

The TFC predicted that Massachusetts needed to spend more—significantly more—on transportation infrastructure, particularly on deficient bridges. It recommended that Massachusetts spend \$37 billion on specific transportation categories between 2007 and 2016. The state actually spent \$34 billion in these areas, representing more than 90 percent of the total investment called for by the TFC over the 10-year period. Figure 2.4 compares actual transportation spending to the spending needs estimated in the report.

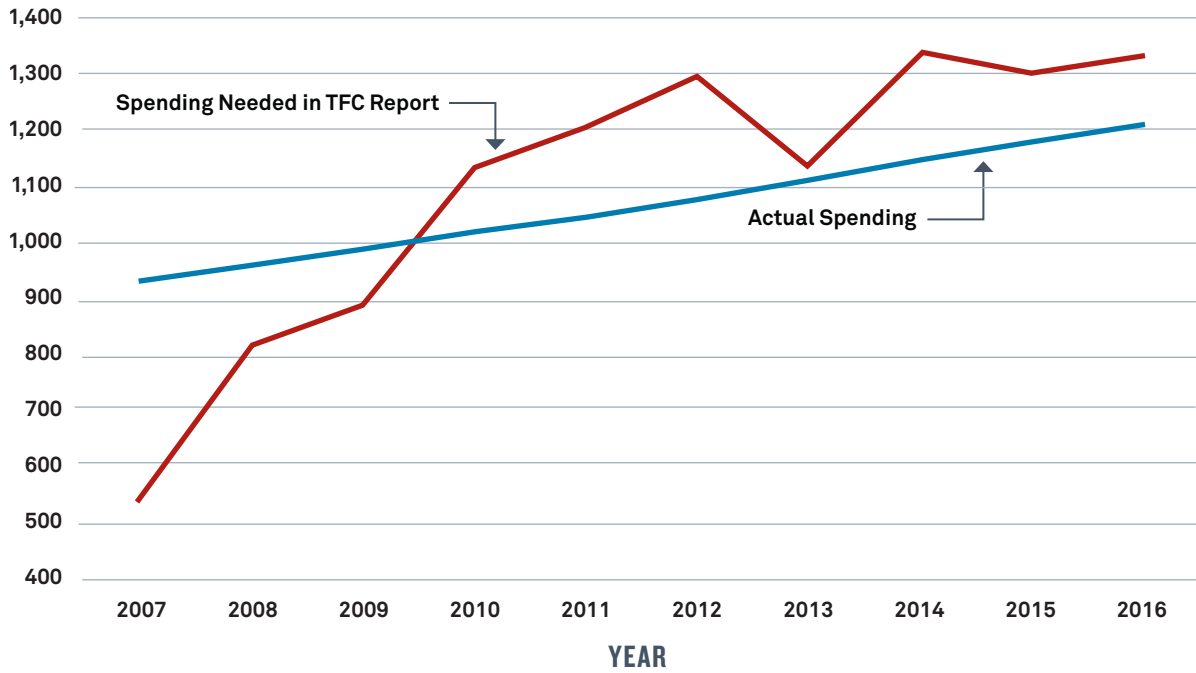
The rate of spending increases varied considerably between road and bridge spending, and MBTA spending. As shown in Figure 2.4, road and bridge spending has exceeded the TFC needs forecast since 2010, when ARRA and ABP spending kicked in.

One area of roadway spending that remains below the TFC target is spending on toll roads, as shown in Figure 2.5. This lower level of expenditure is stressing the ability of the state to maintain the Metropolitan Highway System (MHS) adequately, including the state’s massive investment in the Central Artery/Tunnel project, aka “The Big Dig.”

At the MBTA, the results of the past 10 years are less promising. Capital spending at the MBTA remained significantly below TFC projections for spending on needs until 2015, as shown in Figure 2.7. The TFC projected that the MBTA needed to spend \$570 million annually (plus 2 percent to account for inflation) on capital improvements to the existing system. Unfortunately, the MBTA did not reach that level of spending until FY14 (Fiscal Year 2014). In addition, the MBTA has not completed the State Implementation Plan for Air Quality (SIP) commitments promised in 2006. The Green Line Extension (GLX) to Somerville fell behind schedule, but is moving forward—as a result of reassessment of the project by the Baker Administration following over-budget cost estimates. Some of the Fairmount Line improvements have not yet been completed, such as the Blue Hill Avenue station, and MassDOT withdrew the state’s commitment to the Red Line–Blue Line Connector in 2013.¹⁵

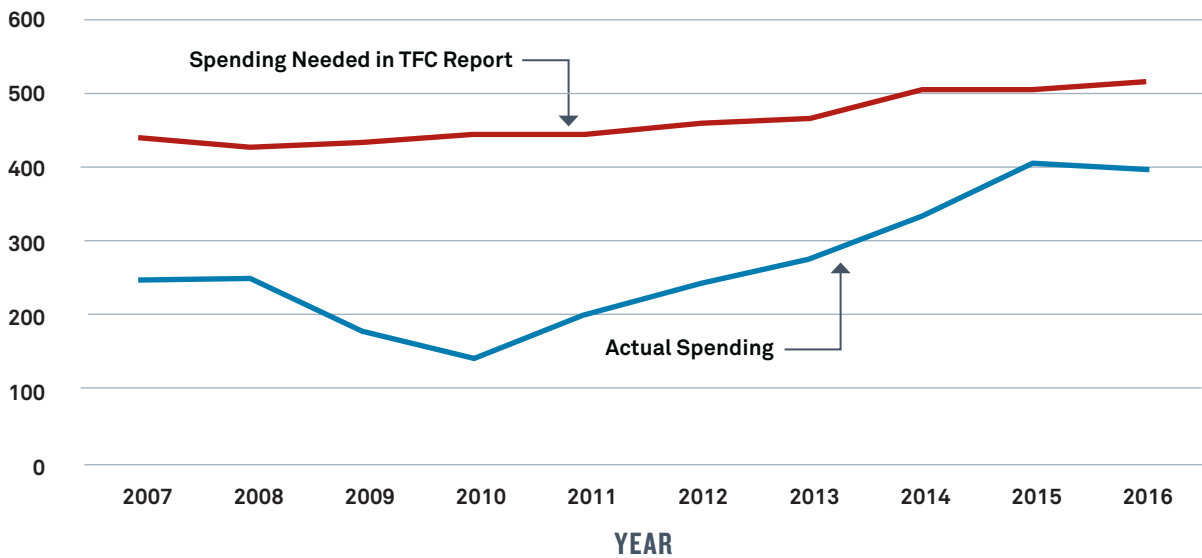
As stated above, the state used increased borrowing as one part of its strategy to close the funding gap. It is in this respect that the recommendations of the TFC were most clearly not achieved. The next section details the implications of this increased borrowing.

FIGURE 2.4: MassHighwayRoad and Bridge Spending, 2007–2016

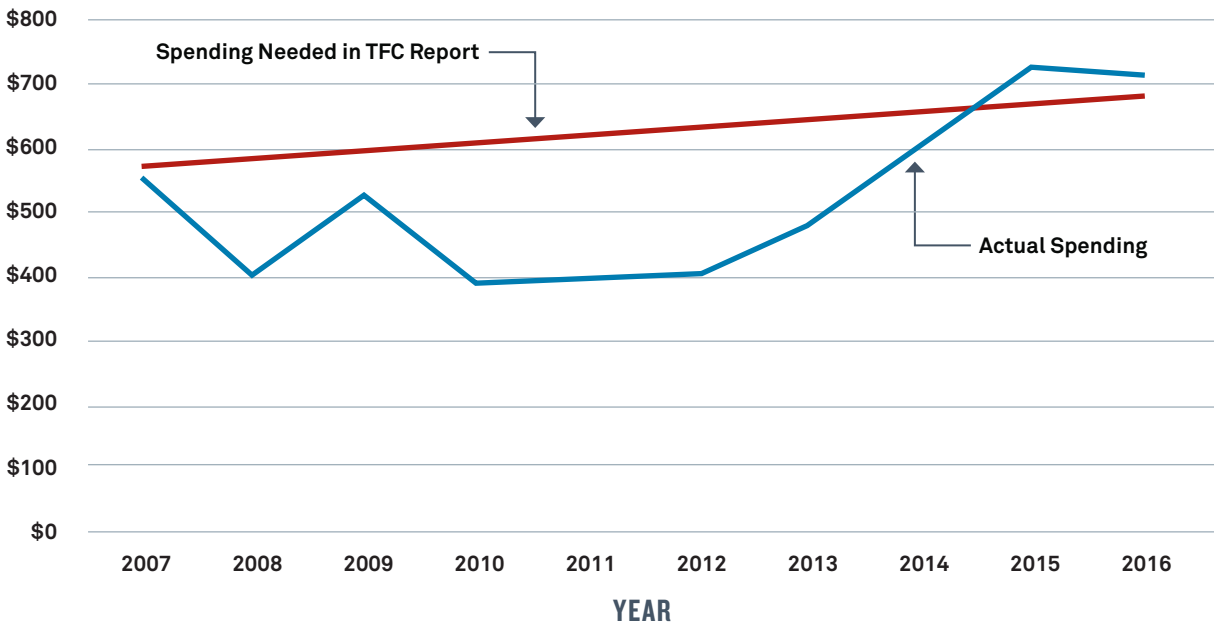


Source: Created by Project Management Team with data from the 2007 TFC report vs. MassDOT budget and CIP Data 2007–2016.

FIGURE 2.5: Toll Road Spending Significantly below TFC Needs Projections, 2007–2016



Source: Created by Project Management Team with data from the 2007 TFC report vs. MassDOT budget and CIP Data 2007–2016.

FIGURE 2.6: MBTA Capital Spending Has Only Recently Met TFC Projections, 2007–2016

Source: Created by Project Management Team with data from the 2007 TFC report vs. MassDOT budget and CIP Data 2007–2016.

DEBT FINANCING

“THERE ARE NO MAGIC SOLUTIONS TO FILL OUR TRANSPORTATION REVENUE GAP. ALL SOLUTIONS REQUIRE REVENUE FROM SOME SOURCE THAT ULTIMATELY COMES OUT OF THE POCKETS OF USERS OR THE GENERAL TAXPAYER. . . . DEBT PUTS OFF THE DAY OF RECKONING, BUT ALSO COMES OUT OF OUR POCKET, WITH ADDED INTEREST CHARGES. TRANSPORTATION SHOULD BE PAID FOR PRIMARILY BY USERS. UNLIKE OTHER PUBLIC GOODS SUCH AS POLICE AND FIRE PROTECTION, TRANSPORTATION IS A UTILITY, AND IT IS REASONABLE FOR USERS TO PAY FOR THE USE AND BENEFIT THEY DERIVE FROM THE SYSTEM.”¹⁶

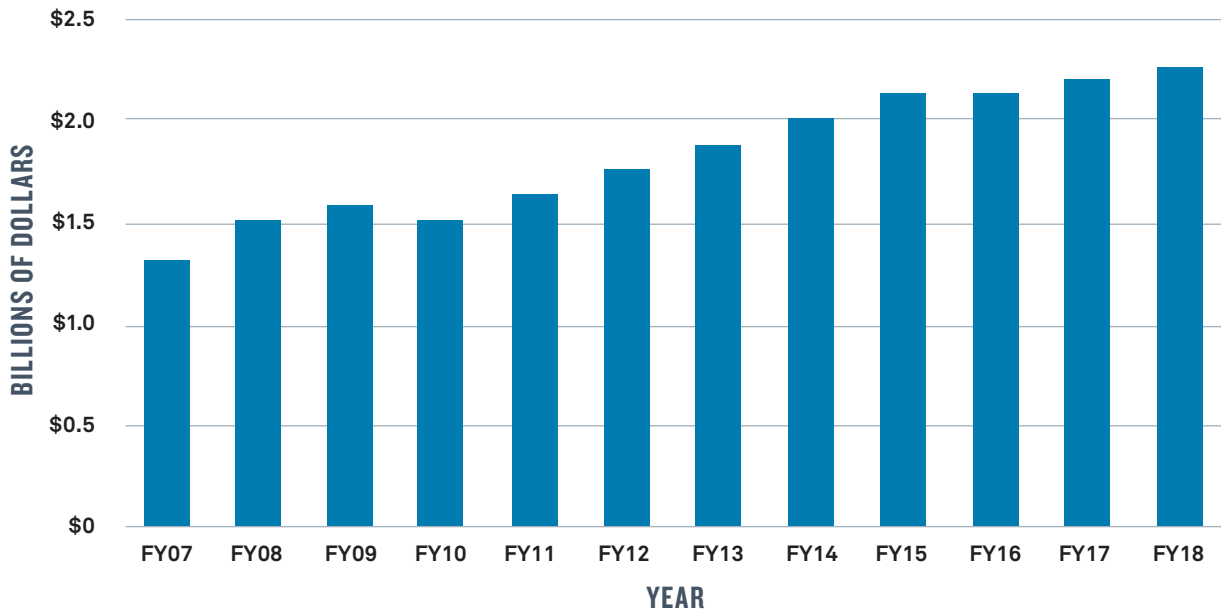
When we look at the result of all four strategic components implemented as a result of the TFC recommendations—increases in transportation spending, revenue, debt, and some savings from reforms—we find that Massachusetts actually closed about half of the \$10 billion projected shortfall in these last 10 years. The largest impacts are a result of increased spending and one-time infusions into new transportation programs.

Unfortunately, this increased new spending was largely debt financed and not backed by a long-term recurring transportation revenue plan to support this debt sufficiently. A debt-financed transportation strategy is problematic if it is unsupported by

additional revenue because it only defers the true cost of the spending into the future, and creates a larger transportation funding gap going forward.

Massachusetts state government is now facing a looming debt challenge, which is slowing the growth of the statewide capital infrastructure program. In the 10 years since the TFC report recommendations, the annual state borrowing supporting the capital infrastructure program (called the bond cap; see Figure 2.8) grew from \$1.3 billion to \$2.1 billion, an increase of 63 percent in that period. However, the growth in the bond cap has recently slowed to just over 5 percent during the last two fiscal years.¹⁷

FIGURE 2.7: Massachusetts Bond Cap Levels, 2007-2018



Sources: Mass.gov/capital

Total Commonwealth debt increased by \$6.6 billion during the 10 years since the TFC report (FY2007–2016), an increase of 36 percent. When we include the recent data for FY2017, total outstanding debt has increased by \$7.7 billion, or 41 percent. If debt had increased at the rate of inflation over this 10-year period, it would have increased by only \$3.4 billion, roughly half the amount of the actual increase. As a result, debt service payments in the annual state budget have increased by \$386 million in those 10 years (a 20 percent increase), and by \$511 million (a 26 percent increase) over the 11-year period. If debt service payments had increased by only the rate of inflation over the 10-year period, they would have risen by just \$84 million.¹⁸

In 2013, Massachusetts created another new borrowing program called “Rail Enhancement Bonds,” supported by the 3 cent per gallon gas tax increase and the future indexing of the gas tax. At the time, the Commonwealth estimated the Rail Enhancement Bonds program could become \$6.7 of additional borrowing through 2023¹⁹ to benefit “significant rail improvement projects outside of the MBTA regular capital program.”²⁰ The projects planned for these funds include the state’s share of the Green Line Extension, new vehicles and upgrades to the Red Line, Orange Line, South Coast Rail, and other major enhancements projects. Unfortunately, when the voters repealed the indexing plan for the gas tax, it also decreased the total amount available in

TABLE 2.3: Estimated Cost of Projects vs Available Rail Enhancement Bond Funds

PROJECT	ESTIMATED COST
State Share of the Green Line Extension	\$1.3 billion
Red Line/Orange Line New Vehicle Program	\$1.0 billion
Red Line/Orange Line Infrastructure Program	\$470 million
Red Line/ Orange Line Signals Upgrade	\$350 million
Red Line / Orange Line SGR projects	\$152 million
Estimated Cost of Rail Enhancement Bond projects	\$3.3 billion
Total available in the Rail Enhancement Bond program through 2023	\$2.1 Billion

Source: Total Available in program from MA General Obligation Bond Disclosure Jan 28, 2014. Estimated Cost from 2018 FMCB presentations

this program to approximately \$2.1 billion, forcing the state to make hard decisions with limited capital resources.

TABLE 2.4: Federal Transportation Funds Owed As Repayment For ABP FY19–FY26³⁶

ACCELERATED BRIDGE REPAYMENT SCHEDULE (GANS)	
Fiscal Year	Amounts
FY19	\$66,015,000
FY20	\$81,570,000
FY21	\$85,190,000
FY22	\$89,590,000
FY23	\$93,985,000
FY24	\$98,715,000
FY25	\$103,650,000
FY26	\$108,835,000
Total	\$727,550,000

Source: MassDOT Federal Aid Programming and Reimbursement Office

This level of borrowing is creating a challenge for the state’s credit rating. For the first time since the recession and resulting financial crisis of 1990, the Commonwealth experienced a credit downgrade by Standard and Poor’s. This downgrade will increase the cost of borrowing in the near future. At the same time, the Commonwealth has seen stronger bond ratings for borrowing that relies on gas tax revenue. The state borrowed against gas tax revenues to fund (partially) the Accelerated Bridge Program and Rail Enhancement Bonds, which are paying for the purchase of new MBTA Red Line and Orange Line vehicles. These one-time measures are unlikely to be replicated in the future without a further increase in the gas tax.

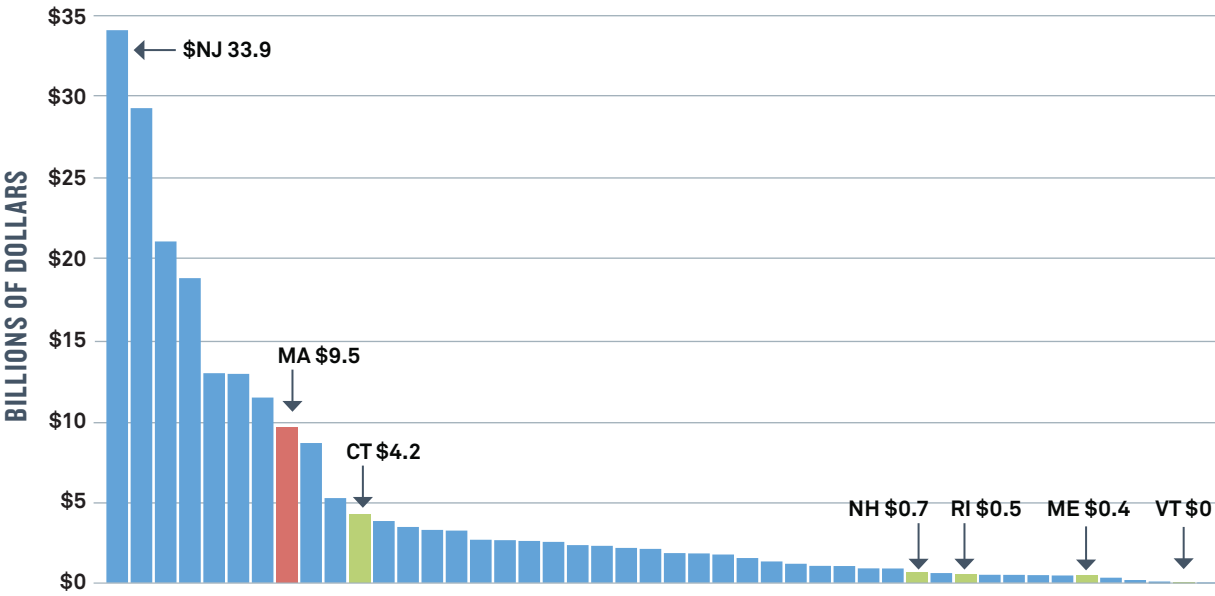
MASSACHUSETTS WILL LOSE OVER \$725 MILLION IN FEDERAL TRANSPORTATION FUNDS BETWEEN FY19–FY26, AS PART OF THE ACCELERATED BRIDGE PROGRAM FINANCE PLAN.



Figures 2.8 and 2.9 show the ranking of Massachusetts's highway and MBTA indebtedness relative to that of other states. The Commonwealth ranks eighth in highway indebtedness, and second in transit indebtedness. The borrowing costs of the ABP represent a significant component of the highway debt going forward. The MBTA's high level of transit indebtedness, however, is partly due to

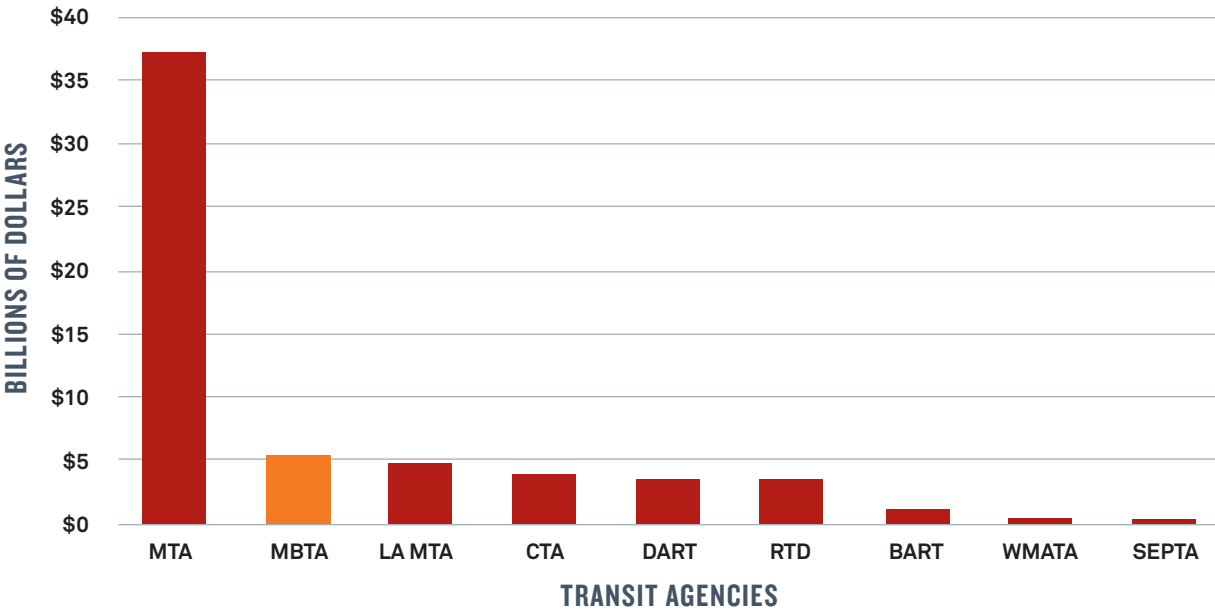
assignment to the MBTA of the costs of previous SIP transit improvement commitments made as part of the Big Dig approval process. The MBTA's indebtedness ranks second only to that of the massive New York Metropolitan Transit Authority, and higher than those of much larger systems, such as the Chicago Transit Authority.

FIGURE 2.8: State Highway Bond Debt, Obligations Outstanding as of 2015²²



Sources: MA data are for 2011, RI data are for 2013, and all others are for 2015; Federal Highway Administration, Highway Statistics Series, SB-2

FIGURE 2.9: Long-Term Transit Agency Debt, 2015²³



Sources: Federal Transit Agency, National Transit Database, 2015 Annual Database Statement of Finances

TRANSPORTATION ASSET CONDITIONS

“ASSET MANAGEMENT SYSTEMS ARE A COST-EFFECTIVE WAY TO SPEND LIMITED RESOURCES. COMMONWEALTH ROAD AND BRIDGE AGENCIES NEED TO INCREASE THE USE AND SOPHISTICATION OF THESE SYSTEMS.”²⁴

How has the transportation system benefited from this infusion of new state spending and borrowing? When the TFC recommendations were developed, the national transportation industry was beginning to move into an era of more rigorous, performance-metric-based evaluation. This transformation was driven by requirements in successive federal transportation funding laws over several decades. This means that the more-informative data available today to assess the performance of the transportation system were largely unavailable when the TFC work was done. Thus, an apples-to-apples comparison of conditions today versus those of 10 years ago is not possible. Therefore, we need to focus on conditions today in response to the decade-long surge in spending and borrowing.

ROAD CONDITIONS

The two principal metrics used to assess the condition of the roadway system are measures of pavement and of bridge condition. Pavement condition is assessed for Interstate (including toll roads) and non-Interstate roadways. Of the state's Interstate roadway pavement, 87 percent is rated good/excellent, as compared with a Federal Highway Administration (FHWA) standard of 90 percent in good/excellent condition. On the other hand, 51 percent of non-Interstate roadways are in good/excellent condition versus a federal target of 62 percent. The relatively good condition of the state's roadways reflects the surge in pavement spending that accompanied the federal ARRA money in 2009–2013. Undoubtedly, over the course of a decade or so, pavement begins to deteriorate again and a new round of investment will be needed in coming years.

BRIDGE CONDITIONS

FHWA measures bridge condition by the percent of bridge deck that is Structurally Deficient (SD), a designation that defines a variety of bridge conditions, but generally means that significant rehabilitation (or replacement) is required. The bridge may have to operate under weight load or lane restrictions to

remain safe, but a Structurally Deficient rating does not necessarily mean that a bridge is unsafe at the time. Any bridge deemed unsafe must be shut down, as we saw a few years ago when the state immediately closed the Long Island Bridge following a safety determination.

Today, 12.7 percent of the state's bridge deck is rated as SD, compared to a FHWA standard of 10 percent maximum SD. This is a somewhat disappointing finding, given the state's massive bridge investment through the ABP during the 10-year lookback period. However, during this period, FHWA changed the rating system from percent of bridges rated SD to the percent of bridge deck rated SD. Thus, a large bridge rated SD is weighted more heavily than many such smaller bridges. MassDOT has a four-year goal of keeping the SD backlog at 13 percent, as reflected in the most-recent Capital Investment Plan (CIP), **but there is not enough funding in the CIP to reach the FHWA standard that there be no more than 10% of bridge deck area considered SD.**

MBTA CONDITIONS

The condition of the MBTA system is more troublesome. The MBTA rates system performance using a State of Good Repair (SGR) 1 to 5 rating system, with 5 being the best and 1 the worst. The MBTA minimum standard is an SGR rating of 2.5. The current overall system rating is 3.02, slightly above the minimum threshold. However, some key elements of the system are close to or below minimum standards, including the following:

- revenue vehicles (buses, subway cars, commuter rail vehicles): 2.85
- track and right of way: 2.57
- parking: 2.36
- technology: 2.13

Clearly, the performance of revenue vehicles, and track and signal systems in recent years has been troublesome, and few riders would likely rate their



51% OF NON-INTERSTATE ROADWAYS ARE IN GOOD/EXCELLENT CONDITION VERSUS A FEDERAL TARGET OF 62%.

performance as adequate. This is why the MBTA is now making a massive investment in new vehicles (buses, Red Line and Orange Line cars, and commuter rail locomotives), and track and signal systems.

In conclusion, the report of MassDOT's Performance and Asset Management Advisory Council (PAMAC) estimated the current State of Good Repair (SGR) backlog as follows:

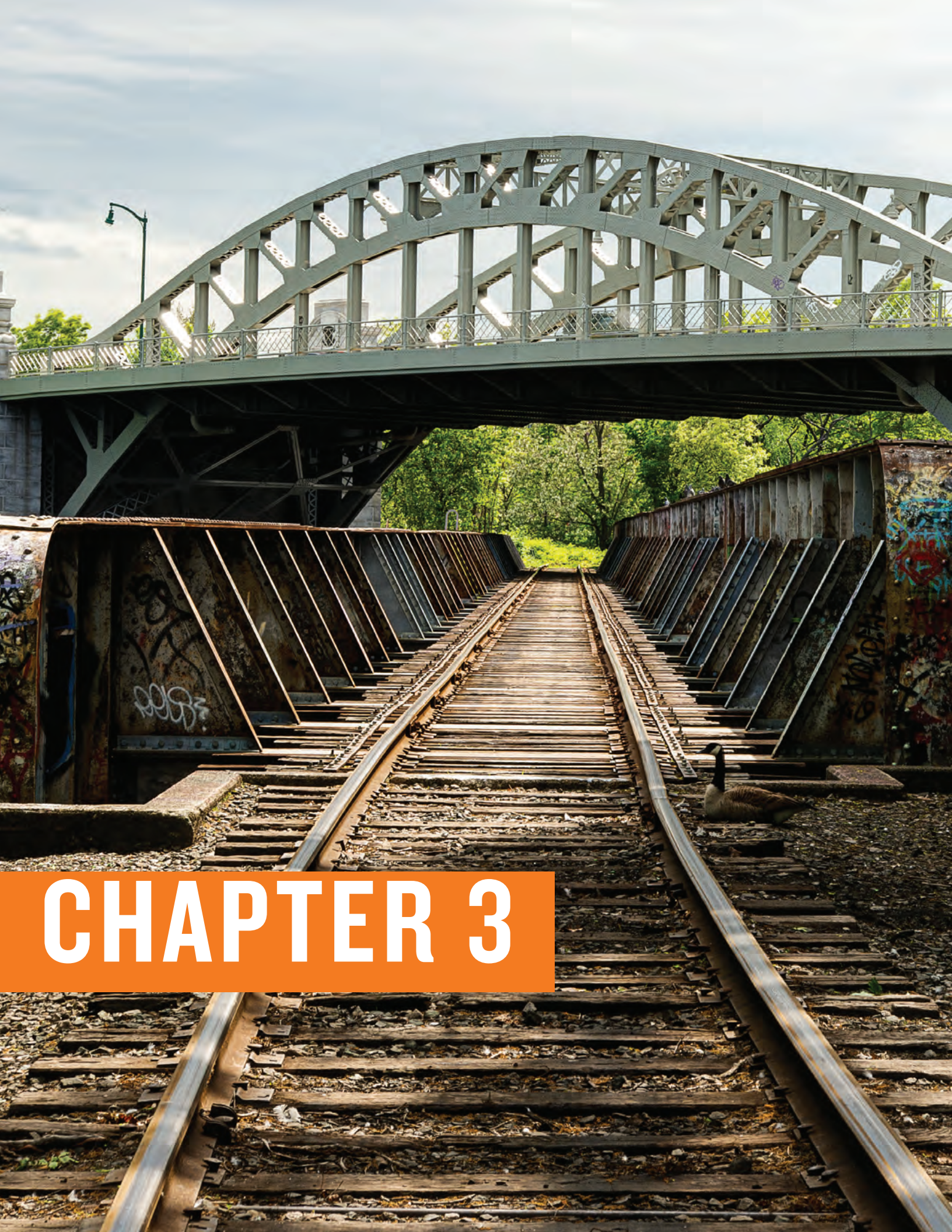
- Highways: \$5.6 billion (B)
 - state pavement: \$1.5B
 - state bridges: \$3.5B
 - municipal (Chapter 90): \$0.6B
- MBTA: \$7.3B, of which the largest elements are:
 - revenue vehicles: \$3.3B
 - track and rights of way: \$1.2B
 - signals: \$1.0B

The MBTA's current large-scale procurements of revenue vehicles and planned track and signal improvements are not reflected yet in these backlog numbers because most of these improvements have not yet come on line, and in many instances, will not be achieved for several years.

In summary, PAMAC estimates a total SGR backlog of \$12.9 billion, yet the 10-year look back analysis found that the state had cut its funding gap in half from a high estimate of \$10 billion to an estimated \$5 billion, and had a relatively smaller spending gap of \$3 billion. Why then is the SGR gap increasing? There are a number of potential reasons:

- backlog and funding gap are not exactly the same measures
- MassDOT is now using much more sophisticated performance measurement tools to estimate SGR and backlog than was the case in 2007
- one-time spending infusions, such as ARRA and ABP, have ended and the borrowing costs of ABP will be coming due in future years
- gas tax indexing, a key TFC recommendation and funding assumption of the state in the Patrick Administration's 2013 financing plan, was repealed by the voters
- the planned 2014 highway toll increase never happened

Chapter 3 focuses, with those factors considered, on forecasting the expected funding gap (if any) for the next 10 years.



CHAPTER 3

LOOKING AHEAD: A TEN-YEAR FORECAST

“IT HAS LONG BEEN ACCEPTED THAT THERE IS NO SUCH THING AS A FREE LUNCH; IT IS TIME FOR PEOPLE TO ACKNOWLEDGE THAT THERE IS NO SUCH THING AS A FREEWAY EITHER. . . . A HEALTHY, VIBRANT TRANSPORTATION SYSTEM DOES NOT MIRACULOUSLY COME FOR FREE. IT MUST BE PAID [FOR] AND ITS COSTS SHOULD NOT BE DEFERRED.”²⁵

A main purpose of this report is to update the original TFC funding gap forecast for the remaining second decade of the original forecast period.²⁶ Similar to the TFC report, this current study focuses on the two main drivers of transportation spending—the MassDOT Highway Division and the MBTA. However this report does not conduct any analysis of the needs in municipally-owned roads and bridges.

For MassHighway roads and bridges, this task was accomplished by analyzing various Asset Management reports through the Performance and Asset Management Advisory Council, and presentations from the MassDOT Capital Programs Committee. These documents forecast the current and future conditions of bridges and pavement during different funding scenarios, and provide the expected result spending that is budgeted in the five years CIP, but also for funding expectations beyond 2023.

There is also a recent evaluation of the Metropolitan Highway System (MHS) to show the current conditions and future needs of these roads, bridges and tunnels located in the metropolitan Boston region. The 2018 Triennial Inspection report includes specific spending recommendations over the next ten years that is necessary to address repair and maintenance needs of MHS assets.

For the MBTA, we utilized the MBTA’s Statement of Revenues and Expenses (SORE), Comprehensive Annual Financial Reports (CAFR), Strategic Plan goals, the current Capital Investment Plan (CIP)²⁷ and the long-term financial planning documents that detail debt service and capital funding projections. Forecast data used were based on published MassDOT sources when available and other forecast assumptions are detailed in Table 3.2 below.

The methodology used to define the funding gap is the same approach used by the TFC. Calculated as the difference between the projected available funding minus the projected spending needed to reach a State of Good Repair.

As shown at the bottom of Table 3.1 the total funding gap forecast for the MassDOT Highway Division is \$6.5 billion over the next ten years, and is \$1.9 billion at the MBTA. This totals a statewide funding gap of \$8.4 billion over the next decade. This is the amount needed beyond the funding included in current budget plans. **It does not include estimates to support any major expansion project that is not already funded in the five-year CIP.**

The \$8.4 billion funding gap over the next ten years is inline with the TFC report prediction of a \$15–19 billion gap over 20 years. In fact, the \$8.4 billion funding gap described in this chapter is another validation of the 2007 TFC predictions and assessment. This magnitude of this shortfall is expected considering that Massachusetts has yet to properly address the revenue needs required to close the transportation funding gap and deliver on ongoing infrastructure maintenance needs.

The MassDOT Performance Asset Management reports provide warnings that the successes achieved over the past ten years are at risk of being reversed. Strategies adopted over the past ten years worked to reduce the transportation funding gap, but as we explained in Chapter 2, TFC recommendations were not fully adopted. Instead we made progress through: a combination of the following:

- partial measures, including a 3 cent increase in the gas tax rather than the 11 cents recommended by the TFC, and the exacerbated by repeal of gas tax indexing
- actions partially foregone, such as planned highway toll increases that didn’t happen (although tolls were restored on the Western Turnpike)
- one-time revenue infusions, such as the federal money received from ARRA and the GLX project
- increased borrowing as exemplified by the state’s Accelerated Bridge Program (ABP)

Today and for the next decade, MassHighway needs a new action plan to address their unmet needs. For MassHighway, the ten year funding gap is comprised of five areas of analysis, with only one component showing no actual funding gap (see Table 3.1)

TABLE 3.1: Ten Year Funding Gap for MassHighway & MBTA

MASSHIGHWAY	2019-2028
Operations, Maintenance & Debt Service	2.0 billion
Interstate pavement	0.0
Non-Interstate pavement	1.2 billion
State-owned bridges	2.9 billion
Tunnels	0.4 billion
Subtotal — MassHighway	6.5 billion

MBTA	
Operations and Capital Investment	1.9 billion
Total Funding Gap	8.4 billion

An analysis of MassHighway financial statements show a deficit is projected for the near future. Expenses, such as spending on employee payroll, fringe benefits, construction and maintenance costs, as well as debt service payments are expected to be higher than the projected revenue. MassHighway revenue comes from tolls; miscellaneous other sources, such as advertising, rest area concessions, real estate, etc.; investment income; and various forms of state contract assistance (in part relating to the operation of the MHS in the Greater Boston area) and transfers from the Commonwealth Transportation Fund (CTF). Revenue from the gas tax underlies the CTF funding. An estimated \$2 billion is needed over the next ten years to bring MassHighway’s finances to be balanced.

In terms of MassHighway’s current infrastructure assets, the reports from the Performance and Asset Management Advisory Council (PAMAC) show that additional funding is needed for non-interstate pavement and state-owned bridges. On a positive note, these same reports will show that pavement for the interstate highway system is in top condition (over 93% rated as “Good or Excellent”) and should remain at this status with the funding levels from the CIP.

NON-INTERSTATE PAVEMENT

For non-interstate pavement, there is a need for additional statewide funding.

The most recent MassDOT asset management report states **“Non-interstate pavement condition remains a long-term challenge for the Highway Division. Performance models predict a downward condition trend at the level investment proposed by the 2019-2023 CIP.”**²⁸

Using PAMAC scenario projections that show conditions of non-interstate roads at different funding levels, to reach the SGR goals of over 60% of the pavement to be “Good or Excellent” condition, Massachusetts needs to be spending \$225 Million annually on non-interstate pavement, which is more than \$100 million more than is currently planned each year.

STRUCTURALLY DEFICIENT BRIDGES

The condition of bridges throughout the entire Commonwealth is still a critical concern. A *Boston Globe* headline raised concerns about sustaining the financial support and attention to statewide



bridge needs when the Accelerated Bridge Program ends. “A sweeping \$3 billion program that has significantly helped reduce the state’s number of structurally deficient bridges is slated to end next year, with no funding to replace it.”²⁹

A PAMAC report provides the answer and predicts that the condition of bridges in Massachusetts is expected to decline by 2027. **“Preliminary 10-year forecasts of asset conditions, assuming the current level of investment, indicate that the Commonwealth will experience a return to growth in the statewide number of structurally deficient bridges.”**³⁰

MassHighway does not have the funding available to meet the federal maximum standards regarding structurally deficient bridge area. (See Figure 3.1 from the MassDOT Capital Planning documents from April 2018.) This shows Massachusetts will not reach federal targets on bridge conditions and the amount of “poor” quality bridge deck is expected to increase through 2027.

Based on this information, and a comparison to previous Performance Asset Management reports showed different scenarios of funding, the Commonwealth will need to increase spending on bridge maintenance by almost \$3 Billion over the next 10 years above the current budgeted plans.

The Boston Globe

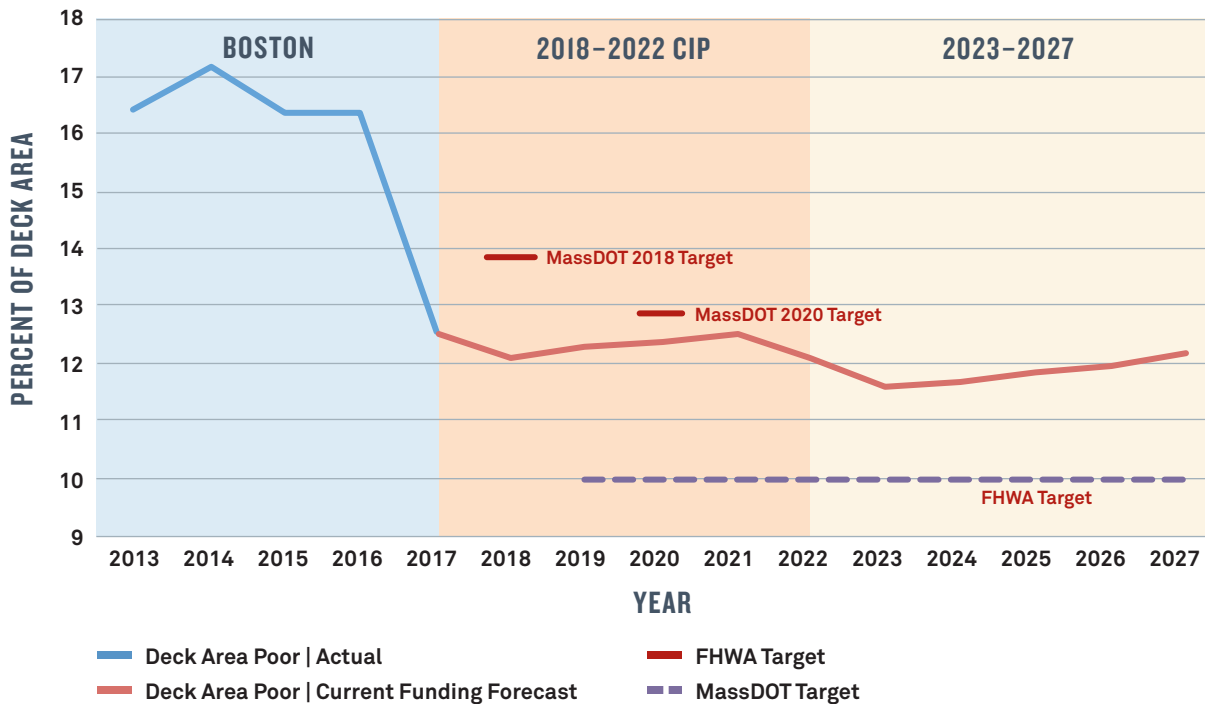
End of financing threatens progress on Mass. bridge repairs



DAVID L. RYAN/GLOBE STAFF

The Longfellow Bridge is being repaired.

FIGURE 3.1: Performance Forecast — Highway Division Percentage of Structurally Deficient Bridges



Source: Massachusetts Department of Transportation



TUNNELS

The vital transportation infrastructure in metropolitan Boston is officially classified as the Metropolitan Highway System. This includes signature assets such as the Central Artery tunnel, three Boston Harbor tunnels (Sumner, Callahan, and the Ted Williams Tunnel), the Zakim Bridge, Turnpike roads from Boston to Weston, as well as other important connections through areas of South Boston and Charlestown, respectively.

These structures are owned by MassDOT and serve hundreds of thousands of travelers each day. Information on the State of Good Repair needs for the MHS pavement and bridges are already included in the previous categories on statewide conditions. However, the SGR needs for tunnel infrastructure require their own grouping for this report.

There are seven MassDOT tunnels, all located in the MHS area, which include the overhead elements such as ceiling panels, lighting, and ventilation equipment.³¹ The 2018 Triennial Inspection Report revealed that every one of these tunnels showed some structural deficiencies and many ceiling panels and roadway lights are currently in poor condition.³² The inspection report recommended advancing specific tunnel repair projects and then provided estimates on the annual expenditure levels needed to reach a SGR. If compared to the amounts dedicated in the MassDOT CIP, it shows there is an estimated need for an additional \$392 Million over the next 10 years for tunnel repairs that is not budgeted at MassDOT.³³

The Inspection report also raises reasonable concerns about the logistics of conducting major rehabilitation efforts to the Sumner, Callahan, and the tunnel infrastructure under the Prudential Center, all to be done in the next ten years. Closing any of these tunnels for repairs will have a major impact on the region's traffic patterns and will need to be carefully sequenced and coordinated. Finally, the recommended repairs to the Sumner Tunnel are not funded by the current MassDOT capital plans.

MBTA

The Baker Administration's commitment of \$8 billion in capital spending is a reason for optimism. If spent as budgeted, this would be a dramatic improvement from historical capital spending levels at the authority. This increase is partially driven by major investments reaching their peak spending years, such as the Green Line Extension (GLX) and the purchase of new vehicles for the Red and Orange Lines.

It is noteworthy how this MBTA plan is funded. Only 27% of this \$8 billion is supported by new MBTA debt. Most of the spending over the next five years is funded through the federal government, one-time borrowing programs financed by state transportation dollars, and annual transfers of aid from the state budget. Utilizing other sources of funds allows the MBTA to address key projects without significantly increasing their long-term debt burden.

The question is how long can the MBTA rely on other sources of funding to meet their SGR spending goals for the next 15 years.

Warning signs are evident from the financial statements submitted to the Federal Transit Administration (FTA) in 2017. As a requirement of the federal aid associated with the GLX project, the MBTA presented a long-term forecast on the sources of funding for capital infrastructure spending. Figure 3.2 compares the information provided to the FTA and the Strategic Plan spending goals.

There is certainly some time to address the MBTA budget in years six through 15 of the Strategic Plan schedule, but the FTA report shows the scale of the challenge facing the MBTA. There are essentially three options for funding SGR spending goals in a given year: additional federal aid, additional state support, or reliance on the MBTA's own revenue and borrowing.

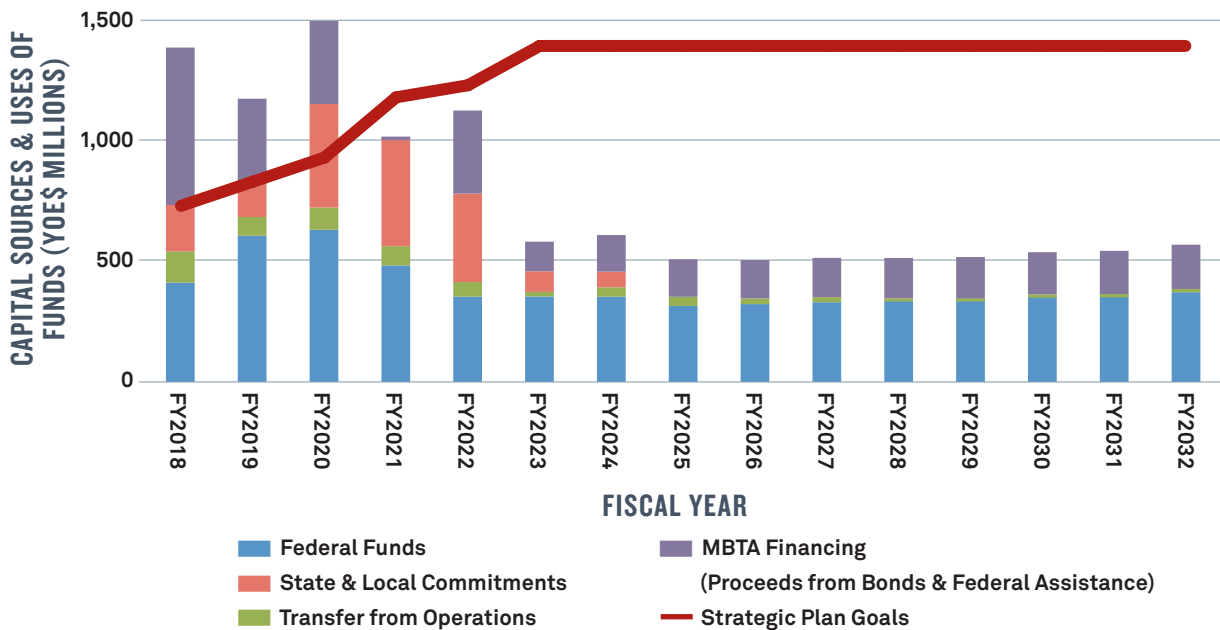
The favorable conditions for the MBTA's FY19-23 capital plan appear to be unique and temporary. GLX is funded through federal funding and the Rail Enhancement Bonds program, which is a special borrowing program supported by Massachusetts' gas tax and RMV revenue. The purchase of new vehicles for the Red and Orange Lines is also largely supported by the Rail Enhancement Bond program. While the MBTA does contribute to these key projects, it is only a small portion of the project costs.

After 2023, when these three important projects are completed and the one-time sources of funding are spent, the MBTA will still face ten more years of increased capital spending to address their \$7+ billion SGR backlog. After 2023, if the MBTA is forced to increase their own borrowing to fund SGR spending goals, the impact of higher debt service costs will increasingly squeeze the MBTA operating budget.

The most likely option for addressing the MBTA SGR backlog is through increasing MBTA debt, which they have the capacity to do. In Chapter 2 we detailed the challenges facing the State's capital budget given the repayment of \$725 million for the ABP debt, the recent slowed growth in the Bond Cap, and the reduction in the amount available for the Rail Enhancement Bond Program. It is unlikely that the state and federal government will fund almost 75% the MBTA capital plan for the next 10 to 15 years. The MBTA will need to increase their share of the SGR costs.

Our modeling assumes increased MBTA debt necessary to reach Strategic Plan goals each year and calculates the impact on the authority's operating budget. Using different scenarios for revenue projects, as described in Appendix 2,

FIGURE 3.2: MBTA Capital Sources of Funds Forecast vs. SGR Spending Targets (millions of dollars)



Source: Graph created with data from the MBTA's GLX Application to Federal Transit Authority (June 2017) For Capital Sources of Funds & data from the MBTA Strategic Plan (April 2017) on SGR Spending Goals.

TABLE 3.2: MBTA Model Input*

REVENUES & EXPENSES	BASE CASE ASSUMPTIONS
MBTA Fares	Proposed 6.3% over 3 years with continued similar increases triennial increases.
MBTA Ridership	Initial fare increase demand elasticity of -1.3% with +0.4% annual increase based on 2006–2016 CAGR in intervening years.
Sales Tax Growth	1.6% annual increase based on 2006–2016 CAGR
Operating Expenses	3.0% annual increase based recent averages (2015–2020(P)) plus assumed pension liability pressure

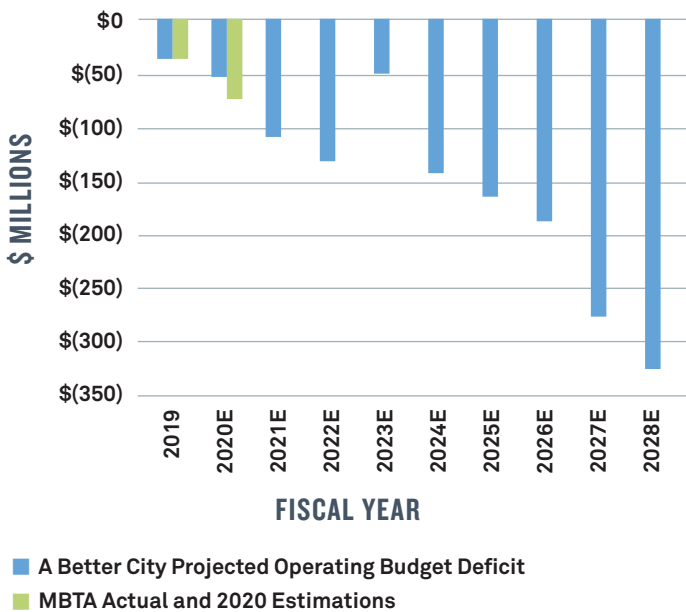
CAPITAL INVESTMENT SOURCES	
Federal FTA Contributions	Historical Average excluding GLX increase
State Bond Cap	Historical Average
MBTA Revenue Bonds	Historical Average

CAPITAL SPENDING PROJECTIONS	
State of Good Repair	MBTA Strategic Plan Estimates of \$1.4 billion/year through 2032.
Expansion	CIP Update 2019–23 Expansion Plans, 2024–2028 annual CPI Construction increase on 2023 level.

GENERAL MACRO INDICATORS	
CPI—Construction	5% p.a.
Cost of Capital	4% p.a.

* See Appendix 2 for further details on assumptions.

FIGURE 3.3: Projected MBTA Operating Budget Deficits

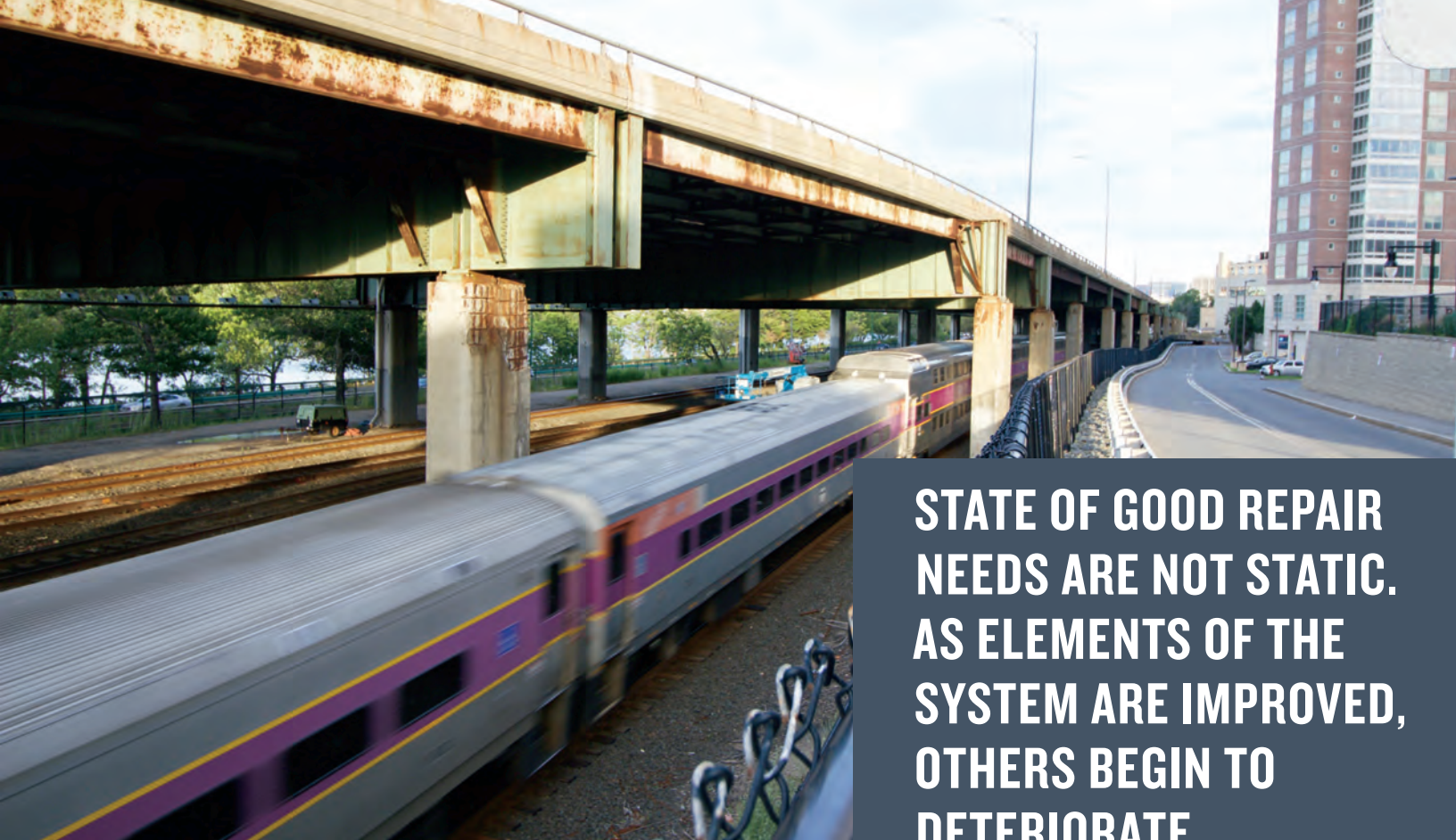


this model predicts the MBTA will face growing operating budget deficits over the next ten years reaching \$142 million in 2024 and more than \$300 million in 2028, even when assuming regular fare increases and favorable borrowing conditions.

The MBTA model we used for this study calculates the operating and capital surplus/deficit together by inputting projected capital investment bonding requirements through debt service on the operating side of the budget. In this methodology, both operating and capital needs are combined in the final funding gap number. This totals a \$1.9 billion funding gap for the MBTA over the next ten years.

Table 3.2 highlights the base case assumptions used in the MBTA model in which we estimate a \$1.9 billion funding gap on top of current spending projections. We also ran a “pessimistic” and “optimistic” scenario analysis with assumptions outlined in Appendix 2. This scenario analysis yields a MBTA funding gap range of \$500 million to \$3.9 billion, with the majority of the upper range dependent upon pension liability assumptions and increased operating expense growth and scheduled fare increases. The higher skew of this range also indicates the relatively conservative estimates we used for our base case projections.

Source: Created by project management team using projected MBTA Revenue vs Expenses. See Appendix 2 for further details on assumptions.



STATE OF GOOD REPAIR NEEDS ARE NOT STATIC. AS ELEMENTS OF THE SYSTEM ARE IMPROVED, OTHERS BEGIN TO DETERIORATE.

TABLE 3.3: Major MBTA Expansion Plans

MBTA EXPANSION PROJECTS	EXPENDITURE
Green Line Extension	\$1.2 billion (\$662 million spent previously)
Silver Line to Chelsea/ Gateway Phase 2	\$81 million
Blue Hill Ave. Station	\$15.3 million (\$11.2 million spent previously)
South Coast Rail (design only)	\$177 million (\$81 million spent previously)
Wachusett Extension	\$6.2 million (\$18.3 million spent previously)

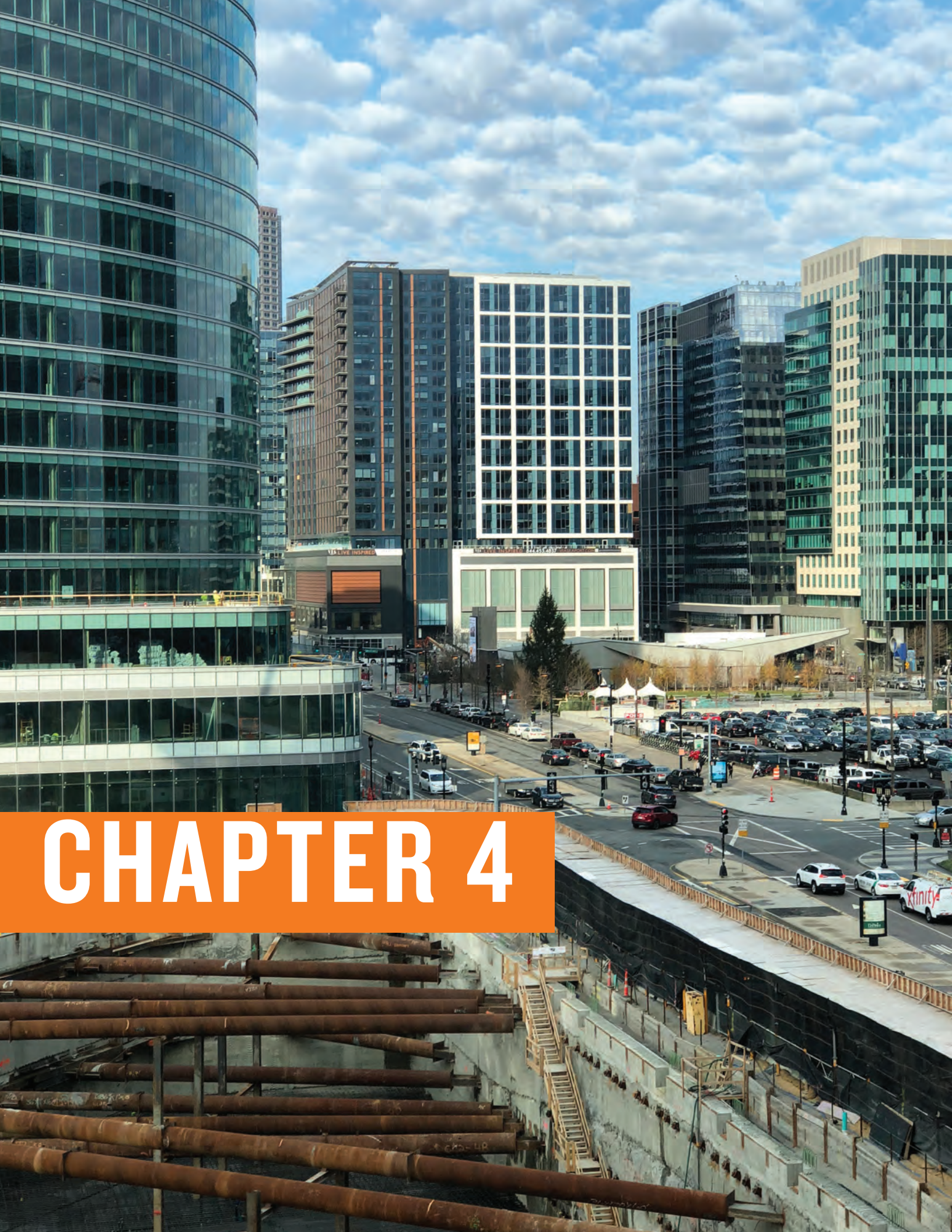
Source: MassDOT Capital Investment Plan Update 2019–2023

FINANCIAL GAP DOES NOT INCLUDE EXPANSION PROJECTS

As shown in Table 3.3, the planned MBTA expansion projects are also relatively modest, with the exception of the Green Line Extension (GLX) to Somerville. In the next chapter, we discuss other expansion projects that are not included in the current CIP.

Given this forecasted funding gap, some combination of the following is likely to occur during this upcoming 10-year period:

- The state will need to find ways to increase transportation revenue.
- The state will increase borrowing to narrow the gap. While the MBTA's debt rating is good and increased bond issuances are possible, Borrowing, absent new revenue sources, simply kicks the can down the road to the next generation and threatens the state's bond rating.
- System performance will suffer. Services and routine O&M can be cut, and expansion projects eliminated. However, most of the expansion projects are small or nearing completion, while the state has recommitted to the one remaining large project, the Green Line Extension. Most likely, as usually happens in conditions of financial constraint, SGR spending will be curtailed. This will result in system performance declining further during the latter half of the 10-year forecast period, and in subsequent years, undoing much of the good work underway today, such as improved MBTA winterization, the purchase of new MBTA vehicles, rebuilding of the subway track and signal system, roadway repaving financed by ARRA, and improvements in bridge conditions financed by ABP borrowing. SGR is not static; it is a moving target. As some elements of the system are brought up to SGR, others begin to deteriorate and need attention in later years.



CHAPTER 4

FUTURE UNMET NEEDS AND THE ECONOMIC IMPERATIVE

“OUR TRANSPORTATION SYSTEM MUST FOSTER, NOT INHIBIT, GROWTH AND DEVELOPMENT. MOST STATES ARE FACING THE ISSUE OF INFRASTRUCTURE DECAY CAUSED BY DECADES OF NEGLECT. STATES THAT CONFRONT THIS ISSUE HONESTLY WILL HAVE A SAFE, RELIABLE, MODERN, AND WELL-MAINTAINED TRANSPORTATION SYSTEM TO SUPPORT ECONOMIC GROWTH.”³⁴

Chapter 3 examined a relatively static universe: what does it take to operate and maintain the existing Highway and MBTA systems, and to meet the needs of the existing population of users in the state? Only a few modest expansion projects—those included in MassDOT’s Capital Investment Plan (CIP) were included in the cost estimates. But of course, we don’t live in a static universe. For many decades Massachusetts, like many northern states with older cities, had slower population and employment growth rates than the nation as a whole. This is no longer the case.

Recent trends show that both population and job growth rates in Massachusetts are increasing. This more-rapid growth is concentrated primarily in the large Boston metropolitan area,³⁵ which is consistent with the 2016 *State of the Built Environment* report findings, and coincident with the center of the MBTA service area.

RENEWED MASSACHUSETTS GROWTH ADDS URGENCY TO TRANSPORTATION IMPROVEMENT NEEDS

Faster economic growth is great news for the residents of the Commonwealth because it means increasing income and economic opportunity. However, it also increases the urgency of closing the funding gap and improving the performance of the Massachusetts transportation system in order to accommodate more-robust population and economic growth. Highlights of projected growth include:

- Massachusetts added 264,000 people from 2010–2016, making it the fastest growing state in the Northeast
- already the third densest state in the nation, Massachusetts is expected to add 500,000 more people over the next 20 years (a 7 percent increase from 2017)
- 62,000 jobs have been added over the past year, the eighth-largest gain in the United States
- 121,000 more people are in the Massachusetts labor force than were a year ago; only Florida, Texas, New York, and Georgia (all much larger states, population-wise) saw larger increases
- Massachusetts has a \$500 billion economy; net GDP growth since 2010 is larger than the current GDP of the State of New Hampshire

POPULATION: MASSACHUSETTS IS NOW THE FASTEST GROWING STATE IN THE NORTHEAST

After relatively low population growth in the 2000s, Massachusetts has become the fastest growing state in the Northeast (see Figure 4.1), and is now growing at a pace just below the national average.³⁶ The state’s growth spurt is focused primarily on Boston and its metropolitan region, with the City of Boston alone accounting for more than one-fifth of the net population increase since 2010. Boston and the urban core surrounding it are benefiting from a wider U.S. trend—the rising popularity of

amenity-rich cities like New York, Washington, DC, Seattle, Portland, and San Francisco. Current projections from the UMass Donahue Institute estimate that Massachusetts will add more than 500,000 people by 2035, growing from 6.8 million people today to 7.3 million. Most of this growth will be concentrated in the densely populated and already heavily congested Metro Boston region. It should be noted, however, that much of this population growth is dependent on two things: the health and strength of the greater Boston economy, and a continued flow of immigrants to the state. Any major decline in the economy of the Metro Boston region could bring this growth to a halt, and with federal immigration policy currently in flux, the prospects of a decreased flow of immigrants to Massachusetts could also threaten the state's recent population growth trajectory.

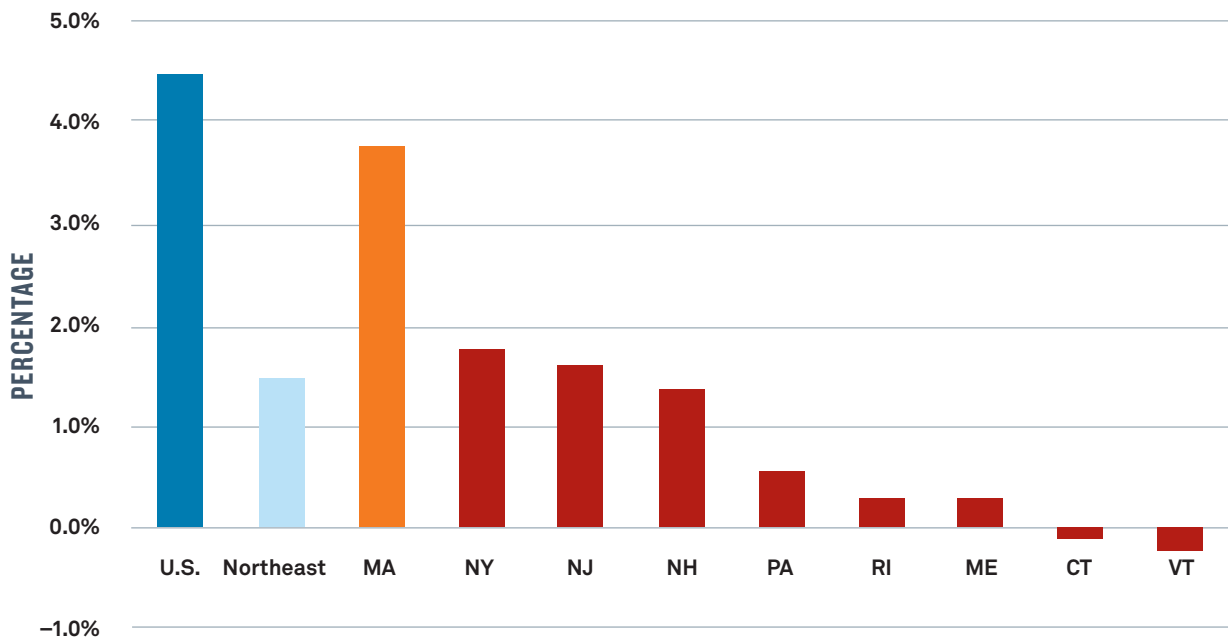
JOBS: MASSACHUSETTS IS NOW A NATIONAL LEADER IN JOB GROWTH

Just as Massachusetts has become more of a draw for people, it has also become a magnet for jobs—with the two dynamics obviously intertwined. Economic opportunity, manifested in the form of jobs, helps retain existing residents and attracts others. Similar to the population trends, Massachusetts

has also experienced faster job growth since 2010 than any other northeastern state (see Figure 4.2). Massachusetts ranked 8th in net job growth from 2016 to 2017, a ranking that far surpasses its 16th ranking in population size. During that period, among metropolitan areas, Boston added more jobs than all of the other metro areas in the U.S. except Dallas-Fort Worth, Atlanta, and New York City.

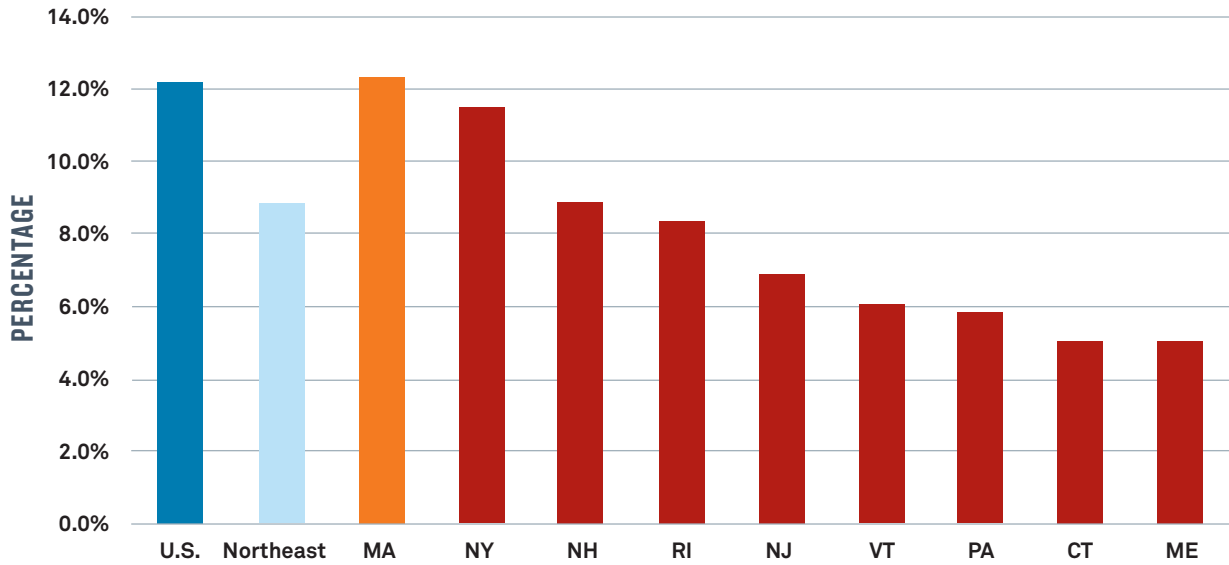
In a pattern similar to that of the state's population growth, Massachusetts job growth has been largely concentrated in and close to Boston, with the urban core (Boston, Cambridge, and Somerville) and Route 128 job centers (including Woburn, Burlington, and Waltham) all growing at a faster pace than the nation and other parts of Massachusetts since the end of the Great Recession. Combined, these six key employment centers have accounted for more than one-third of the state's job growth since the economic recovery began in 2009. The job growth in these cities has not been matched by proportional improvements in transportation capacity, leading to rising congestion levels—a fact readily apparent to the region's commuters. **Projected forward and barring unforeseen economic circumstances, Massachusetts is likely to add as many as 500,000–600,000 jobs through 2040.**

FIGURE 4.1: Population Growth by State, 2010-2016



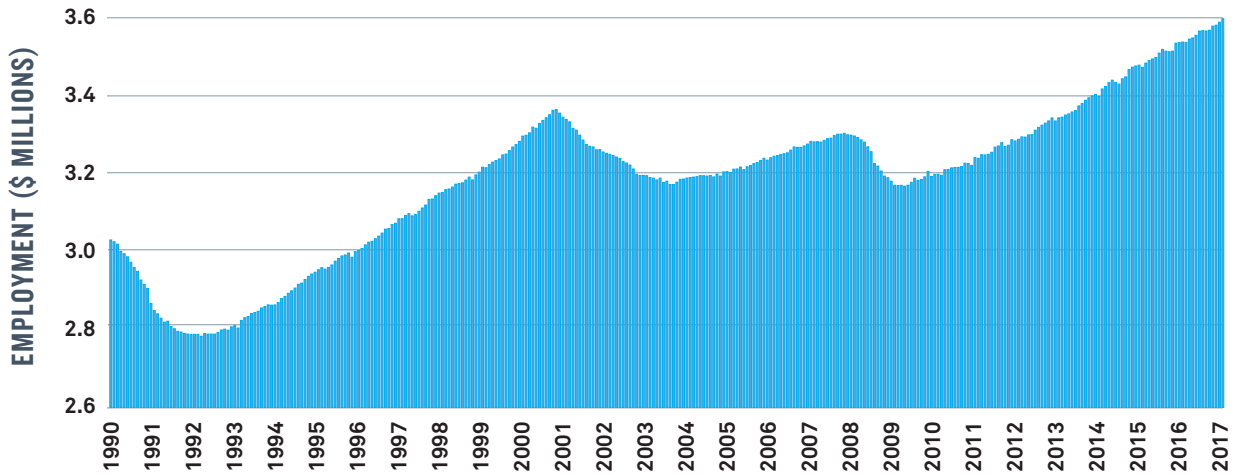
Source: U.S. Census Bureau

FIGURE 4.2: Massachusetts Leads Northeast in Jobs Growth, 2010-2017



Source: U.S. Bureau of Labor Statistics, Current Employment Statistics

FIGURE 4.3: Massachusetts Job Growth, 1990-2017



Source: Bureau of Labor Statistics, Current Employment Statistics, Seasonally Adjusted

MASSACHUSETTS HAS ENTERED A NEW PERIOD OF EXPANSION, BUT MAY MISS FUTURE OPPORTUNITIES IF INFRASTRUCTURE CAPACITY DOES NOT KEEP UP

During the last 20 years, Massachusetts has gained stature on the domestic and international stages as a technological and economic powerhouse. Numerous composite rankings (see Table 4.1) and indicators point to the Commonwealth as a national leader in researching, developing, and assimilating new technologies. The Commonwealth is arguably the leading world hub for the life sciences industry, a center of finance, and a leading destination for overseas visitors. Today, Massachusetts has a \$500 billion economy that is 50 percent larger than it was, in real terms, in 1997. Since 1997, Massachusetts has become the second wealthiest state in terms of per capita income; that growth is exceeded only by a handful of much smaller, mostly energy-producing states. The looming question, however, is whether Massachusetts can, in the future, maintain its enviable economic development record and

attractiveness, and the numerous opportunities that have come with it, without providing the infrastructure and transportation services such trends will require.

The shortcomings in the Massachusetts transportation network have created growing congestion problems throughout the state, but most notably in the Boston metropolitan area. Increasing congestion is onerous to businesses and labor, lowering efficiency, adding to costs, and ultimately reducing the Commonwealth's appeal and competitiveness. Congestion also makes it more difficult for students to reach schools, and for parents to manage jobs and child rearing responsibilities, and it can mar the experiences of people visiting Massachusetts. The lack of mobility, notably within the I-495 ring, can precipitate decisions that are detrimental to the state in the long run, namely, people deciding to leave the state and businesses choosing to expand elsewhere.

Fed by the aforementioned growing population and an expanding economy, traffic volumes in the Boston metropolitan area are continuing to increase, from 52.3 million vehicle miles traveled per day in 1990 to 77 million in 2014, according to the Texas A&M Transportation Institute (TTI), in its annual Urban Mobility Scorecard. During the same 24-year period, the average number of hours spent in gridlock by Boston's peak-period travelers rose from 44 to 64 hours per year.³⁷ Boston now has the fifth-worst traffic in the country, according to the TTI (see Figure 4.4), behind only Washington DC, Los Angeles, San Francisco, and New York.

Sitting idly in traffic comes with a price, which the TTI has estimated for major U.S. metropolitan areas. The costs include the value of lost time for commuters and commercial vehicles.³⁸ With heavy trucks costing more than \$1.59 per minute to operate, congestion levels impact business costs that must be absorbed in some form by shippers, trucking companies, and consumers.³⁹ According to TTI's estimates, the annual cost of congestion in metropolitan Boston reached \$3.4 billion in 2014. In the smaller metro areas of Springfield and Worcester, the costs of congestion are also substantial: \$408 million and \$302 million, respectively (see box). All three areas have experienced substantial increases in the total number of hours people spend in traffic annually, as shown in Figure 4.5.

MASSACHUSETTS AND GREATER BOSTON RANKINGS

Boston #1 – Top Life Sciences Cluster
(Jones Lang LaSalle)

Boston #1 – Innovation that Matters
(U.S. Chamber Foundation)

Boston #9 – World Financial Center
(Economist Intelligence Unit)

#1 – “Best States” ranking
(U.S. News and World Report)

#1 – Most Innovative State
(Bloomberg)

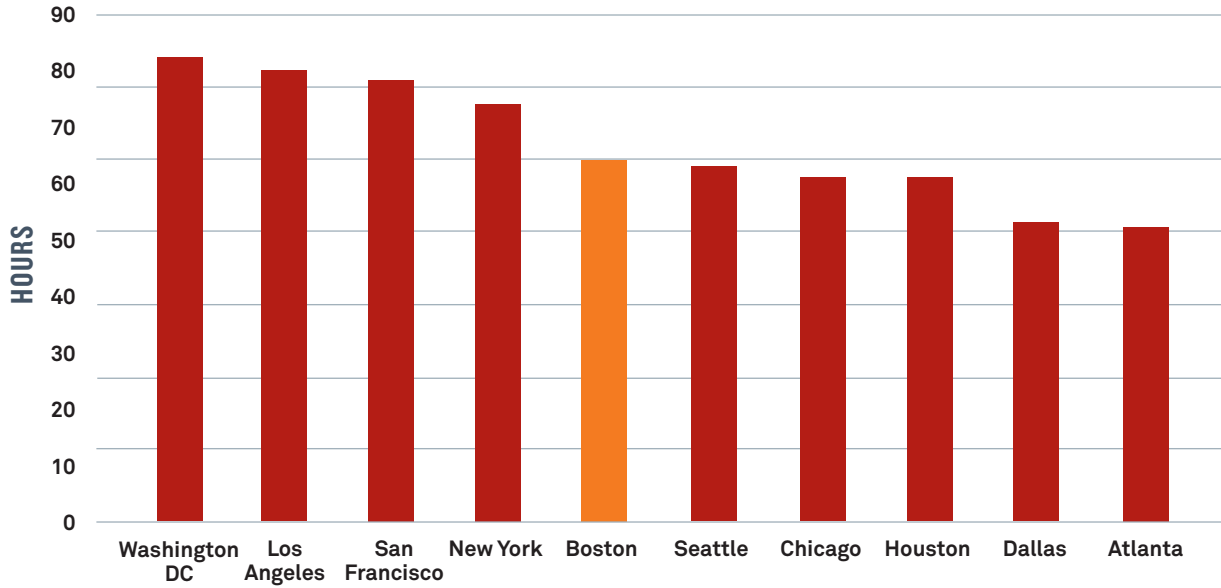
#1 – State Technology and Science Index
(Milken Institute)

#1 – State Competitiveness Report
(Beacon Hill Institute)

#1 – Tech Industry Concentration
(CyberStates)

#6 – Overseas Visitors
(U.S. Department of Commerce)

FIGURE 4.4: Annual Hours of Delay per Auto Commuter, 2014



Source: Texas A&M Transportation Institute, "2015 Urban Mobility Scorecard," Texas A&M University

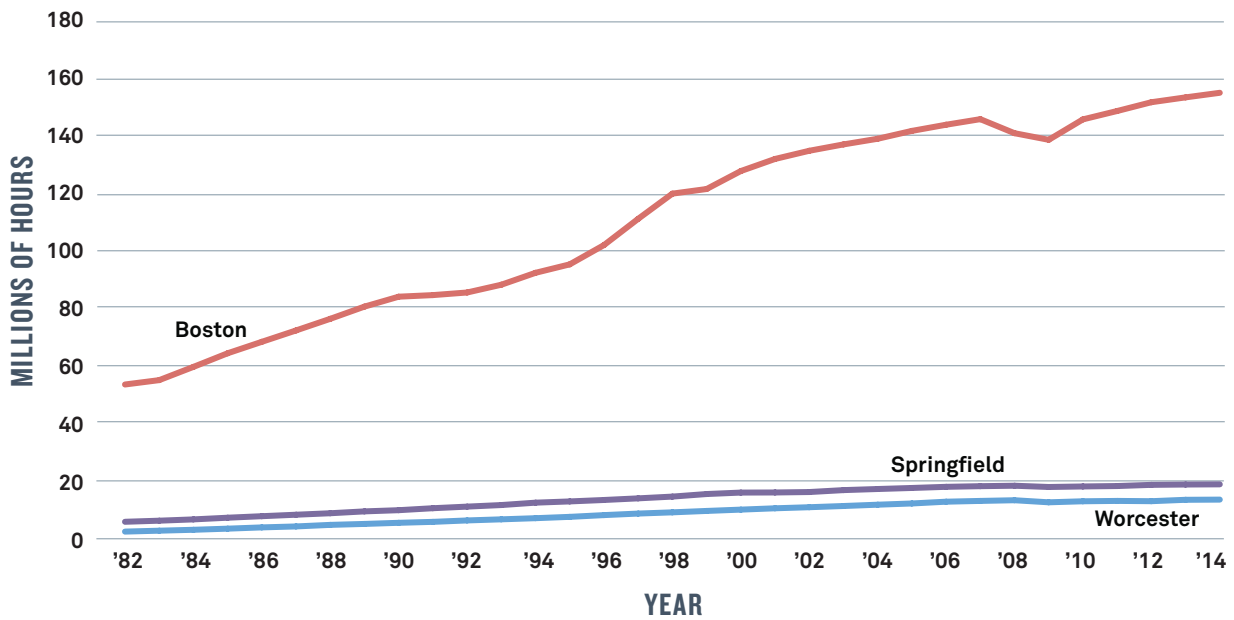


TABLE 4.1: Measures of Congestion by Major Metropolitan Area in Massachusetts, 2014

CONGESTION MEASURE	BOSTON	SPRINGFIELD	WORCESTER
Annual Hours of Delay (in millions)	154	18.4	13.1
Annual Hours of Delay per Auto Commuter	64	38	38
Annual Cost of Traffic Congestion (in billions of dollars)	\$ 3.4	\$0.4	\$0.3
Annual Cost of Congestion per Auto Commuter	\$1,388	\$831	\$865
Excess Fuel Consumed due to Traffic Delays (millions of gallons)	71.6	9.3	6.4

Source: Texas Transportation Institute, “2015 Urban Mobility Scorecard,” Texas A&M University.

FIGURE 4.5: Total Annual Delay in Massachusetts, by Metropolitan Area, 1982–2014



Source: Texas A&M Transportation Institute, “2015 Urban Mobility Scorecard,” Texas A&M University

In a high-cost state like Massachusetts, the price tag for congestion borne by commuters and truckers, who depend on minimizing trip times, can work against business attraction and livability. Without the major transportation expansion investments of recent decades—extension of the Red Line to Braintree and Alewife; the relocation of the Orange Line and its extension to Oak Grove; the restoration of the three branches of the Old Colony commuter railroad; the construction of the Silver Line; commuter rail extensions to Providence, Worcester, and Newburyport; three new terminals and a new runway at Logan Airport; the completion of I-495; the original Massachusetts Turnpike extension to Boston; and the Big Dig—either congestion would be much worse or much of our recent economic growth would have gone to other states.

More recently, published congestion data from Inrix corroborate troubling trends in Boston-area congestion, which has actually grown substantially since the 2014 end date for the TTI congestion data. In just a four-year span, from mid-2013 to mid-2017, certain segments on Boston area highways have seen non-peak travel times increase by more than 50 percent, indicating that heavy congestion is no longer confined to rush hour traffic to and from Boston.³³ Recent examples of congestion on those segments include the following:

- 12.5–18 minutes on I-93 northbound between exit 24 (Government Center) and exit 27 (Charlestown) between 2pm and 3pm

- 13.6–22 minutes on I-93 northbound between exit 8 (Quincy) and exit 24 (Government Center) for noontime trips

LOOKING INTO THE FUTURE: PROJECTS TO ADD TRANSPORTATION CAPACITY AND SUPPORT ECONOMIC EXPANSION ARE NOT FUNDED

Although the Commonwealth's economic expansion is enviable, it has become increasingly clear that the state's burdened transportation infrastructure, as evidenced by rising congestion levels, has not kept up with that expansion. Beyond the need to continue to operate and maintain the system in a State of Good Repair is the need to expand the system to meet the increases in demand that are likely to occur in coming decades. Failure to do so will result in missed opportunities and could well choke off some of this projected growth.

MassDOT has approximately 6,000 projects in its project database that are currently unfunded. Some of the most well-known and significant of these projects, and current cost estimates, are listed here (right). Though many Massachusetts residents may think these projects are currently in a funding pipeline, there is no funding currently available for these projects beyond that for some initial design work.

These projects were not included in the funding gap analysis and their inclusion would add billions of dollars to the price of the state's unmet transportation needs. Preservation is critical, but reaching the State of Good Repair should be considered only as a starting point. Expansion projects and the benefits they bring—less congestion, increased

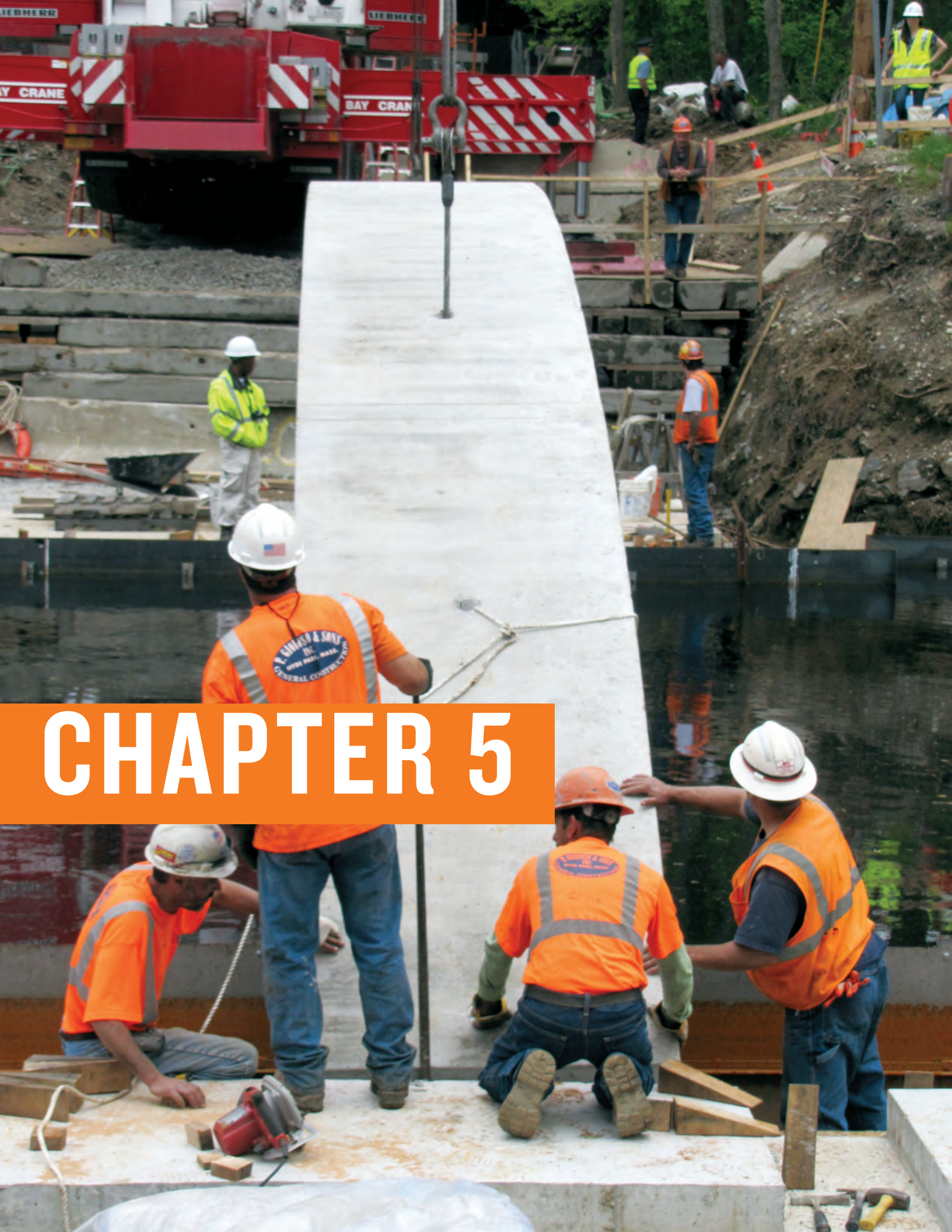
mobility and connectivity, and time savings—are crucially important to the long-term health of the Massachusetts economy.

Two prominent examples offer themselves. The City of Boston touted the potential benefits of the Red Line–Blue Line Connector—though several years ago, the state was allowed to remove this project from its list of CA/T transit SIP commitments. Similarly, the state unveiled a \$1 billion project to redesign the Allston-Brighton Interchange of the Massachusetts Turnpike,³⁴ and add various other amenities, such as the West Station commuter rail station—despite the fact that this project does not have funding secured at this time. is completely unfunded.

Major Unfunded Capital Projects (\$14.8–20.1 billion total)

- South Coast Rail
- Allston Interchange
- West Station (Allston Commuter Rail Station)
- East-West High Speed Rail Service
- Red-Blue Connector
- Blue Line Extension to Lynn
- Southeast Expressway Capacity Improvements
- Cape Cod Transportation Plans
- Route 1 Widening from Rte. 60 to Rte. 99
- Silver Line Phase III
- South Station Expansion
- North-South Rail Link





CHAPTER 5

STATE TRANSPORTATION AGENCY STRATEGY SCAN: RECENT DEVELOPMENTS IN PROJECT DELIVERY AND FINANCE

“OVER THE YEARS, PROCESSES HAVE EVOLVED THAT THWART THE EFFECTIVENESS OF PROJECT DELIVERY. LIMITATIONS ON PROCUREMENT METHODS DEPRIVE STATE OFFICIALS OF OPTIONS AND INCREASE COSTS BY REDUCING COMPETITION.”⁴¹

Although the Massachusetts Department of Transportation (MassDOT) has made great strides over the past decade, MassDOT has long faced significant challenges with respect to various aspects of its operating and governance structures. Budget cuts, revenue reductions, growing labor and operating costs, and an aging network have hampered the agency’s efforts to upgrade, maintain, and extend the Commonwealth’s transportation services and network effectively and efficiently.

Not all strategies to improve the capacity and performance of state transportation agencies require a significant infusion of funds to achieve success. Procedural initiatives, such as updating asset management and project prioritization systems, exploring alternative solicitation and procurement frameworks, and developing financing tools can be undertaken with relatively minimal cost. This chapter presents a national scan on recent trends in the strategies that have been adopted by other state transportation agencies and how MassDOT is faring on implementing these strategies.

ASSET MANAGEMENT AND PROJECT PRIORITIZATION

Transportation infrastructure requires a significant amount of maintenance and upkeep in order to remain safe and in a State of Good Repair. In an era of tight budgets and limited funds, project prioritization and asset management are essential tasks

for directing resources effectively. Although project prioritization and asset management are distinct tasks for transportation agencies, these practices often share common intent.

- Asset management is the method of measuring and tracking the quality (or relative deterioration) of the physical infrastructure. Asset management helps identify which projects should receive priority in terms of funding and construction timing or order.
- Project prioritization is the means by which transportation administrators decide which proposed or planned projects receive priority with respect to construction and implementation.

In short, cataloguing and tracking the condition and performance of transportation infrastructure via asset management is essential for gauging current and future systemic needs via project prioritization.

ASSET MANAGEMENT

Asset management has become a priority among transportation administrators as a means of cost minimization and strategic investing. MAP-21, the federal transportation funding and authorization legislation that governs spending on surface transportation, mandates asset management as a key activity for state transportation agencies. Under the law, states are now required to develop comprehensive asset management plans that cover both the maintenance of roads that are part of the National

Highway System, and transit systems that receive federal dollars.

The U.S. Department of Transportation maintains that there is no standard or uniformly recommended approach for implementing asset management plans,⁴² and that agencies should tailor plans that best meet their needs. The following are among the most-consistent best-practices recommendations for asset management and subsequent project prioritization and suggest that agencies should:

- conduct comprehensive organizational self-assessments as a first step in developing an asset management framework⁴³
- consider adopting a “preservation-first” approach that prioritizes the maintenance of existing infrastructure over investing valuable resources in new capital projects
- adopt investment principles that are based on the entire life cycle of various infrastructure elements, rather than use a “worst first” approach to project prioritization that responds to the most-outdated or oldest pieces of infrastructure in the short term
- take care to select reliable and valid accountability measures that accurately reflect performance
- incorporate risk assessment as a factor in asset management practices
- explore new technologies and innovative approaches to data collection and organization (such as GPS-enabled laptops or handheld devices) and make efforts to stay current with technology
- be sure to maintain documents and data related to asset management even if these activities are contracted out to third parties
- use asset management approaches that are directly linked to performance measurement approaches, so as to add a “third layer” to institutional evaluation and analyses

The Transportation Finance Act of 2013 (TFA) mandated several programmatic changes that directly speak to asset management practices in Massachusetts. MassDOT has created a Performance and Asset Management Advisory Council (PAMAC), and



delivered several data-rich progress reports related to asset management to the Legislature. Those reports served as key sources for this report, and reorganized internal program governance over asset management to include personnel from across the Highway Division. Notably, for the first time, MassDOT's 2017–2021 Capital Investment Plan (CIP), published in 2016, includes the MBTA. The TFA also mandated that MassDOT develop a unified asset management system that covers highway, aeronautic, and transit operations. To this end, annual progress reports now include synopses on each of these divisions, and the integrated Planning for Performance (PfP) tool, discussed in more detail below, includes asset management data across the majority of MassDOT divisions.

The State Smart Transportation Initiative (SSTI) notes that the MBTA's transit asset management system is already nationally recognized.⁴⁴ In 2012, the MBTA received funds from the FTA to develop a comprehensive asset management program in anticipation of MAP-21 requirements. The MBTA used these funds to develop an asset management approach that centers on four separate, but integrated, initiatives:

- a five-year asset management plan
- a “decision support tool” used for project prioritization
- the State of Good Repair (SGR) database
- maintenance management systems

The Highway Division has also made significant progress in updating its databases and monitoring protocols. In 2015, a strategic plan for asset management was developed and working groups have been formed to oversee progress toward the goals that were identified. Action items for 2017 included:

- meeting pre-defined targets for pavement quality
- implementing a predictive model that identifies deck area on structurally deficient bridges
- ensuring that pedestrian and bicycle facilities are available on all roadways

MASSDOT HAS DELIVERED SEVERAL DATA-RICH PROGRESS REPORTS RELATED TO ASSET MANAGEMENT.

PROJECT PRIORITIZATION

Project prioritization is the means by which transportation administrators select projects for investment. There are two general frameworks under which project prioritization activities unfold; differences between the two can be thought of as approaching the task from two different perspectives. The traditional “bottom up” view evaluates all transportation projects simultaneously and without regard to the type of transportation infrastructure or program to which the project belongs. The “top down” view allocates funds to specific programs to match agency goals, and then prioritizes projects against only other projects within the same program. Rather than put several vastly different projects with significantly different implications in direct competition with each other, the top down approach allows those initiatives that are similar in scope, size, mode, or goal to be judged solely against each other.

Even within each project prioritization framework, there are different ways in which the process of prioritization can unfold. A straightforward method known as the “worst first” approach simply identifies those pieces of infrastructure that are in the worst condition, and prioritizes those projects first. On the other hand, multi-criterion prioritization approaches weigh each project according to several factors, such as economic impact, safety, and/or social equity. Under a multi-criterion approach, environmental concerns might lead transportation administrators to fast-track projects that are directly related to greenhouse gas emissions, or toward increasing the volume of green space in a city. In many cases, projects are scored according to a variety of criteria; in some iterations, different criteria are differentially weighted to account for the goals and values emphasized by transportation agencies.

Massachusetts has taken significant steps to add depth and substance to its project prioritization activities. A Project Selection Advisory Council (PSAC) was established to develop recommendations for the prioritizing of capital projects according to a multi-criterion framework. Over an 18-month period beginning in 2013, the Council held 12 public meetings and six public hearings, and delivered its final set of recommendations to the Legislature in July 2015. The PSAC encouraged MassDOT to evaluate transportation projects according to several criteria:

- system preservation
- mobility
- cost effectiveness
- economic impact
- safety
- social equity and fairness
- environmental and health impacts
- policy support

The PSAC also recommended that the project prioritization process adopt a top-down perspective and differentiate between different types of transportation projects during the prioritization process. It recommended that “modernization” projects, meaning those projects intended to rehabilitate or replace existing assets, be ranked according to factors that include system preservation, mobility, cost effectiveness, economic impact, safety, environmental and health effects, and policy support. The council recommended that “capacity” projects, meaning those that expand or build connections within the existing network, be ranked according to social equity and fairness, mobility, cost effectiveness, economic impact, safety, environmental and health effects, and policy support.

Following the work of the PSAC, MassDOT successfully launched the Planning for Performance (PFP) tool in September 2016. PFP is a dynamic and sophisticated tool that allows decision makers to assess the impacts of different investment and funding scenarios on infrastructure outcomes, and is potentially valuable both in project prioritization and asset management. PFP integrates performance and asset management data from several MassDOT management systems, including the Bridge Inspection Management System, the Deighton Total Infrastructure Management System, the MBTA’s SGR Database, the RTA’s TransAM platform, and the Aeronautics

Division’s AIR-Port framework.⁵⁰ MassDOT is working to incorporate performance targets into the PFP, as well as streamline the models and measures used in the tool to reflect more directly the MBTA’s SGR priorities.

The 2017–2021 Capital Investment Plan (CIP) was the first to prioritize projects according to these criteria. Since then, the PSAC has met periodically to oversee the implementation of its proposed strategies.

PROJECT DELIVERY

PROJECT MANAGEMENT STRUCTURE

One of the most important elements of any project delivery system is the project management structure. A poorly designed management structure can lead to undesirable outcomes, ranging from inconsistent communication and ill-defined roles to the outright failure of a project. An effective project management system can also help to mitigate risk in ways that enhance the overall delivery process.

Best practices in this area tend to focus on the importance of creating cohesive, multidisciplinary project teams with a clearly defined set of responsibilities and expectations for team members. Most agencies opt to use a single Project Manager (PM) throughout the life cycle of a project, in order to avoid continuity issues that can arise when switching managers. The Virginia DOT (VDOT) is one agency that uses a single PM for each project, but PM requirements are variable, depending on the scope and scale of the project. Mega-projects may have a single PM supported by in-house staff and consultants, and smaller, less complex projects may require the PM to take on other technical duties if supporting staff are not available.

If an agency is using consultants as part of the project management structure, it is strongly recommended that the agency maintain close oversight of consultants’ work efforts, and clearly define project roles for both the consultant and internal agency staff. To this end, the Washington State Department of Transportation (WSDOT) has created a Project Management Academy to train both in-house and consultant staff on how to be an effective PM.

STAFFING

Staffing levels, meaning the number of and roles taken on by transportation workers, also affect the



choice of project delivery method and the subsequent outcomes. As many state transportation agencies have increasingly turned to private consultants, concerns have arisen about how to maintain core competencies in agencies with fewer full-time employees. A 2015 WSDOT report includes recommendations related to this issue, including stabilizing the DOT workforce as well as minimizing the cyclic hiring and downsizing of internal staff that is often a feature of large-scale projects. The shift toward use of private consultants requires agencies to transition their own staff from the traditional roles of design and quality management to an emphasis on oversight and compliance.

Many agencies use outside consultants to help manage the project delivery process. The National Cooperative Highway Research Program's (NCHRP's) 2009 Best Practices in Project Delivery Management study notes that some agencies used consultants for 20 to 80 percent of project management processes.⁴⁵ For large-scale projects, agency best practices generally include outsourcing management responsibilities; this includes hiring external, full-service firms to provide quality assurance (QA) and materials testing services. For smaller projects, many agencies prefer to develop in-house expertise to manage these projects and provide oversight and QA duties. Even when using a private project manager, an agency staff member is still needed to provide oversight of the consultant PM and ensure the PM is meeting contract and performance requirements.

In order to rein in and stabilize operating costs, the MBTA started, in 2001, to reduce aggressively the size of its non-union workforce. By 2015, the non-union headcount had been reduced from 590 full-time employees (FTE) to 182. Some of this reduction was due to managers moving into union ranks in order to obtain pay raises, rather than actual staffing decreases. Rather than reduce costs, however, the FMCB noted in its 2017 Strategic Plan that this "depletion of management talent and capacity" led to rising operating costs, significant growth in the SGR backlog, and reduced service quality. The lack of internal capacity to manage capital projects is believed to have contributed to the failure of the first iteration of the Green Line Extension (GLX) project, discussed in greater detail below.

PROJECT DELIVERY APPROACHES

DESIGN-BID-BUILD

Design-Bid-Build (DBB) is the traditional delivery approach for transportation projects in the U.S. DBB separates the design and build process into two disparate steps with two separate contracts (and procurement processes). Generally, DBB provides delivery of adequate infrastructure projects with the lowest initial bid. The separation of services and resulting discoordination, though, can lead to adversarial relationships among the various parties and to significant cost growth and schedule expansion.



Under DBB, project management responsibilities lie almost entirely with the agency, as does the majority of the risk associated with costs and scheduling.

Given the long history of DBB project delivery approaches, it is not surprising that the vast majority of Massachusetts's roads and MBTA infrastructure was built under a DBB model. However, the MBTA, in particular, has experimented in recent years with alternative approaches, as discussed below.

CONSTRUCTION MANAGEMENT AT RISK, AKA CONSTRUCTION MANAGER/GENERAL CONTRACTOR

A newer model for project delivery is “construction management at risk” (CMAR, also known as construction manager/general contractor, or CMGC). Under CMAR, the transportation agency will typically hold two contracts, one with the designer and one with the construction manager (CM). The CM acts as a consultant during the design phase, providing input in order to ensure a more-efficient construction phase of the project. After the design is substantially complete, the CM commits to delivering the project within a defined schedule and at a specific price, which can be fixed or a Guaranteed Maximum Price (GMP).

The CMAR model has seen increased usage in recent years by such agencies as the Utah and Arizona departments of transportation. MassDOT has very limited experience working with a CMGC approach, but has shown willingness to experiment with the method. MassDOT's and the MBTA's initial plans for the GLX proceeded under a CMGC approach. However, a 2015 review of the project found multiple issues with respect to implementation of this project delivery approach.

The review found that the MBTA was not adequately prepared to implement this new approach: the MBTA's internal capacity to manage and direct this type of project was very limited; consultants to the project were granted too much autonomy and authority over the project, which led to cost estimates early in the planning and design phase that were far higher than had been anticipated; performance measures failed to indicate the presence or scale of project obstacles; and the emphasis on external timelines led to oversights in other project management areas. Further, the review found that the MBTA's process-oriented culture limited the ability of project managers to be innovative and focus on goals and outcomes. Before MassDOT or the MBTA endeavors to engage in a CMAR or CMGC

delivery approach in the future, administrators should take care to resolve these issues in the early stages of the project.

DESIGN-BUILD

Design-Build (DB) is an integrated approach that delivers design and construction services under one contract with a single point of responsibility. As compared to the standard DBB method, DB allows for a shortened time frame to project completion because a single entity is responsible for both designing and building the project. This eliminates multiple procurement processes for discrete project phases, while removing the need for the agency to coordinate among different design and build teams. Under a DB arrangement, the majority of project risk is transferred to the DB team. Though DB is still generally considered an “innovative” project delivery method, many DOTs are using it regularly, including Florida, Utah, Missouri, and Indiana.

The most-oft-cited benefits of DB include faster project delivery, better project quality and cost control, fewer claims, and improved relationships with contractors, third parties, and the community. More specifically, a review of literature on DB performance turned up multiple studies showing DB performance improvements,⁴⁶ including:

- delivery time: DB 14 percent to 33 percent faster than DBB
- unit cost: DB 3 percent to 13 percent less than DBB
- schedule expansion: DB 15 percent higher to 12 percent lower than DBB
- cost growth: DB 5 percent lower cost growth than DBB

Although DB projects exhibited the most variability in their schedule expansion performance, they consistently outperform DBB projects in all other areas of measurement. Clearly, DB project outcomes, like all other project delivery methods, will depend on

the effectiveness and skill sets of the agency staff overseeing the project, as well as the experience of the selected DB team.

MassDOT—more specifically, the MBTA—has also used a DB approach in the past. Given the time constraints, MassDOT decided on a DB approach for the Greenbush commuter rail line that opened in 2012. Although the project was delayed by several years and the cost rose by 24 percent—from \$408 million to \$519 million—by the time it opened, many of the problems facing project administrators were ancillary to the DB approach. **After reviewing the progress of the GLX project in 2015, MassDOT administrators (with the support of the FMCB) chose to re-launch that project under a DB contract.**

PUBLIC-PRIVATE PARTNERSHIPS (P3S)

The term “public-private partnership” (P3) is so ubiquitous that it can mean a variety of things. For the present purposes, a P3 is a project delivery method that involves a contractual agreement between public and private sector entities to provide DBFOM services—the design, build, finance, operation, and maintenance of transportation infrastructure assets. This is in line with the Federal Highway Administration’s (FHWA’s) Center for Innovative Finance Support, which focuses on “P3s that involve private partners that design, finance, construct, operate, and maintain new highway capacity over a long term.”⁴⁷ Although P3s can in fact be used for the ground-up construction of new assets as well as the rehabilitation of existing infrastructure assets, P3 contracts are almost always long term and often measured in decades.

One of the main benefits of the P3 delivery model is that a public agency effectively transfers most of the risk it would normally incur under more traditional delivery methods onto its private sector partner. If the private sector partner also assumes long-term operation and maintenance duties, the risk transferred from the public to the private sector even exceeds that of other delivery models.

THE REVIEW FOUND THAT THE MBTA’S PROCESS-ORIENTED CULTURE LIMITED THE ABILITY OF PROJECT MANAGERS TO BE INNOVATIVE AND FOCUS ON GOALS AND OUTCOMES.

Although these benefits can be quite attractive for a public agency, P3s can also carry their own risks. Overall, experience with transportation P3s in the U.S. has been mixed. Several P3 projects from the mid-2000s have resulted in investor bankruptcies because the projects failed to meet traffic volume and revenue goals. Texas State Highway 130 and the South Bay Expressway outside San Diego are two examples of “greenfield” highway projects in which the private sector partner ended up going bankrupt due to overly optimistic revenue and traffic estimates, among other reasons. Similarly, the Indiana Toll Road, Chicago Skyway, and Pocahontas Highway in Virginia were separately leased under long-term concessions to private entities under a P3 model, but each of the private sector partners ended up going bankrupt and/or selling its ownership stake.

Notwithstanding, many P3s have been successes. The North Tarrant Express project, which reconstructed and added tolled managed lanes to 13 miles of highway near Fort Worth, and the LBJ Express project north of Dallas, which involved reconstructing the LBJ-635 highway while adding managed lanes, have generally been considered success stories. These two projects have provided additional roadway capacity while generating sufficient revenue to pay the debt service and operating costs, as well as providing profit for the private operators.

A project in Orange County, California to add four 10-mile managed lanes in the median of the existing State Route 91 was successfully completed in 1993 using a Build-Operate-Transfer P3 franchise. Though the express lanes were popular and considered a success, a non-compete clause in the P3 contract prohibited Caltrans (the California Department of Transportation) from making capacity improvements to adjacent, non-managed lanes. Due to realized and projected growth in traffic volumes along the corridor, the Orange County Transportation Authority was forced to buy out the operating franchise in

order to extinguish the non-compete restrictions and expand the adjacent highway.

In Massachusetts, the Route 3 North improvement project, completed in 2005, was the state’s first DB infrastructure project. Executed by the Route 3 North Transportation Improvements Association using a Design-Build-Operate P3 structure, lease payments from the Highway Division to the association were used to secure the bonds that funded the addition of a travel lane in each direction, as well as other improvements. In 2015, the Route 3 North Transportation Improvements Association was dissolved and all assets and liabilities were transferred to MassDOT.⁴⁸

As part of the state’s 2009 transportation reform legislation, Massachusetts created the Public-Private Partnership Oversight Commission to identify, review, and recommend opportunities for P3 transportation infrastructure projects. The Commission proposed two toll projects—a third bridge over the Cape Cod Canal, and the addition of managed lanes to Route 3 south of Boston—but both projects were eventually shelved following a change in the state’s strategic approach to P3s under the Baker Administration.

OTHER INNOVATIVE TECHNIQUES FOR PROJECT DELIVERY

MassDOT has also seen success in using non-traditional approaches for delivering its capital projects. In particular, the method of upgrading or rehabilitating transportation facilities via a complete but short-term shutdown has led to better on-time and cost performance than when transportation officials leave the facilities open but reduce capacity over long periods of time. Across 10 weekends in the summer of 2011, MassDOT replaced

AS PART OF THE STATE’S 2009 TRANSPORTATION REFORM LEGISLATION, MASSACHUSETTS CREATED THE PUBLIC-PRIVATE PARTNERSHIP OVERSIGHT COMMISSION TO IDENTIFY, REVIEW, AND RECOMMEND OPPORTUNITIES FOR P3 TRANSPORTATION INFRASTRUCTURE PROJECTS.

14 bridges on I-93 in Medford and Somerville. A six-mile section of the highway was closed in each direction, with traffic shifted to share the opposite side roadway for 55 hours each weekend, allowing construction crews to work effectively nonstop. Without the full highway closures, the project would have been expected to take four to five years. This Fast 14 project won the American Council of Engineering Companies (ACEC) 2012 Grand Conceptor Award.

Following the success of the Fast 14 project, the MBTA followed suit when it closed the Government Center subway station from March 2014 to March 2016 to allow for infrastructure upgrades. Closing the station eliminated the need to build a temporary headhouse, allowed construction work to continue without interruption, and minimized delays to the system. The station re-opened on time and on budget, and was the winner of the ACEC's 2017 Diamond Award in Transportation. The reconstruction of the Commonwealth Avenue Bridge in Boston, was completed under a phased shutdown approach over three weekends across two years (as opposed to three to four years in the absence of shutdowns).

CHAPTER 90 PROJECT DELIVERY

MassDOT's Chapter 90 program was established in 1973 as a means to provide state support to localities to expand, upgrade, and preserve roadways. Eligible projects and expenses are primarily related to resurfacing work, including the equipment necessary to build and maintain roadways, garages for the storage of road-building equipment, updated street lighting and associated electrical components, landscaping, and right-of-way acquisition.

The Chapter 90 program works through a process of up-front spending and subsequent reimbursement. Local authorities are allocated a portion of the overall funding package, based on a formula that accounts for local road miles, population, and employment. Once a city or town has executed and paid for the capital project, they then submit receipts to MassDOT, which reimburses the spent money. Since January 2015, roughly \$200 million per year and \$700 million in total funds have been released to reimburse municipalities for Chapter 90 expenses.

Though Chapter 90 is intended to help relieve pressures on localities facing deteriorating infrastructure, both state and local officials are likely to view the program as strained. For local officials, the late spring announcement of how much funding is



available and what each municipality's allocation will be makes planning for the prime May–September construction season very difficult. Without sufficient heads-up on how much money cities and towns have to work with, committing to projects is a near impossibility, especially to those that need to be turned around quickly.

Localities have advocated for more money to be allocated to the Chapter 90 program. Local officials have estimated that the costs associated with basic annual upkeep of Massachusetts roads to be \$600 million, significantly more than the state's \$200 million annual allocation.

From a state perspective, there is a growing sense that the state is providing funds for work that should be largely shouldered by local municipalities, especially larger cities that have greater resources to

dedicate to transportation infrastructure. Though the state might consider assuming responsibility for work in smaller jurisdictions, there is also a sense that more training would help localities figure out how to secure and utilize Chapter 90 funding more efficiently. Of all the infrastructure components examined in the TFC report and in this one, the performance metrics on which allocation of funding is based are most meager in regard to Chapter 90 funds.

PERFORMANCE MEASUREMENT AND MANAGEMENT

Ensuring that transportation services and transportation infrastructure are safe, reliable, and efficient, and meet the needs of users, is an important task within transportation agencies. In concert with its emphasis on asset management, MAP-21 also highlights performance management as critical for the performance of federal and state transportation systems.

The NCHRP defines performance management as “the regular ongoing process of selecting measures, setting targets, and using measures in decision-making.”⁴⁹ Performance management and measurement allow transportation administrators to make strategic short- and long-term decisions about investment, policy, and planning that help transportation agencies meet their missions and goals.

In general, the recommended steps for developing and implementing an effective performance management framework are consistent between highway and transit. A first step involves identifying agency-wide goals, followed by developing strategic objectives that operationalize these goals. For example, King County, Washington Metro Transit’s “environmental sustainability” goal is supported by two specific strategies: “help reduce greenhouse gases in the region,” and “minimize Metro’s environmental footprint.”

Evaluation frameworks are often built around the stated mission, goals, and objectives of a transportation agency. These commonly include safety, reliability, quality, and environmental impact, among others. For example, the FHWA’s national performance assessment is centered on safety, infrastructure condition, congestion reduction, system reliability, freight mobility and economic vitality, environmental sustainability, and reducing project delivery delays.⁵⁰

A critical factor that determines the effectiveness of various performance management and measurement approaches is the proper selection of performance indicators. Selected indicators must reliably and validly reflect each goal, service objective, or other evaluation principle. More than one measure should be used to reflect each project delivery and/or operating goal. For example, the MBTA’s recently updated Service Delivery Policy identifies the agency’s objectives as accessibility, reliability, comfort, communication, safety and security, rider satisfaction, and environmental benefit. In the case of reliability, the MBTA has set standards related to schedule adherence, passenger wait time, and service operated (i.e., percent of scheduled service that is actually provided)—each of which can be measured, compared to agency-set performance targets, and tracked over time. The data at the core of performance measurement and evaluation activities must be of high quality. Steps should be taken to ensure that the data are reliable, valid, and clean, and data that are used to measure progress should be updated at short, regular intervals.

It is recommended that performance management take place both system-wide and with respect to specific parts of transportation infrastructure or aspects of service. This allows the opportunity to evaluate the entire transportation network as a whole, as well as individual elements of the system. Within public transit agencies, for example, this two-tiered approach to performance management might include assessing the degree to which reliability goals are met across the entire system, with respect to specific service and route types, as well as which goals are met for individual routes.

Performance management should also occur at the project level. Metrics beyond simply whether a project is completed on time and on budget should be used to evaluate contractor and consultant performance, and those results should be used in evaluating firms for subsequent work with the agency.

Performance management should be prioritized by agency executives, and evaluation results should be carefully analyzed and disseminated to all administrators and stakeholders. As a recent NCHRP report notes, “The most successful agencies have established organizational cultures that support the use of performance data to drive maintenance and preservation decisions.”⁵¹ Performance management is a critical task for transportation agencies, and thus, should be as comprehensive as possible. Sufficient resources, both financial and logistical, should be dedicated to developing, implementing,

and maintaining an effective performance management structure. The NCHRP report goes on to emphasize that “the cost of collecting data for [evaluation] programs is insignificant when compared with the impact the results can have,” especially because performance measurement data should be used to inform critical decisions related to asset management, maintenance, and project prioritization.

Agencies are also encouraged to evaluate projects and services on a wide range of criteria—even those that go beyond the agency’s stated goals and objectives—and to define goals and objectives according to principles that extend beyond level of service and destination accessibility.

The “best practices” and recommendations discussed here draw on a number of reports released by transportation agencies at both national and state levels. Following a best-practices scan of various transportation agencies’ maintenance quality assurance (MQA) programs, the NCHRP made several recommendations for state performance management approaches.⁵² In addition to those already discussed, the NCRP recommends:

- exploring the use of innovative technologies to collect data and measure progress
- standardizing commonly used performance measures for comparison across agencies
- linking performance data to budget allocations
- improving strategies for disseminating information on performance to all stakeholders; as an example, the Virginia DOT has developed an online performance measurement dashboard that is open to the public: <http://dashboard.virginiadot.org>.

A growing number of agencies are using formal performance frameworks to select performance measures. Performance frameworks are structured processes that provide guidance for selecting performance measures (e.g., the “Balanced Scorecard” framework⁵³). A recent NCHRP report⁵⁴ reviews insights on performance management from transportation highway administrators, organized around various topics, as shown in Table 5.1.

TABLE 5.1: Performance Management Insights Matrix

TOPIC	INSIGHT
Use Performance Management to Help an Organization Focus	Initiate a Performance Management Program to Identify and Address or Avoid a Compelling Problem
	As a Program Develops, Use Measures to Diagnose Problems
	Support Performance Management with a Nimble Strategic Planning Process
	User Performance Management to Improve Agency Transparency
Performance Management Must Engage with Employees	Senior Management Must Support the Program
	Hold Staff Accountable for Agency Performance
	Empower Staff to Take Ownership of the Program
	Employee Challenges Are Inevitable
Performance Management Requires a Customer Focus	Align Performance Targets with Customer Expectations
	Learn How to Better Balance Multiple Constraints in Decision-Making
	Build Agency Credibility via Modest, Customer-Focused “Quick Fixes”
Sustain Performance Management by Building Constituencies	Senior Management Must Work to Institutionalize Performance Management
	Ensure Many DOT Managers and Employees Are Involved in Performance Management
	Use Performance Management to Build Bridges with State Legislators
	Make Performance Management Efforts Visible to the Public

Source: Best Practices in Project Delivery Management, NCHRP

In 2011, the newly integrated MassDOT launched the Office of Performance Management and Innovation (OPM&I) as the agency's central hub for evaluation, monitoring, data collection, and new technologies and strategies. OPM&I also monitors agency progress in meeting system-wide performance targets.⁵⁵ To date, OPM&I has published seven system-wide performance management reports (called "Trackers") and since the fall of 2015 has posted weekly performance reports specific to the MBTA.

REVENUE-RAISING STRATEGIES

In an era of strained budgets and reduced federal investment in transportation, many states are coming up with new ways to raise revenue and cover costs. Many of these strategies share a common theme in that they attempt to charge transportation users according to their usage of transportation infrastructure. Under a VMT (Vehicle Miles Traveled) tax, the more people drive and the more wear and tear they exact on roadways, the more they will be accountable for the costs of repairing and maintaining them. Under a Congestion Pricing approach, those who choose to drive in dense downtown neighborhoods and/or at peak travel times, and thereby contribute the most to congestion, will pay into a system that improves alternative transportation options. Under Tax Increment Financing (TIF) structures, growth in value from businesses that benefit from being located in a heavily served transit area can be captured at relatively little cost to the business itself. See the section on Tax Increment Financing, below.

IN AN ERA OF STRAINED BUDGETS AND REDUCED FEDERAL INVESTMENT IN TRANSPORTATION, MANY STATES ARE COMING UP WITH NEW WAYS TO RAISE REVENUE AND COVER COSTS.

CONGESTION PRICING

Congestion pricing is a method of tolling that can take several forms, but whose goal is consistent: reduce congestion by increasing toll charges at certain times of the day to expedite the freer flow of traffic. There are several congestion pricing tools that can be put into place, ranging from fees to enter crowded central business districts to tolling based on time of day or vehicle occupancy on busy corridors or bridges.

Perhaps the best-known application of congestion pricing is found in London. The London model, which is a place-based and boundary-specific congestion pricing scheme known as "cordon pricing," is intended to reduce traffic in the city's downtown. As cars pass through an invisible line into the Congestion Charge Zone (CCZ, or what is locally known as the "Ring of Steel"), drivers are charged roughly \$15 (U.S.) via cameras equipped with automated license plate recognition technology. Since congestion pricing was first implemented in 2003, there have been noticeable changes in traffic flows and overall transportation behaviors.

During the first year of the program, officials observed an 18 percent reduction in traffic volume and a 30 percent reduction in congestion. The mode share of private cars fell to 10 percent in the CCZ and traffic speeds have increased, resulting in more-reliable travel time predictions, lower costs of travel, and more-efficient movement throughout the city's inner core. The revenue raised by the congestion fee has been used to fund improved transit in the city center, which encourages travelers to explore alternatives to driving.

Although the London model has been largely considered a success, only a handful of other jurisdictions have implemented or attempted to implement cordon pricing, including Singapore, Stockholm, Milan, Trondheim, Oslo, and Bergen. Attempts to implement cordon pricing in the U.S. have been met with opposition on the part of both the public and government officials. New York City's then-mayor Michael Bloomberg attempted to introduce cordon pricing in certain parts of Manhattan, but was met with opposition from state lawmakers, who held final approval over the initiative. Though recently the concept has again become a subject of discussion in New York City, no action has been taken to implement cordon pricing.

Congestion pricing in the U.S. tends to follow the managed (or express) lanes concept, i.e., high occupancy tolling (HOT) or high occupancy vehicle (HOV)



road lanes. Under these approaches, vehicles are allowed access to designated freeway lanes for a fee, though HOVs may be allowed free access. These lanes usually have limited access points and operate “express” to their destinations. The lanes use variable pricing strategies to ensure that the highest prices are charged during the most-congested times to keep the managed lanes themselves from becoming congested. The I-495 corridor in Virginia, the I-15 corridor in San Diego, State Route 91 in Orange County, I-394 in Minneapolis, SR-167 outside of Seattle, and I-10 in Houston all have incorporated some form of variable congestion pricing based on vehicle occupancy. For travel over its Cape Coral and Midpoint bridges, Lee County, Florida has adopted a congestion pricing model similar to London’s, but based on time of travel rather than vehicle occupancy.

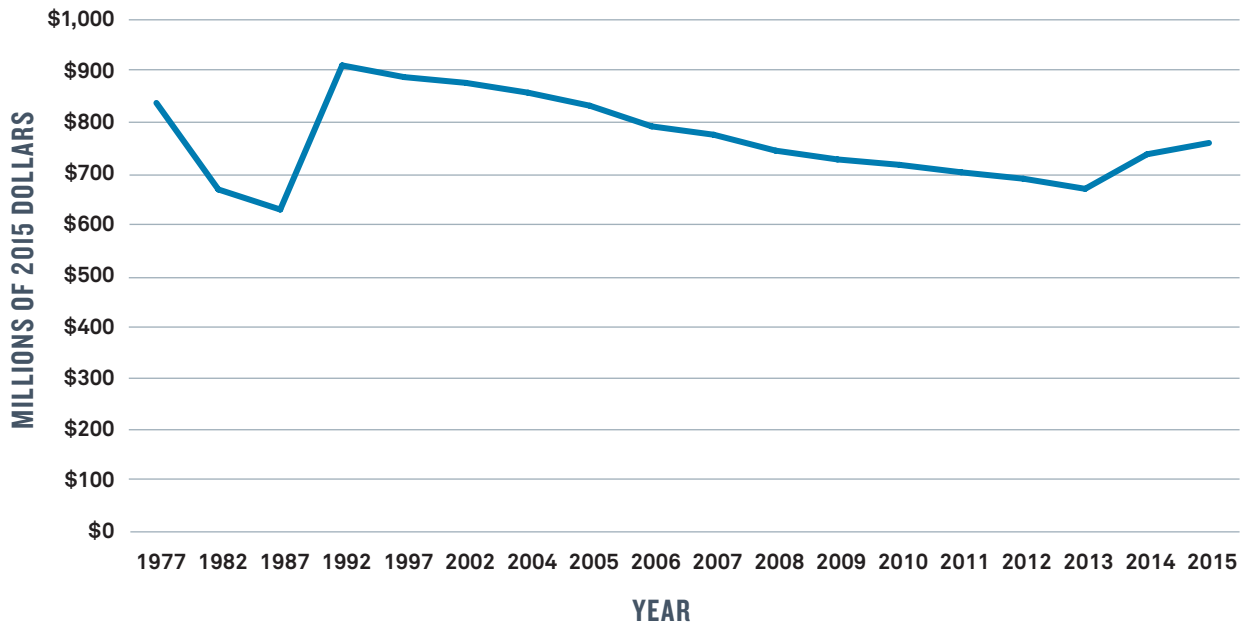
There are just two roadways in the entire Commonwealth that qualify as managed lanes, both immediately outside of Boston: a permanent 1.6-mile HOV lane on the southbound side of I-93 in Somerville, and a 5.4-mile corridor on the I-93 Southeast Expressway that offers rush-hour HOV lanes via Road Zipper Moveable Barrier System technology. Neither lane is tolled. The implementation of all-electronic tolling (AET) on the Massachusetts Turnpike (I-90) and on tolled bridges and tunnels in the Boston area provides the state with greater flexibility to institute creative tolling structures (such as

congestion or cordon pricing), or adding tolls to currently non-tolled roads (see Interstate Tolling, below).

INTERSTATE TOLLING

Although passing through toll gantries that scan transponders is more convenient for drivers than stopping at toll booths, the introduction of AET can also be considered an important revenue-raising opportunity for MassDOT. Generally, tolling on the federal Interstate systems had been prohibited since the Federal Interstate Highway System was created in 1956 (with the exception of roads that were already tolled when incorporated into the network). The authorization of the Interstate System Reconstruction and Rehabilitation Pilot Program (ISRRPP) in 1998 did allow a limited number of states to introduce tolls on Interstate highways. In 2015, Congress added a provision to ISRRPP allowing for a state to be removed from the program if it did not take concrete steps to introduce tolls within a certain timeframe.⁵⁶

As slots in the ISRRPP have become available, states are more often considering the possibility of tolling highways. In 2017, Connecticut state lawmakers considered reinstating tolls for the first time since 1983, and state governments in Indiana, New Jersey, and Wisconsin have considered adding tolls to existing non-tolled highways. The Trump

FIGURE 5.1: Massachusetts Gas Tax Revenue for Selected Years, 1977–2015

Source: State and Local Government Finance Data Query System; <http://sldqs.taxpolicycenter.org/pages.cfm>

Administration has expressed a willingness to consider a more-permissive regulatory approach to tolling existing Interstates, hinting that states could be given more power in deciding to toll Interstate highways. It would be relatively easy for MassDOT to install tolling gantries on non-tolled Interstate highways such as I-93 and I-95; this step could be a significant revenue generator for the state. However, complex issues, such as tolling roads not specifically designed to accommodate this purpose, and the potential of diverting some traffic to local non-tolled roads, would have to be analyzed.

GAS TAXES

A gasoline tax is a common way for states and the federal government to collect money to pay for transportation infrastructure. Gas taxes are typically formulated as a flat fee per gallon, and are often left unchanged for many years. In an era of increased fuel efficiency, lower gas prices, and changing driving habits, the decline of gas tax revenue, as shown in Figure 5.1, has negatively impacted transportation funding levels.

One approach to addressing the decline in gas tax revenue growth is known as “indexing,” which links the value of a tax to a price index, traditionally the Consumer Price Index (CPI). Indexing eliminates the need to propose and vote on specific types of tax increases, especially ones that are intended to take

place annually. Most recently, California’s SB1—The Road Repair and Accountability Act of 2017—increased and indexed both the state gas tax and the state diesel tax. Several other states have also indexed their gas taxes since 2012, including Indiana, Utah, Georgia, New Hampshire, Rhode Island, and Maryland. Michigan is on track to begin indexing by 2022. North Carolina not only indexes its gas taxes to inflation, but also adjusts it based on population fluctuations. At the end of 2017, at least 15 more state legislatures were considering legislation to increase gas taxes.

As other states have done, the Massachusetts Legislature—given the reliance on the state gas tax to fund transportation projects in the Commonwealth—passed a plan to raise the tax by three cents and index it in 2013. Under the plan, funds for transportation expenses were expected to increase by \$600 million per year, and generate \$1 billion over a 10-year period. However, opponents of gas tax indexing were able to overturn the law via a ballot referendum in 2014.

Since 2013, the state’s gas tax has been 26.5 cents per gallon (24 cents in tax plus the 2.5 cent Underground Storage Tank [UST] fee). As shown in Figure 5.2, the Massachusetts gas tax is only the 30th highest in the nation, and relatively affordable compared with Pennsylvania’s at 58.2 cents per gallon; or the national average of 33.78 cents. Of the New

England states, only New Hampshire (23.8 cents per gallon) has a lower gas tax than Massachusetts.

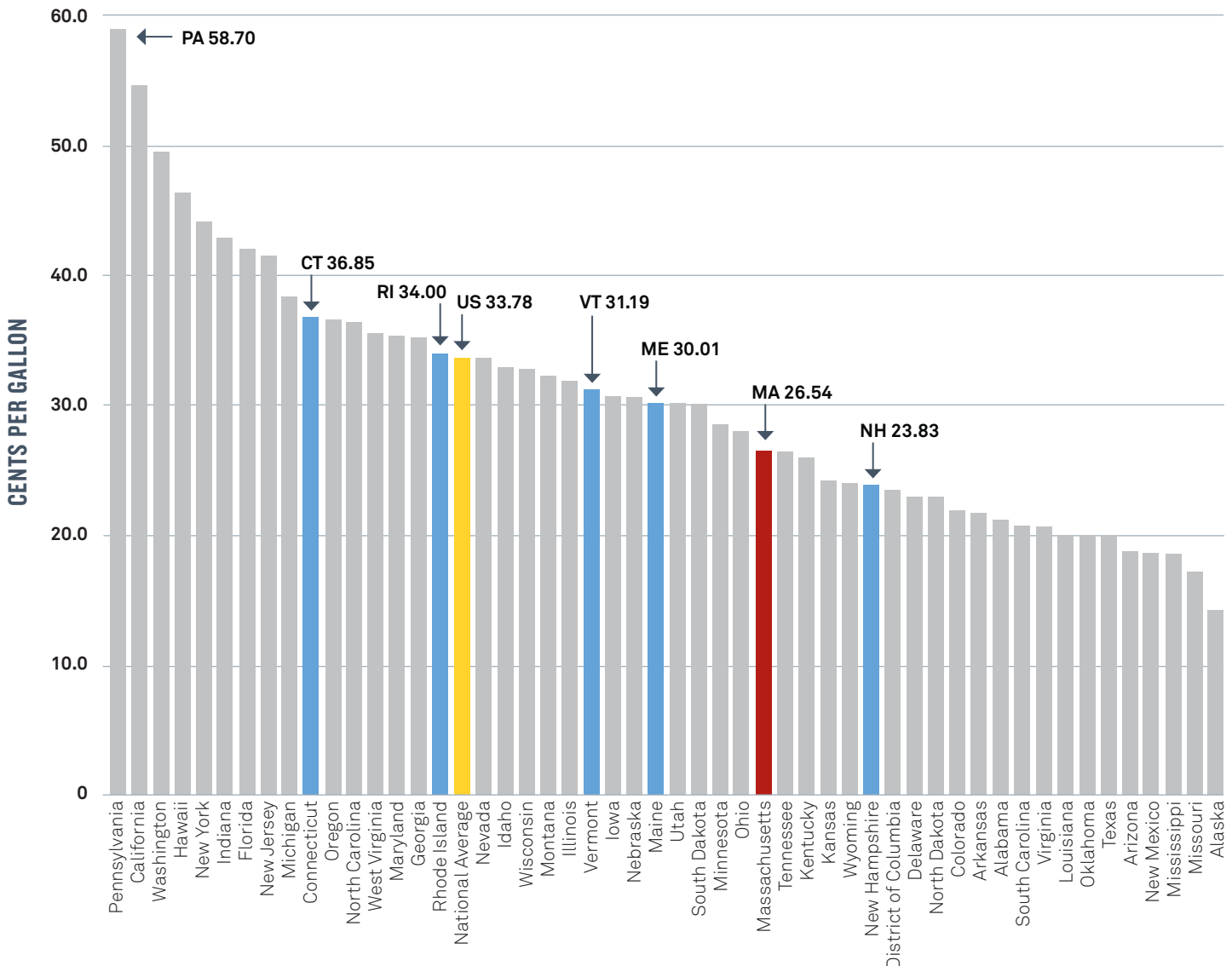
VEHICLE MILES TRAVELED (VMT) TAX

One much-discussed alternative to a gas tax is the vehicle miles traveled (VMT) tax, also known as the mileage-based user fee (MBUF). Under a VMT tax, drivers are charged a fee based on how much they drive, as measured by odometer or GPS readings. VMT taxes are seen by some as more socially equitable and accountable than gas taxes because VMT taxes charge drivers based on how much they and their cars actually use roads and generate wear

and tear. VMT taxes are also not subject to the market fluctuations of the petroleum industry that affect the price of gas, and are better insulated from transportation technologies like energy-efficient vehicles that, though better for the environment, reduce revenue generated through gas taxes.

Material published online by the National Council of State Legislatures (NCSL) notes that between 2013 and 2015, at least 65 VMT-related bills have been considered in 23 states.⁵⁷ A federal VMT tax has also been proposed by two separate transportation commissions, as well as the Congressional Budget Office (CBO). Congressional Representative

FIGURE 5.2: State Gas Taxes, January 2019



Source: American Petroleum Institute Motor Fuel Taxes Report; <http://www.api.org/oil-and-natural-gas/consumer-information/motor-fuel-taxes>

Earl Blumenauer of Oregon also proposed a national pilot program to study the economic impacts of a federal VMT.

In August 2017, the I-95 Corridor Coalition—a partnership among several of the East Coast states through which the Interstate runs—announced a VMT pilot program in Pennsylvania and Delaware. Fifty cars are to be equipped with GPS tracking devices to test the technology, as well as identify policy-related issues that could arise with the introduction of a VMT tax, such as how to count miles driven by out-of-state drivers and how to reconcile payments between states. The project is being funded through a grant issued by the Federal Highway Administration.

Despite growing interest, only Oregon has instituted a VMT tax, having been at the forefront of a VMT tax for several years, convening a task force to study its feasibility in 2001, and running voluntary pilot programs in 2006 and 2012. In 2015, the permanent Road Usage Charge Program was established; this charges drivers 1.5 cents per mile, minus both the amount of gas tax incurred at the pump and any out-of-state travel. Drivers are required to choose one of three service plans, and receive and use a mileage reporting device that automatically sends mileage information to the Oregon Department of Transportation. The program is capped at 5,000 cars and light trucks; to date, 1,379 vehicles have participated.

TAX INCREMENT FINANCING

Tax Increment Financing (TIF) is a monetary tool that captures increases in tax revenue due to development, and uses these captured funds to pay for infrastructure improvement costs. Traditionally, a parcel of land will be designated as a TIF district, and any increase in tax revenue will be earmarked to pay back any incurred development costs.

TIFs can also be used for almost any type of municipal or state project. Transportation projects can be considered ideal applications of TIF financing. Because transportation infrastructure positively influences property values more often than not, the growth in tax revenue on those parcels targeted for transportation-related investments can be designated for other purposes, such as repayment of financing or development costs, or investment in other transportation-related projects. Money raised through municipal TIF bonding can also be used to leverage financing and matching funds from other sources, such as the federal government.

The largest TIF-financed project in the country to date is the Hudson Yards Financial District, the New York City redevelopment project that includes the one-mile extension of the MTA's #7 subway line. Though the city is contributing funds to cover the interest on the \$3 billion bonds that were taken out to finance the project, the principal is being paid





THERE ARE NOW EIGHT ACTIVE BIDS IN THE COMMONWEALTH, THREE NEW ONES CREATED IN 2018 ALONE.

through the value-capture contributions from the 45-block area of the Hudson Yards Financial District.

In 2015, the Illinois Senate passed a bill that allows Chicago to designate transit TIF districts in the half-mile radius around Chicago Transit Authority (CTA) station areas. The city's transit-specific TIF dedicates funds specifically for transportation-related projects. In November 2016, the Chicago City Council voted unanimously to approve the biggest TIF district in city history—a six-mile expanse to fund improvements to the CTA's Red Line.

Although Massachusetts offers what are officially known as TIF bonds,⁵⁸ the financing mechanism used by the state that is more akin to a traditional TIF tool is what is known as a District Improvement Financing (DIF) bond. Although use of DIF bonds in the Commonwealth for transportation-related purposes has been limited, the City of Somerville issued \$25 million in bonds to fund the Assembly Row project, a mixed-use development that includes a new Assembly Square MBTA Orange Line station. Though the funds provided through the DIF bonds were not specifically earmarked for transportation uses, the agreement between Somerville and the project developer makes specific provisions for public infrastructure improvements, including road and intersection upgrades, storm water conduits, and internal street networks (e.g., a shared-use path).

A value-capture tool related to TIFs and DIFs is the Business Improvement District (BID). Like traditional TIFs and DIFs in the Commonwealth, a BID defines a specific geographic area in which to raise funds, and to which funds will be dedicated. Traditionally located in heavily trafficked retail areas like Boston's Downtown Crossing, property owners in a BID enter into an agreement to pay increased or additional taxes in order to fund a higher level of services and upgrades to an area. In 2018 three new BIDs were created in Massachusetts (Hudson, The Greenway BID, and Worcester), resulting in eight active BIDs now in the Commonwealth. The Greenway BID in Boston has a connection to transportation, because it is the area located as the roof of the Central Artery and the infrastructure is owned by MassDOT. The Greenway BID is expected to contribute approximately \$1.5 million annually, through increased assessments to specific commercial properties located along the Greenway corridor, with \$1 million dedicated to Greenway maintenance and horticulture costs and \$500,000 set aside for park enhancements. In general, BIDs are not a silver bullet solution for every infrastructure challenge, as they are unable to support large-scale public infrastructure projects, but they can serve a complementary role with the public sector's investment plans.



CHAPTER 6

RECOMMENDATIONS AND OPTIONS FOR CLOSING THE GAP

“THE TRANSPORTATION FINANCE COMMISSION HAS CONCLUDED THAT OUR SYSTEM HAS BEEN NEGLECTED FOR YEARS, AND THAT THE SYSTEM WE TAKE FOR GRANTED WILL FAIL IF WE DO NOT TAKE PROMPT AND DECISIVE ACTION.”⁵⁹

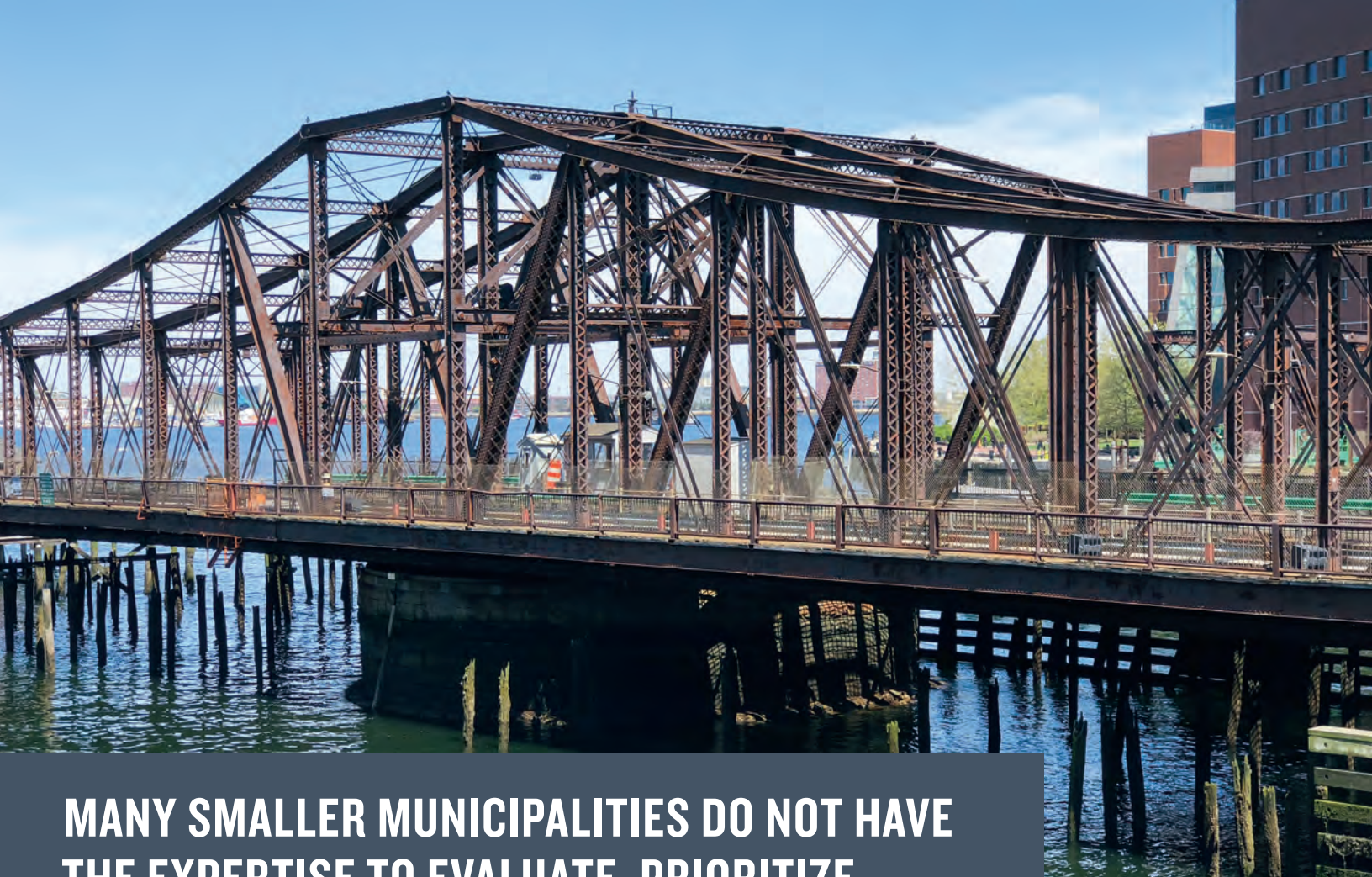
Although MassDOT has made substantial progress in updating its management procedures and implementing the TFC reform and revenue recommendations during the past decade, more needs to be done. The following management reforms and revenue-raising measures are proposed for consideration in coming years.

MANAGEMENT REFORMS ACROSS BOTH MBTA AND THE HIGHWAY DIVISION

- **Fully implement a data-driven asset management system:** The MBTA and the Highway Division have made substantial advances in this direction, but both efforts are still works in progress, and still exist in relative isolation from each other. Though there are major differences in the types of assets managed by the two agencies, both are now part of a unified MassDOT and there should be more commonality between the two approaches. The development of the Planning for Performance (PFP) tool is a good step in this direction.
- **Rebuild staff capacity:** For many years, both the MBTA and the Highway Division have responded to constrained budgets by reducing staff levels and delegating more work to consultants. This approach makes sense in many ways, an obvious one being that it is not cost-effective to maintain large staffs of design engineers to undertake relatively short-term surges in design needs for large projects. However, there is considerable evidence that the agencies don't even have the staff capacity to supervise their consultants. The previous, out-of-control cost estimate for the MBTA's Green Line Extension was a good example. Agency staff size and capacity need to be rebuilt with the level of skill and experience needed to manage projects in the 21st century.

- **Further explore the use of creative project delivery mechanisms:** These include Design-Build and Public Private Partnership (P3) approaches. The state is woefully behind national trends in these areas. Both techniques can be particularly helpful in financing projects with projected revenue streams, such as toll roads.
- **Fully implement a data-driven project prioritization system:** The state has made substantial strides in this direction but more can be done.
- **Move the MBTA's debt overhang to the state:** This action has been a recommendation of nearly every financing study going back to and including the TFC report. As part of the environmental approval for the Big Dig, the state committed to several large transit projects, including the Greenbush Branch of the Old Colony commuter railroad; significant expansion of parking at commuter rail stations; and the eventual (after other projects were swapped out) extension





MANY SMALLER MUNICIPALITIES DO NOT HAVE THE EXPERTISE TO EVALUATE, PRIORITIZE, AND IMPLEMENT PROJECTS WITHOUT GREATER STATE ASSISTANCE; LARGER MUNICIPALITIES SHOULD PERHAPS HAVE GREATER AUTONOMY.

of the Green Line to Somerville. The debt burden for these projects was placed not on the Commonwealth as a whole, but on the MBTA alone. The MBTA needs to be able to address ongoing SGR needs. Because taking this action would increase the strain on the state's overall capital spending and its resulting bond rating, it would need to be done as part of a comprehensive review of state borrowing and the revenue streams needed to support it adequately.

- **Improve the operation of the Chapter 90 municipal finance program:** Chapter 90 funding remains the most-opaque and non-performance-based element of state transportation funding, as it was at the time of the TFC report. During the release of the TFC report, the state allocated \$120 million annually to municipalities, and since FY2011 it has generally allocated \$200

million annually, with a one-time increase to \$300 million at the beginning of the Baker Administration. Chapter 90 allocations returned to \$200 million in FY16 and continue at this level through the current five-year CIP that extends to FY2023.

Neither the funding amount, nor method of allocation, is based on a single performance metric. Many smaller municipalities do not have the expertise to evaluate, prioritize, and implement projects without greater state assistance; larger municipalities should perhaps have greater autonomy. The spring schedule for the award of funding makes no sense; it leaves municipalities no time to gear up to implement projects during our relatively short construction season, with one result that many dollars go unspent and deferred to later years.

OPTIONS FOR NEW OR EXPANDED SOURCES OF REVENUE

- **Further increase the gas tax:** The TFC recommended an 11 cent gas tax increase plus annual indexing to inflation. The gas tax was increased only by 3 cents and indexing was repealed by the voters. Clearly, indexing is not coming back, but there is nothing to stop the Legislature from enacting periodic gas-tax increases, just as it has allowed for MBTA fare increases. Massachusetts ranks 30th in the nation in the level of the gas tax. If the tax had been raised by 11.5 cents in 2007, as recommended by the TFC, the funding gap would be \$3.6 billion less today. An 11.5 cent increase today would reduce the future (2028) gap by \$3.9 billion.
- **Assess the sales tax on gasoline purchases:** Currently Massachusetts does not assess the 6.25 percent sales tax on the sale of gasoline. If the current sales tax were to be assessed on gasoline purchases (in addition to existing state and federal gas taxes), an estimated \$6.1 billion could be raised over the TFC's 10-year forecast period.
- **Take advantage of the new All Electronic Tolling (AET) technology:** Allow for toll revenue to be used to support the needs of the entire transportation system in certain areas (such as commuter rail, subway, and BRT [bus rapid transit] programs). Options include:
 - Increase base tolls on existing toll facilities for the first time since 2008: The MBTA has raised fares three times since the last toll increase. This inequitable treatment of transit riders and motorists is difficult to justify. Everyone benefits from a robust MBTA, not the least being drivers who do not have to fight for space on the roadways, and transit riders who would, absent an effective transit system, have to drive. A single, modest increase of 10 percent would raise \$350 million over the 10-year forecast period.
 - **Implement congestion pricing during peak periods:** For many years, the Massachusetts Turnpike Authority provided commuter discounts to regular roadway users, most of whom travel during peak periods. Implementing congestion pricing (easily done with AET) could help raise revenue, and encourage travel time and mode shifting, thereby reducing congestion. For example, by implementing a system similar to London's, a 5am–7pm weekday congestion charge of \$5.00 imposed on major roadways crossing I-95/MA 128 could raise \$2.9 billion over 10 years.
- **Impose border tolling:** Currently, Massachusetts residents pay tolls when they cross into or return from New Hampshire, Maine, and New York. Except for the tolls on the Mass-Pike, on I-90 at the New York border, and on vehicles entering I-90 in Sturbridge near the Connecticut border, Massachusetts does not reciprocate. A bi-directional toll of \$2.00 on the other Interstate and similar highways that travel between Massachusetts and neighboring states—I-91 Vermont and Connecticut; I-93 New Hampshire; I-95 New Hampshire and Rhode Island; I-195 and I-295 Rhode Island; I-395 Connecticut; and Route 3 New Hampshire—would raise approximately \$3.8 billion in gross revenue over 10 years, assuming no growth in traffic volumes or toll amounts.
- **Expand in-state tolling:** It is inequitable that only drivers on I-90, over the harbor bridges, and in the harbor tunnels pay a toll to enter the congested Boston region, while drivers on I-93 and I-95 pay nothing. Taking advantage of the AET technology, the use of in-state tolls could be expanded to I-93 and I-95 in the greater Boston area. The imposition of a \$1.00 toll in both directions at four new tolling locations (two on I-93 and two on I-95) could raise an estimated \$199 million a year, or nearly \$2 billion over 10 years.
- **Transportation Climate Initiative (RGGI for Transportation):** A regional approach to reducing carbon emissions is also a method to increase revenue for transportation needs. Massachusetts has participated in the Regional Greenhouse Gas Initiative (RGGI) since 2007, where a collection of US states in the northeast and Mid-Atlantic region are working together to reduce carbon emissions. This partnership can be expanded to address emissions in the transportation sector, but also to raise revenue for transportation investment needs.

California is currently managing a cap and trade program for fuel distributors. If Massachusetts follows the California pricing structure it could generate hundreds of millions annually for transportation investments, but there are still

THERE WERE ALMOST 65 MILLION RIDES THROUGH TNC SERVICE IN 2017, WITH NEARLY 100,000 HAPPENING EACH DAY IN BOSTON ALONE, RESULTING IN A DRAMATIC INCREASE TO VEHICULAR CONGESTION.

questions on how much Massachusetts can expect from this new program under lower rates, and also when any funding could become available. The revenue estimates for RGGI are still being worked out, so we have listed this as “TBD.” More importantly, this funding is restricted to infrastructure improvements that will reduce carbon emissions. Therefore, it is unlikely these funds can be used to address maintenance needs of state roads and bridges, although there may be opportunities with zero-emission new buses and other transit vehicles.

- Increase TNC fees:** In 2017, Massachusetts implemented a 20 cent per ride surcharge on all TNC rides, like Uber and Lyft. It generated \$13 million in the first year. This 20 cent per ride surcharge should be increased a rate this is equal to the price of an MBTA bus fare. Connecting this surcharge to a MBTA bus fare is reasonable because of the relationship between this transportation service and public infrastructure of roads and bridges, to say nothing of the impact on congestion. It is also important to address the displacement impact on MBTA revenues when travelers choose TNCs in the metropolitan Boston region while public transit options are available.

There were almost 65 million rides through TNC service in 2017, with nearly 100,000 happening each day in Boston alone, resulting in a dramatic increase to vehicular congestion. If increased to the rate of an MBTA bus fare, it could generate over \$800 million over the next decade that could be used to support road, bridge and public transit infrastructure needs.

- Implement a Vehicle Miles Traveled (VMT) Tax:** VMT taxes have been much discussed, but implemented by only one state, Oregon, and on a limited basis, at that. A VMT tax is a fee on each mile driven. The technology currently exists in all new cars to collect such data while protecting motorists' privacy. We estimate that a VMT tax of 1.31 cents per mile would have raised \$766 million in 2016, enough to equal the amount of revenue from the gas tax. Over the 10-year forecast period, that same VMT tax would raise \$8.8 billion.
- Increase RMV Fees:** RMV fees are deposited in the Commonwealth Transportation Fund. Though some RMV fees were relatively recently increased (in 2014), an average increase of 10 percent across all RMV fees would add approximately \$50 million in revenue annually, or half a billion dollars across the forecast period.

TABLE 6.1: Summary of Revenue Raising Options

REVENUE RAISING OPTION	POTENTIAL REVENUE, 2019–2028
Further increase the gas tax	\$3.9 billion
Assess the sales tax on gasoline purchases	\$6.1 billion
“RGGI for Transportation” carbon price	TBD
Implement congestion pricing during peak periods	\$2.9 billion
Impose border tolling	\$3.8 billion
Expand in-state tolling	\$1.9 billion
Increase base tolls on existing toll facilities	\$350 million
Implement a Vehicle Miles Traveled (VMT) fee	\$8.8 billion
Increase RMV fees	\$500 million
Increase TNC fees	\$800 million

Altogether, as shown in Table 6.1, these options for raising revenue could bring in as much as \$29 billion over the 10-year forecast period, more than eliminating the funding gap identified under any of the three scenarios forecast in Chapter Three. The VMT tax alone could raise \$8.8 billion, and all other items, without the VMT tax, could raise \$19.5 billion.

OTHER REVENUE-RAISING OPTIONS

- **Transportation Improvement Districts (TIDs):** This tool can capture a small part of the value of increased property valuations brought about by transportation improvements. Massachusetts and the City of Boston have experimented with Development Improvement Districts (DIDs) not specifically related to transportation. The

recent effort to create a BID to fund the ongoing operations of the Rose Fitzgerald Kennedy Greenway in downtown Boston is a good example. Similar efforts to create TIDs in congested urban areas should be tried.

- **Regional Option Taxes:** Many states, including conservative “red” states, such as Georgia, allow regional authorities to hold referenda on whether to impose regional option taxes, typically sales taxes of one kind or another. Often these votes are tied to pre-announced and highly specific projects that could be implemented with the additional revenue, thereby committing to the tax-paying residents the benefits realized from their increased taxes. Such regional option taxes could be implemented in Massachusetts on a Metropolitan Planning Organization (MPO), county, or municipal basis.





APPENDICES

APPENDIX 1

ACRONYMS

ABP	Accelerated Bridge Program	HOV	High Occupancy Vehicle
ACEC	American Council of Engineering Companies	ISRRPP	Interstate System Reconstruction and Rehabilitation Pilot Program
AET	All Electronic Tolling	MAP-21	Moving Ahead for Progress in the 21st Century Act
ARRA	American Reinvestment and Recovery Act	MassDOT	Massachusetts Department of Transportation
BEA	Bureau of Economic Analysis	MBTA	Massachusetts Bay Transit Authority
BID	Business Improvement District	MBUF	Mileage-Based User Fee
BRT	Bus Rapid Transit	MHS	Metropolitan Highway System
CBO	Congressional Budget Office	MPO	Metropolitan Planning Organization
CCZ	Congestion Charge Zone	NCHRP	National Cooperative Highway Research Program
CEO	Chief Executive Officer	NCSL	National Council of State Legislatures
CIP	Capital Investment Plan	O&M	Operation & Maintenance
CM	Construction Manager	OPM&I	Office of Performance Management and Innovation
CMAR	Construction Management at Risk	P3	Public Private Partnership
CMGC	Construction Manager/General Contractor	PAMAC	Performance and Asset Management Advisory Council
CPI	Consumer Price Index	PfP	Planning for Performance
CTA	Chicago Transit Authority	PM	Project Manager
DB	Design-Build	PSAC	Project Selection Advisory Council
DBB	Design-Bid-Build	QA	Quality Assurance
DBFOM	Design, Build, Finance, Operation, and Maintenance	SD	Structurally Deficient
DCR	Department of Conservation and Recreation	SGR	State of Good Repair
DID	Development Improvement District	SIP	State Implementation Plan
DIF	District Improvement Financing	SSTI	State Smart Transportation Initiative
DOT	Department of Transportation	TFA	Transportation Finance Act of 2013
EOTPW	Executive Office of Transportation and Public Works	TFC	Transportation Finance Commission
EPPR	Economic & Public Policy Research	TID	Transportation Improvement District
FHWA	Federal Highway Administration	TIF	Tax Increment Financing
FMCB	Fiscal and Management Control Board	TTI	Texas A&M Transportation Institute
FTA	Federal Transit Administration	UST	Underground Storage Tank
FTE	Full-Time Employee	VMT	Vehicle Miles Traveled
GLX	Green Line Extension	WSDOT	Washington State Department of Transportation
GMP	Guaranteed Maximum Price		
GPS	Global Positioning System		
HOT	High Occupancy Tolling		

APPENDIX 2

KEY VARIABLES AND METHODOLOGY IN MAKING OUR PROJECTIONS

The key variables in making these projections to MassHighway's and MBTA's budgets over the next ten years are growth rates assumed for the various revenue sources and expenses:

- Historical annual (2000–2016) growth rate in Massachusetts personal income, from the U.S. Bureau of Economic Analysis (BEA), of 1.5 percent (adjusted for inflation). This underlying growth rate was used as a default value when more-specific data were not available.
- Historical annual growth rates (if available) were used for specific variables, such as the growth in Operation & Maintenance (O&M) expenses.
- MassDOT's CIP five-year projections (2019–2023) are a key source of data for the first half of the 10-year forecast period. A key decision point then becomes how to carry these assumptions into the future, whether to flatline them, increase by the underlying growth rate, or revert to historical norms. For this analysis, Highway capital spending levels have been kept flat for 2024–2028, based on the CIP spending levels, because no major highway expansions are currently planned for either timespan.
- “Flatlining” means keeping current levels of revenue or expenses constant going forward. For example, we assumed that the state's \$125 million in annual assistance to support the debt service for bonds on the Metropolitan Highway System (MHS), and the O&M of the Central Artery/Tunnel roadways will remain constant, given that it has done so for many years. However, there is nothing to say that the Legislature will not increase or decrease this amount in coming years, and many have argued for some time that the current amount is inadequate.

The following describes some of the growth rate assumptions for key variables:

- **User fees:** No increase was assumed in highway tolls, which have not been raised since 2008 despite an originally planned 2014 increase. Many different assumptions about either variable could be made.
- **Transfer from the Commonwealth Transportation Fund (CTF):** The CTF provides contract assistance of \$125 million annually to Highways, in part to cover MHS debt service and CA/T operating costs. This amount has been held constant for the duration of the projection period. In order to account for the additional (discretionary) transfers that take place, the historical amount of these transfers was averaged, and then reduced by the projected increase in CTF debt service costs.
- **Operating costs:** The underlying growth rate of 1.5 percent was used for highway expenses.
- **Debt:** Specific estimates of debt service costs were provided by the MBTA. The underlying growth rate of 1.5 percent was assumed for highway debt.
- **Federal capital funding:** Reduced using the 2011–2016 growth rate of -4.1 percent, reflecting a gradual erosion in historical funding levels. Federal funding could be considered to be in jeopardy, given the policies of the current federal administration and the long-term erosion of the federal Highway Trust Fund, caused by the inflation-adjusted decline in gas tax revenue and increases in vehicle fuel efficiency.

Dedicated state taxes: The dedicated one cent of sales tax revenue received by the MBTA was increased at the personal income growth rate of 1.5 percent. It should be noted that sales tax growth has consistently been disappointing over the past few decades, due in part to the diversion of purchases to untaxed Internet sales, some of which are now coming under the sales tax purview with the

establishment of Amazon warehouses in the state. MBTA local property tax assessments were increased at the 0.5 percent annual historical rate (2011–2016). These contributions have been capped for decades by the effects of Proposition 2.5, and now constitute a much smaller percentage of MBTA revenue than in past decades.

TABLE A2.1: Key Variables in Making the MBTA Projections

REVENUES & EXPENSES	BASE CASE ASSUMPTIONS	LOW END	HIGH END
MBTA Fares	Proposed 6.3% over three years with continued similar triennial increases.	5% biennial increases beginning in 2020.	No fare increases
MBTA Ridership	MBTA estimated –1.3% ridership loss due to fare increases in subsequent year with 0.4% annual increase based on 2006–2016 CAGR in intervening years.	1% based on 2008–2012 CAGR	0.4% annual increase based on 2006–2016 CAGR
Sales Tax Growth	1.6% annual increase based on 2006–2016 CAGR		
Local Assessments	0.5% increase annual historical rate (2011–2016)	Increased growth of 1%	
Operating Expenses	3.0% annual increase based upon recent trend (2015–2020(P) average) plus an assumed upward pressure from pension costs.	2.0% annual growth based on recent trend (2015–2020(P).)	Higher annual pension liability inflation of 5% p.a. historical average
CAPITAL INVESTMENT SOURCES			
Federal FTA Contributions	Historical Average excluding GLX increase	Recent Historical Average (2017–2019)	
State Bond Cap	Historical Average		Estimates from GLX Report 2017
MBTA Revenue Bonds	Historical Average		Estimates from GLX Report 2017
CAPITAL SPENDING PROJECTIONS			
State of Good Repair	MBTA Strategic Plan Estimates of \$1.4 billion/year through 2032		
Expansion	CIP Update 2019–2023		
GENERAL MACRO INDICATORS			
CPI–Construction	5% p.a.	3% p.a.	
Cost of Capital	4% p.a.	3% p.a.	5% p.a.
Projected Funding Gap	\$1.9 billion	\$500 million	\$3.9 billion

* If blank, uses “Base Case” assumption

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