Moving Forward: Transportation and the Massachusetts Economy

A White Paper for Our Transportation Future

Prepared by:

Economic Development Research Group, Inc.
2 Oliver Street, 9th Floor, Boston, MA02109

Prepared for:

Table of Contents

Acknowledgements

This white paper was prepared by Economic Development Research Group, Inc. for Our Transportation Future (OTF), a diverse coalition of organizations representing business, industry, planning, labor, municipal and environmental interests working together for increased transportation investment in Massachusetts. OTF comprises the following member organizations:

- A Better City, Inc. (ABC)
- American Automobile Association - Southern New England (AAA)
- Alternatives for Community and Environment (ACE)
- American Council of Engineering Companies of Massachusetts (ACEC/MA)
- Massachusetts Building Trades Council
- Boston Society of Civil Engineers Section/ASCE (BSCES)
- Conservation Law Foundation (CLF)
- Construction Industries of Massachusetts (CIM)
- Economic Development Council of Western Massachusetts
- Metropolitan Area Planning Council (MAPC)
- MassCommute
- MBTA Advisory Board
- Massachusetts Motor Transportation Association (MMTA)
- Massachusetts Municipal Association (MMA)
- Massachusetts Public Interest Research Group (MASSPIRG)
- Massachusetts Organization of State Engineers and Scientists (MOSES)
- Massachusetts Smart Growth Alliance
- NAIOP Massachusetts
- Pioneer Valley Planning Commission (PVPC)
- Urban Land Institute Boston (ULI)
- Urban Edge

Glen Weisbrod and Susan Moses were the primary authors of this white paper, although they were greatly aided by maps and spatial data provided by Eric Bourassa and Tim Reardon of MAPC, and by suggestions and comments by members of the OTF Committee, including Richard Dimino, ABC; Marc Draisen, MAPC; Elizabeth Weyant, MASSPIRG; Rafael Mares, CLF; John Pourbaix, CIM; Frank Callahan, Mass. Building Trades Council; Abbie Goodman, ACEC/MA; and Richard Keenan, BSCES. Additional comments and suggestions were provided by Richard Parr and David Straus of ABC, Amy Goodrich and Conor Yunits of Liberty Square Group, and Ann Donner of Ann Donner Consulting.

Our Transportation Future is funded in part by a generous grant from The Boston Foundation.

Executive Summary

From the earliest roads between the Massachusetts Bay Colonies to the construction of the nation's first subway system and up to the recently completed Central Artery/Tunnel Project, Massachusetts has always planned and built transportation infrastructure with an eye to the future. In every era, major projects have helped lay the foundation for the economic prosperity we enjoy today.

Just as investment in transportation can pave the way to prosperity, underinvestment can endanger that prosperity. It is tempting, after having invested so much in the past decades, to take a step back, and it is proper to use that time to learn from the mistakes of the past and reform. And the Commonwealth deserves full credit for the reforms it has enacted so far. In 2007, the Massachusetts Transportation Finance Commission identified reforms to make better use of the state's current revenue sources. In 2009, the state passed landmark legislation to enact many of those recommendations, including unifying the state's disparate transportation agencies as a new, multimodal Massachusetts Department of Transportation. Since then, MassDOT has pursued cost-saving measures while investing in to repair the state's roads, bridges and transit systems.

Transportation reform is off to a strong start in Massachusetts, but, as the Transportation Finance Commission noted, reform and cost-savings will not close our transportation finance gap. Spending to fix our current transportation infrastructure is essential, but to do so without investing for the future puts Massachusetts at risk of falling behind other states. In order to safeguard our economic future, Massachusetts needs a comprehensive, multimodal transportation investment strategy to complement its new, multimodal transporation agency.

This white paper reviews state, regional and national literature on the relationship between transportation investment and the economy to make the case that Massachusetts must continue to invest boldly in its transportation future in order to ensure its economic future. Among its key findings:

- Investing in transportation creates jobs and income that largely remains within the Massachusetts economy. Every $1 billion spent on highway construction and transit capital projects is estimated to have a total impact of 14,000 jobs in the state.
- Numerous national, regional and state studies have found that investing to improve transportation system performance saves residents and businesses time, fuel and money, and expands markets for goods, services and employment. Conversely, failing to invest adequately in transportation can have the opposite effect, costing our state its economic competitiveness.
- Key Massachusetts industries all rely on a robust transportation system to transport their employees, business partners, supplies, goods and services.
- The condition of our transportation infrastructure is deteriorating to the point of threatening Massachusetts' economic competitiveness. Massachusetts roads are ranked 45th in the nation in terms of surface condition; 12% of our bridges are structurally deficient and 40% are functionally obsolete; and the MBTA faces a $2.7 billion repair backlog just to maintain a state of good repair.

- Bottlenecks during peak travel periods are a warning sign that our roads and transit lines are nearing capacity. Already, 58% of vehicle miles traveled in Metro Boston during peak hours are in congested traffic. The problem will only worsen as traffic volume is projected to outstrip population growth.
- Massachusetts must also recognize that the investments necessary to support a sustainable transportation system vary across the state. New research by the Metropolitan Area Planning Council reveals a diverse set of transportation challenges in nine key job clusters representing over half of the state's 3.2 million jobs. Nearly half of commuting miles to the Boston-Cambridge job cluster are made by transit, highlighting the importance of MBTA state of good repair. Meanwhile, some of the fastest job growth has been found in regions where most commuters travel by car, highlighting the need for coordinated transportation and land use planning that can provide workers with different transportation choices such as transit, shuttles, and biking.
- Despite challenging economic times, other states in all regions of the nation are investing in multimodal transportation strategies to secure their economic futures. If Massachusetts hopes to remain competitive, it must do the same.

The white paper addresses these points over the course of five sections. The first provides a brief history of major infrastructure investment and reform in the Commonwealth, while the second explains the relationship between transportation investment and economic performance. The third hones in on key Massachusetts industries and analyzes their transportation infrastructure needs. The fourth examines the condition, capacity and configuration of Massachusetts' transportation infrastructure. And the fifth looks at other states that are addressing their transportation needs and argues that Massachusetts must do the same.

This white paper is the first in a series on the importance of investing in transportation in Massachusetts. Our Transportation Future will publish follow-up reports in the months to come, in the hopes of making the case for a comprehensive, multimodal transportation investment strategy which positions Massachusetts for continued economic prosperity.

1

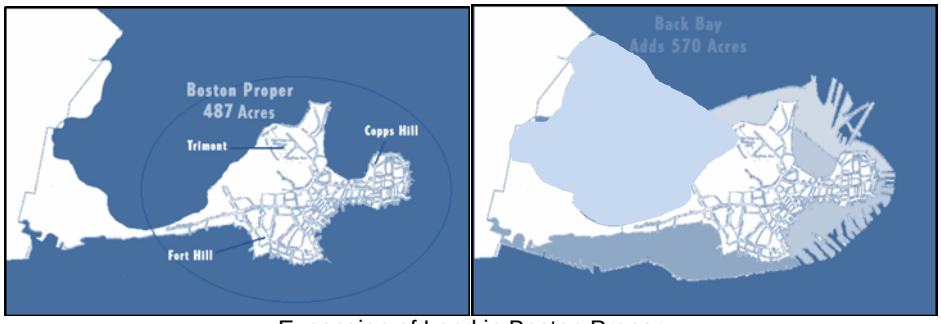
A History of Innovation and Investment

Throughout history, the Massachusetts economy has changed with shifts in markets, production technologies and transportation technologies. In fact, Massachusetts is widely recognized for having an unusually resilient economy, repeatedly bouncing back from the inevitable life-cycle decline of its core industries and finding new sources of economic growth.

Massachusetts is widely recognized for having an unusually resilient economy, the result of actions taken to enable the economy to respond to new challenges and opportunities.

That resilience is no accident. It is the result of actions taken by leaders, and supported by the populace, to enable the Massachusetts economy to respond to new challenges and opportunities, including a history of advanced planning and farsighted investments in infrastructure.

Landfill. During the 1800s, the city of Boston land area tripled in size, as three hills were taken down to fill marshes and create new land along waterfront and riverfront areas. During this period, investment was also made to expand Boston's port facilities.



Expansion of Land in Boston Proper

Source: www.iboston.orgCopyright © 2003 Dave Wieneke. All rights reserved.

Aviation. In the second half of the 20th century, major investments were made to expand Boston Logan Airport into one of the premier international air gateways to the United States, with six runways and 14 miles of taxiways. In a typical year, $7 billion of Massachusetts-made products are shipped to foreign destinations via Logan.[1]

Highways. Also in the second half of the 20th century, major investments were made in the interstate highway system, including the Massachusetts Turnpike and Central Artery. Today, Massachusetts has 16 interstate highways crisscrossing the state. During that same period, Route 128 was developed as one of the nation's earliest circumferential freeways, and later became home to much of the state's high tech industry. These roads are also vital to freight transportation, as trucks transport 72% of the $201 billion in products shipped from sites in Massachusetts and 76% of the $160 billion of good shipped into the Commonwealth.[2]

[1] Wisetrade international trade database, average of 2007-2009

[2] *Future Mobility in Massachusetts: Meeting the State's Need for Safe and Efficient Mobility.* TRIP, 2008.

Rail and Transit. During the mid and late 1800s, Massachusetts thrived as new railroad lines crisscrossed the state. This was followed by major investments enabling the opening of the nation's first underground transit line and, later, the first underwater mass transit tunnel in Boston. That pattern of investment has continued, culminating in one of the nation's largest rail transit systems. During the second half of the 20th century, there was an expansion of both rapid transit and commuter rail lines across eastern Massachusetts, including the extension of the Red Line to Alewife and the rerouting of the Orange Line under the Charles River and through the Southwest Corridor. Today the MBTA boasts 61 miles of light and heavy rail transit lines, serving 125 stations. There are also 12 commuter rail lines serving 123 stations. In addition, Massachusetts continues to rely on rail to transport freight, using 1,100 route miles of track, nearly two dozen rail switching yards, 5 intermodal yards and several rail transfer yards.[3]

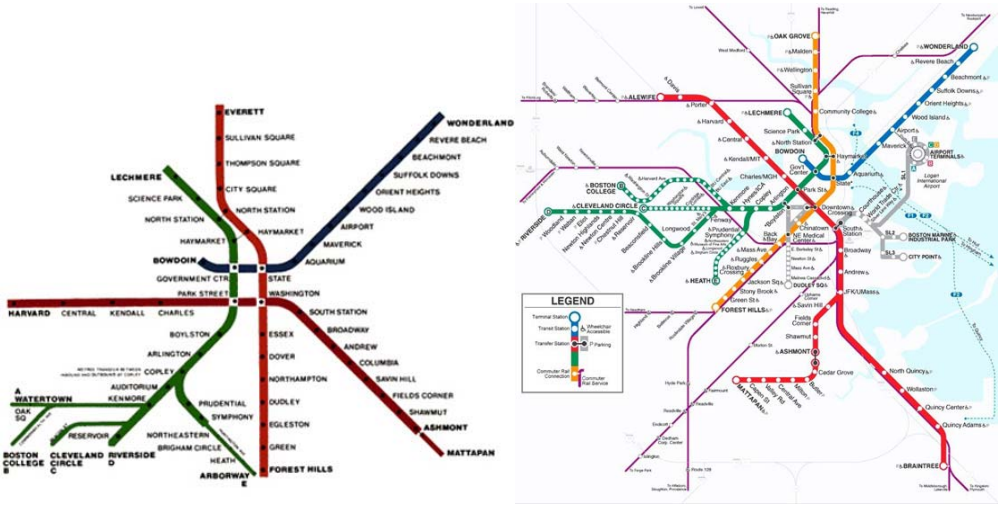


Table 1: MBTA System Map, 1967 versus 2007

Recent Mega-Projects. Over the past 20 years, the Boston area has seen a set of major multi-billion dollar infrastructure investments, including billions invested for the MWRA Boston Harbor Project; electrifying intercity tracks for Acela, the nation's only high-speed train service; and the I-90 harbor tunnel, Silver Line transit tunnel and underground relocation of I-93 comprising the Central Artery/Tunnel Project.

Transportation Reform. In 2004, after two decades of major projects, Massachusetts convened a Transportation Finance Commission to examine the long-term capital and operating needs of state's transportation system. In 2007, the Commission issued two report identifying a major cap in the state's transportation finances and identifying cost savings, efficiencies and new revenues to close that gap. In 2009, Massachusetts began enacting many of those recommendations by passing transportation reform legislation. That law consolidated most of the state's transportation agencies in a new Massachusetts Department of Transporation (MassDOT). Since its formation in November 2009, MassDOT has been aggressive in cutting costs and finding efficiencies. It has also managed a substantial increase in funding and the repair of existing infrastructure.

[3] *Massachusetts Freight Rail*, vol. 5, no. 1, December 2008.

Moving Forward. During each era of Boston's history, there was tremendous discussion and interest in major transportation infrastructure investments, and a long series of major debates about the relative advantages of road, rail, air and marine investments. But throughout the past 380 years, the debate was over the best forms of transportation investment. The fundamental need to invest in the future was not in doubt.

Today, many elements of the Commonwealth's transportation infrastructure – roads, bridges, rail lines and airport facilities – are aging and in need of reconstruction and maintenance. Equally ominous is the fact that many of our major highways, airports, commuter rail and rapid transit services are already operating at or near capacity, leaving little or no leeway to meet future demand. Unfortunately, some of these systems, including Boston Logan airport, lack the physical space for simple expansion of capacity. Despite the progress made in reforming transportation in Massachusetts, the fact remains that the Commonwealth will need to identify new approaches to finance investment in its transportation infrastructure.

This situation raises a need to look carefully at both available options and potential costs involved to meet future transportation needs in Massachusetts, as well as the wider economic stakes involved in transportation decisions and, finally, the consequences of failing to act.

2

Transportation and the Economy

Road crews and bus drivers: when most people think of the economic impact of investing in transportation, they think of these sorts of jobs. While these jobs have real and important economic benefits, spending on transportation also has broader effects. Investing to improve transportation services, capacity and performance can reduce the costs of living and of doing business for all residents and businesses in the Commonwealth. Conversely, failing to do so can increase costs for households and businesses and lead to substantial negative economic consequences.

Spending on Transportation Facilities

Forms of Economic Impact: Direct, Indirect and Induced. One of the key advantages of transportation investment is that it creates jobs within the state economy. Because the construction and maintenance of transportation infrastructure necessarily occurs at the facilities themselves, jobs and income are generated primarily within the Commonwealth, by businesses operating in Massachusetts and employing mostly Massachusetts residents. Similarly, the operation and maintenance of transportation vehicles tends to take place locally.

A competitive economy depends on transportation investment to enable:

- Worker access to jobs
- Business access to skilled workers and professional consultation
- Tourism and convention activities
- Deliveries of products and services to and from Massachusetts companies

These impacts are referred to as the "direct economic impacts" of transportation spending. Because of the nature of transportation spending, these direct impacts tend to stay in the state more so than the impacts of buying goods or services produced out-of-state.

Direct economic impacts also lead to "indirect" (or supplier) economic impacts. For instance, new road construction calls for materials such as crushed stone, largely from Massachusetts sites, and cement mixed and delivered by local companies. New transit stations and terminals also require construction materials, and the services of specialized building trades provided by local suppliers. These indirect impacts are an added layer of economic benefit which, because of the local nature of transportation construction and operation, tend to stay within the Commonwealth.

Finally, as these direct and indirect impacts generate additional work income, that income is spent on consumer purchases at retail stores, restaurants, recreation facilities and other activities across the state. These are referred to as the "induced economic impacts" of transportation investment.

Magnitude of Economic Impact. The direct economic impacts depend on the specific mix of spending between public transit and road projects, and between capital investment and operations. A report by the American Public Transportation Association shows that each additional $1 billion of public transportation capital and operations spending in a

given year *directly* supports an average of 17,450 jobs in the United States in that year. As for road spending, the Federal Highway Administration reports each additional $1 billion of annual spending on highway construction directly supports an additional 10,300 jobs in the US in that year.[4] While the amount of additional indirect and induced impact varies widely by state, past studies using input-output models for the Massachusetts economy indicate that $1 billion of additional highway construction and transit capital spending has a *total impact* – direct, indirect and induced effects – of roughly 14,000 total jobs supported in the year the investment is made.[5]

Impact of Improving System Performance

The ultimate goal of investing in transportation facilities is not just to employ the transportation workers, but to improve the quality and function of transportation systems used by everyone in the Commonwealth. Put simply, better transportation system performance – improving the capacity, safety, speed, reliability and availability of transportation facilities – saves people and businesses money. That makes the economy more competitive and better able to retain, grow and attract business activity. That, in turn, generates more jobs and income for residents of the Commonwealth.

Conversely, when the transportation system cannot accommodate growing demand and facilities are not kept up, system performance degrades, raising costs and reducing income for residents and businesses alike. These economic impacts occur through four key processes:

Operating Expense. Cars in crawling or stop-and-go traffic use more fuel, as do aircraft waiting to take off or circling to land and buses and trains idling before entering or leaving a terminal. Wasted fuel means wasted money. Furthermore, when maintenance is deferred on roads and bridges, the result can be reduced speeds, weight limits banning some trucks or even outright closures (forcing drivers onto more circuitous routes) and increased wear and tear on vehicles. All of these effects increase fuel use and costs for Massachusetts residents and businesses. Conversely, facility improvements can reduce fuel use and operating costs.

Time Cost. Delays due to congestion, repairs, accidents and rerouting not only cost fuel; they also cost time. For professional drivers, that lost time translates directly to added expense for their employers. For other business travelers, the extra travel time represents either extra cost for the employer (if the worker is paid on an hourly basis) or lost productivity and income. A 2010 study by the Associated General Contractors of America found that delays caused by traffic congestion cost the construction industry $23 billion each year, including 3.7 million person-days of lost productivity. For commuters, the added travel time represents a loss of personal time, and there is a substantial body of research showing that employers end up paying more money to compensate workers in areas with adverse traffic and parking conditions. In all of these cases, longer travel times add to business operating costs, while reduced travel time and delays save businesses money.

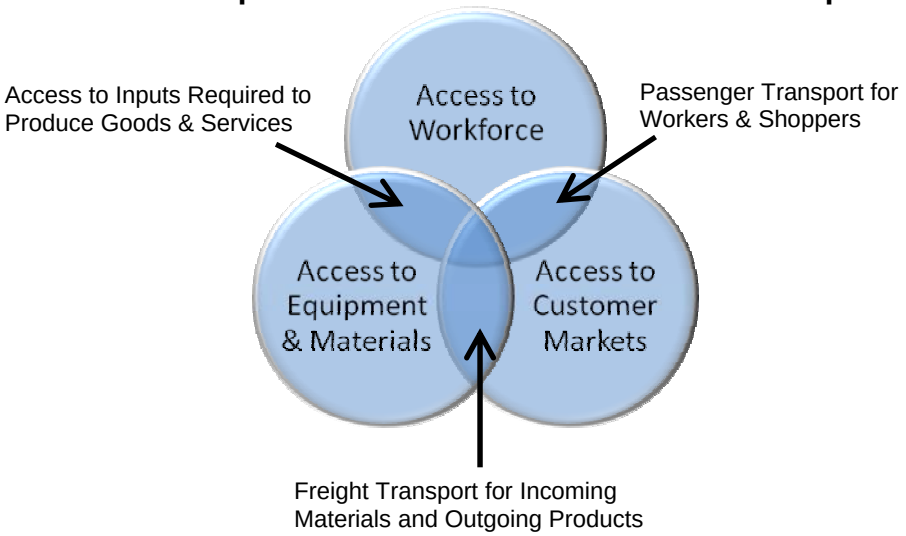
---

[4] *Employment Impacts of Highway Infrastructure Investment*, Federal Highway Administration, updated March 2010. http://www.fhwa.dot.gov/policy/otps/pubs/impacts/index.htm

[5] Analysis by Economic Development Research Group, using the 2008 IMPLAN input-output model for Massachusetts

Market Access. Traffic jams and transit delays are the most visible effects of an inadequate transportation system. But in the long run, the most devastating impact of a diminished transportation system is the shrinking of markets available to businesses in the Commonwealth. As the speed and reliability of transportation diminishes, so do the labor and service delivery markets which businesses can access. The result can be: (a) higher costs required to attract needed workers and serve the customer base, or (b) a reduction in business size and a loss of economies of scale. Either way, there is a loss of business productivity and competitiveness. For Massachusetts residents, that can also mean a reduction in employment and shopping opportunities. On the other hand, investing in transportation to improve capacity, speed and reliability can help expand labor and business delivery markets, reducing the unit cost of delivering products and services, increasing productivity, and creating additional jobs and income for Massachusetts residents.

Role of Transport and Access to Enable Business Operations



The graphic above illustrates how transportation effects access to and between three of the primary factors of production: workforce, input materials and equipment, and output products provided to customers. Transportation investment to facilitate the overlaps between these factors can reduce the cost of labor or materials, increase business productivity and/or expand business output.

National, Regional and State Research. There have been a number of national studies confirming the relationship between transportation investment and business productivity growth, including a widely-respected national study of highway investment conducted for the Federal Highway Administration. That study confirmed that "highway investments have lowered production and distribution costs in virtually every industry sector" and that U.S. industries have realized continuing production and distribution cost savings ranging from 7 to 31 cents annually for each dollar invested in road systems.[6]

[6] *Contribution of Highway Capital to Industry and National Productivity Growth*, by M. Nadiri and Mamuneas, for Federal Highway Administration, 1996. See also "*Productivity and the Highway Network: A Look at the Economic Benefits to Industry from Investment in the Highway Network*", FHWA, undated.

In addition to national research, a growing number of state and regional agencies have commissioned forward-looking studies to assess the economic consequences of investing or not investing in transportation system improvements. All of these studies, a representative sample of which are summarized in the table below, have confirmed that transportation investment decisions can have substantial long-term impacts on the economic growth or decline of a region. For more on these studies, please see the Appendix at the end of this report.

Other states and regions have sponsored studies that show the importance of transportation investment to maintain economic competitiveness and jobs.

Multimodal Investments	
Virginia DOT, 2009	Proposed 6-year, $33 billion investment program would generate 78,000 jobs; long-term productivity gains from program would generated an average of 24,000 new jobs each year over 25 years.
Maine DOT, 2008	$139 million long-range plan would create 2,500 more jobs by 2030 than otherwise.
Northeast CanAm Connections, 2009	Identified cross-border highways and rail improvements which would generate up to 140,000 U.S. and Canadian jobs by 2035.
Port of Portland, Metro and Oregon DOT, 2005	Failing to invest in transportation could cost Portland region 6,500 jobs and $844 in annual income by 2025.
Greater Vancouver Gateway Council, 2003	Failing to upgrade transportation systems could cost region 7,000 jobs and $475 million in GDP by 2021.
Public Transportation	
University of North Texas, 2003	Building proposed Dallas light-rail system would generate $4 billion and an average of 6,400 jobs per year in economic activity between 2009 and 2014; ongoing operations would generate another $663 million annually and more than 5,300 jobs.
Chicago Metropolis 2020, 2007	Increasing investment in public transportation by $2.4 billion per year would lead to regional economic growth of $3.8 billion per year, adding 22,307 jobs.
Durham, Ontario, 2010	Plans for regional bus, light rail and heavy rail would generate support 15,000-31,000 job-years during construction, and create between 1,100 and 1,800 jobs annually as of 2031.
Georgia State University, 2007	Funding Metropolitan Atlanta Regional Transit Authority would generate 20,000 more jobs and $2 billion more business output than not funding; difference in jobs grows to 45,000 annually by 2055.

3

Transportation Needs of Key Massachusetts Sectors

To understand how transportation investments can affect Massachusetts' economic development, it is critical to understand how different elements of the economy depend on movements of goods and people. This section identifies those industries that drive broader economic growth in the Commonwealth and how they rely upon transportation infrastructure.

Key Massachusetts Industries

The industries below were identified based on their high concentration in the Commonwealth relative to the national average – indicating that they are much larger than needed to serve the local population and therefore are serving outside customers – and/or their growth rate here relative to the national average. Many of these industries – including financial services, information technology, life sciences, the creative economy, clean energy, and industries involved in specialized manufacturing – have also been targeted as key engines of future economic growth by the Massachusetts Executive Office of Housing & Economic Development.

Higher Education and Health Care. In addition to the key private business sectors listed below, it is important to acknowledge the vital role that Massachusetts' "eds and meds" – its world-class colleges, universities and hospitals– play in driving the Commonwealth's economy. Institutions of higher learning employ nearly 110,000 workers[7] and enroll nearly 350,000 full-time students,[8] while the state's hospitals have nearly 180,000 employees.[9]

Key Growth Industries

- Higher Education and Health Care
- Financial Services
- Information Technology
- Life Sciences
- Medical Devices
- Tourism / Creative Economy
- Defense Products
- Clean Energy
- Marine Science

In addition to employing hundreds of thousands of residents and attracting students and patients from around the world, these institutions provide the vital spark of innovation that ignites many of the industries below, from the life sciences and medical devices to defense to clean energy. Like many of the private companies in the industries examined below, schools and hospitals rely on transportation to enable their employees, students/patients and research partners to travel reliably.

Financial Services.[10] Massachusetts has been a leader in financial services, an industry which employs 180,000 residents and generates $38.5 billion in gross sales – 10.8% of the state's gross output. The industry is broad-based, encompassing banking, accounting, asset management and insurance, and ranks among the top five in the Commonwealth.

---

[7] U.S. Bureau of Labor Statistics May 2010.
[8] U.S. Department of Education, 2007. Courtesy Association of Independent Colleges and Universities in Massachusetts (AICUM).
[9] U.S. Bureau of Labor Statistics May 2010.
[10] This discussion draws from *"Securing Massachusetts' Leadership Position in Financial Services,"* by Mass Insight Corporation for the Greater Boston Chamber of Commerce.

The industry relies on a dependable, broad-based pool of talent. It also employs a large number of clerical and administrative workers who find living in the region difficult, due to the high cost of housing close to Boston and difficulties commuting from more affordable housing farther away.

Information Technology.[11] The IT cluster includes IT services, hardware and software development and production, networking, robotics, gaming, mobile communications and digital media. In 2009, there were 10,300 IT firms in Massachusetts with over 178,000 employees, and another 50,000 IT workers in supporting firms outside the industry. The availability and condition of passenger transportation inhibits expansion of the industry outside I-495 – a region better able to support downstream manufacturing because of its lower cost of living for low and mid-level workers. Thirty percent of IT firms surveyed said that improving the physical infrastructure – including roads, airports, and commuter rail/transit – should be a key priority for retaining and growing this industry.

Life Sciences.[12] The life sciences cluster in Massachusetts includes biotechnology, health care, and pharmaceuticals, and has been heavily concentrated on upstream research and cutting-edge technology. The cluster is concentrated largely along the I-495 corridor, with another concentration near Worcester. Massachusetts employment in life sciences is estimated to exceed 60,000.

The life sciences depend on access to the state's leading educational and research facilities, including its top teaching hospitals. Massachusetts' concentration of preeminent facilities attracts top researchers and large pharmaceutical companies. There is a need for face-to-face interactions between researchers and practitioners, and many practitioners also teach at the research institutions.

In the past, the Commonwealth has supported growth of biotech industries with major transportation investments such as the extension of Red Line rapid transit to Alewife. It continues to provide indirect support through Public Works Economic Development (PWED) grants that provide supporting access infrastructure to biotechnology facilities. Firms like Genzyme specifically chose Boston because public transit access was deemed critical.

More recently, however, the state of transportation infrastructure in the Commonwealth has been criticized as threatening the future of life sciences in the state. Fifty-nine percent of businesses surveyed for a 2007 report on the life sciences in Massachusetts identified transportation as a major problem, with the vast majority (83%) citing difficulty getting to work as their primary transportation concern.

---

[11] This discussion draws from: (1) *The IT Industry: Hub of the Massachusetts Technology Economy* by M. Goodman et al, 2009 and (2) *Innovate MassTech*, www.masstech.org/it_collaborative/061809.html

[12] This discussion draws from four reports: (1) *Manufacturing in Massachusetts: Biotechnology*, by Sarah Breznitz in MassBenchmarks, 2006, Vol. 8, Issue 1, (2) *Taking Stock of Progress and Challenges Massachusetts Life Sciences Supercluster*, by The Massachusetts Technology Collaborative/John Adams Innovation Institute, October 2006, (3) *Super Cluster: Ideas, Perspectives and Updates from the Massachusetts Life Sciences Industry*, PriceWaterhouse Coopers, 2007 and (4) *A Critical Alliance: The Biotechnology and Pharmaceutical Industries in Massachusetts*, by Eric Nakajima and Rebecca Loveland, April 2007

Medical Devices.[13] The medical devices industry, which makes products used for patient diagnosis, therapy or surgery, is a key manufacturing target for the state. Massachusetts ranks within the top five states in the nation producing medical devices, employing 20,000 workers in the field. Proximity to the state's medical research institutions is a major draw for this industry, as is the state's long history of precision manufacturing and its ability to adapt to changes in technology. A final factor is access to international markets via air freight. Exports within this subsector increased by 15% between 2004 and 2006, with the top three export destinations being Western Europe, Asia and Australia.

Tourism and the Creative Economy.[14] The creative economy is a growing industry cluster that incorporates tourism, education, arts and culture and is not well-defined by traditional categories. It has been estimated that this sector employs over 100,000 workers in Massachusetts. One important element of income for the creative economy is the operation of museum and performance venues that depend on visitor access by transit and car for locals or via rail and air for tourists. The economic viability of these venues may be threatened if visitors cannot get to them either due to highway congestion or reductions in transit and rail service.

Defense and Homeland Security.[15] This industry sector is defined as "commercial activity generated by U.S. defense and homeland security contracts, military personnel payroll, and retiree benefits paid to state residents." Major sectors include professional and technical services, and manufacturing of computer and electronic products and transportation and telecommunications equipment. In 2005, direct and indirect spending on Massachusetts defense contractors totaled over $13 billion and supported over 70,000 jobs

Massachusetts has long been a national leader in the development of products using missile, radar, gyroscope, robotics and sensors technologies – all of which rely on local innovations emerging from the IT industry, the precision equipment industry and research institutions. It also requires a wide labor pool to attract highly skilled employees. This industry more than others also depends on ground freight transportation services for receiving supplies and shipping products.

Clean Energy.[16] The clean energy sector includes businesses involved in the development, production, distribution or use of renewable energy equipment and generation, power electronics, energy conservation (including architects, developers, builders and producers of components), and clean energy research. This is a relatively small but emerging growth industry; in 2007, it employed roughly 14,400 workers in Massachusetts.

---

[13] This discussion draws from (1) *Massachusetts Medical Devices: Leveraging the Region's Capabilities* by Sarah Breznitz in MassBenchmarks, 2006, vol. 8, #1, and (2) *The Medical Device Industry in Massachusetts: An Updated Profile*, Univ. of Massachusetts, May 2007.

[14] This discussion draws from (1) *The Creative Economy: A New Definition" by Douglas DeNatale and Gregory H. Wassall, November 2007, and (2) Creative Economy Council, Mid-Year Report*, Massachusetts Office of Housing and Economic Development, August 2009.

[15] This discussion draws from *The Massachusetts Defense Industry: Characteristics and Economic Impact*, by R. Loveland et al, November 2007

[16] This discussion draws from *Massachusetts Clean Energy Industry Census*, by Global Insight, 2007.

The clean energy sector dovetails with the high technology and research base of the Commonwealth, and also relies on highly skilled workforce as well as connections to research institutions. Due to the technical nature of the work this sector draws upon specialized workers from a particularly wide area and thus depends upon both public transportation and roads for employee commuting.

Marine Science and Technology.[17] Massachusetts long-established maritime industry has evolved in recent years into a technology-oriented sector comprising five subsectors: (1) marine instruments and equipment, (2) marine service, (3) marine research and education, (4) marine materials and supplies, and (5) shipbuilding and design. In 2004, the industry employed 8,800 Massachusetts workers and was continuing to grow, despite declines in other New England states. Massachusetts is also well-positioned to take advantage of new and emerging markets, including growth in shallow water operations for homeland security (relying on marine instruments), federal initiatives in oceanographic and atmospheric monitoring, and the development of offshore wind power.

This sector of the Massachusetts economy benefits from access to research institutions, other complementary industries like semiconductor and electronic manufacturing, and testing facilities. However, both the cost of accessible housing for workers and the physical infrastructure in Massachusetts were cited as disadvantages of the area by many industry members. Most of the businesses rely on delivery from New England suppliers, with the exception of firms in the electronics and sensors subsector, where there is dependence on air-to-ground delivery from supplies outside the region.

Common Transportation Issues

Each industry examined in this report has a unique set of needs that must be met for it to thrive and drive broader economic growth in Massachusetts. However, there are some striking common requirements for transportation access across these industries, which fall into four categories:

Transportation Access to Education and Research Institutions. Many of the key growth and target industries rely on their proximity to the region's colleges, universities and research institutions, but that proximity is only useful if there are road and transit options available to allow convention, visitor and business travelers to quickly and effectively move between these sites.

Transportation Access to Cultural and Tourism Attractions. Since quality of life is a major factor in attracting and retaining a highly skilled workforce, access to a range of cultural opportunities and housing options are also particularly important. In addition, tourism is one of the five largest industries in the state, and many visitors travel to destinations dispersed throughout the Commonwealth, from the Cape to the Berkshires. Visitors need multimodal connections to move between air, sea and rail terminals for

[17] This discussion draws from *The Marine Science and Technology Industry in New England*, by Clyde Barrow et al, May 2005.

intra- and intercity travel, as well as local transportation options to their ultimate destinations.

Transportation Access and Options for Commuting. Many of the key growth industries employ a workforce with specialized skills and rely on access to a wide labor market to find those workers. In addition, the high cost of housing in eastern Massachusetts makes it more difficult for businesses to fill low- to mid-level service positions without paying a premium in wages. An efficient, multimodal, super-regional transportation system can help alleviate this problem by expanding the labor pool within a reasonable commuting distance from employment centers.

Freight Transportation. The state is trying to retain and attract manufacturing firms in many of the key industries, and indeed Massachusetts has many advantages for development of specialized technology products. As manufacturers increasingly rely on just-in-time deliveries to reduce inventories, transportation uncertainties and delays can lead to late shipments and lost sales. A reliable, multimodal freight transportation system – connecting trucks to both rail and air terminals – is necessary to serve manufacturers.

Key Transportation Dependencies of Massachusetts Growth Industries

Industry Sectors	Commute: Road/Transit	Visitor Road/Rail	Trucks (Freight)	Air-Grnd Trans	Sea-Grnd Trans
"Eds and Meds"	X	X			
Fin. Services/IT	X				
Life Sciences	X	X			
Medical Devices	X		X	X	
Tourism/Creative Econ.		X		X	
Defense/Clean Energy	X		X		
Marine Sciences	X				X

Note: All sectors depend to some extent on commuting, visitors, truck deliveries, etc., so this chart should be interpreted as highlighting differences in relative reliance among the sectors

4

State of Transportation Infrastructure

Highways, public transit, railroads, and air and seaports have helped Massachusetts past economic success. But today, infrastructure across all modes is aging and nearing capacity and changing business and population patterns are creating a need for modified facilities and services to keep up with changing needs. The state's economic competitiveness is likely to be threatened unless investment is made to improve and update the *three C's of transportation infrastructure: (1) Condition, (2) Capacity and (3) Configuration.*

The Three "C's" of Infrastructure Planning

- Condition
- Capacity
- Configuration

Infrastructure Condition

Aging Roadway Infrastructure. Approximately 26% of Massachusetts roads are rated as being in "poor" or "mediocre" road roughness condition (accounting for cracks, potholes, etc.), giving Massachusetts the dubious rank of 45th in statewide road conditions among the 50 states.[18] The costs for Massachusetts drivers are significant, although studies have differed on exactly how large they are. One study estimated that "driving on roads in need of repair costs Massachusetts motorists $718 million annually – $156 per driver – in extra vehicle operating costs, including accelerated vehicle depreciation, additional repair costs and increased fuel consumption and tire wear."[19]Another study that factored in time delays found that "the added cost of driving on poor roads in urban areas now totals $400 annually per vehicle, or $1.2billion annually for Boston metro area drivers."[20]

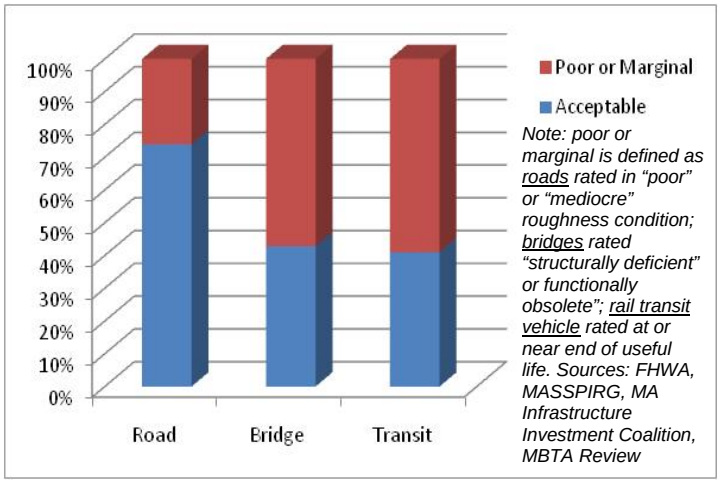


Chart: Infrastructure Condition

[18]Federal Highway Administration, *Highway Statistics 2008*, Table HM-64, October 2009; see also MASSPIRG, *Road Work Ahead*, April 2010.

[19] TRIP (2008) – cited in note 15

[20]Massachusetts Infrastructure Investment Coalition, *Infrastructure Status Report*: *Massachusetts Roadways*, vol. 2, no. 1, April 2006

Aging Bridges. The condition of the Commonwealth's bridges is also of deep concern. Altogether, 12% of bridges are currently rated as structurally deficient; 40% are functionally obsolete (not wide enough, etc.). The state has begun to tackle this problem through its $3 billion accelerated bridge program, which so far has reduced the number of structurally deficient bridges by 10 percent. But there is much work that remains to be done.There is also a significant cost to not repairing bridges, as closures and posted weight restrictions force larger vehicles onto longer bypass routes that cost time, fuel and economic efficiency.

Aging Public Transport Equipment. The degraded condition of public transit equipment is also evident. A survey of MBTA rapid transit and commuter rail cars and locomotives found that 59% (677 out of 1157) are at or near the end of their rated useful life.[21] Another study found 38% of MBTA buses, 82% of rapid transit cars, 69% of commuter rail locomotives and 84% of commuter rail coaches in poor or marginal condition, and 1 in 5 miles of track in immediate need of repair.[22] The total cost of rehabilitation is substantial; the MBTA has a current backlog of $2.7 billion in needed rehabilitations.[23] Recent MBTA estimates run as high as $4 billion. MassDOT has committed $500 million to the T's state of good repair, but that is an eighth of the total needed.

Infrastructure & Service Capacity

Traffic along some stretches of highway, freight rail lines and urban transit lines is now slowed down by congestion bottlenecks during peak periods – a sign that volume is at or near capacity in those areas. But these problems pale in comparison to conditions in the next two or three decades if no action is taken to address future demand growth. The number of bottleneck locations will increase, the severity of backups will grow, and the periods of delay will widen.

The problem of capacity is magnified by the long development cycle of new or expanded infrastructure projects, which can take many years or even decades to be designed, funded, approved and constructed. That is why it is so important to identify and anticipate future mobility and travel demands, and then invest in appropriate services, facilities or policies to address those needs. Failure to accommodate future economic growth can carry a high price, driving away existing business from the state and forestalling new job opportunities.

Traffic Growth. Making the capacity problem worse is the fact that roadway traffic volumes are growing far faster than the population. From 2000 to 2006, statewide population grew 1.3% (the Boston metro area population increased 6.6%), but the total annual vehicle-miles travelled (VMT) on major highways in Massachusetts increased 20%. Projections are for statewide VMT to increase another 20% by 2025.[24] Hidden

[21] Useful life is 25 years; 59% were found to be at least 21 years old; source: D'Alessandro, David et al., *MBTA Review*, November 2009.

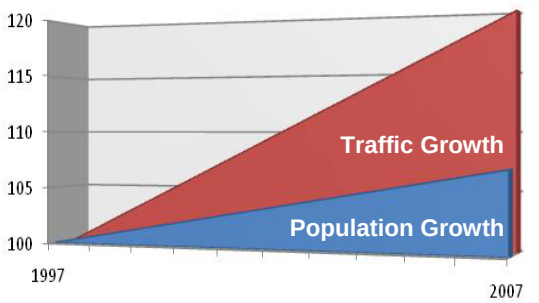
[22] TRIP (2008) – cited in note 15

[23] *Transportation Finance in Massachusetts: An Unsustainable System*, March 28, 2007

[24] During this period, Boston metro area population increased from 6.0 to 6.4 million and statewide population grew from 6.3 to 6.4 million. During that same time, VMT on major highways in Massachusetts increased from 46.1 billion to 55.5 billion. Projections are for statewide VMT to increase to 64 billion by 2025. Source: TRIP (2008) – cited in note 15.

within those VMT statistics is the fact that truck traffic is already growing at twice the rate of car traffic, with motor carrier tonnage expected to grow 84% by 2020.[25]

Traffic Congestion. Studies of urban highway conditions, conducted by the Texas Transportation Institute, confirm that congestion delays are mounting. In the Boston metro area, over 58% of all peak-hour VMTs are now in congested traffic. This translates to 91 million person-hours of additional delay and an extra 61 million gallons of fuel consumed annually. The annual cost of congestion in the Boston area increased 212% from 1997 to 2007 and now exceeds $940 million per year, or $945 per car.



Rate of Population and Traffic Growth
Source: TRIP (2008)

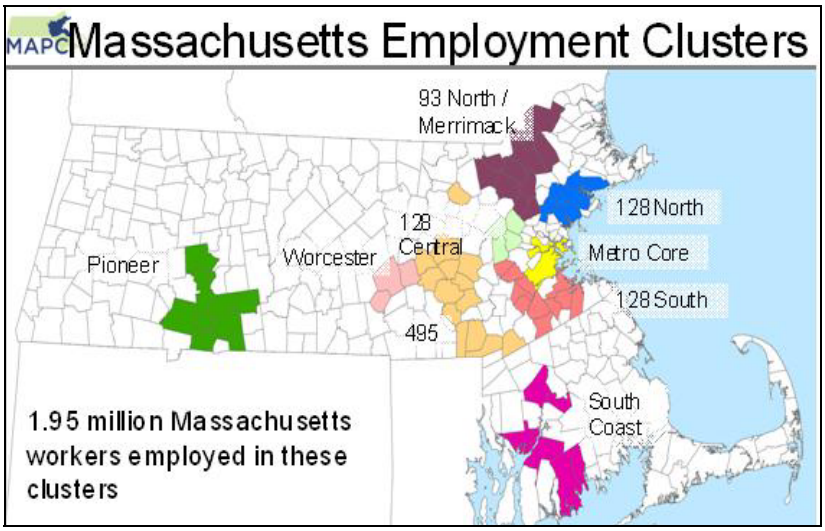
Congestion is not limited to Metro Boston. In the Springfield area, over 21% of all vehicle-miles traveled during peak hours are in congested traffic, leading to 4 million person-hours of additional delay and an extra 2.4 million gallons of fuel consumed annually. The annual cost of congestion in the Springfield area increased from 80% from 1997 to 2007 and now exceeds $77 million per year.[26]

Configuration of Transportation Service

Even if we fully maintain and expand capacity at existing transportation facilities and services, we may still be solving yesterday's problems tomorrow. Housing and business location patterns are continuing to evolve, and with them travel patterns are changing as well. To optimally invest in future jobs and economic development, it is necessary to understand how these shifting patterns effect the configuration of transportation systems: origin and destination locations, corridors and the mix of modes. These elements must be optimized to serve three elements of future travel demand: (a) internal travel for commuting trips, (b) visitor travel for tourism, recreation, cultural events, business meetings and conferences, and (c) incoming and outgoing freight deliveries.

Internal Movements: Commuting and Employment Clusters. Non-agricultural employment in Massachusetts was once strongly concentrated in major cities. Today, both employment and residences are more widely scattered. As a result, commuting distances have become longer. There are a number of reasons for this trend, including zoning and land use policies, local development approval processes, highway locations, and rail or rapid transit station locations.

[25] *Massachusetts Freight Rail*, vol.5, no.1, Dec. 2008.
[26] Texas Transportation Institute: *2009 Annual Urban Mobility Report*, Texas A&M University.



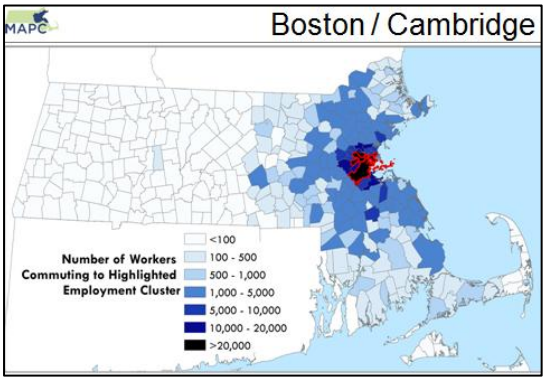
The map above, provided by the Massachusetts Area Planning Council, shows the largest clusters of employment in Massachusetts today. For each of these employment clusters, there is a corresponding pattern of worker home locations. Some clusters, such as the Boston/Cambridge Core, have a widely dispersed labor market that fans out in all directions. Others, such the "128-North" and "495 Corridor" clusters, have labor markets that follow highway corridors. Labor market areas also vary widely in breadth. The "South Coast" cluster draws from a narrow set of towns that reflects its more constrained transportation options, while the "128-South" cluster draws from a more widely dispersed labor market area.

The table below shows characteristics of these clusters. It shows that the "128-Central" and "Boston/Cambridge" clusters exhibit a combination of a high rate of commuting in from outside areas, long average commute distances and high average wages. On the other hand, the "South Coast," "Worcester" and "Pioneer Valley" clusters exhibit a low rate of commuting in from the outside areas, shorter average commute distances and lower average wages. The differences between these employment clusters are quite dramatic; both average wages and commuting percentages differ by a factor of roughly 2:1. Clearly, a multimodal transportation strategy encompassing both road and transit infrastructure is necessary to serve a state with such widely divergent commuting patterns.

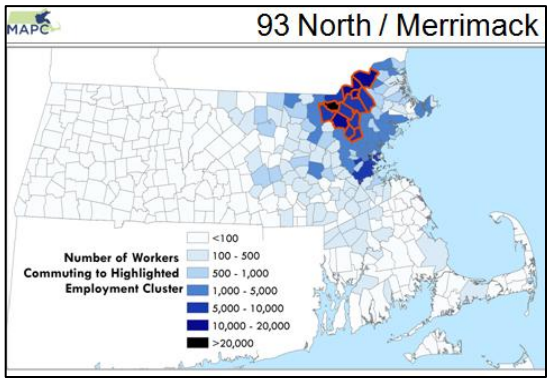
Massachusetts Ten Largest Employment Clusters

Cluster	Cities/ Towns	Employment	Avg. Wage	Commute % from Outside	Average Commuter Distance (miles)	Commute Miles: % Auto
Boston-Cambridge	2	676,748	$ 78,764	61%	15.0	52%
93 North/Merrimack	12	294,362	$ 59,368	45%	13.8	93%
128 South	11	224,184	$ 57,888	61%	13.9	91%
495 Corridor	15	204,957	$ 62,870	58%	15.9	94%
Pioneer Valley	10	202,448	$ 42,655	23%	10.7	91%
128 North	9	150,965	$ 48,415	42%	12.4	92%
South Coast	6	122,710	$ 40,163	28%	9.2	91%
Worcester	3	122,082	$ 47,195	48%	9.2	90%
128 Central	4	80,922	$ 82,420	78%	16.2	93%
Elsewhere in MA	279	1,122,961	$ 45,011	N/A	12.0	90%
Grand Total	**351**	**3,202,339**	**$ 56,362**	**49%**	**12.9**	**82%**

Source: Analysis by the Metropolitan Area Planning Council, Boston, using 2008 data from the Massachusetts Executive Office of Labor and Workforce Development and the US Census Transportation Planning Package (workers residing in Massachusetts only).

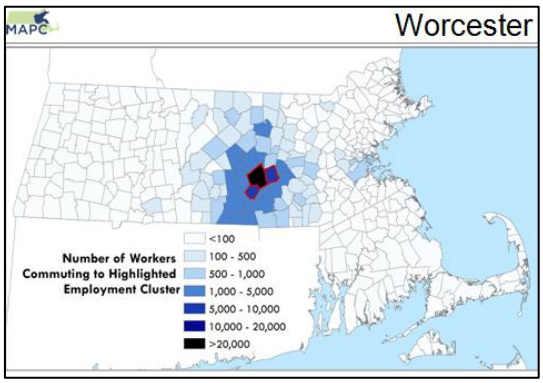


Boston/Cambridge: With 675,000 workers, Boston and Cambridge comprise the largest employment cluster by far, and also the broadest commuter shed. Fifty-two percent of commuting miles are by car – the lowest percentage by far of any of the clusters, and an indication of the importance of public transit in the cluster. A number of long-planned projects, including the Green Line extension to Somerville and Medford, the Urban Ring circumferential Bus Rapid Transit route, the Red Line/Blue Line connector, Silver Line Phase III, and expanded capacity at South Station, would improve life for transit commuters and drivers alike by taking cars off the roads.

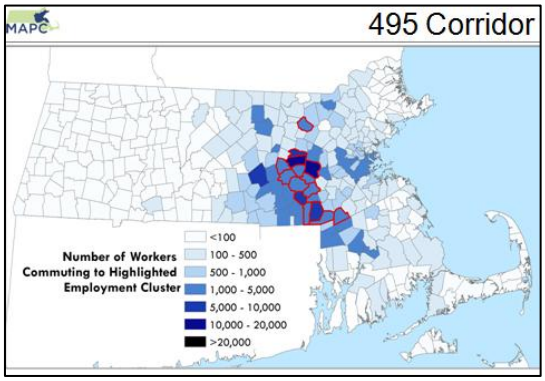


93 North/Merrimack: The Merrimack Valley region around Lawrence and Lowell is the state's second largest employment cluster, employing nearly 300,000 workers. More than 93% commuting miles are by car, and capacity on I-93 is a constant problem. Widening I-93 through Andover and Methuen and building a new interchange near Lowell are among the infrastructure projects which would help alleviate congestion in this cluster. Allowing bus-on-shoulder service on I-93 would further expand capacity while giving commuters a cost-effective transit option.

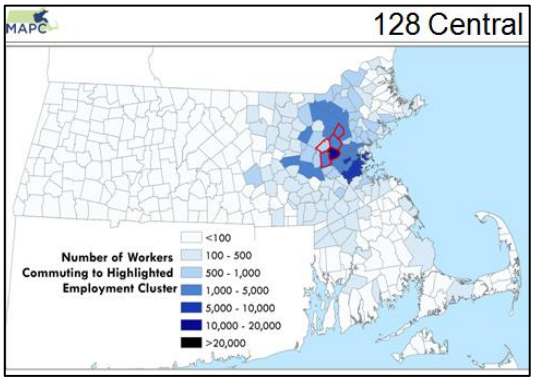
Worcester: The Worcester cluster dominates central Massachusetts. Most of its 120,000 workers live inside the cluster. Still, these workers have an average commute of more than nine miles per day, and 90% of their commuting miles are by car. Additionally, thousands of Worcester-area residents work in the Boston/Cambridge cluster, fueling demand for expanded commuter rail access. Improving Routes 20 and 146 to expand their capacities would also benefit the cluster.



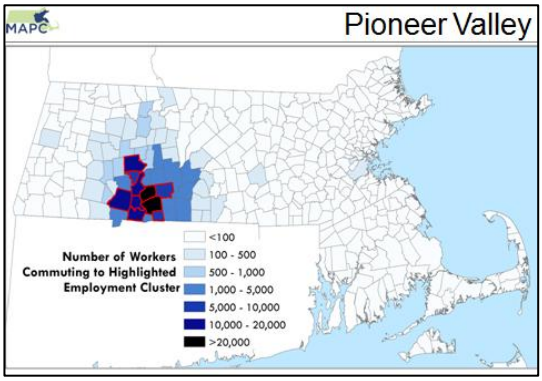
495 Corridor: The 495 Corridor has been a center of economic activity in Massachusetts since its construction. More than 200,000 professionals currently work along its stretches, with more than half traveling from outside the cluster. Ninety-four percent of the cluster's commuting miles are by the car, the highest percentage of any cluster in Massachusetts. Building new interchanges where 495 meets I-290, in Marlborough and Hudson, and I-90 in Northborough could help alleviate congestion and increase capacity, while funding for the MetroWest Regional Transit Authority would provide broader commuting options.



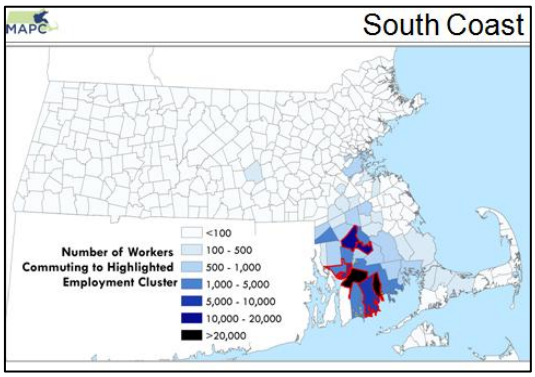
128 Central: One of the smallest clusters in terms of area, 128 Central draws the highest percentage of workers from outside the cluster. Its commuters, many of whom work in the high-tech industry, average more than 16 miles per day; 93 percent of those miles are by car. Improving the infrastructure around this cluster, including the Concord Rotary on Route 2 and the I-93/I-95 Interchange in Reading and Woburn, is critical to ensuring that high-tech firms continue to locate in the region. In addition to these roadway improvements, constructing the proposed Intermodal Transit Center along the Fitchburg Commuter Rail line would provide feeder bus service to employment hubs.



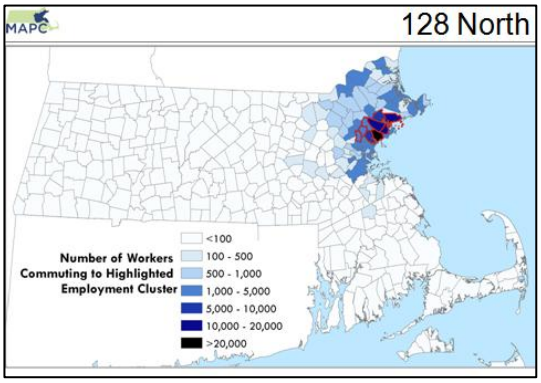
Pioneer Valley: Springfield and nine other communities around it make up a large share of jobs in Western Massachusetts. Perhaps because of the large number of towns in which these jobs are located, a relatively high percentage of workers commute from within the cluster. Still, those commutes average 10.7 miles in distance, and 91 percent of those miles are traveled by car. The Pioneer Valley Planning Commission has identified improvements to the South End Bridge connecting Routes 5 and 57 between Springfield and Agawam as a key project that would improve traffic flow and safety in the area. Improving rail along the "knowledge corridor" which runs through Springfield into Holyoke, Northampton and into Vermont would also facilitate commuter rail and future high-speed rail service in the region.



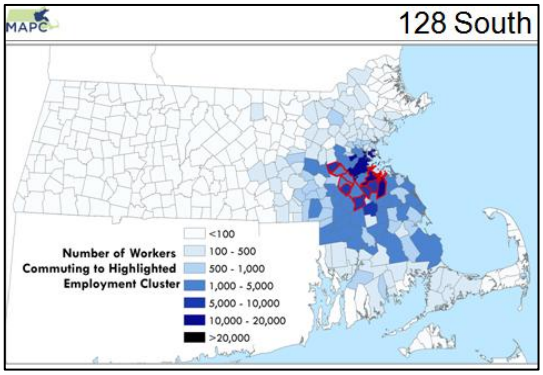
South Coast: Like Pioneer Valley, a large percentage of workers are commuting from within the South Coast job cluster. The proposed South Coast commuter rail project, a priority of the current administration, would better connect this region to jobs in Greater Boston, giving workers access to higher-paying opportunities outside a cluster with the lowest average wage of the ten studied.



128 North: Commuting patterns here mostly align along Route 128, although 42% of workers are traveling outside the cluster, some from as far as the New Hampshire border. With 92% of commuter miles being traveled by car, this region would benefit from interchange improvements along Route 128, including the Brimball Ave. exit in Beverly.



128 South: This cluster draws widely from
Southern Massachusetts: 61% of workers are commuting from outside the cluster. Improving the interchange between I-93 and I-95/128 would help traffic flow through this area. The extension of the commuter rail to the South Coast would pass through this cluster, as well.



External Passenger Connections for Tourism and Visitor Travel.[27] Visitors coming to Massachusetts depend on transportation connections into and within the state. In fact, of the $15.6 billion that visitors spend annually in Massachusetts, transportation accounts for 43% of that total, including 30% for commercial transportation services (air, rail, bus and transit) and 13% for automobile-related costs (car rental and gasoline). Nearly 11% of all visitors come from foreign countries, and most of them arrive via airplane. Of domestic visitors, 2/3 drives their own vehicle into the state, 1/5 comes via air, and the rest come via train, bus, ship, rental car or camper.

Top Ten Tourism Counties *(ranked by visitor expenditures)*

1. Suffolk
2. Middlesex
3. Barnstable
4. Norfolk
5. Worcester
6. Essex
7. Plymouth
8. Hampden
9. Bristol
10. Berkshire

The destinations of these visitor trips are also widely dispersed throughout the state. The top ten destination counties, listed to the right, span the state from east to west. All of these listed counties have over 3,000 jobs supported by visitor spending. This dispersed tourism pattern highlights the fact that road and rail facilities and services across the state – and their connections to airport facilities – are critical for the continuation and growth of visitor activity.

External Freight Connections for Business Deliveries. Massachusetts-made products are shipped throughout the United States and abroad, bringing income into the state. In 2009, approximately $24 billion of products were shipped out of Massachusetts to overseas destinations alone, including computer software, information technology products, medical devices, defense and marine technology equipment, and seafood. Some products are shipped via air (going by truck to Boston Logan, New York/JFK airport, or Newark airports, or via overnight freight service to Cleveland or Anchorage). Other freight is shipped via sea (going by rail or truck to the Port of Boston, Port of NY/NJ, or Port of New Orleans). Still other products are shipped via rail or truck to cross the Canadian and Mexican borders.

Top Ten Ports of Export for Mass.-Made Products *(by value of shipments)*

1. JF Kennedy Airport, NY
2. Boston Logan Airport, MA
3. Port of NY-NJ
4. Anchorage Airport, AK
5. Port of Boston, MA
6. Buffalo, NY Border
7. Cleveland, OH Airport
8. New Orleans, LA Seaport
9. Newark, NJ Airport
10. Laredo, TX Border

The mix of specific land, air or sea "ports" is determined by the destinations of products being shipped and the availability of commercial transportation routes and services to those destinations. In nearly all cases, though, there are requirements for trucking of products to those ports or to intermodal rail terminals that then serve those ports. Thus, Massachusetts road and rail facilities are also critical to enable both international shipments and interstate travel.

[27] All data cited in this part is drawn from: (a) *Massachusetts Office of Travel and Tourism, 2009 Annual Report*; and (b) *The Economic Impact of Travel on Massachusetts Counties 2008*, by the US Travel Association (UTA) for the Mass. Office of Travel and Tourism, 2009.

5

Moving Forward

A Multimodal Solution to a Multi-faceted Problem

As the preceding section makes clear, our transportation needs are growing and are multi-faceted. For each job cluster there are several road and/or transit projects which, if funded, could address these needs. The problem we face is not a lack of ideas, but a lack of funds and a lack of consensus on which options to pursue over others. Building that consensus will involve a public dialogue and an appreciation of the potentially high stakes for the future economic competitiveness of Massachusetts and the well-being of its residents.

The problems are multi-faceted, but there are many ways to address them. A consensus on solutions and tradeoffs can be developed, but the dialogue must start with an appreciation of the high stakes involved for the Massachusetts economy.

There are groups supporting different types of projects and initiatives to invest in our transportation infrastructure: highways, public transit, high speed rail, bikeways, land use policies and others. But the challenge Massachusetts faces spans all modes, and it is best met by the advocates of all modes in unison. That is why the groups comprising Our Transportation Future have come together to speak in unison about the connection between transportation and economic prosperity.

For a useful dialogue to move forward, four fundamental facts should be recognized by all:

1. **There are multiple ways to optimize transportation system performance and thus economic competitiveness for the future.** A strategic investment strategy can include:
   - *Capacity Expansion*: Enlarging the capacity of existing roads, transit lines and terminals and building new facilities to accommodate future demand;
   - *Substitution*: Encouraging alternative modes and routes, redistributing demand to make more efficient use of existing infrastructure and services; and
   - *Demand Reduction*: Implementing policies to modify residential and business location patterns in ways that can reduce trip generation rates and average travel distances.

2. **No single mode can address all of our emerging transportation needs.** Buses and trains can carry commuters along heavily traveled corridors, but they won't replace all trips to all destinations. Trains can replace trucks carrying bulk and container freight on long distance trips, but not for high-value, time-sensitive perishable goods over short distances. Flexible work hours may be viable for workers in some technical and professional services but not for those in manufacturing production workers. A nuanced transportation strategy will recognize that a mix of different solutions may be applicable to cover widely varying needs and situations.

3. **Different modes are complementary.** Essentially all air freight and many air passengers travel on highways to and from the airport. Similarly, most marine transportation involves travel via railroad or highways to get to and from the port. Demand for passenger and freight rail transport can depend on the availability of parking and the location of intermodal terminals on the roadway network. Buses travel the same roads as cars, and their speed and reliability is effected by the same congestion. Because of these intermodal relationships, it may actually be counterproductive to promote some travel modes to the exclusion of others.

4. **Financing is a challenge, but not necessarily an insurmountable one.** As noted in the recent TRIP report, "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."[28]Yet, as shown below, other states are moving forward with multimodal transportation strategies – and creative financing solutions – in the face of comparably severe financial constraints.

Initiatives in Other States

At first blush, it might be assumed that states across the nation are responding to tough economic times by pulling back on spending and investment in the future. Indeed, some are, but many others recognize they are at a critical crossroads, where actions must be taken to preserve their current competitiveness and invest in future economic growth.

As noted earlier, since its formation last year the new MassDOT managed to invest in transportation infrastructure while also pursuing cost savings and efficiencies. MassDOT has doubled its highways and bridge spending over 2 years to $1.1 billion, spent $500 million toward bringing the MBTA up to a state of good repair and begun a $3 billion accelerated bridge program. Some of the funding for these investments has come from an increase in the sales tax.

Nonetheless, it is instructive to examine efforts underway elsewhere. The table below lists some transportation infrastructure initiatives undertaken by other states over the past two years. In general, they share four common features:

- A recognition of the connection between transportation investment and economic development;
- A multimodal approach that integrates highway, rail and air/marine investments;
- Investment in infrastructure systems beyond mere maintenance; and
- Exploration of creative financing options.

[28] TRIP (2008) – cited in note 15; see also discussion in *Born Broke: How the MBTA Found Itself with too much Debt, the Corrosive Effects of this Debt, and a Comparison of the T's Deficit to its Peers*, by Brian Kane, MBTA Advisory Board, 2009. The financing challenge is also laid out in *Transportation Finance in Massachusetts (2 volumes)*, Massachusetts Transportation Finance Commission, 2007; solutions are explored in *Building Massachusetts' Economy through Transportation Investment: A Review of Potential New Funding Sources for Transportation*, by Cambridge Systematics for ABC - A Better City, 2009.

State	Planning	Financing
Kansas	2008: Adopted new long-range transportation plan. 2009: Overhauled infrastructure project selection process.	2009: Established intermodal transportation revolving fund. 2010: $8 billion for transportation raised through sales tax, registration fees and expanded bonding authority for state DOT.
North Carolina	Long-range multimodal investment planning based on different tiers of facilities.	2009: Local governments permitted to raises taxes to fund transit; state DOT can partner with private developers on privately funded projects. 2010: Proposed bill would let cities and regions enter in public-private partnerships for transportation improvements.
Minnesota	Plans based on strategic impact of projects on state's regional trade centers.	2008 & 2010: Two separate bills funding transportation, studying alternative financing and adjusting bond authorizations.
California	Plans based on goals of improving mobility and accessibility, preserving the transportation system, supporting the economy, enhancing public safety, reflecting community values and enhancing the environment.	2008: Expanded L.A. MTA's bonding ability; demonstration project using high occupancy tolling lanes to fund transit. 2009: Expanded role for design-build contracts and public-private partnerships, including leasing transportation assets to private entities. 2010: Pending bill would create Transportation Financing Authority to issue bonds.
Oregon	"Least-cost" planning approach that looks at alternative investments, forecast and performance measures.	2009: Pilot congestion pricing project to address climate change; new revenue sources: lottery bonds, title, registration and ID fees, $0.06 gas tax hike.
Florida	2009: Goal of 25% design-build construction contracts for new infrastructure projects.	Strategic Intermodal System: One of the country's first multimodal funding mechanisms. 2009: Toll rates indexed to inflation.
Washington	2006: Multimodal plan emphasizes managed growth, strategic investments, innovative revenue sources, land use planning, reduced fossil fuel reliance, safety and rural vitality.	2009: Tolls to repair bridges and repay bonds; state DOT allowed to toll highways. 2010: Pending bills would authorize $8.5 billion in transportation spending, tax cars based on their fuel economy ratings.

For more detailed information on these states, please see the Appendix at the end of this report.

Next Steps

Massachusetts has an enviable history of innovation in transportation planning and investment. The Commonwealth should remember that history as it takes on the transportation investments needed to ensure its economic well-being and competitiveness for the future. If we don't, we risk falling behind other states, as well as international competitors who are investing in infrastructure at a feverish pace.

Massachusetts took a bold first step last year by beginning transportation reform and creating a truly multimodal department of transportation. But it is only a first step. Rather than rest on that accomplishment, it is now time to use that new, integrated department to craft a smart, forward-thinking and truly multimodal transportation investment strategy. Our transportation future and our economic future are intertwined. The sooner we understand and act on that connection, the better positioned Massachusetts will be for the future.

Appendices

Appendix: State and Regional Transportation Investment Research

Multimodal Transportation Investment

Economic Impact of Transportation Infrastructure Improvements in Virginia. Virginia DOT, 2009. The study estimated that a proposed a six-year, $33 billion multimodal investment program would generate 78,000 jobs – 14,000 for every $1 billion spent. It also found that long-term productivity benefits of this investment would spur economic growth, bringing an average of 24,000 additional jobs each year over the next 25 years.

Connecting Maine: Maine's Long Range Transportation Plan, Appendix 3: Changes in the Maine Economy From Strategic Investments in the Transportation System, Maine DOT, 2008. The study found that a long-range plan to spend $139 million per year on transportation would create over 2,500 more jobs in the state by 2030 than otherwise.

Northeast CanAm Connections: Integrating the Economy & Transportation. Maine DOT, on behalf of a consortium of four states and Canadian provinces, 2009. The study found that businesses in northern New England faced higher shipping costs because of congestion delays in New York. It identified a program of cross-border highway and rail improvements that could generate up to 140,000 additional jobs by 2035.

The Cost of Congestion to the Portland Region. Portland Business Alliance, Port of Portland, Metro and Oregon DOT, 2005. The study showed that failing to invest adequately in transportation improvements would result in a potential loss of 6,500 jobs and $844 million in annual income by 2025.

Economic Impact of Investment in a Major Commercial Transportation System for the Greater Vancouver Region. Greater Vancouver Gateway Council, 2003. The study showed that failing to upgrade transportation performance and capacity would lead to cost the region 7,000 jobs and $475 million in Gross Domestic Product by 2021.

Public Transportation Investment

Economic and Fiscal Impacts of Dallas Area Rapid Transit Light Rail System Buildout and System Operations. University of North Texas, 2003. The study assessed the economic impact of a proposed 45-mile rail transit system in the Dallas area. It concluded that, between 2009 and 2014, the light rail investment would generate more than $4 billion in new economic activity including an average of 6,400 jobs per year. Ongoing operations of the multimodal transit agency would also generate $663 million in annual economic activity and more than 5,300 jobs.

Time is Money: The Economic Benefits of Transit Investment. Chicago Metropolis 2020, 2007. The study assessed future scenarios for reducing, raising or holding transit funding constant in the Chicago region. It found that increasing investment in public transportation by $2.4 billion per year would lead to regional economic growth of $3.8 billion per year and add 22,307 jobs.

Durham Region Transit Long Term Transit Strategy. Regional Municipality of Durham, Ontario, 2010. This study examined the economic impacts of bus, light rail and heavy rail options for public transit. It found that construction of new transit would support 15,192 to 31,023 job-years of employment, generating $44-65 million in additional wages. Long-term impacts on economic growth would support 1,196 to 1,769 jobs annually as of 2031, surpassing the number of construction jobs generated over time.

The Economic Impact of the Metropolitan Atlanta Rapid Transit Authority. Georgia State University, 2007. The study assessed the expected regional and statewide economic impacts of funding or not funding the Metropolitan Atlanta Rapid Transit Authority (MARTA) operations from 2001 to 2055. Funding MARTA, the analysis showed, would create an initial impact of over 19,570 jobs and $2 billion of business output growth, rising over time to more than double those values.

Highway Investment

Economic Impact of KDOT Highway Preservation Funding. Kansas DOT, 2008. The study assessed implications of a hypothetical drop of 65% in annual funding for pavement and bridge maintenance. It concluded that by 2020, the Kansas economy would experience a loss of over 12,000 jobs and over $670 per year in Gross Domestic Product due to higher costs of living and doing business in the state. It concluded that there was a 5:1 benefit/cost ratio associated with continued preservation funding.

The Cost of Highway Limitations and Traffic Delay to Oregon's Economy. Oregon Business Council, 2007. The study found that failing to invest adequately in proposed transportation improvements would lead to additional travel delay and reductions in market access, resulting in a potential annual loss of 16,000 jobs and $1.7 in income billion by 2025.

Economic Impact of Michigan DOT's 2007–2011 Highway Program. Michigan DOT, 2007. The study found that the proposed statewide highway program would result in travel time savings for households and cost savings for businesses, generating $5.7 billion of additional Gross State Product, including $4.1 billion in real personal income and 15,000 to 23,000 additional jobs.

Appendix: Transportation Planning and Finance in Other States

Kansas has a policy to support transportation investment based on objectives to preserve the transportation system, make travel safer and support economic growth. In 2008, the governor set up the T-LINK (Transportation - Leveraging Investments in Kansas) task force which in 2009 led to an overhaul of the state's infrastructure project selection process, to make it more adaptable to changing needs and more responsive to economic development opportunities and local priorities. A new Long-Range Transportation Plan, completed in 2008, presented a vision for each mode and policy area, and showed how investment in the system is expected to benefit the state. The vision was supported by the state legislature, which passed a 2009 bill establishing an "intermodal transportation revolving fund" and a 2010 bill that provides $8 billion for preservation, expansion and "economic opportunity" projects. The latter bill raises new revenues through a sales tax increase, heavy truck registration fees, and expands KDOT's bonding authority. It also allows localities to finance transportation improvements using a revolving loan fund, and authorizes new toll roads (if found feasible).

North Carolina DOT has developed a "Multimodal Investment Network Tier" system for statewide long range planning, under which state transportation needs are assessed and funded for different "tiers" of facilities. Based on those needs, the North Carolina legislature passed a bill in 2009 allowing local or county governments to raise sales taxes and vehicle registration fees to provide additional money for transit. Another 2009 bill was passed to allow NCDOT to contract with private developers for privately funded transportation projects (PPP: public private partnerships). A bill pending in 2010 would further empower cities and regional entities to enter into PPP agreements for new transportation improvements.

Minnesota DOT develops its statewide transportation investments based on a system of performance-based planning for each of the state's inter-regional corridors. It is based on a concept which identifies a hierarchy of regional trade centers which support the state's economic base. Projects are then prioritized based on their strategic significance in supporting Minnesota's trade centers. The policies have been supported by the legislature which passed new highway and transit funding bills in 2008 and 2010. The earlier bill increased funding for highway, rail, transit and port projects and initiated study of new financing alternatives for the state. The latter bill raises funds for transit construction and also shifts bond authorization dates.

California DOT develops its transportation plans based on goals of improving mobility and accessibility, preserving the transportation system, supporting the economy, enhancing public safety, reflecting community values and enhancing the environment. While the state's capacity to spend current funds is very limited, the legislature has taken a series of steps to enable more creative financing and implementation of transportation projects. A bill passed in 2008 enabled the Los Angeles MTA to issue additional bonding. Another bill passed in 2008 allowed for "value-pricing" and a transit development demonstration program involving HOT (high occupancy toll) lanes to be administered on two major highways. A bill passed in 2009 expanded the capability for California DOT to

enter into design-build contracts and public-private partnerships with private entities, and also authorized it to enter into lease agreements with private entities that may charge tolls or user fees. More recently, California considered, but has not yet passed, a bill creating the California Transportation Financing Authority with powers to issue bonds for new transportation projects backed by various revenue streams and tolls.

Oregon DOT has developed a statewide planning process that makes use of staff analysis of alternative investment scenarios, forecasts and performance measures for multi-modal transportation improvement strategies. To address environmental and economic considerations, Oregon's legislature passed a bill in 2009 to implement a congestion pricing pilot project, and implement a "least-cost planning " approach for the planning and development of transportation projects. The bill also allows for the issuance of lottery bonds for transportation projects. The bill raises revenue from additional sources including fees registration and titling and identification cards as well as a 6 cent per gallon increase in the gas tax.

Florida was one of the first states in the union to develop a multi-modal transportation funding mechanism. The Florida Strategic Inter-modal System (SIS) provides funding for facilities across modes prioritized based on a facilities' status on the strategic-inter-modal system improvements. In 2009 the Florida legislature passed a transportation bill setting a goal of procuring up to 25 percent of construction projects through design-build contracts. The bill allows toll rates to be indexed to the Consumer Price Index.

Washington State DOT plans projects under a 2006 multimodal transportation plan that emphasizes managed growth and strategically targeted investments. Emphasis is placed on innovative approaches to increasing revenues, along with goals to integrate land use and transportation planning, improve safety, reduce reliance on fossil fuels, consider economic impacts and support rural economic vitality. The legislature passed a 2009 bill approving a toll-financed bridge replacement, requiring the tolling authority to set toll rates to maintain travel time, speed, and reliability in the corridor as well as support bond repayment. The law also gave the DOT responsibility to administer a highway corridor tolling program. A bill under consideration in 2010 would authorize $8.5 billion of transportation investments, with much of it going to the rail capital program to implement the high-speed rail and the remainder to accelerate bridge replacement and corridor improvements. Another bill that is still pending would increase the tax on motor vehicles by an amount based on the vehicle's fuel economy rating.