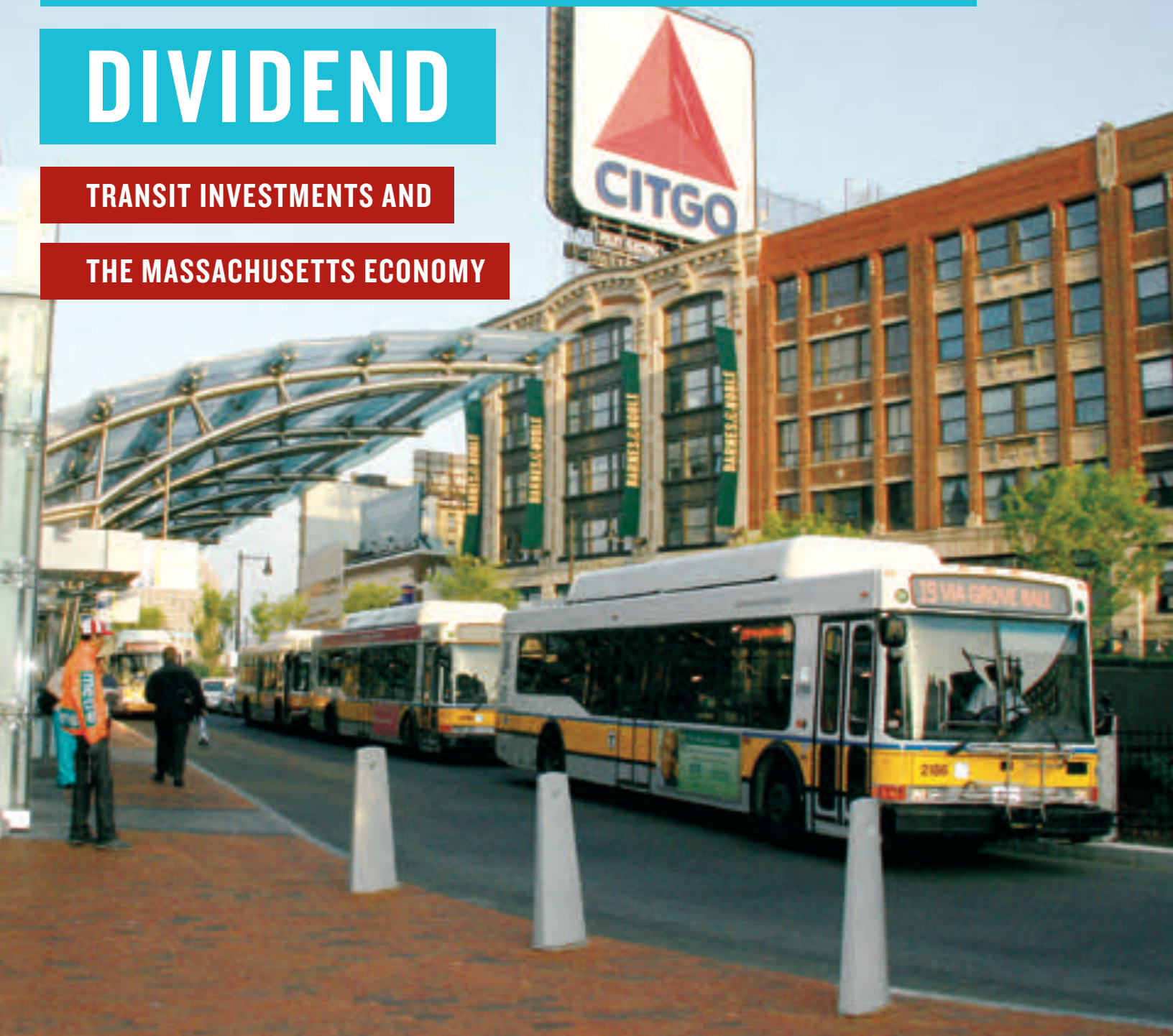


THE TRANSPORTATION DIVIDEND

TRANSIT INVESTMENTS AND

THE MASSACHUSETTS ECONOMY







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REPORT TEAM

A Better City

- Richard Dimino
- Thomas Nally
- Kathryn Carlson

AECOM

- Alden Raine
- Toni Horst



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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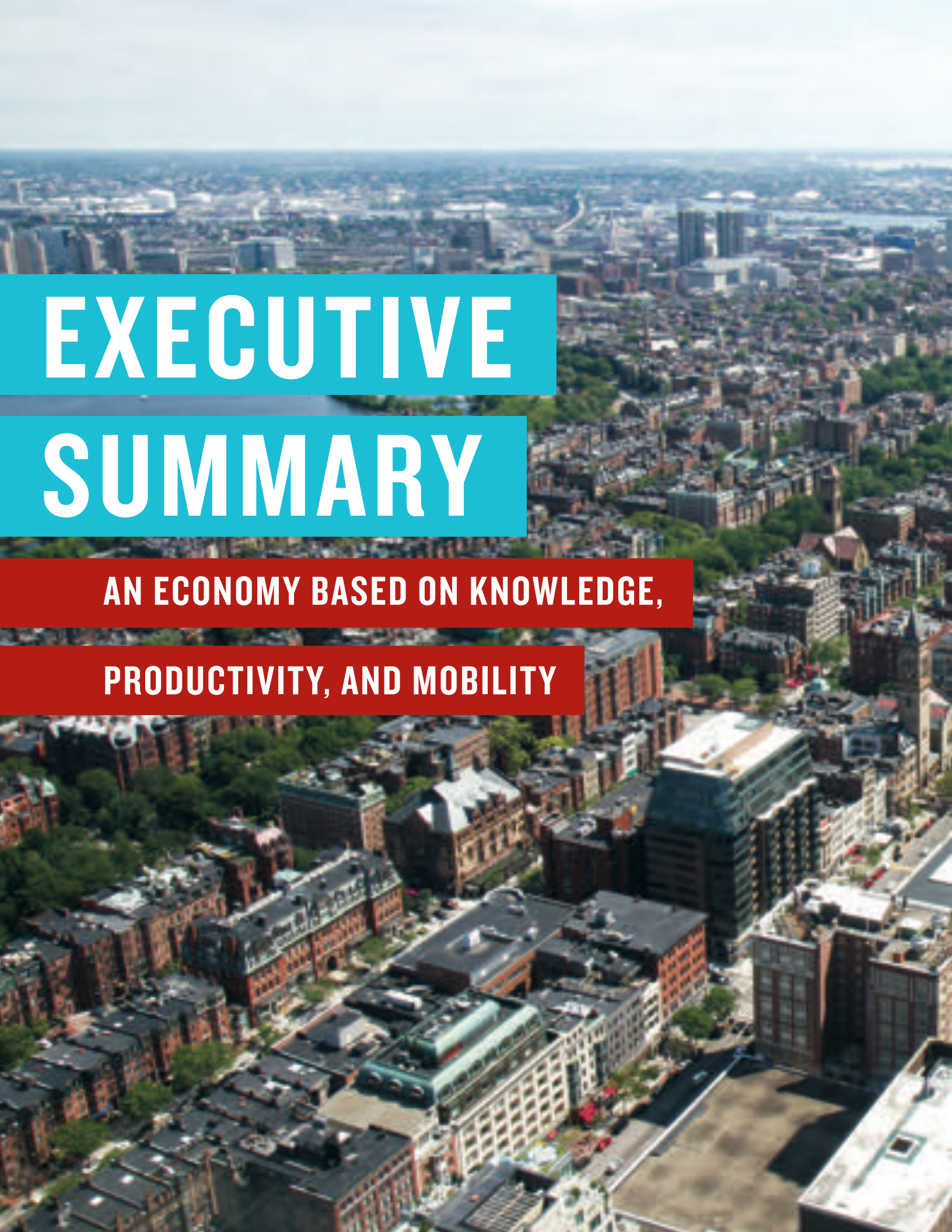
NOTE TO READER

This report is accompanied by three Technical Appendices, which describe the research and present the findings in greater detail. The appendices are available at www.abettercity.org/assets/images/The_Transportation_Dividend/Technical_Appendix.pdf.

- Technical Appendix A addresses the transportation and economic modeling analysis used to estimate the regional benefits of the existing MBTA system and its potential improvement.
- Technical Appendix B provides the definition and demographic analysis of the Metropolitan Boston region and its Inner Core.
- Technical Appendix C defines, describes, and analyzes the Transit Growth Clusters and Strategic Corridors that form the basis of Chapter 2 of this report. The estimated development capacity of these geographic areas is documented in Technical Appendix C1.

Throughout this report, endnotes are used to guide the reader to the corresponding Technical Appendix and to provide a capsule summary of the relevant methodology or analysis.





EXECUTIVE SUMMARY

**AN ECONOMY BASED ON KNOWLEDGE,
PRODUCTIVITY, AND MOBILITY**



EXECUTIVE SUMMARY

The Massachusetts economy is driven by Metropolitan Boston. The 164-community metropolitan region houses 69% of the state's population, provides 74% of its jobs, and generates 84% of its gross domestic product.¹ Metropolitan Boston is projected to continue growing through 2040 in population, jobs, and housing units, even though the cost of doing business in this region exceeds that of virtually all other northeast and “knowledge economy” regions, and exceeds the national metropolitan average by 20%.²

Our region's positive growth outlook is tied directly to its productivity—Metropolitan Boston produces *six times as much gross domestic product per square mile* as the national metropolitan average.³ Our driving industries—finance, medicine, education, technology, research—are transaction-based sectors that benefit from the availability of skilled labor, frequent and relatively inexpensive transportation, specialized technical and professional services, and a large client base. These factors—which economists call “agglomeration effects”—diminish the cost of transactions, enabling firms to operate in higher cost locations. The highly-clustered, knowledge-based structure of our metropolitan economy—a structure geared to transit—is key to the region's outsized performance.

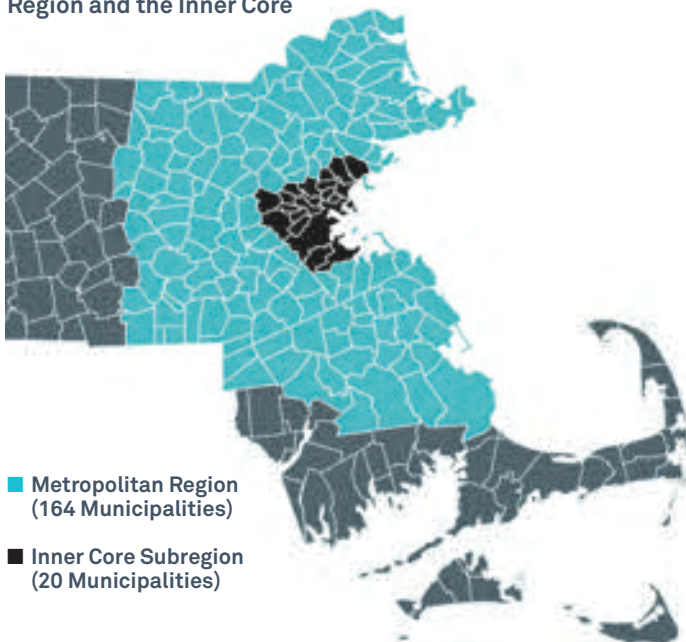
Metropolitan Boston is one of the nation's half-dozen “legacy transit” regions, along with metropolitan New York, Philadelphia, Washington, D.C., Chicago, and San Francisco. These are regions where land use and development have been organized around a broad and deep public transportation network for over a century. Transit helps offset the negatives of operating in a dense urban environment by reducing the growth rate of congestion in the core and allowing working households to mitigate the high cost of living by selecting residential locations with lower commuting costs. At the metropolitan level, MBTA operations pour billions of dollars' worth of benefits into the regional economy year after year. Our high-productivity, knowledge-based economy relies on these efficiencies.

Metropolitan Bostonians take 1.3 million weekday rides on the MBTA. Since 2000, ours is one of a handful of US regions to achieve significant gains in the percentage of daily commuters using transit.⁴ From 2010 to 2016, as our region bounced back from the Great Recession and the metropolitan population grew by 5%, daily MBTA ridership grew by 10%.⁵

The vast majority of the MBTA's physical infrastructure and daily travel occurs in Metropolitan Boston's 20-community “Inner Core.” The Inner Core contains a disproportionate share of the region's population and employment and is expected by planners and economists to spearhead regional growth over the next quarter-century. When the unit of analysis is shifted to specific districts and corridors in the Inner Core, the impact of transit on land use, development, labor market connectivity, and future growth emerges in sharp relief.

A regional economy concentrated in a footprint much smaller than its road system gains efficiency and productivity, but it is also unusually vulnerable to the pressures of an overburdened transportation system. Despite its transit orientation, Metropolitan Boston remains indisputably one of the most traffic-congested regions in the US, a condition reflected in a series of national and global studies.⁶ Moreover, MBTA rail and bus lines suffer from congestion and delays. Congestion—the loss of efficient mobility—is the enemy of regional productivity and growth. A highly functioning and expansive transit system can be (among other things) an effective way to reduce congestion. But transit service levels have not kept pace with rising demand.⁷

FIGURE I: The 164-Municipality Metropolitan Boston Region and the Inner Core



Source: Region definition from MAPC

FIGURE 2: Economic Benefits of the MBTA**INFRASTRUCTURE NEEDS AVOIDED****\$11.4 BILLION ANNUAL REGIONAL BENEFIT**

Source: AECOM. Note: Analysis based on a hypothetical “No MBTA” scenario.

The region is at a critical point, but there is a clear path forward. Transportation and economic modeling at the regional level, as well as a more granular analysis of development districts and corridors in the Inner Core, demonstrate the inextricable link between public transit and private sector investment. For regional growth to be sustainable, its transit underpinnings must be strengthened through data-driven strategies that fix what is broken, enhance core capacity, and expand service offerings in response to demonstrated economic development opportunities. We have the chance, through strategic investment in our transit system, to consolidate our recent economic gains and ensure future progress.

CHAPTER I: A REGIONAL ECONOMY POWERED BY TRANSIT

Existing MBTA operations generate enormous, quantifiable benefits to Metropolitan Boston residents and businesses. These benefits reflect travel time savings, travel cost savings, crashes avoided, and reduced vehicular emissions, especially in the daily work commute. Together, these recurring economic benefits have a combined monetized value of approximately **\$11.4 billion annually**. The development of this estimate is explained in Chapter 1 of this report (especially pages 14–15), and in Technical Appendix A.⁸

By comparison, the MBTA's annual budget is approximately \$2 billion. Simply put, each year the MBTA returns regional economic benefits worth more than five times what we, as a region and Commonwealth, spend to operate it. The \$11.4 billion in annual economic benefits also represents 3% of Metropolitan Boston's annual gross domestic product, and translates into an *average annual gain of \$6,700 per household across the metro region*.

Nearly two-thirds of the overall annual benefits come from travel time savings of \$7.1 billion. Thanks to the MBTA, drivers avoid over 1.7 million additional hours *per day* on our congested roadways. These avoided hours behind the wheel not only help ease the daily workforce commute but facilitate critical goods movement that relies on our highways. As UMass Boston's Donahue Institute concluded: “In a high-cost state like Massachusetts, the costs of congestion borne by commuters and truckers who depend on minimizing trip times can work against business attraction and livability. Without the investments of recent decades, congestion would be that much worse or much of our recent economic growth would have gone elsewhere.”⁹

In addition to its enormous annual operating benefit to the regional economy, the very existence of the MBTA means that the Commonwealth and its people have avoided, over time, the capital cost of nearly 2,300 additional lane miles of roads and 400,000 parking spaces that would have been

needed without the transit system. If it had to be built today, that additional vehicular infrastructure would cost at least \$15 billion, not including the cost and availability of land and the dislocation of more productive land uses. Just in dollars and cents—let alone the negative impacts to our quality of life and the environment—the value of avoiding those additional capital investments far outweighs the multi-year capital investment required to bring the MBTA up to a State of Good Repair, currently estimated by the MBTA at \$7.3 billion.¹⁰

The benefits of existing MBTA service are integral to Metropolitan Boston's high-productivity, knowledge-based economic structure, which thrives despite costs of doing business that are among the nation's highest. These benefits are reflected in the cumulative investment decisions made by the private sector

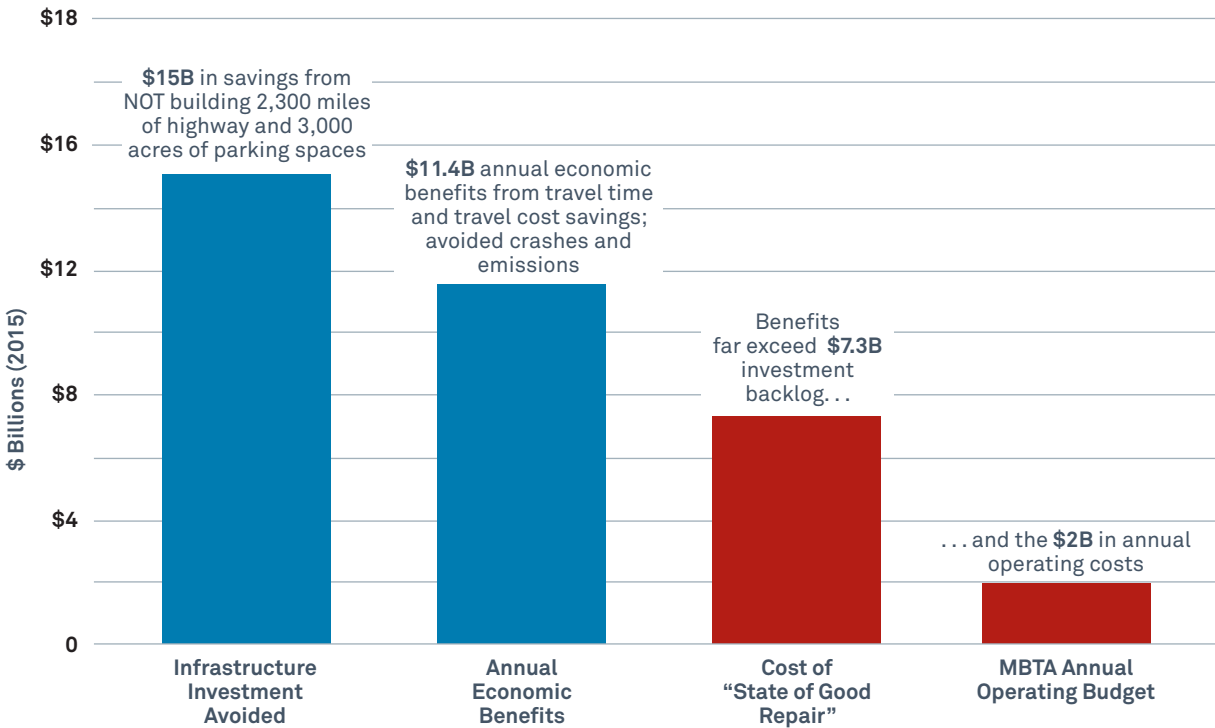
marketplace. In the MBTA system as a whole, the half-mile radii around rapid transit and commuter rail stations, representing just 5% of the region's land area, hold 25% of its people and 37% of its jobs, and generate a disproportionate and growing share of its real property valuation.¹¹

Alternatively, one can look at the "Inner Core"—the 20-municipality subregion where MBTA service is concentrated and proximity to rail and bus service is most common.¹² The Inner Core occupies just 11% of the metropolitan region's land area but contains 37% of the region's population and 44% of its jobs. In fact, the Inner Core Subregion contains a quarter of all the people and a third of all the jobs in Massachusetts.¹³ The men and women who hold these jobs commute from all over the Inner Core, the metropolitan region, and the Commonwealth, following historic

**CONGESTION—THE LOSS OF EFFICIENT MOBILITY—
IS THE ENEMY OF REGIONAL PRODUCTIVITY
AND GROWTH. WE HAVE THE CHANCE, THROUGH
STRATEGIC INVESTMENT IN OUR TRANSIT SYSTEM,
TO CONSOLIDATE OUR RECENT ECONOMIC GAINS
AND ENSURE FUTURE PROGRESS.**



FIGURE 3: Quantifying the Economic Impact of the MBTA



Source: AECOM.

mobility patterns that developed as Metropolitan Boston evolved as a monocentric region connected through a “hub and spokes” transportation network.

On the outer spokes of that system are 16 commuter rail communities that are either Gateway Cities, Regional Urban Centers, or both.¹⁴ Many residents of these urban centers commute to jobs in the Inner Core. But these communities are also emerging as destinations, whose businesses, educational institutions, and cultural venues seek to attract workers, students, and visitors *from* the Inner Core to their walkable, mixed-use downtowns. Transit connections to the Inner Core support the revitalization of these outlying centers.

CHAPTER 2: TRANSIT, DEVELOPMENT, AND LABOR MARKET CONNECTIVITY

Metropolitan Boston’s growth over the next two decades will not be spread uniformly across the region; nor will it be isolated in a handful of stand-alone development centers. Rather, like the existing distribution of population and employment, growth is expected to occur disproportionately near transit and disproportionately in the Inner Core.¹⁵ It is reasonable to expect the strongest growth potential in places that combine these locational advantages—places that are in the Inner Core *and* within walking distance of transit.

EACH YEAR, THE MBTA RETURNS REGIONAL ECONOMIC BENEFITS WORTH MORE THAN FIVE TIMES WHAT WE, AS A REGION AND COMMONWEALTH, SPEND TO OPERATE IT.

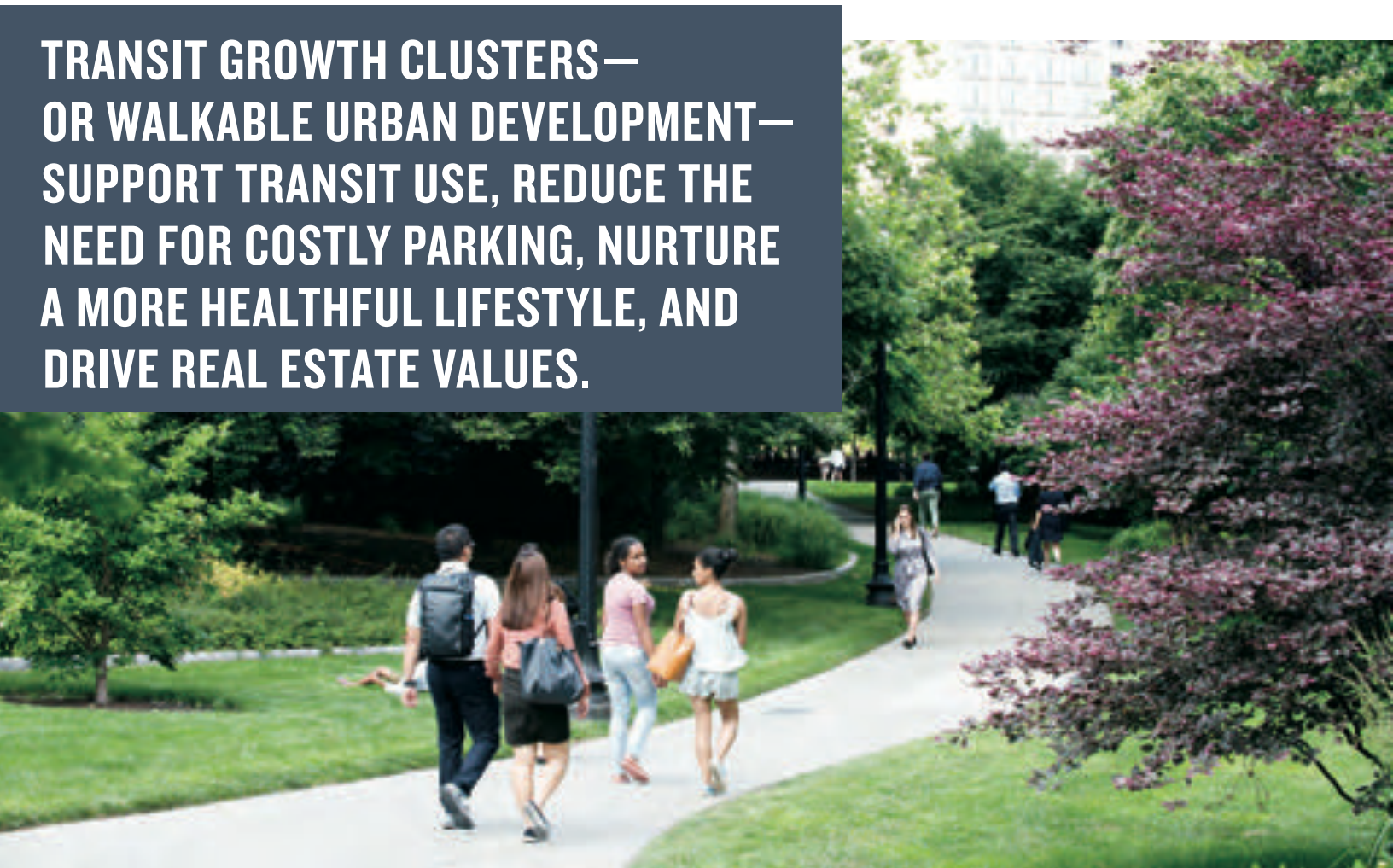
TABLE 1: Corridors and Clusters

STRATEGIC CORRIDOR	TRANSIT GROWTH CLUSTERS
The Hub	Downtown Boston; Back Bay; Longwood Medical Area/Fenway; Kendall; Seaport District; South Bay Corridor
Near North Shore Corridor	East Boston Waterfront; Chelsea; Suffolk Downs/Wonderland; Lynn Waterfront
North Corridor	E. Cambridge/E. Somerville; GLX Villages; Medford/Malden River Corridor
Charles River Corridor	Allston/Brighton Rail Corridor; Arsenal Street; Newton Rail TOD Corridor; Needham Street; Downtown Waltham
South Neighborhoods Corridor	Upper Southwest Corridor/Dudley; Lower Southwest Corridor/Egleston; Lower Blue Hill Avenue; Hyde Park Villages
Red Line Outer Markets	Alewife; Quincy Rail TOD Corridor

The Inner Core contains dozens of districts where state economic policy, local land use policy, and market interest converge around rail or bus transit. This report refers to such districts as *Transit Growth Clusters* and has defined a representative subset of them—24 in all—to serve as case studies allowing a detailed examination of what makes the Inner Core “tick” when it comes to economic development. These sample Growth Clusters are located in 14 of the 20 Inner Core communities, and represent three distinct (but non-mutually exclusive) economic development scenarios:

- **Established:** ongoing, large-scale development districts where significant build-out capacity remains; examples are the Seaport and the Upper Southwest Corridor.
- **Transformative:** emerging development opportunities of transformative scale—for example, Allston Landing, Suffolk Downs, or the envisioned redevelopment of the Lynn Waterfront.

**TRANSIT GROWTH CLUSTERS—
OR WALKABLE URBAN DEVELOPMENT—
SUPPORT TRANSIT USE, REDUCE THE
NEED FOR COSTLY PARKING, NURTURE
A MORE HEALTHFUL LIFESTYLE, AND
DRIVE REAL ESTATE VALUES.**



- **Infill:** significant infill and adaptive reuse opportunities that strengthen the linkage between transit and sustainable, equitable development—for example, the revitalization of Quincy Center, Arsenal Street, or Lower Blue Hill Avenue.

Transit Growth Clusters are exemplars of “walkable urban development,” where density, mixed uses, and an attractive pedestrian environment combine to support transit use, reduce the need for costly parking, nurture a more healthful lifestyle, and drive real estate values well above those of “drivable suburban development.”¹⁶

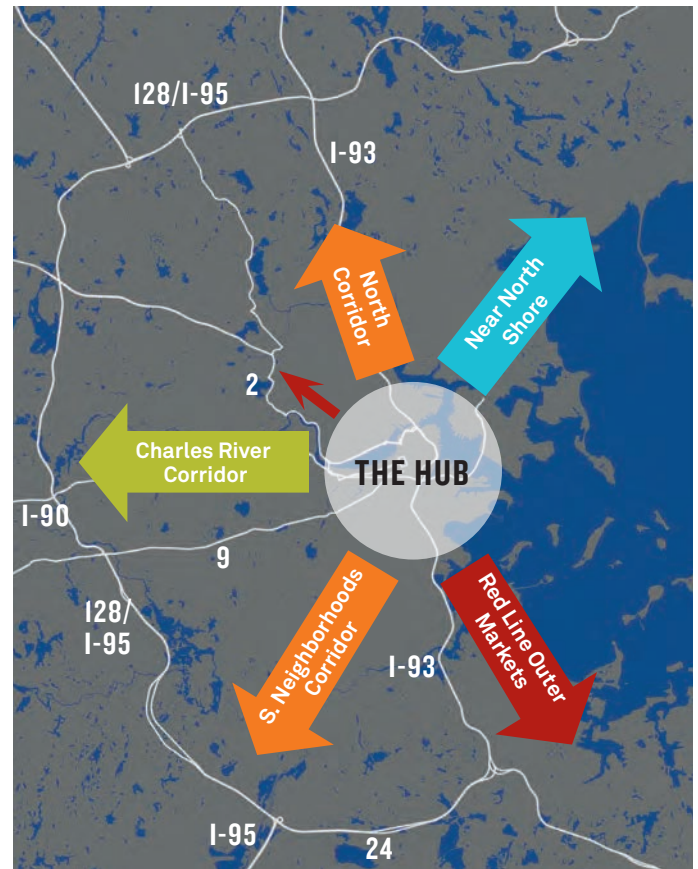
The 24 Growth Cluster case studies form six “Strategic Corridors” linked by geographic proximity, transit connectivity, and current or potential economic synergy. Described and mapped on pages 29–34, these include “The Hub” and five radial corridors connected to it.

It is noteworthy that Transit Growth Clusters were paramount in all of the Boston-area bids submitted to Amazon in 2017 for its second headquarters: Suffolk Downs, East Cambridge/East Somerville, the Medford/Malden River Corridor, the Allston/Brighton Rail Corridor, Downtown Boston, the Seaport, Kendall, and the South Bay Corridor. These sites are characterized not only by land availability and direct transit service, but also by transit connectivity—and needed connectivity improvements—within and between Strategic Corridors.

The economic potential of the Growth Clusters was evaluated through two original data analyses performed as part of this study:

- **Development capacity.**¹⁷ A detailed review was conducted of the roughly half-mile radii surrounding the MBTA stations in each Transit Growth Cluster, including (i) recently built or current development; (ii) specific development plans now in the approval pipeline; and (iii) high-level estimates for potentially transformative sites where development is anticipated but not yet planned in detail (such as Suffolk Downs and Wonderland). The 24 illustrative Growth Clusters contain approximately 49,000 housing units recently built, under construction, or in the approval pipeline, and the potential to accommodate roughly 49,000 more. They also contain enough commercial and industrial space newly built, under construction, or in the pipeline to accommodate some 146,000 jobs, and potential space for 116,000 more.¹⁸

FIGURE 4: The Hub and the Strategic Corridors



Source: AECOM

- **Labor market connectivity.** The Center for Neighborhood Technology publishes two online interactive datasets that enable site-specific estimation of transportation and economic outcomes: the AllTransit Database and the Housing+Transportation Affordability Database. These were used to create several indices of labor market connectivity, a key concept in regional economic development. It is not enough to build jobs and housing; it is essential to connect them in a reliable, affordable way.

The data show that Transit Growth Clusters consistently outperform the metropolitan region as a whole across a number of key connectivity metrics: a larger job shed (the number of jobs that can be reached by a 30-minute transit commute plus a quarter-mile walk); a larger labor shed (the number of workers who can reach a given employment site by a similar commute); a lower average cost of commuting; and a lower level of automobile usage.¹⁹

For example: Across the MAPC region as a whole, the average job shed contains approximately 300,000 jobs, and the average labor shed contains approximately 150,000 workers. These averages are outstripped by all 24 illustrative Transit Growth Clusters. There are 15 Growth Clusters whose residents—if the MBTA system works reliably—can reach over 650,000 jobs within a 30-minute transit ride and a quarter-mile walk. In 16 Growth Clusters, a business looking to hire employees has a pool of over 250,000 workers who can get there by a similar commute.

Growth in these strategically important areas is fueled in large part by a transit system that preceded it—in many cases, along transportation routes that have organized our region’s urban form since the rail era began. These conditions can be durable and resilient if the transit system meets current and projected needs; otherwise future development might be cut back, and projects already built could lose value or even viability. By examining a broad sample of Transit Growth Clusters, it is possible to identify real-world mobility barriers to economic development and targeted interventions in response—not as a “laundry list” of individual projects but as a series of investment strategies.

CHAPTER 3: STRATEGIC INVESTMENT IN TRANSIT AND ECONOMIC GROWTH

The levels of growth that are expected over the next quarter-century cannot be accommodated without investing strategically and deliberately in transit. The challenge is not merely that most subway lines and Inner Core bus routes are at or near capacity. It is that even those places best suited for transit-oriented economic development face mobility challenges that, if left unaddressed, will inhibit the realization of the region’s sustainable growth potential. A detailed examination of mobility needs in the 24 sample Growth Clusters reveals that issues of *reliability, capacity, and connectivity* recur, in locally specific but broadly thematic ways, across the Inner Core and its Strategic Corridors. These challenges require a strategic response, and the analysis yielded three broad investment strategies. Two involve repair and modernization of the existing system, while the third would enhance services to create a more inclusive, versatile, and integrated transit network.

The first investment strategy is to **eliminate the MBTA’s multi-billion dollar State of Good Repair backlog**, as the Commonwealth has committed to

do. This is not merely something to “get out of the way” or a box to check. Virtually every one of the 24 Growth Clusters examined in this report has a particular State of Good Repair issue.²⁰ The billions of dollars in annual economic benefits arising from existing levels of MBTA service assume that the system will not deteriorate below those levels. And bringing the rapid transit system up to its defined State of Good Repair will produce more than \$400 million in additional annual benefits, not counting new development attracted to the affected Growth Clusters and Corridors.²¹

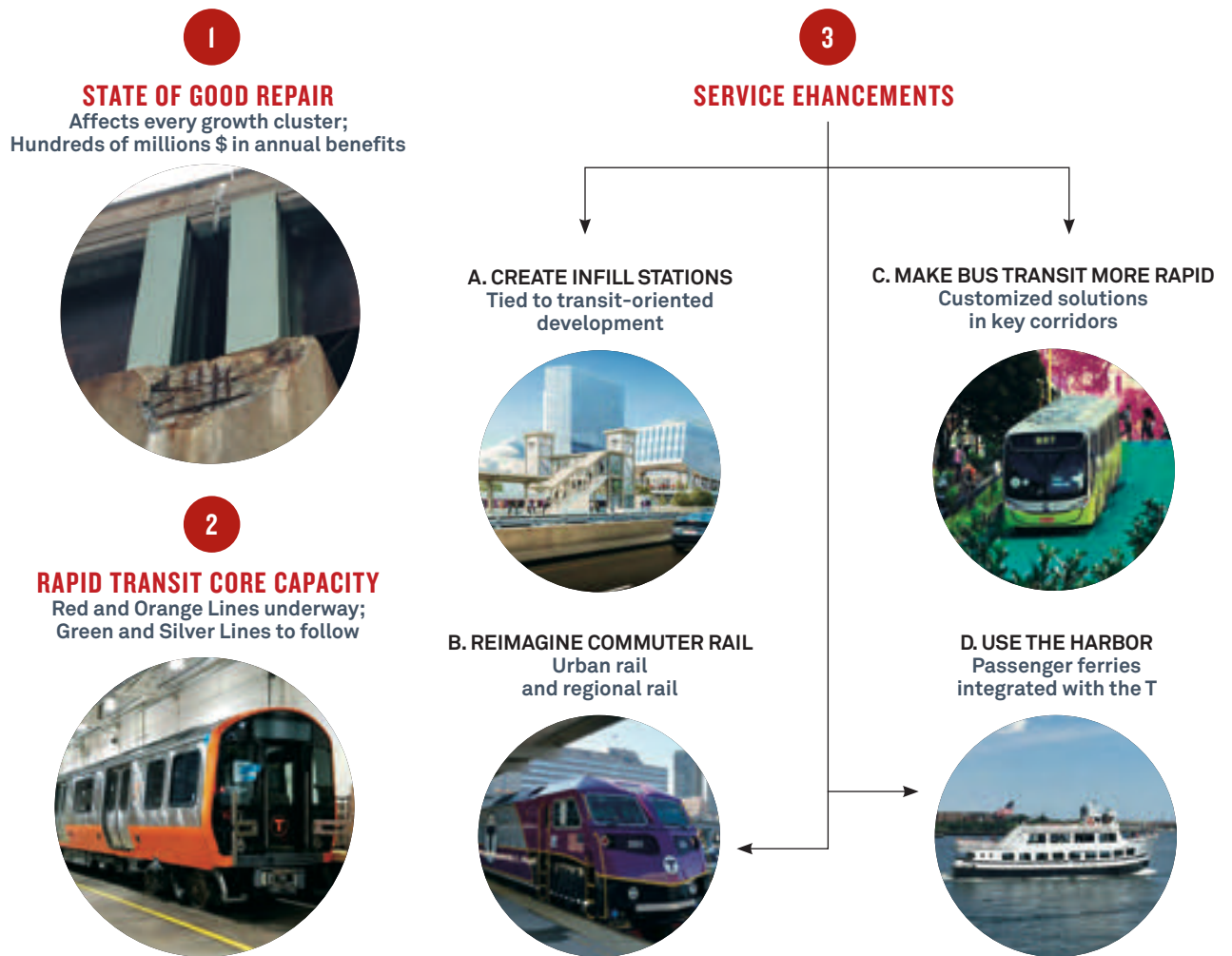
THE LEVELS OF GROWTH THAT ARE EXPECTED OVER THE NEXT QUARTER-CENTURY CANNOT BE ACCOMMODATED WITHOUT INVESTING STRATEGICALLY AND DELIBERATELY IN TRANSIT.

The second investment strategy is to **enhance the core capacity of the rapid transit backbone**, as the MBTA is currently doing by replacing the Red and Orange Line fleets and modernizing their signal systems and maintenance facilities. These investments will enable peak period capacity increases of 50% on the Red Line and 30% on the Orange.

An analogous effort is needed on the Green Line, specifically its fleet, its surface operations, the condition of the central subway, and its signal and traction power systems, all of which would improve reliability and capacity, enabling three-car trains to run dependably during peak hours. A successful Green Line modernization strategy, combining State of Good Repair and enhanced core capacity, would address economic development needs across multiple Growth Clusters and Corridors and is especially important to the Longwood Medical Area and the development districts, both transformative and infill in nature, along the Green Line Extension.



FIGURE 5: Investment Strategies for Growth



For the Silver Line Waterfront service to function as a legitimate high-capacity, high-frequency rapid transit line—and for it to serve as the mobility backbone for the growing Seaport District—it will require capacity enhancements through fleet expansion and resolution of its operational bottleneck at D Street.

The third investment strategy consists of **service enhancements**. With the exception of the Green Line Extension, these do not involve new corridors that extend the MBTA’s footprint. Rather, they are investments that make the MBTA’s existing footprint more nimble, more interconnected, more responsive to demonstrated need, and more attractive to businesses deciding where to invest and households deciding where to live. These service enhancements are *strategic*, each representing a category of individual projects that can be prioritized, implemented, and delivered incrementally. To varying degrees they invite participation by the private sector or

local government. Four specific categories emerged from the analysis of Growth Clusters and Strategic Corridors:

- Create new **“infill” stations** linked directly to transit-oriented development. These investments define their Transit Growth Clusters and lend themselves to public-private partnerships, as demonstrated at Assembly Square, Boston Landing, and Yawkey Way and as envisioned at Quincy Center, Allston Landing, the Lynn River Works, Wonderland, and potentially the Malden River, the Everett Waterfront, and Alewife.
- Re-imagine our commuter rail system, so that this extensive, in-place legacy infrastructure can evolve into two complementary types of service. **Urban rail** would use shorter, more nimble “multiple unit” trains to provide frequent, rapid transit-like service on corridors within the Inner Core. Potential opportunities include

Boston's Fairmount Line from Readville to South Station; the Near North Shore from Lynn and Wonderland to Chelsea and North Station; and the Charles River Corridor from Newton to Brighton, Allston, Yawkey, Back Bay, and South Station. Each of these investments would serve multiple Transit Growth Clusters, connecting them to each other and to Downtown Boston.

Regional rail would provide enhanced peak and reverse peak service to outlying cities and towns, addressing two distinct regional goals. One is the need to reduce congestion by diverting more Hub-bound commuters from automobile to rail, using additional remote parking and semi-express service that skips stations served by Urban Rail. The other is to support growth in outlying city and town centers served by commuter rail, particularly Gateway Cities and Regional Urban Centers, through more frequent service and stronger last-mile connections. Improved connectivity will bring new opportunities to grow in economic synergy with the Inner Core.

- Use the versatility of **bus rapid transit (BRT)**, and leverage its relative affordability, to connect underserved Transit Growth Clusters within and between Strategic Corridors. The new Silver Line Gateway, connecting the Seaport, Logan Airport, the potentially transformative Chelsea Growth Cluster, and the North Shore commuter rail line is a powerful example. A variety of BRT and dedicated bus lane solutions can be tailored to other corridors in the Inner Core, where economic development is constrained by bus routes with delay or capacity issues. BRT could connect places like Forest Hills, Blue Hill Avenue, Dudley, the Longwood Medical Area, Kendall, Lechmere, Everett's Lower Broadway, North Station, and the Seaport.

Some of these opportunities involve corridors that the MBTA has designated as Key Bus Routes, characterized by high ridership and high frequency schedules.²² Even where BRT or dedicated lane solutions are not feasible, the improvement of Key Bus Route performance through traffic signal prioritization and improved passenger amenities is essential.

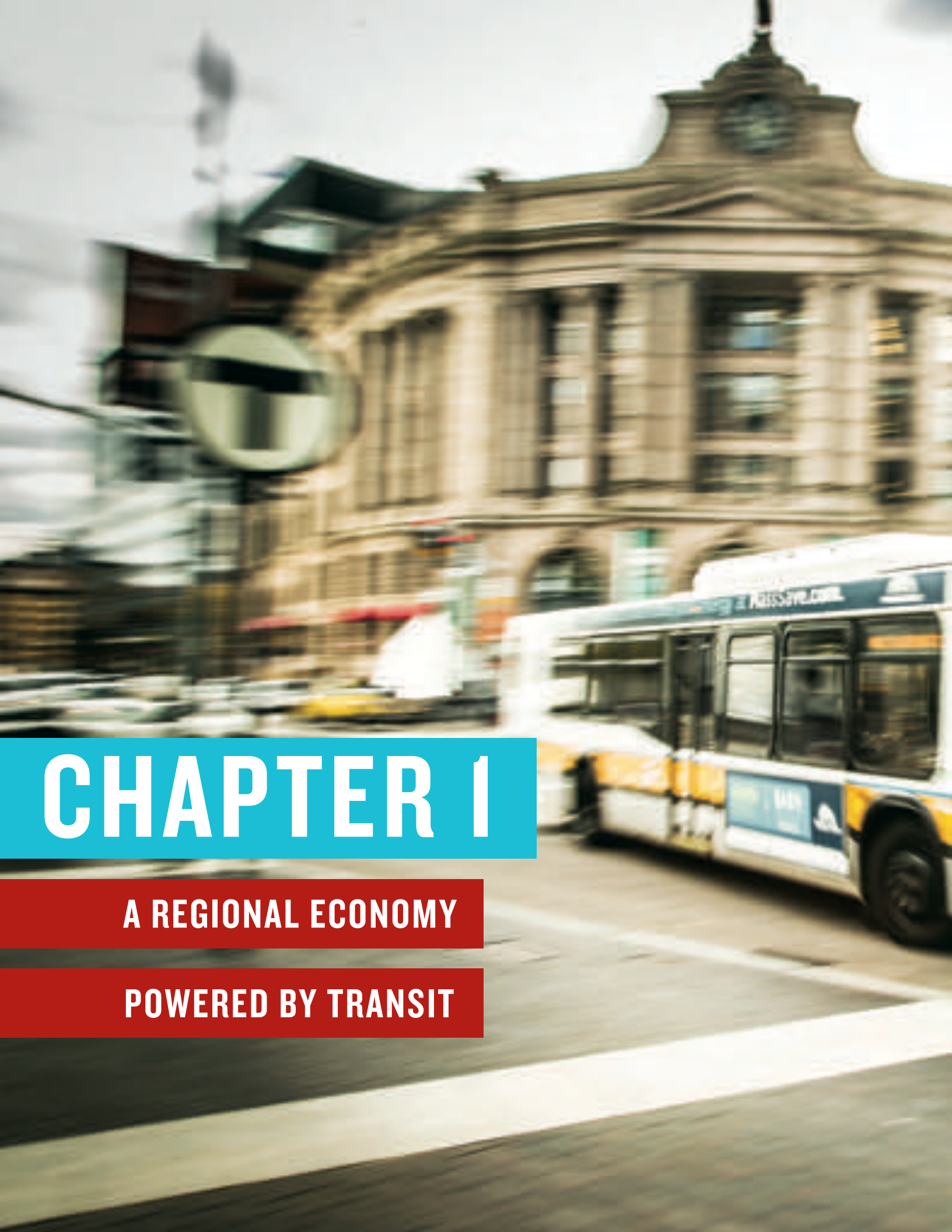
- Make **passenger ferries** an integral part of the transit network for the Seaport, Downtown, East Boston, the Everett Waterfront, the Lynn Waterfront, and other Inner Harbor, North Shore, and South Shore locations. MassDOT, private developers, municipalities, economic



development agencies, and civic organizations are engaged in ferry planning and implementation. A robust system of scheduled ferry routes, even with diverse ownership and operational arrangements, can be seamlessly integrated, from the passenger's perspective, with the landside MBTA network.

As it nears the end of this century's first quarter, Metropolitan Boston finds itself at a mobility crossroads. The major transportation investments of the 1990s set the stage for impressive and continuing economic growth, but those investments are well behind us, and the region now faces new challenges—particularly chronic and increasing traffic congestion—and opportunities that require a strategic response. The strategies presented here respond to the data at both a regional and a more granular level, and they address the mobility preferences of a new generation of workers who favor the agility of a multimodal transit network.

The durability of the Metro Boston economy, and the impressive rate of current and potential growth in its Transit Growth Clusters, is the product of neither accident nor coincidence. It is, rather, the private sector's ongoing response to the region's transit legacy and the associated patterns of transit-oriented land use and development. Metro Boston's economic ecosystem was historically, and is currently, powered by transit, and our continued success depends on our ability and willingness to follow this path forward. If we do, Metropolitan Boston and its transit-rich, pedestrian-friendly Inner Core will remain a steady and reliable engine for the larger economy of the Commonwealth.



CHAPTER 1

A REGIONAL ECONOMY

POWERED BY TRANSIT



CHAPTER I

AN ECONOMIC ECOSYSTEM

CONNECTING PEOPLE AND JOBS, FUELING PRODUCTIVITY

A thriving regional economy is an ecosystem composed of a set of interconnected and mutually reliant components—the residential population; the workforce; individual jobs and aggregate employment centers; institutional and commercial destinations; airports, seaports, and distribution centers; professional and technical services that support the other physical and functional elements. The MBTA is an important part of Metropolitan Boston's economic ecosystem, linking people and businesses to the essential destinations of their daily lives: work, health care, education, services, entertainment.²³ In the process, the MBTA produces regional economic benefits that can be modeled, quantified, and monetized. The results of such an analysis at the metropolitan level are dramatic, both in recurring annual benefits and in the avoidance of costly highway and parking investments.²⁴

Annual Operating Benefits. Existing MBTA operations generate enormous benefits to metropolitan residents and businesses. These benefits are estimated through a regional model reflecting current economic, land use, and transportation conditions. As explained more fully in Technical Appendix A, the model estimates the benefits of the MBTA—as it exists and operates today—by simulating what

would happen if its 1.3 million weekday trips had to be accommodated through driving and other means.²⁵

The MBTA's annual operating benefits reflect travel time savings, travel cost savings, crashes avoided, and reduced vehicular emissions—quantifiable differences between transit use and driving, especially in the daily work commute. Together, these recurring annual economic benefits have a combined monetized value, in 2015 dollars, of approximately **\$11.4 billion annually**. They include the following.

- **Travel time savings.** Thanks to the MBTA, drivers avoid spending more than 1.7 million additional hours *per day* (over and above existing conditions) on our congested roadways. Transit use reduces daily car trips by 6.7%—but it reduces aggregate time spent driving by 43%.²⁶ Time is money, and the MBTA as it currently operates saves the regional economy an estimated \$7.1 billion worth of travel time, in 2015 dollars, year after year.²⁷ These benefits are enjoyed by MBTA riders, as well as by drivers whose commutes are less congested because others use transit.²⁸
- **Travel cost savings.** Commuting by transit is also less expensive in direct out-of-pocket terms. For the average regional traveler, the cost of fuel, car maintenance, insurance, tolls, and parking typically exceeds the corresponding MBTA fare. Taking the T instead of driving saves households about \$3.6 billion annually in car operating expenses.²⁹ This is over and above the cost of buying a car. Today, 27% of MBTA light and heavy rail riders are from zero-car households. For those who choose transit over car ownership, the MBTA is a money-saver; for those who cannot afford a car, the MBTA is a job-saver.
- **Crashes avoided.** Thanks to transit use, the regional economy saves more than \$640 million a year in vehicular crashes avoided and the added congestion that would accompany those crashes.³⁰ The crash rate for transit travelers is less than for auto travelers, so use of the MBTA system reduces the expected annual number of fatality, injury, and property-damage crashes. Moreover, without transit, intensified congestion and dispersion of traffic to arterials in an effort to avoid the greatest bottlenecks would likely lead to additional crashes.

THE MBTA PRODUCES REGIONAL ECONOMIC BENEFITS THAT . . . ARE DRAMATIC, BOTH IN ANNUAL BENEFITS AND IN THE AVOIDANCE OF COSTLY HIGHWAY AND PARKING INVESTMENTS.

FIGURE 6: MBTA Generates \$11.4 Billion in Annual Benefits

Source: AECOM

These recurring annual benefits of \$11.4 billion are more than *five times* the MBTA's annual operating budget of approximately \$2 billion.³¹ Simply put, each year the MBTA returns regional economic benefits worth more than five times what we, as a region and Commonwealth, spend to operate it. The \$11.4 billion in annual economic benefits also represents 3% of Metropolitan Boston's annual gross domestic product, and translates into an average annual gain of \$6,700 *per household* across the metro region.

Moreover, these are just the monetized *transportation* benefits—dollars pumped into the regional economy by enabling people to save time, save automobile-related costs, and avoid crashes. Transit use also makes the region a more environmentally sustainable place. MBTA usage reduces regional vehicle miles traveled (VMT) by 6%.³² Net of the fuel consumed by its own buses and trains, MBTA usage saves the region 86 million gallons of fuel annually. As a result, about 1,100 short tons of volatile organic compounds, 1,000 short tons of nitrogen oxides, and 843,000 short tons of carbon dioxide—a primary greenhouse gas—are avoided *annually* in Metropolitan Boston due to transit.³³

As the regional economy grows, the quantifiable value of MBTA operations will grow as well. In 2030, assuming no systematic deterioration of service, the annual benefits derived from travel time savings, travel cost savings, crash avoidance, and emission reduction would reach \$17.3 billion. These 2030

results are expressed in constant 2015 dollars and thus do not reflect inflation; they reflect the benefits of today's MBTA operating in a larger regional economy.³⁴

Long-Term Capital Costs Avoided. Today's MBTA represents a century and a half of transit investment and evolution. Thanks to this legacy, our region and the Commonwealth have been able to avoid billions of dollars in capital spending on additional automobile infrastructure. Based on the modeling analysis, without the MBTA our region would have required:

- nearly 2,300 additional lane-miles of public roads, from interstate highways to local streets;³⁵
- 400,000 additional parking spaces—enough to fill more than 100 Prudential Towers with cars.³⁶

If those facilities had to be built today, they would cost at least \$15 billion—\$7.6 billion for highways and \$7.1 billion for parking. Moreover, these estimates do not include the cost of land, which, if available at that scale, would be prohibitively expensive and would be diverted from more productive uses. By the most conservative estimate of dollars and cents—let alone economic dislocation, quality of life, and sustainability—the value of avoiding these additional highway and garage capital costs far outweighs the long-term capital investment required to bring the MBTA up to a State of Good Repair, currently estimated by the MBTA at \$7.3 billion.

HIGH REGIONAL COSTS OFFSET BY EXCEPTIONAL PRODUCTIVITY

The role of transit in the region’s economic ecosystem extends further. The Metropolitan Boston economy produces *over six times more gross domestic product per square mile* than the national metropolitan average. It does so despite an exceptionally high cost structure. Metropolitan Boston’s cost of doing business (a weighted mix of labor, energy, office space, and taxes) compares unfavorably to those of other metro areas along the Northeast Corridor and competing research centers in other parts of the country. Metropolitan Boston has the second highest costs, surpassed only by metropolitan New York.³⁷

Yet our high-cost economy thrives because it is productive. Its driving industries—finance, medical, education, technology, research—are transaction-based sectors that benefit from the availability of skilled labor, frequent and relatively inexpensive transportation, specialized technical and professional services, and a large client base. These factors—which economists call “agglomeration effects”—diminish the cost of transactions, enabling firms to operate in otherwise high-cost locations.

Congestion threatens this paradigm of productivity and efficiency. Despite Metropolitan Boston’s heavy

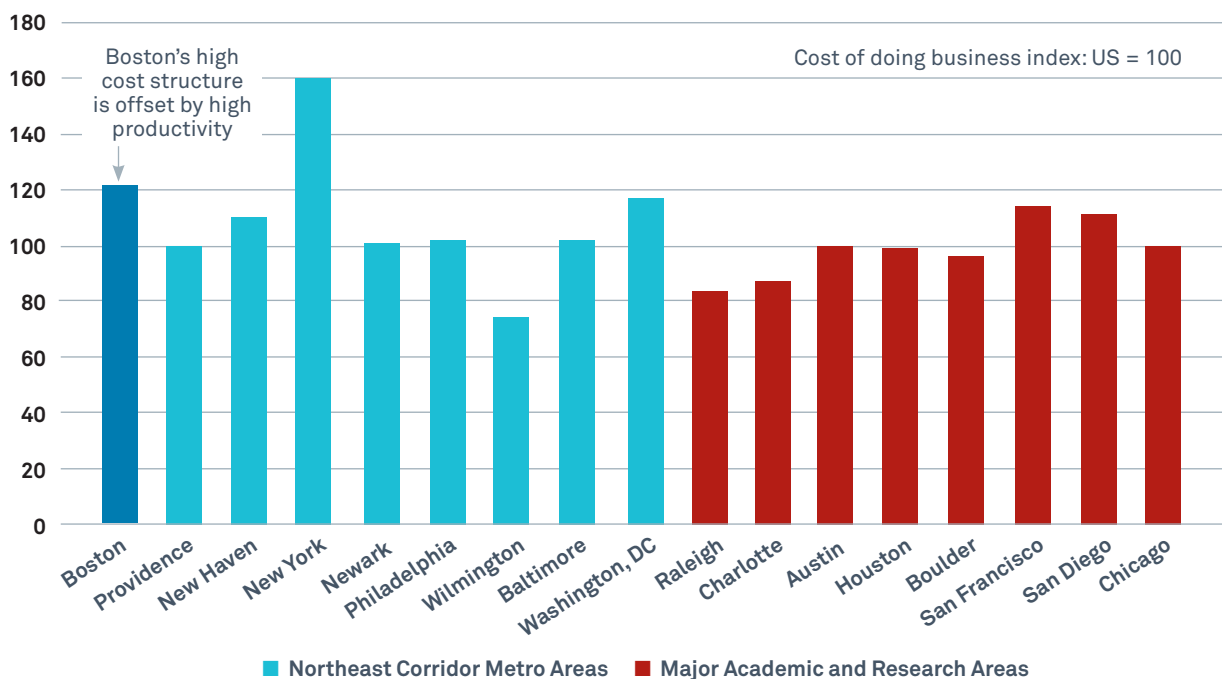
use of transit, we also rank high among US metro regions in traffic congestion. Between 1990 and 2014, the average number of hours spent in gridlock by Metropolitan Boston’s peak-period travelers rose from 44 to 64 hours per year.³⁸

The widely cited INRIX analysis of traffic congestion in US and world cities found that Boston is among the most congested cities in the country when measured by the hours that the average driver spends in gridlock or the percentage of total drive time spent in gridlock. When measured by the percentage of peak hour time spent in gridlock, Boston is the most congested city in America.³⁹

In terms of business impact, the INRIX analysis is equally arresting. Freight delivery and business-related travel are slowest in Chicago and Boston. Average congested daytime speeds within the two cities are just 4.9 mph. Chicago, Boston, San Francisco, Seattle, and Los Angeles are the five most congested major cities for businesses, with 13-14% of daytime travel congested on arterials and city streets.⁴⁰

Transit is the key. MBTA service helps offset the costs of operating in a dense urban ecosystem by reducing the congestion increase in the core; allowing workforce households to select residential locations with lower transportation costs; and

FIGURE 7: Cost of Doing Business, Metro Boston versus Other Regions



Source: Moody’s Analytics



**THE DENSITY OF
ECONOMIC ACTIVITY
IN THE BOSTON AREA'S
URBAN CORE WOULD
BE FUNCTIONALLY
IMPOSSIBLE WITHOUT
TRANSIT SERVICES.
THIS DENSITY IS
CRUCIAL TO PROVIDING
THE COMMONWEALTH'S
ECONOMIC EDGE.**

MASSBENCHMARKS, 2015

efficiently connecting businesses located in the core to each other, to the airport, to intercity rail, and to the universities and research centers where their ideas and talent come from. A regional economy clustered in a footprint much smaller than its road system gains efficiency and productivity.

A 2015 MassBenchmarks report by UMass Boston's Donahue Institute concluded: "By enabling more productive geographic concentrations of economic activity, transit does far more to make the Massachusetts economy a global standout than just bringing people to their jobs. The density of economic activity in the Boston area's urban core would be functionally impossible without transit services. This density is crucial to providing the Commonwealth's economic edge."⁴¹

The authors of *Foot Traffic Ahead: Ranking Walkable Urbanism in America's Largest Metros* find Metropolitan Boston in the national forefront of "walkable urban development," in which congestion is not only mitigated by regional transit but sidestepped by agglomerative development that uses transit, walking, and cycling to drive real estate values. Their message is clear: "[I]nvestments in MBTA capacity and resiliency are prerequisites for the billions of dollars of private sector capital seeking to flow into walkable urban places over the coming decades."⁴²

A TRANSIT-CENTERED ECONOMY

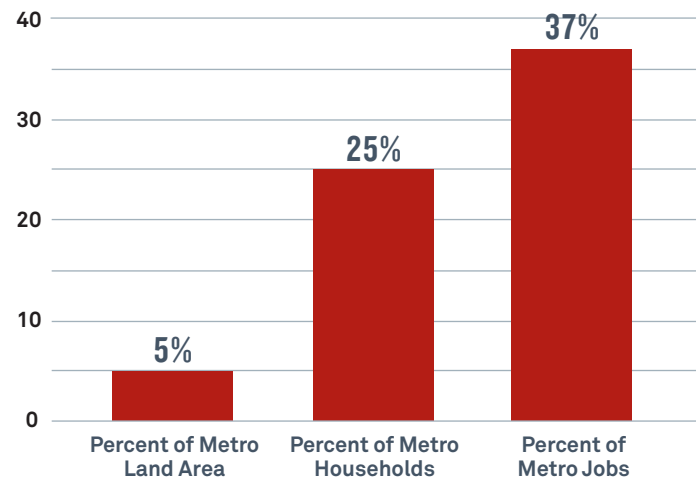
CONCENTRATED NEAR STATIONS AND IN THE INNER CORE

The marketplace of private sector economic investment recognizes the benefits of our public transportation system. This is visibly evident in the concentration of businesses and residences in places served by transit. This concentration can be measured in two ways, each of which makes a point central to this analysis: *a small percentage of the region's land area supports an outsized share of its economic activity.*

Proximity to Stations

One approach is to look at the aggregate of development within a given radius of stations throughout the system. The MBTA has 268 rapid transit and commuter rail stations in Metropolitan Boston.⁴³ Their half-mile radii represent, in total, only 5% of the region's land area. Yet those half-mile radii contain at least 25% of the region's households and 37% of the region's jobs.⁴⁴ If MBTA bus routes are added to the analysis, the land within *a quarter-mile*

FIGURE 8: Within a Half-Mile of an MBTA Transit or Commuter Rail Station (268 Stations)



Source: AECOM. Compiled from MBTA Blue Book (2014), MAPC Growing Station Areas (2012).

of any rail station or bus stop contains 30% of the region's households and 40% of its jobs.⁴⁵

This concentration is reflected in property valuation. In the 77 Metro Boston cities and towns with rapid transit or commuter rail service, real estate located within a half-mile of those stations constitutes 38% of the aggregate property valuation on just 12% of the land. In Boston, real estate within a half-mile of MBTA stations represents 81% of total property valuation on 65% of the land. Each year, municipalities with rapid transit or commuter rail service collect over \$160 million in additional property tax revenues due to the valuation premium associated with proximity to rail stations.⁴⁶ This finding is consistent with the **WalkUP Wakeup Call Report: Boston**, which found a large and growing valuation premium for “walkable urban development” (most of it served by transit) over “drivable suburban development.”⁴⁷

The valuation premium is resilient. A 2013 study compared the “transit shed” (the aggregate of all station areas) to the region as a whole in Metropolitan Boston, Chicago, San Francisco, Phoenix, and Minneapolis–St. Paul between 2006 and 2011—the period bracketing the Great Recession. In all five markets, the drop in average home sale prices within the transit shed was smaller than in the region as a whole or the non-transit area. Boston station areas outperformed the region the most—by 129%. Thus, not only is development attracted to transit, it is worth more per square foot and it holds its value more consistently.⁴⁸

**INVESTMENTS IN
MBTA CAPACITY AND
RESILIENCY ARE
PREREQUISITES FOR THE
BILLIONS OF DOLLARS
OF PRIVATE SECTOR
CAPITAL SEEKING TO
FLOW INTO WALKABLE
URBAN PLACES OVER
THE COMING DECADES.**

**FOOT TRAFFIC AHEAD:
RANKING WALKABLE URBANISM**

The Inner Core

The other way to understand the concentration of economic activity around the MBTA system is to focus on the cluster of communities in the core of the region, where the radial transit network converges and transit service, connectivity, and proximity are densest. MAPC defines an Inner Core Subregion of 20 municipalities, centered on Boston and extending out to Quincy, Lynn, and Waltham. As shown in Figure 9, the Inner Core includes “the original 14”—the cities and towns served by the Metropolitan Transit Authority (MTA), predecessor of the MBTA, from its creation in 1947 (and before that by the private subway, elevated, streetcar, and bus operations that the MTA acquired). This is the core of Metropolitan Boston’s transit legacy, where urban form began organizing itself around mass transit more than a century ago.⁴⁹

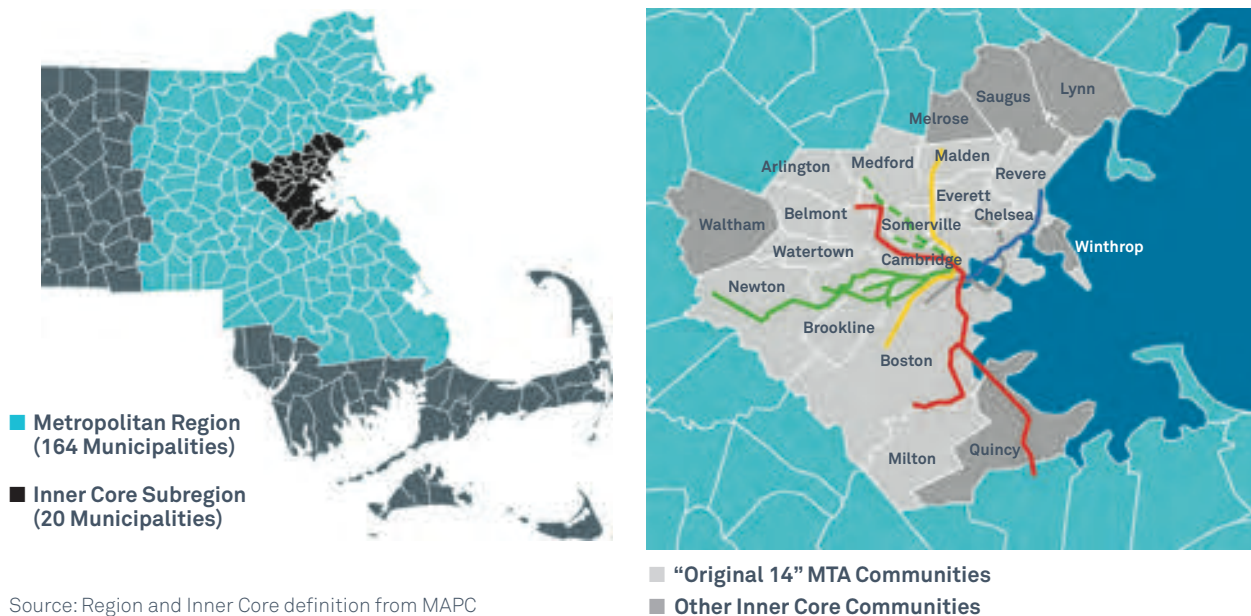
The Inner Core contains the Orange, Blue, Green, and Silver lines in their entirety, the entire Red Line (except Braintree Station), and the Ashmont-Mattapan high-speed trolley line. Thus almost all of the MBTA’s 780,000 weekday rapid transit trips, *from end to end*, occur within the Inner Core.⁵⁰ Two current MBTA enhancement projects—the Green Line Extension and the Silver Line Gateway—are located entirely in the Inner Core as well.

Most MBTA bus routes—which carry 447,000 people each weekday—run within the Inner Core and feed its rapid transit corridors. The MBTA’s 15 designated

IN CITIES AND TOWNS WITH RAPID TRANSIT OR COMMUTER RAIL, REAL ESTATE LOCATED WITHIN A HALF-MILE OF THOSE STATIONS CONSTITUTES 38% OF THE AGGREGATE PROPERTY VALUATION ON JUST 12% OF THE LAND.

Key Bus Routes are located entirely in the Inner Core.⁵¹ Virtually all of the MBTA’s 122,000 weekday commuter rail trips take people into and out of the Inner Core. In much of the Inner Core, it is rare to find places that are *not* within walking distance of a rapid transit station, commuter rail station, or bus stop.⁵² *The MBTA’s regional economic impact is largely, by definition, its impact on*

FIGURE 9: Metropolitan Boston, the Inner Core, and the Rapid Transit System



Source: Region and Inner Core definition from MAPC

the Inner Core and on the Inner Core's ability to support the larger metropolis and the Commonwealth.

The 20 municipalities of the Inner Core Subregion represent just 11% of Metropolitan Boston's land area. But as of 2015, they housed 37% of the metropolitan population—and a quarter of the state's population.⁵³ The concentration of jobs is even more pronounced. In 2015, the Inner Core contained 44% of jobs in Metropolitan Boston—and a third of all the jobs in Massachusetts. Key growth sector jobs are more concentrated still. The Inner Core contains 49% of all regional jobs in health care, 61% in education, and 68% in financial services.⁵⁴

AN ENDURING PATTERN: OVER A CENTURY OF GROWTH IN A TRANSIT-RICH INNER CORE

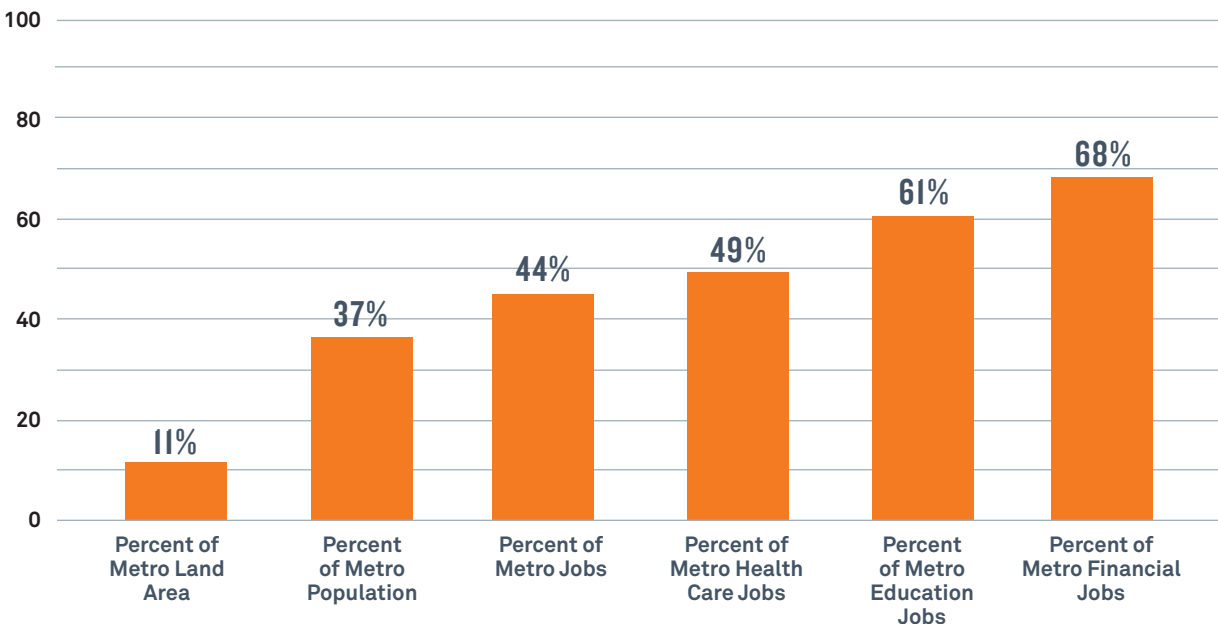
The concentration of population and economic development in the transit-rich Inner Core is neither theoretical nor new. On the contrary, it is longstanding and well-documented, and has survived the centrifugal forces that have prevailed in many other regions. In 1900, with the Industrial Revolution well established and Boston a pre-eminent American city, the metropolitan population was 1.9 million, of which 57% resided in the 20 communities now defined by MAPC as the Inner Core Subregion. In 1950, the first post-World War II decennial census year, the metropolitan population had grown to 3.2 million, and the Inner Core had grown apace, representing 58% of the total.

In the ensuing postwar decades of 1950–1980, both the population of the Inner Core and its share of the metro population declined steadily, as was the case in many mature northeastern and midwestern metro areas facing the rise of suburbanization and the pull of the Sunbelt. *But in Metropolitan Boston, that trend ended long ago.* After losing 17% of its population between 1950 and 1980, the Inner Core has bounced almost all the way back, regaining 13%. Its share of the metropolitan population has held steady and in 2015 was 37%.

The City of Boston had a 1950 population of 801,000, its all-time high; by 1980, it had dropped to its post-war low of 562,994—even as the metropolitan region was growing significantly. But as of 2015, Boston's estimated population was 667,137—a rate of resurgence that stands out among peer cities of the northeast and midwest.⁵⁵ In a regional economy based on knowledge, productivity, and mobility, the importance of a center city and Inner Core that are steadily growing rather than “hollowing out” cannot be overstated.

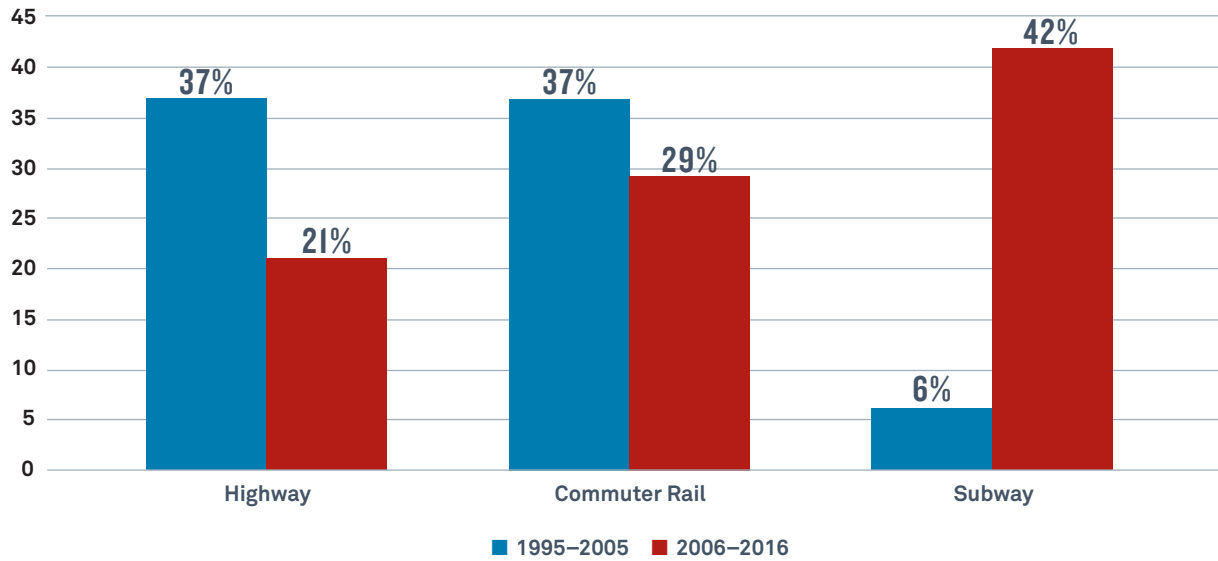
While historic trend data for the concentration of jobs is more limited, Figure 10 suggests a significant shift in the geographic focus of job growth toward the Inner Core. In the decade of 1995–2005, most job growth occurred in areas served primarily by highways and commuter rail lines; in the decade of 2006–2016, job growth in highway settings receded, while job growth in subway settings—all of them in

FIGURE 10: Metro Boston's Inner Core Subregion (20 Communities)



Source: U.S. Census, 2015 data; MA Department of Labor ES-202 Data Base, 2015.

FIGURE 11: Share of State's Net Job Growth by Transportation Infrastructure



Source: MassINC analysis of ES-202 data provided by the Executive Office of Labor & Workforce Development

Note: Highway includes communities along major highways with no subway or commuter rail stations; commuter rail excludes communities with both subway and commuter rail service.



FROM 1980 TO 2015—WHILE MANY OLDER CENTRAL CITIES AND THEIR INNER-RING SUBURBS WERE LOSING POPULATION—THE METRO BOSTON INNER CORE GREW BY 13% AND THE CITY OF BOSTON GREW BY 18%.

the Inner core—surged.⁵⁶ The Inner Core's share of metropolitan jobs held steady at 43–44% from 2001 to 2015, as did Boston and Cambridge's combined share of metropolitan jobs at 29%. Unlike the many mature metro regions where Great Recession job losses hit the core hardest, Metro Boston's modest job losses were distributed evenly between the Inner Core and the rest of the region, and as of 2015, those losses have been recouped and then some.⁵⁷

These persistent patterns did not happen by accident. Metropolitan Boston has long organized itself around transit, density, and the primacy of the regional core. The legacy of mass transit extends back to the street railways of the nineteenth century, and the core of today's Red, Blue, Orange, and Green Lines is over a century old. Boston won the race to build America's first subway in 1898 and the first underwater transit tunnel in 1904.⁵⁸ The marketplace has made innumerable land use and development decisions in response to the metropolitan transit network. Moreover, in the lifetime of many people reading this report, our region made seminal public policy decisions to:

- Abandon urban superhighways in favor of new transit extensions, when the postwar Master Highway Plan was stopped in 1972 and its funding converted to transit. The Commonwealth decided to build the Southwest Corridor Project, the Red Line extensions to Alewife and Braintree, and the Orange Line extension to Melrose—instead of the Southwest Expressway, Route 2 Extension, and Inner Belt. Those highways and their interchanges would have consumed hundreds of acres of land in Boston, Cambridge, Somerville, and Brookline, and imposed other costs on those communities and their neighborhoods. Today's Greater Bostonians

might not recognize the region that would have resulted had those expressways been built.

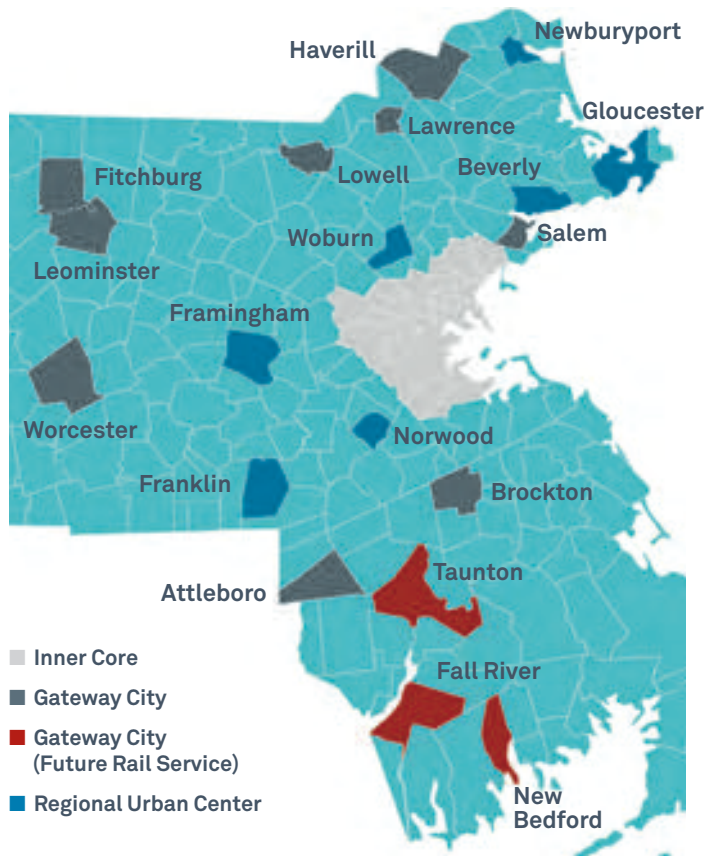
- Retain our international airport in the center of the region, expand its terminals, increase its operating capacity, and make it one of the most transit-accessible airports in the United States. Overall transit and high-occupancy vehicle mode share for Logan passengers is approaching 30%, with a target of 40% by 2027.⁵⁹ With on-site employee parking deliberately minimized, much of Logan's 17,000-person workforce commutes by transit as well.⁶⁰
- Salvage and recreate the north and south commuter rail systems and their hubs at North and South Stations. When the Commonwealth purchased the commuter rail tracks forty years ago, the systems had all but disappeared, North Station was decrepit, and South Station had literally been saved from the wrecking ball. Since then, a commuter rail network carrying 122,000 trips a day has re-emerged. It has been expanded to Newburyport, Fitchburg, and Worcester, with Taunton, New Bedford, and Fall River on the horizon. Private developers are investing, or preparing to do so, in the concourses and public areas of North, South, and Back Bay Stations, and the districts surrounding those intermodal hubs are thriving.

The regional transportation decisions outlined here set Metropolitan Boston on course toward a more transit-driven, transit-oriented economy than almost all of its peer regions. Today, as Metropolitan Boston navigates the challenges and opportunities of a growing population and economy, together with the imperative of maintaining a quality of life necessary to sustain that growth, the importance of transit mobility has never been more apparent.

Bernard LaCasse's "Beat the Belt" mural in Cambridge recalls protest that stopped the Inner Belt Interstate highway development.



FIGURE 12: Gateway Cities and Regional Urban Centers Located Outside the Inner Core and Served by Rail



Source: AECOM. Definition of Gateway Cities from MA Executive Office of Housing and Economic Development; Regional Urban Centers, MAPC.

A REGIONAL SYNERGY

LINKING THE INNER CORE TO GATEWAY CITIES AND REGIONAL URBAN CENTERS

On the outer “spokes” of the commuter rail system are 16 communities either designated by the Commonwealth as Gateway Cities, categorized by MAPC as Regional Urban Centers, or both. Gateway Cities are priority targets for state economic development programs, and Regional Urban Centers are projected by MAPC as the next-fastest growing set of communities after the Inner Core.⁶¹ These historic railroad cities are not simply bedroom communities. In Haverhill, Salem, Beverly, Brockton, Attleboro, and others, multi-family housing is being developed as part of walkable mixed-use downtowns. Downtown Lowell and Worcester, with their academic, medical, and visitor sectors, are emerging rail destinations. The viability of Gateway Cities and Regional Urban Centers, their connection to the Inner Core, and the potential synergies among them, is a strategic ingredient of regional growth.⁶²

The link between transportation, land use, and development outside the Inner Core can be seen in the way residential density patterns might have evolved without transit. When this hypothetical scenario is examined through regional modeling, the Inner Core remains largely unchanged.⁶³ But outside the Inner Core, population would shift to areas near major highway interchanges, such as the confluence of the Massachusetts Turnpike and Route 9 in MetroWest; the interchanges of I-495, I-93, and Route 213 in the Merrimack Valley; the I-95/I-93 split on the South Shore; and the outer arc of Route 128, near its interchanges with I-95, I-93, Route 2, and Route 3 north of Boston, and with I-95 and Route 24 south of Boston.⁶⁴ Residential location decisions would be dominated by highway proximity (as major employment location decisions already are) without the mitigating effect of commuter rail and other transit. The opportunity to nurture more sustainable, walkable growth in outlying city and town centers, supported by rail connections to Boston, would be lost. While only hypothetical, this scenario illustrates how rail connections to the Inner Core support the opportunity to develop housing and jobs in Gateway Cities and Regional Urban Centers.

The importance of transit to the economy of Metropolitan Boston and its Inner Core, and the potential for revitalization in Gateway Cities and Regional Urban Centers to be spurred by transit connections to the Inner Core, are not theoretical; the data demonstrating these relationships are powerful and compelling. In Chapter 2, we turn from a regional level of analysis to one focused on representative Inner Core locations where robust growth is occurring today or is strongly encouraged by state and local development policies. A granular assessment of what is happening “on the ground” in these dense, transit-rich locations illuminates the importance of transit to our region’s expectations of continued growth.

A GRANULAR ASSESSMENT OF WHAT IS HAPPENING “ON THE GROUND” ILLUMINATES THE IMPORTANCE OF TRANSIT TO OUR REGION’S EXPECTATIONS OF CONTINUED GROWTH.



CHAPTER 2

TRANSIT, GROWTH, AND

LABOR MARKET CONNECTIVITY



CHAPTER 2

THE TRANSIT ORIENTATION OF REGIONAL GROWTH

CLUSTERED AROUND STATIONS, CONCENTRATED IN THE INNER CORE

Metropolitan Boston is expected to continue growing through 2030 and beyond. In 2014, MAPC published its regional population projections, describing two alternative growth scenarios. The “Status Quo” scenario shows the 2010 metro population growing by 5% to 2030 and 7% to 2040. In the more robust “Stronger Region” scenario, the 2010 population increases by 10% to 2030 and 13% to 2040.⁶⁵

This anticipated growth will not be spread uniformly across the region, and it will not be isolated in a handful of major development centers. Rather, like the existing distribution of population and employment, growth is expected to be clustered *disproportionately near transit and disproportionately in the Inner Core*.

- **Disproportionately near transit.** In 2012, an estimated 30,000 housing units and 45 million square feet of commercial space were planned or under construction near rapid transit and commuter rail stations, and there was capacity to accommodate 76,000 additional housing units and 130,000 additional jobs. A more recent analysis reveals that between 2010 and 2017, 13,500 housing units were built near transit, while an additional 67,000 were under construction or planned. These 80,500 units represent nearly a quarter of the region’s projected housing unit demand between 2010 and 2030—on 5% of the region’s land area.⁶⁶
- **Disproportionately in the Inner Core.** Based on MAPC’s projections, continued regional growth depends disproportionately on growth in the Inner Core. This is true in both the Status Quo and the Stronger Region scenarios. In the latter, by 2030, the following is expected to occur:⁶⁷
 - The metropolitan population is projected to grow by 430,000 or 10%. Over half that growth—235,000—is projected in the Inner Core, which grows by 14%.
 - The regional labor force is projected to grow by 5%, occurring almost entirely in

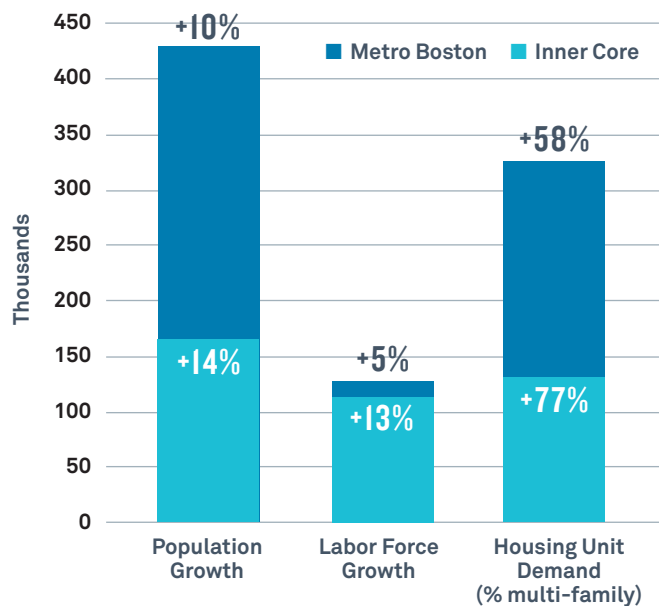
the Inner Core and intensifying demand for transit-accessible jobs.⁶⁸

- To accommodate population growth and shifting household composition, the region will need 329,000 new housing units, of which 58% are expected to be multi-family. The Inner Core would require 129,000 of these new units, 77% of them multi-family—a hallmark of transit-oriented development.⁶⁹

These population growth, labor force distribution, and housing development outcomes will not merely unfold more efficiently, competitively, and sustainably if focused on the Inner Core. It is not clear that they could be achieved any other way.

Given these projections, under either the Stronger Region or Status Quo scenario, it is reasonable to expect the strongest growth potential in places that share both locational advantages—that is, places that are in the Inner Core *and* within walking distance of transit.⁷⁰ It is useful to take an on-the-ground look at key Growth Clusters, to understand the transit assets that attract development to these locations, and to identify the kinds of transit investments and land use policies that will be needed to sustain this pattern.

FIGURE 13: Projected Growth, 2010–2030—MAPC Stronger Region Scenario



Source: Compiled from MAPC, Population and Housing Demand Projections, 2014.

GROWTH CLUSTERS AND STRATEGIC CORRIDORS

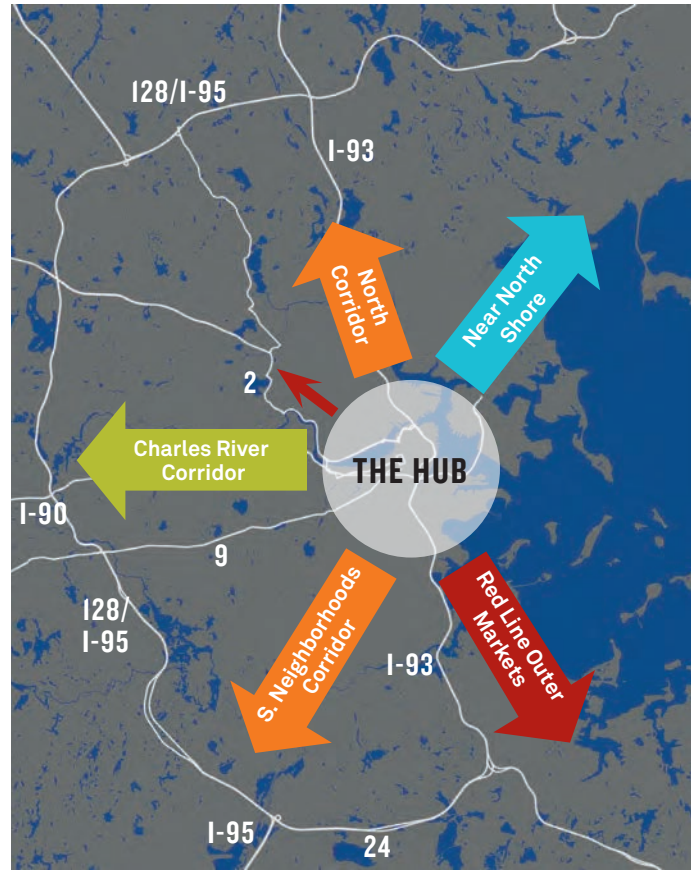
TRANSIT-ORIENTED DEVELOPMENT ON THE GROUND

The Inner Core contains dozens of districts where state economic policy, local land use policy, and market interest converge around rail or bus transit. This report refers to such districts as *Transit Growth Clusters* and defines a representative subset of them—24 in all—to serve as case studies allowing a detailed examination of what makes the Inner Core “tick” when it comes to economic development. These sample Growth Clusters are located in 14 of the 20 Inner Core communities, and represent three distinct (but non-mutually exclusive) economic development scenarios:

- **Established:** ongoing, large-scale development districts where significant build-out capacity remains; examples are the Seaport and the Upper Southwest Corridor.
- **Transformative:** emerging development opportunities of transformative scale—for example, Allston Landing, Suffolk Downs, or the envisioned redevelopment of the Lynn Waterfront.
- **Infill:** significant infill and adaptive reuse opportunities that strengthen the linkage between transit and sustainable, equitable development—for example, the revitalization of Quincy Center, Arsenal Street, or Lower Blue Hill Avenue.

Transit Growth Clusters are exemplars of “walkable urban development,” where density, mixed uses, and a strong, engaging pedestrian environment combine to support transit use, reduce the need for costly parking, nurture a more healthful lifestyle, and drive

FIGURE 14: The Hub and the Strategic Corridors



Source: AECOM

real estate values well above those of “drivable suburban development.”⁷¹

The connectivity and development potential of these Transit Growth Clusters are best understood when they are viewed not as stand-alone districts but as “Strategic Corridors” linked by geographic proximity, transit connectivity, and current or potential economic synergy. Described and mapped on pages

TABLE 2: Corridors and Clusters

STRATEGIC CORRIDOR	TRANSIT GROWTH CLUSTERS ⁷²
The Hub ⁷³	Downtown Boston; Back Bay; Longwood Medical Area/Fenway; Kendall; Seaport District; South Bay Corridor
Near North Shore Corridor	East Boston Waterfront; Chelsea; Suffolk Downs/Wonderland; Lynn Waterfront
North Corridor	E. Cambridge/E. Somerville; GLX Villages; Medford/Malden River Corridor
Charles River Corridor	Allston/Brighton Rail Corridor; Arsenal Street; Newton Rail TOD Corridor; Needham Street; Downtown Waltham
South Neighborhoods Corridor	Upper Southwest Corridor/Dudley; Lower Southwest Corridor/Egleston; Lower Blue Hill Avenue; Hyde Park Villages
Red Line Outer Markets	Alewife; Quincy Rail TOD Corridor

29–34, these include “The Hub” and five radial corridors connected to it.

The economic potential of the Transit Growth Clusters was evaluated through two original data analyses:

- **Development capacity.** A detailed review was conducted of the roughly half-mile radii surrounding the MBTA stations in each Transit Growth Cluster, including (i) newly built or current development; (ii) specific development plans now in the approval pipeline; and (iii) high-level estimates for potentially transformative sites where development is anticipated but not yet planned in detail (such as Suffolk Downs and Wonderland). In the aggregate, the Transit Growth Clusters contain:⁷⁴
 - About 49,000 housing units recently built, under construction, or in the approval pipeline.
 - The potential to accommodate approximately 49,000 additional housing units.
 - Commercial and industrial space built, under construction, or in the approval pipeline for approximately 146,000 jobs.
 - Potential future space for approximately 116,000 additional jobs.⁷⁵

As in any dynamic real estate market, the outcome and timing of potential future development cannot be predicted with certainty. Not all of the potential

Growth Cluster development will occur, and some that does occur will represent the replacement of existing housing and employment (in a more sustainable, transit-oriented pattern) rather than net growth. But these Growth Clusters and others like them have the physical capacity and the transit penetration to drive the absorption of Inner Core growth that underlies MAPC’s Stronger Region scenario.

- **Labor market connectivity.** Labor market connectivity is a foundational concept in regional economic development. It is not enough to build jobs and housing; it is essential to connect them in a reliable, affordable way. The Center for Neighborhood Technology publishes two online interactive datasets that enable site-specific estimation of transportation and economic outcomes: the AllTransit Database and the Housing+Transportation Affordability Database. These were used to create connectivity metrics on which the Transit Growth Clusters consistently outperform the metropolitan region as a whole.

The following pages provide high-level overviews of the six Strategic Corridors. Each includes a summary description; a map showing the individual Transit Growth Clusters; the relevant rapid transit and commuter rail lines and Key Bus Routes; and an estimate of the corridor’s current, planned, and potential development capacity. Technical Appendix C provides more detailed mapping, descriptions, and analyses for each of the 24 Growth Clusters.



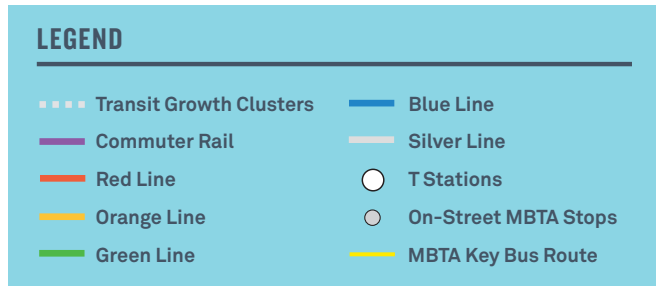
Red Line, Ashmont Station

FIGURE 15: The Hub⁷⁶



The Hub is an amalgam of six closely connected Transit Growth Clusters. At the “bulls-eye” of the radial transit network, **Downtown Boston** is served by 13 subway stations and the North and South Station multimodal hubs. It has the highest job density and daily ridership of any Growth Cluster and is continuing to grow—and attract new residents—through large-scale mixed-use projects. The high-density Growth Clusters of **Back Bay**, **Kendall**, and the **Seaport District** are contiguous to **Downtown Boston**. So is the **South Bay Corridor**, served by the Red Line and the Fairmount commuter rail branch. This corridor is targeted for housing and job growth on both sides of I-93, including Dorchester Avenue between Broadway and Andrew Stations and the future potential of Widett Circle. **The Longwood Medical Area** is spurring development in the Fenway and Brookline Village and enjoys a knowledge-based economic synergy with Kendall and the Seaport. All of these Growth Clusters rely on the MBTA for connections to their regional workforce and to each other.

Source: AECOM



The Hub: Current and Potential Development		
	Housing	Jobs
Recent, Current, and Pipeline Projects	21,000	83,000
Estimated Long-term Potential	18,000	35,000

FIGURE 16: Near North Shore Corridor⁷⁷

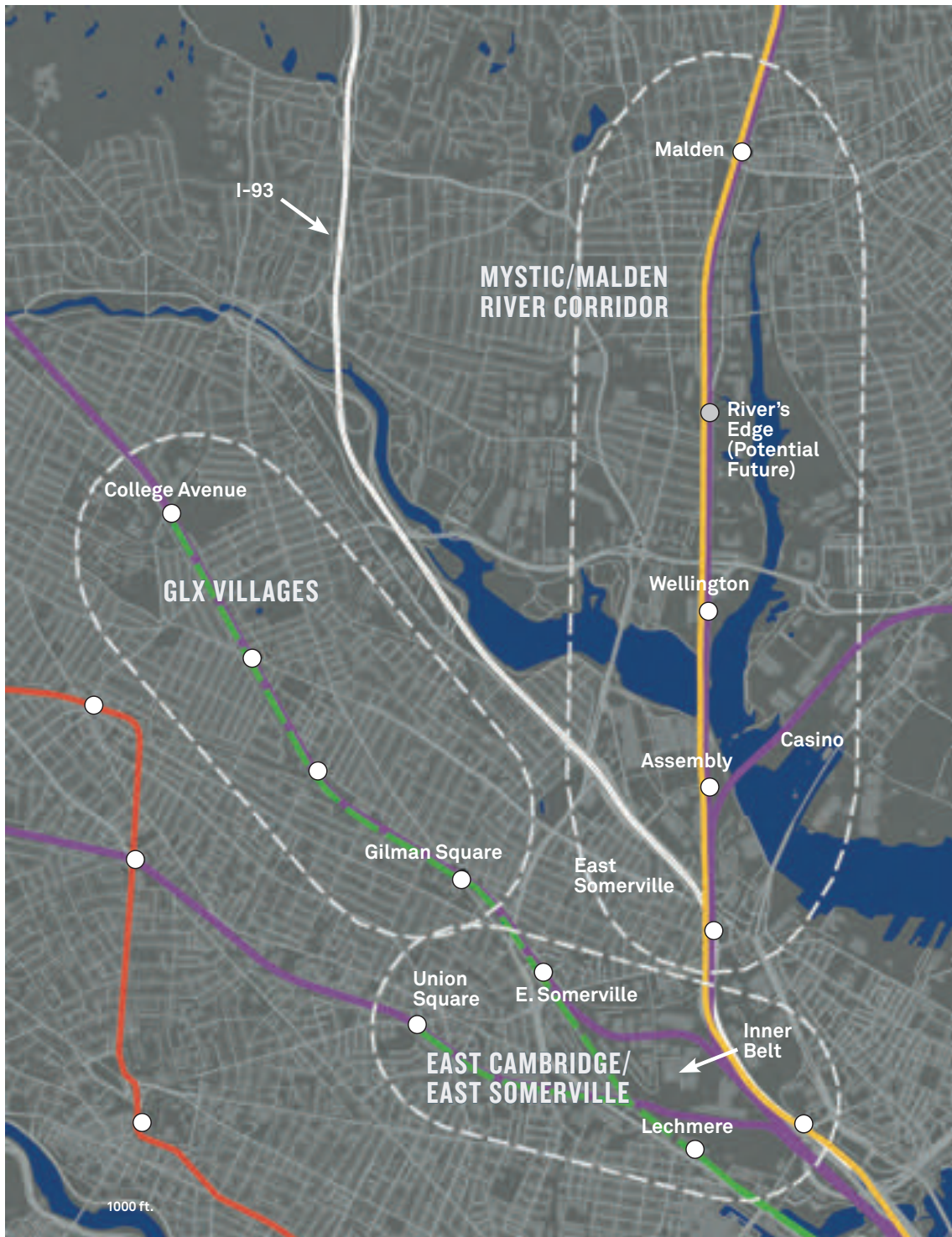


The Near North Shore Corridor extends to Lynn along Route 1A, the Newburyport-Rockport commuter line (the historic Eastern Railroad), the Blue Line, and the new Silver Line Gateway. Influenced by Logan International Airport, its Growth Clusters include the **East Boston Waterfront** and potentially transformative opportunities at **Chelsea's** new rail/bus hub, **Suffolk Downs, Wonderland,** and the **Lynn Waterfront.** While connected to the interstate highway system by the Ted Williams Tunnel, Route 1A suffers chronic congestion and cannot sustain large-scale development. The Near North Shore's regional growth potential lies in transit-oriented development.

Source: AECOM

Near North Shore Corridor: Current and Potential Development		
	Housing	Jobs
Recent, Current, and Pipeline Projects	6,000	4,000
Estimated Long-term Potential	14,000	31,000

FIGURE 17: North Corridor⁷⁸



The North Corridor extends from Charlestown and East Cambridge along the rail, highway, and river routes of eastern Middlesex County. It consists of three Growth Clusters. **East Cambridge-East Somerville** includes the massive Cambridge Crossing mixed-use development at Lechmere and the future Union Square and East Somerville Green Line stations, targeted for growth by the City of Somerville. The other future Green Line station areas make up the **GLX Villages**. The **Mystic/Malden River Corridor** runs along the Orange Line from Sullivan Square to Malden. It includes the transformative Assembly Square development, the Wynn Casino, the re-emerging Malden Center, and the River's Edge mixed-use district.

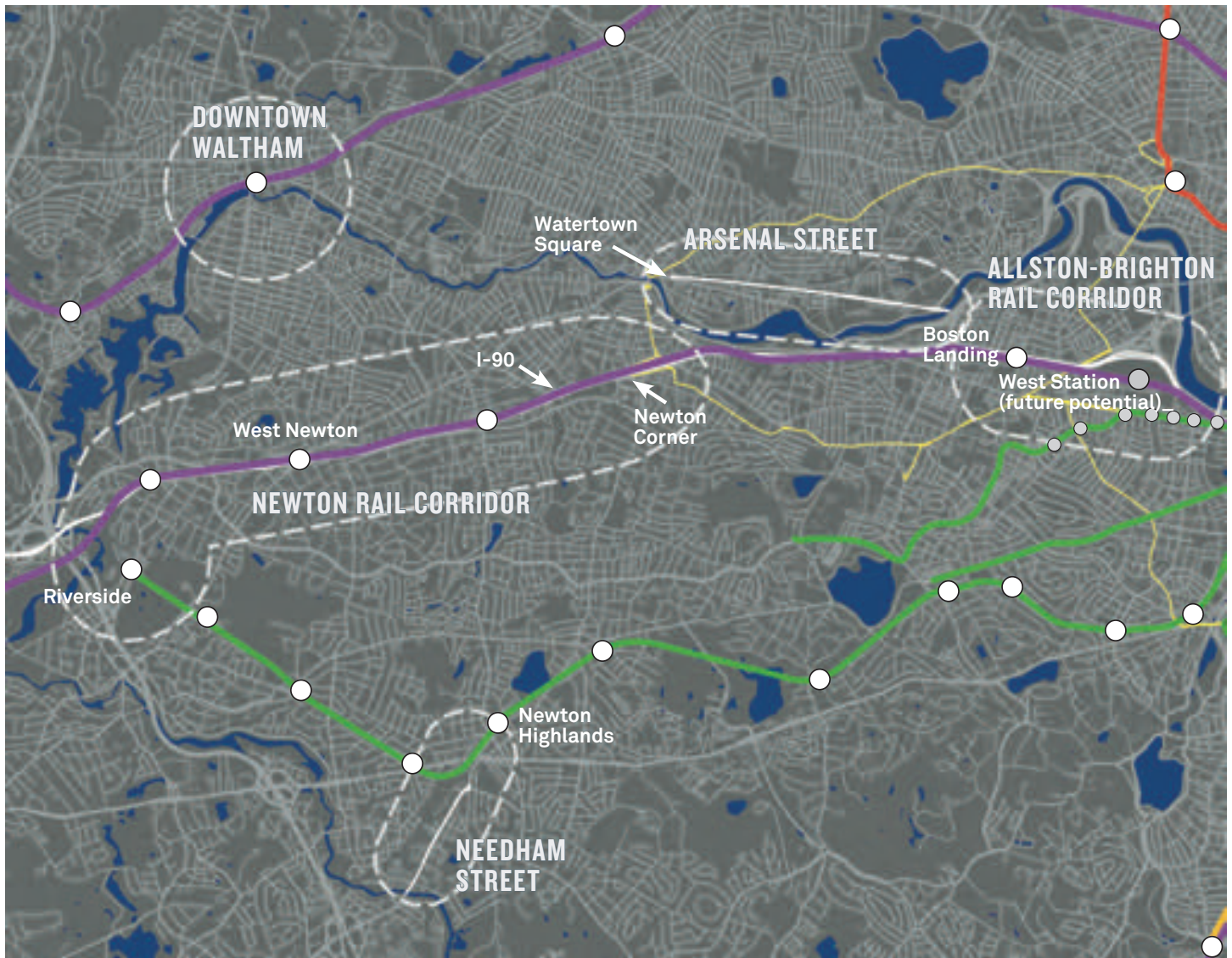
LEGEND

- Transit Growth Clusters
- Commuter Rail
- Red Line
- Orange Line
- Green Line
- T Stations
- Major Corridor Roadway

Source: AECOM

North Corridor: Current and Potential Development		
	Housing	Jobs
Recent, Current, and Pipeline Projects	8,000	35,000
Estimated Long-term Potential	6,000	27,000

FIGURE 18: Charles River Corridor⁷⁹



Extending westward from Allston, several Growth Clusters share an orientation to the MBTA rail network, the Massachusetts Turnpike (I-90), and the Charles River. In **Allston-Brighton**, opportunities for new transit-oriented neighborhoods are centered on two infill train stations—the new Boston Landing and the future West Station. Watertown’s **Arsenal Street** is a development “hot spot” reliant on traditional bus connections to the rapid transit system. Historic **Downtown Waltham** is a re-emerging commuter rail downtown with strong regional bus connections as well. **Newton’s rail corridor** has three train stops and a commuter express bus portal in its villages along Washington Street and the Turnpike, and a multimodal development site at Riverside. **Needham Street**, on the Charles River a short Greenline ride from Riverside, is a traditional industrial district re-emerging as a mixed-use redevelopment priority for the City of Newton.

Source: AECOM

LEGEND

- Transit Growth Clusters
- Commuter Rail
- Red Line
- Green Line
- T Stations
- On-Street MBTA Stops
- Major Corridor Roadway
- MBTA Key Bus Route

Charles River: Current and Potential Development		
	Housing	Jobs
Recent, Current, and Pipeline Projects	6,000	15,000
Estimated Long-term Potential	5,000	10,000

FIGURE 19: South Neighborhoods Corridor⁹⁰



The South Neighborhoods Corridor lies in the City of Boston. It includes the Southwest Corridor, a focus of economic and community development since the 1970s, when the Commonwealth decided to cancel the Southwest Expressway, build the Orange Line and MBTA-Amtrak main line instead, reconnect neighborhood streets, and create a generation of civic infrastructure. The **Upper Southwest Corridor/Dudley** Growth Cluster includes Ruggles and Dudley Stations, multimodal hubs surrounded by current and planned development along the Orange and Silver Lines. The **Lower Southwest Corridor**, from Jackson and Egleston Squares to Forest Hills, is one of Boston's priority transit-oriented housing corridors. The Fairmount and Blue Hill Avenue transportation corridors converge on **Lower Blue Hill Avenue**, Mattapan's "main street," served by rail, trolley, and a key MBTA bus route. The **Hyde Park Villages** of Cleary Square and Readville are linked by two commuter rail lines and by Hyde Park Avenue, also a key bus route. This area is a target for blue-collar employment as well as new housing.

LEGEND

- Transit Growth Clusters
- Commuter Rail
- Red Line
- Orange Line
- Green Line
- T Stations
- On-street MBTA Stops
- Major Corridor Roadway
- MBTA Key Bus Route

Source: AECOM

South Neighborhoods Corridor: Current and Potential Development		
	Housing	Jobs
Recent, Current, and Pipeline Projects	5,000	5,000
Estimated Long-term Potential	4,000	3,000

FIGURE 20: Red Line Outer Markets⁸¹



As development intensifies in The Hub, the real estate market has turned to “book-end” opportunities at the outer ends of the Red Line. At **Alewife** in North Cambridge, the development potential of the Red Line terminus is now being realized; a commuter rail infill stop would add to the district’s market appeal. **Quincy**’s urban stations are development targets as well, with considerable activity underway at Quincy Center and North Quincy. These locations have available land and the ability to tap the Red Line’s underused counter-peak capacity through mixed-use development, generating rush-hour trips in both directions. A 2016 real estate forum called Red Line service to Alewife and Quincy “the Brain Train.”

Source: AECOM

LEGEND

- ⋯ Transit Growth Clusters
- Commuter Rail
- Red Line
- T Stations
- Major Corridor Roadway

Red Line Outer Markets: Current and Potential Development		
	Housing	Jobs
Recent, Current, and Pipeline Projects	4,000	4,000
Estimated Long-term Potential	2,000	6,000

LABOR MARKET CONNECTIVITY

TRANSIT GROWTH CLUSTERS AFFORDABLY CONNECT PEOPLE AND JOBS

The benefits of development in Transit Growth Clusters extend beyond their sheer volume of jobs and housing. The clustering of jobs and housing around Inner Core transit stations enables the daily mobility that is so critical to Metropolitan Boston's economic efficiency. Using data from the Center for Neighborhood Technology and from MAPC, it is possible to create a range of metrics that compare the Growth Clusters to the MAPC region as a whole on the key concept of labor market connectivity. Keeping in mind that these 24 Growth Clusters are illustrative of many other Inner Core locations, three findings stand out.

Transit Growth Clusters are hubs of job access.

Using the Center for Neighborhood Technology's All-Transit database, two key connectivity measures were constructed:⁸²

- the *job shed*—the number of jobs that can be reached from a given residential location via a transit commute of up to 30 minutes plus a quarter-mile walk on either end;
- the *labor shed*—the number of workers who can reach a given employment site via a similar 30-minute transit-plus-walking trip from their home.

For the MAPC region as a whole, the average job shed contains approximately 300,000 jobs, and the average labor shed contains approximately 150,000 workers. These averages are outstripped by all 24 illustrative Growth Clusters. There are 15 Growth Clusters whose residents—if the MBTA system

THE CLUSTERING OF JOBS AND HOUSING AROUND INNER CORE TRANSIT STATIONS ENABLES THE DAILY MOBILITY THAT IS SO CRITICAL TO METROPOLITAN BOSTON'S ECONOMIC EFFICIENCY.



New Balance Headquarters, Brighton

works reliably—can reach more than 650,000 jobs within a 30-minute transit ride and a quarter-mile walk. In 16 Growth Clusters, a business looking to hire employees has a pool of over 250,000 workers who can get there by a similar commute.

The strength of the Growth Cluster job and labor sheds is no academic concern. A 2013 Brookings study showed that in the preceding decade, employment had decentralized in many US metro regions, making job access more challenging and more costly for workers who live in city neighborhoods.⁸³

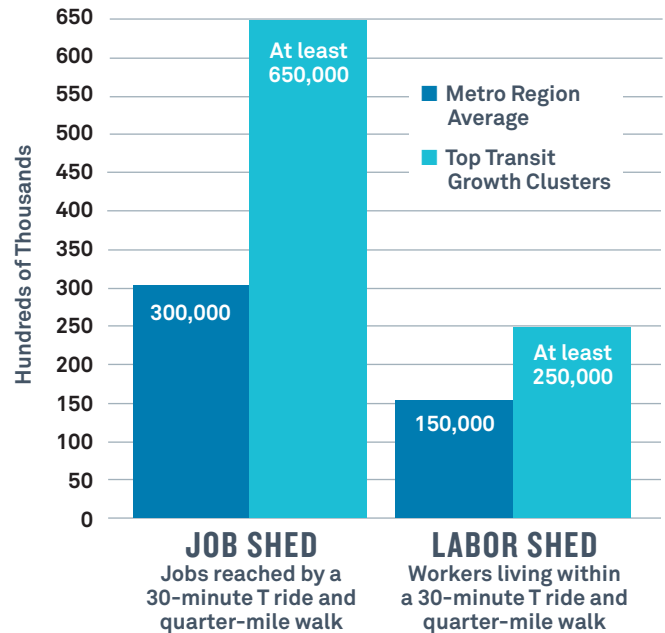
The trend in Metropolitan Boston is more encouraging. Six company headquarters have recently located near MBTA stations in the Inner Core: Partners HealthCare's 4,500-person administrative headquarters at Assembly Square; General Electric, a short walk from South Station; Vertex Pharmaceuticals at the Seaport's Courthouse Station; Converse Shoe at North Station; New Balance at Boston Landing; and Reebok in Boston's Raymond Flynn Marine Park, a 160-acre industrial zone served by transit.⁸⁴ The MBTA's initiative to redevelop Readville Yard #5 as an industrial district, and the City of Boston's relocation of its public school headquarters to Dudley Station, embody the same principle. And in the recent bidding for Amazon's second headquarters, all of the proposed Boston-area sites are located in Transit Growth Clusters.

Transit Growth Clusters enable workers to offset high housing costs with low commuting costs.

Metropolitan Boston is one of the nation's most expensive housing markets, and it is well understood that transit-oriented development and the accompanying rise in property values can bring or exacerbate gentrification and economic displacement. A prime example is the Green Line Extension corridor in Somerville and Medford, where an analysis by MAPC predicted accelerating rent increases and condominium conversions in advance of the project, with a likely negative impact on low- and moderate-income households.⁸⁵ This dynamic is hardly unique to Metropolitan Boston. A quantitative analysis of the San Francisco Bay Area and Los Angeles County found a clear correlation between transit investment and gentrification, especially in the downtowns and other core areas and often with the loss of low-income households.⁸⁶

It is essential that public policy respond to the challenge of generating a sufficient inventory of affordable housing to meet the anticipated regional job growth, through a variety of strategies including the targeting of affordable and workforce housing

FIGURE 21: Transit Growth Clusters—Hubs of Labor Market Connectivity



Source: AECOM. Compiled from CNT All Transit and Housing + Transportation databases, MAPC

resources into areas served by transit and the use of inclusionary housing requirements in transit-oriented districts. The Commonwealth, MAPC, city and town governments, MassDOT, and the MBTA have all adopted such policies.⁸⁷

But location efficiency is important as well, since lower commuting costs can help offset higher housing costs. The traditional definition of affordability is that housing costs not exceed 30% of household income, but this tells only part of the story. The Housing + Transportation Affordability Index developed by the Center for Neighborhood Technology defines affordability as the *combination* of housing *and* commuting costs not exceeding 45% of income. From the household budget perspective, lower commuting costs can help offset higher housing costs.

For the MAPC region as a whole, the average share of household income consumed by housing and transportation costs combined is 48%—just above the 45% affordability benchmark. But in 22 of our 24 illustrative Transit Growth Clusters, there are neighborhoods that fall *below* that benchmark.⁸⁸

When the housing and transportation components are sorted out, the contrast is striking. Within the Inner Core, census blocks with housing costs below 30% of the region's average moderate household



income are scattered, reflecting the reality of a tight, expensive residential market. On the other hand, commuting costs that fall below 15% of average moderate household income prevail almost everywhere in the Inner Core.⁸⁹ This is no small matter. More than 30% of households in East Boston, Dorchester, Mission Hill, Longwood, and Roxbury, for example, do not have access to private automobiles and have household incomes under \$52,000.⁹⁰

Transit Growth Clusters enable workers to commute more sustainably.

MAPC’s station area database makes it possible to compare Transit Growth Clusters to the metro region as a whole on two key measures of household commuting activity: average vehicles owned and average

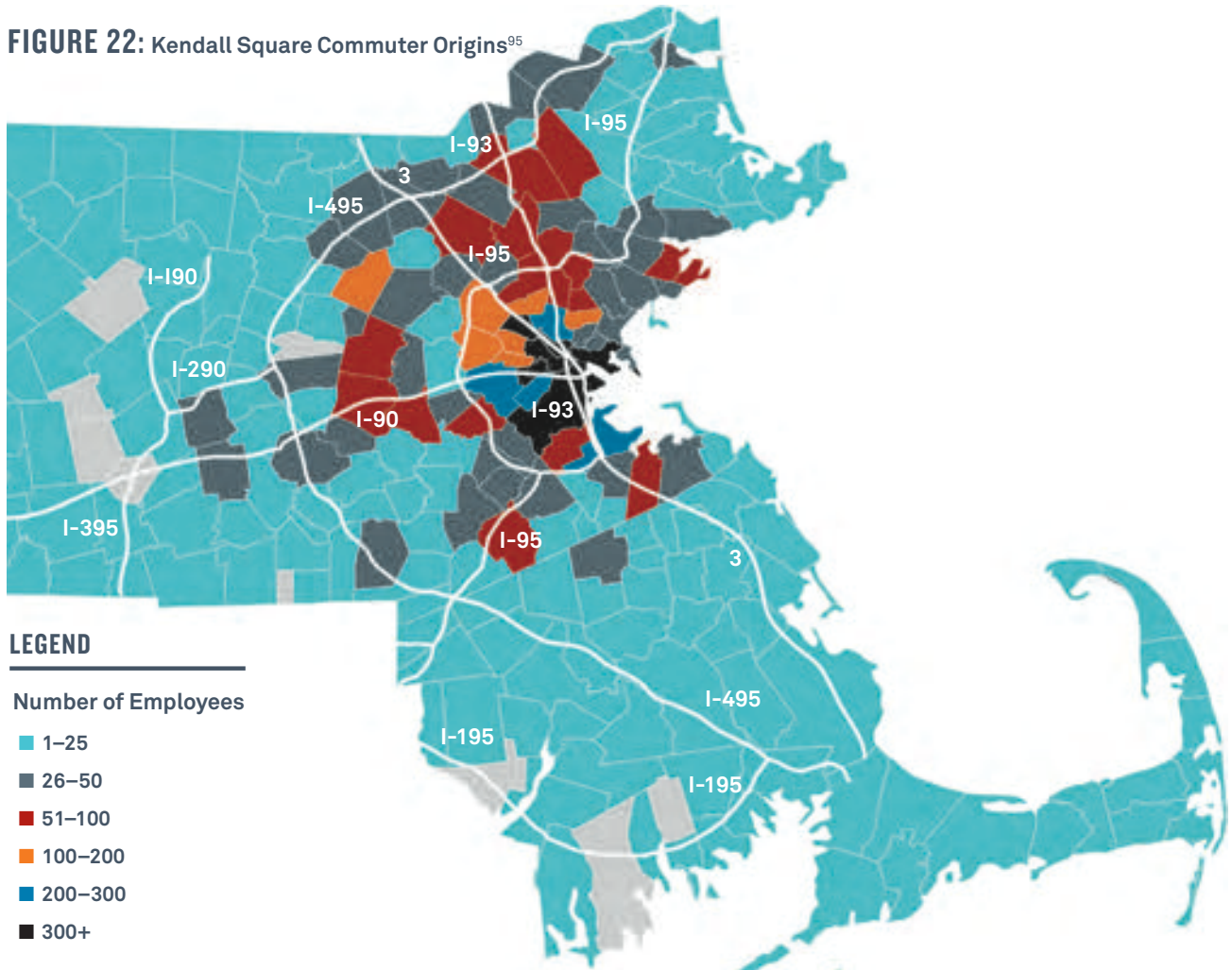
daily vehicle miles traveled (VMT). The comparison could not be clearer: Every Growth Cluster is far below the regional average on both measures of automobile use, and with a handful of exceptions on the periphery of the Inner Core, they are also well below the average for all rapid transit and commuter rail stations.⁹¹ Non-automobile commuting reduces VMT and greenhouse gas emissions and helps improve public health.

Not only do households in Transit Growth Clusters generate high levels of non-automobile commuting; so do Growth Cluster workplaces, especially in The Hub. According to the US Census, from 2006 to 2015 the share of inbound transit commuters to Boston increased from 37% to 40%, while the share arriving by car fell from 52% percent to 47%.⁹² The impact

TABLE 3: Non-Automobile Commuting in Three Key Growth Clusters

STRATEGIC CORRIDOR	ESTIMATED WORKFORCE	CURRENT PERCENT: TRANSIT+WALK+BIKE	EXPECTED PERCENT: TRANSIT+WALK+BIKE
Longwood	49,900	65%	65% +
Seaport	37,000	54%	64% (2035)
Kendall	50,000	46%	65% (2030)

Source: MASCO 2013 and 2017; South Boston Waterfront Sustainable Transportation Plan (2015); Kendall Square Mobility Task Force (2015)

FIGURE 22: Kendall Square Commuter Origins⁹⁵

Source: MassDOT Kendall Square Mobility Task Force (2015)

can be seen in three Growth Clusters that are among the region's most intense employment and development hot spots. The Longwood Medical Area employs about 49,000 people; the Seaport District about 37,000; and Kendall Square about 50,000. All are growing, with particularly large increases through new development expected in the Seaport and Kendall.

As shown in Table 3 (p. 37), these three regional workplace destinations have high percentages of transit, pedestrian, and bicycle commuting today, and all are targeting significantly higher percentages—as a matter of necessity—for their larger workforces of the future.⁹³

Using Kendall Square as an example, Figure 22 shows two key characteristics of these commuter flows. The highest concentrations of Kendall workers live in the Inner Core, where transit connections are most available. But Kendall employs people who live all over the metropolitan area and beyond, with secondary concentrations along the spokes of both the highway and commuter rail systems. The Longwood and Seaport workforces show a similar pattern.⁹⁴ The ability to reach these key job centers reliably, affordably, and sustainably matters directly to households throughout eastern Massachusetts.

CHOOSING TRANSIT OVER PARKING

A PARADIGM EMBRACED BY THE MARKET

Developers are now building, and municipalities are welcoming, projects that rely explicitly on transit—not merely through location but through a deliberate strategy of providing less parking than either the market or local zoning historically required. Parking is costly, whether in land for surface lots or construction dollars for garages, and reducing those costs makes development more feasible (and, in the case of housing, more affordable). New zoning initiatives in Boston, Cambridge, Somerville, Brookline, Malden, Chelsea, Quincy, and other communities, as well as transit-oriented development policies adopted in 2017 by MassDOT and the MBTA, reflect this understanding.

Recent development projects across the Inner Core have low, transit-oriented parking ratios built into their site plans and their cost structures. To cite just a few examples:

- Development in Downtown Boston has historically provided minimal parking and continues to do so; a 157-unit condominium building at Lovejoy Wharf near North Station has been undertaken with literally no on-site parking for residents.
- The Seaport District has been governed throughout its emergence by a district-wide parking cap; General Electric's new headquarters, when built out, will have 800 employees, 150 bicycle parking spaces, and 30 automobile spaces.
- In Kendall Square, the massive redevelopment of the Volpe Center is planned with a parking cap of .8 space per 1,000 square feet of office and lab space—a downtown-like ratio even though the only current rapid transit service is Kendall's single Red Line station.
- An expanded medical office complex next to Brookline Village Station will have parking at 2.4 spaces per 1,000 square feet, a low ratio for medical outpatient use.⁹⁶
- At Forest Hills, hundreds of apartments are springing up with parking in the range of .6-.75 parking spaces per unit; one project boasts "more spaces for bicycles than for cars."⁹⁷

DEVELOPERS ARE BUILDING, AND MUNICIPALITIES ARE WELCOMING, PROJECTS THAT RELY EXPLICITLY ON TRANSIT.

- The nearly 500-unit Clippership Wharf development on the East Boston waterfront has a similar ratio, taking advantage of its location near Maverick Station.⁹⁸

The pull of both public policy and market decision-making toward lower parking supplies is illustrated by a 2017 MAPC analysis of 80 multi-family developments in five Inner Core communities. The data showed that even when residential parking is *supplied* at or near traditional ratios, parking *demand* (as measured by actual utilization) is lower. On average, units were supplied with 1.15 parking spaces but used only .85—a utilization rate of 74%. Just in this sample of 80 properties, there were 1,187 unused spaces, all in surface lots, representing 356,100 square feet of unused empty space and \$11,870,000 in needless capital costs. Parking demand per unit was clearly associated with the number of jobs accessible by a 30-minute transit trip; where the job shed is larger, the real-world need for car ownership and parking are lower.⁹⁹

In short, households are choosing places to live, businesses are recruiting workers, and developers are increasingly building projects on the assumption that transit service will be adequate and reliable. If not, the risk is not only that future phases or projects might not be built; it is that projects *already built* will lose value or even viability.

Growth in the Inner Core is fueled in large part by a transit system that preceded it—in many cases, along transportation routes that have organized our region's urban form since the rail era began. These conditions can be durable and resilient if the transit system meets current and projected needs; otherwise future development might be cut back, and projects already built could lose value or even viability. Chapter 3 uses the examination of the illustrative Growth Clusters and Strategic Corridors to identify real-world mobility barriers to economic development and targeted interventions in response.

5:56 PM

CHAPTER 3

STRATEGIC INVESTMENT IN TRANSIT



CHAPTER 3

The levels of growth expected over the next quarter-century cannot be accommodated without investing strategically and deliberately in transit. The challenge is not merely that most subway lines and Inner Core bus routes are at or near capacity. It is that even those places best suited for transit-oriented development face mobility challenges that, if left unaddressed, will inhibit the realization of our region's sustainable growth potential. A detailed examination of mobility needs in the 24 sample Growth Clusters reveals that issues of *reliability, capacity, and connectivity* recur, in locally specific but broadly thematic ways, across the Inner Core and its Strategic Corridors. Transit-oriented development helps create livable communities and is at the heart of any strategy to achieve more growth with less gridlock. It can only happen if the transit platform on which it rests is up to the task.

These recurring issues of reliability, capacity, and connectivity are present in every Growth Cluster and their impacts are felt across the region. Understanding the specific manifestations of these mobility

challenges is essential to fashioning informed investment strategies to support transit-oriented growth.

MOBILITY CHALLENGES TO TRANSIT-ORIENTED GROWTH

DEMAND OUTSTRIPS AVAILABILITY OF SERVICE

With the exception of the Blue Line, the rapid transit system is at or near capacity. As the MBTA's *Focus40* long-term planning report concludes, there is "a status quo of greater demand than availability of service."¹⁰⁰ Capacity constraints also affect the bus system, where half of the Local Routes and *all 15 Key Bus Routes* fail the MBTA's own standard for crowding.¹⁰¹ Many more bus routes are projected to face capacity issues by 2040, if housing and job growth continue and operating conditions remain as they are or improve only marginally.¹⁰² MAPC, in its 2017 Regional Indicators report, points out that since 2010, while MBTA ridership has grown by 10%, "MBTA revenue service hours have increased only 0.15%. The result is increasingly crowded buses and trains, which in turn can affect speed, reliability, and safety."¹⁰³

As part of *Focus40*, the MBTA asked passengers to identify their top priority for improving service. Over 1,400 riders responded, and for 56% the top choice was "fixing the existing system." Another 26% chose "increase capacity on overcrowded segments" and 20% chose "access areas not currently served."¹⁰⁴ Those passenger priorities closely reflect the mobility needs of the Transit Growth Clusters used in this report to illustrate the synergy of transit and development in the Inner Core. The specific mobility needs of each Growth Cluster, and the Strategic Corridors into which they are grouped, are assessed in detail in Technical Appendix C. Some overarching themes emerge from those assessments.¹⁰⁵

- Virtually every Growth Cluster depends on the reliability and capacity of the rail rapid transit backbone, whether located directly at a rapid transit station or not. Transit-oriented development anywhere in the Inner Core assumes not only that the "host" transit line will run efficiently, but that its connecting services will as well. The commuter rail branches and most bus routes intersect the Red, Orange, and Green

WHILE MBTA RIDERSHIP HAS GROWN BY 10%, "MBTA REVENUE SERVICE HOURS HAVE INCREASED ONLY 0.15%. THE RESULT IS INCREASINGLY CROWDED BUSES AND TRAINS, WHICH IN TURN CAN AFFECT SPEED, RELIABILITY, AND SAFETY."

MAPC, STAYING ON TRACK

Lines and are inextricably tied to their quality of service.

- The Red Line is a vital link among established and emerging Growth Clusters, and its reliability and capacity issues have far-reaching implications. Within The Hub, the economic synergies among Kendall, Massachusetts General Hospital, the Seaport, UMass Boston, and the emerging housing corridor on Dorchester Avenue are only as strong as the Red Line makes them. At the outer ends of the Red Line, the emergence of Alewife and the Quincy station districts as markets for both housing and employment depends on the Red Line connecting to The Hub more reliably and conveniently than commuting by car.
- The reliability and capacity of the Orange Line is fundamental to growth in the South Neighborhoods Corridor, whether for neighborhoods directly served by the Orange Line (like Forest Hills, Jackson Square, and Ruggles) or for those connected to it by bus (like the Hyde Park Villages, Egleston Square, and Dudley). The quality of Orange Line service is also essential to development on the North Corridor from Cambridge Crossing and Sullivan Square to Malden Center.
- The reliability and capacity of the existing Green Line is essential for the development planned along the Green Line Extension in Somerville and Medford, and for the continued growth of the Longwood Medical Area and its spillover development in the Fenway and Brookline Village. As Green Line demand increases, it confronts crowded trains and a congested central subway.
- The Blue Line, with good service and available capacity in its own right, is not connected to the Red Line and thus depends on the Orange and Green Lines for connectivity in Downtown Boston. The seamlessness and reliability of those transfers is essential in realizing the tremendous development potential at Suffolk Downs and Wonderland. Moreover, by 2040 the Blue Line faces its own internal capacity constraints as development in the Near North Shore Corridor advances.¹⁰⁶
- The challenges of accommodating rapid growth in the Seaport District are unique in the region. With worsening gridlock, a district-wide parking limit, Silver Line service in walking distance of virtually every development site, untapped potential for commuting by ferry, and significant



dependence on the Red Line, the Seaport demands a transit-based set of solutions, as outlined in the 2015 *South Boston Waterfront Sustainable Transportation Plan*.

- There remains an absence of higher-capacity, higher-quality crosstown connections between the MBTA's radial rapid transit and commuter rail lines. These cross-cutting links would connect emerging Growth Clusters in and near The Hub, while relieving transfer-generated congestion in the downtown stations. The new Silver Line Gateway, connecting the Blue Line, the Red Line, and the Newburyport-Rockport commuter rail line, is the exception that proves the rule.
- There are places in the Inner Core that are well situated in the region's economic geography and are located on a rail line, but still lack high-capacity transit. Either they have no station, like Allston Landing, or they have infrequent commuter rail service, like Lynn, Chelsea, the neighborhoods in Boston's Fairmount corridor, or the Washington Street villages of Newton.
- There are Growth Clusters served largely or exclusively by bus routes, and their ability to grow as transit-oriented development districts is limited by delay and capacity issues. Examples include Blue Hill Avenue, Arsenal Street in Watertown, and Needham Street in Newton.
- The challenge of first mile/last mile connectivity is a widespread constraint wherever development opportunities occur in proximity to a station but outside normal walking distance.

Transit is not the totality of a regional growth strategy. Even transit-oriented development with high levels of rail and bus utilization will generate additional automobile and truck trips. But a growth strategy based on highway expansion rather than maintenance, replacement, and local improvements is not viable. The Big Dig and the more recent Route 128/I-95 “add-a-lane” project are the last major highway capacity expansions that Metropolitan Boston can expect for a long time. The land required for major roadway expansion is available, if at all, only at prohibitive cost; environmental hurdles are prohibitive as well; and as a region, we have concluded that in most cases we cannot solve highway congestion by building more highways.

Transportation Network Companies and other “new mobility” models like employer shuttles and bike sharing are valuable components of a multimodal mobility solution in the Inner Core but cannot by themselves accommodate new growth. These services *complement* fixed-route public transit—providing first-mile/last-mile connections, filling geographic gaps, and providing on-demand service. To the extent they add vehicle miles traveled (or replace VMT from private automobiles), they add to congestion and its related costs. These services can extend the reach of public transit and enhance its effectiveness, but they cannot replace it. Nor can biking and walking, which are integral features of smart growth and which benefit from the mixed-use environment typical of transit-oriented development.

INVESTMENT STRATEGIES FOR SUSTAINABLE GROWTH

TARGETED, GROWTH-DRIVEN INTERVENTIONS THAT BUILD ON WHAT WE HAVE

This report recommends a series of investment strategies to sustain continued transit-oriented economic growth. These strategies respond to the growth-inhibiting mobility challenges observed in the Transit Growth Clusters and Strategic Corridors. They represent targeted, growth-driven interventions that build on what we have. Three broad investment strategies emerge from the analysis. The first two—achieving a State of Good Repair and enhancing the rapid transit system’s core capacity—involve repairing and modernizing the existing system.

**IN A STATE OF GOOD
REPAIR, THE RAIL SYSTEM
WOULD GENERATE AN
EXTRA \$430 MILLION A YEAR
IN ANNUAL TRANSPORTATION
BENEFITS BY 2030.**

Strategy 1: Attack and Eliminate the State of Good Repair Backlog

When 56% of those responding to the MBTA’s 2015 passenger survey chose “fixing the existing system” as their top priority, they confirmed the fundamental importance of investing in what the transit community calls a “State of Good Repair.” These investments address the reliability needs of the rail and bus systems, as well as the overcrowding that results from late or missed trips and slow service.

The MBTA’s State of Good Repair backlog is now estimated at \$7.3 billion. The Massachusetts Department of Transportation (MassDOT) and the MBTA intend to spend \$4.4 billion over the next five fiscal years in transit State of Good Repair investments; this is part of a longer-term program to invest \$765 million a year until the backlog has been eliminated.¹⁰⁷ A paramount issue is the MBTA’s ability to move that volume of spending “out the door.”

The modeling analysis used in this report estimates that achieving a state of good repair on the rapid transit and commuter rail systems, and thereby bringing the Red, Orange, and Green lines up to the MBTA’s on-time performance standards, would generate quantifiable transportation benefits in the regional economy in excess of \$430 million dollars a year by 2030.¹⁰⁸ These benefits, largely in the form of commuter cost reductions and additional crash avoidance, would be felt particularly in places with rail transit service and high levels of labor market connectivity—that is, Transit Growth Clusters.

Moreover, these estimates are inherently conservative, because the “downside” is as important as the “upside.” If system conditions, rather than improving,

were allowed to deteriorate from their current condition, costs would rise exponentially as riders shifted to other modes or less convenient times, avoided trips, or ultimately moved to other locations. Most Transit Growth Clusters depend, either directly or indirectly, on the rail transit backbone; the surge of development in those transit-rich locations is a bet that their reliability will improve, not decline.

Strategy 2: Enhance Core Capacity

The line between State of Good Repair investments (which bring existing assets up to an acceptable standard of performance) and investments that enhance the system's actual capacity is sometimes blurry. Such is the case with the Red and Orange Lines' superannuated rolling stock, identified in *Focus40* as the single largest reliability issue in the entire transit system. These vehicles are being replaced through a \$1.2 billion program of fleet replacement, signal system overhauls, and expanded vehicle maintenance facilities scheduled to conclude in 2022.¹¹⁰

On the Red Line, the MBTA's decision to replace rather than overhaul the least aged portion of the fleet—a step beyond State of Good Repair strictly defined—will increase maximum hourly train throughput from 13 to 20, a potential peak hour capacity increase of 50%.¹¹¹ The new Orange Line fleet will enable the MBTA to improve peak hour headways from the current six minutes to as little as 4.5, a change that translates to a potential 30% increase in peak hour capacity.¹¹² These capacity gains will be crucial in supporting new development.

**THE MBTA'S
REPLACEMENT OF THE
RED AND ORANGE LINE
FLEETS WILL REDUCE
HEADWAYS AND
SIGNIFICANTLY RAISE
THE PEAK HOUR
CAPACITY OF BOTH
LINES.**



New Orange Line car

On the Green Line, the reliability and capacity issues affecting existing service will become even more evident when the Green Line Extension opens in 2021. The value of running three-car trains during peak hours is widely recognized, but the ability to do so is constrained by the aging signal and traction power systems.¹¹³ A strategy that combines State of Good Repair investments with an effective increase in peak hour capacity would pay dividends along the Extension, in the Longwood Medical Area, and throughout the system.¹¹⁴

The Silver Line Waterfront service must function as a high-capacity, high-frequency rapid transit line if it is to serve as the mobility backbone for the growing Seaport District. This depends on the enhancement of its effective carrying capacity, which in turn depends largely on the expansion of the Silver Line's unique fleet and on resolving the operational bottleneck at the D Street crossing.¹¹⁵

A BUSINESS MODEL IS EMERGING IN WHICH NEW STATIONS ON EXISTING RAPID TRANSIT OR COMMUTER RAIL LINES ARE DELIVERED THROUGH A PARTNERSHIP BETWEEN THE MBTA AND A PRIVATE DEVELOPER OR INSTITUTION.

Strategy 3: Invest in Service Enhancements

The third broad investment strategy is to expand MBTA services, creating a more inclusive, versatile, and integrated transit network. Beyond the Green Line Extension, which is now underway, these investments do *not* involve new corridors that extend the MBTA's footprint. Rather, they make the existing footprint more attractive to businesses deciding where to invest and households deciding where to live. Service enhancements are *strategic*,

each representing a category of individual projects that can be prioritized, implemented, and delivered incrementally. To one degree or another, they invite participation by the private sector or local government. Four such categories emerged from the analysis of Growth Clusters and Strategic Corridors:

- **Create infill stations.** A business model is emerging in which new stations on existing rapid transit or commuter rail lines are delivered through a partnership between the MBTA and a private developer or institution. These stations are centerpieces of their respective Growth Clusters.
 - At Assembly Square on the Orange Line, a new station created through such a partnership has unlocked one of the largest mixed-use, transit-oriented development districts in the northeastern United States. This project was so successful that MassDOT has suggested another developer-assisted Orange Line station in the River's Edge district along the Malden River.¹¹⁶ At Lechmere, the relocated Green Line station will be funded in part by the developer of the Cambridge Crossing mixed-use district.
 - The new Boston Landing station on the Framingham-Worcester commuter line was built and funded by New Balance as part of its mixed-use development program, while Yawkey Station will be expanded by the developer of the Fenway Center. At Allston Landing, the plan for West Station involves participation by Harvard University and potentially Boston University as well. West Station will be a major transit-oriented development site and a multimodal rail/bus hub.
 - Future infill station opportunities are envisioned on the Near North Shore at Wonderland and at the Lynn River Works waterfront site (where a developer partnership was announced in 2017); at Alewife, to supplement the Red Line and expand Alewife's job and labor sheds to the west; and on the Fairmount Line as part of any future air rights development at Widett Circle.

There is a tension between adding new stations, on the one hand, and delivering faster service to existing stations, on the other. Each proposal must be evaluated by the MBTA to ensure compatibility with existing service and anticipated service improvements. But in the right circum-



**Assembly Station—
Unlocking 130 acres
of transit-oriented
development**

stances, the model of delivering new, growth-focused rail stations through developer partnerships can be attractive and cost-effective.¹¹⁷

- **Reimagine commuter rail.** The MBTA commuter rail system serves 50 communities with 14 branches, 138 stations, and 388 route miles of track. It is one of the most extensive metropolitan rail networks in North America, and portions of it have been transporting people and freight since the dawn of the Industrial Revolution. The system carries 122,000 passengers on an average weekday. But it could do even more. A re-imagined commuter rail system could evolve into two complementary types of service, each in support of sustainable development and regional growth.

Urban rail would provide shorter trains and higher frequencies on selected corridors within the Inner Core—a hybrid of commuter rail and rapid transit service for Growth Clusters that are now under-served. The MBTA has explored the concept of using multiple units (MUs) for this purpose.¹¹⁸ These individually powered diesel or electric cars can be deployed in single or two-car trains and provide more versatile service, with more local stops, than conventional trains pulled by locomotives. Implementing Urban Rail would require acquisition of rolling stock as well as other capital improvements, but it can be deployed incrementally—a corridor at a time. It represents an expansion not of the MBTA's rail footprint but of how that footprint is used. As shown in Fig. 23, three corridors seem particularly well-suited to this concept:

- The Fairmount Branch. Urban rail has long been contemplated for the Fairmount Branch, whose entire nine-mile service from Readville to South Station runs within the City of Boston. The MBTA has built or modernized five stations and is about to build the Blue Hill Avenue Station. Transit-oriented development planning has been underway for two decades; what's missing is high-quality rail transit. The revitalization of the Hyde Park Villages (Readville and Cleary Square), Blue Hill Avenue, and South Bay are all affected.
- The Near North Shore Corridor. Urban rail service between North Station and Lynn Central Square, combined with development-driven stations at Wonderland and the River Works, would provide rapid transit-like service to three potentially transformative Growth Clusters: Chelsea and the nearby Everett Commercial Triangle, Suffolk Downs/Wonderland, and the Lynn Waterfront. At the new multimodal Chelsea Station, urban rail would allow frequent transfers to the Silver Line Gateway, serving the Airport and Seaport. Urban rail service could relieve future capacity constraints on the Blue Line as these Growth Clusters realize their potential.
- The Charles River Corridor. An urban rail service could operate on the Worcester-Framingham line, starting at Riverside on Route 128.¹¹⁹ It would serve Auburndale, West Newton, Newtonville, Boston Landing, and West Station, connecting them to Yawkey Station, Back Bay, and South Station.

FIGURE 23: Three Potential Urban Rail Corridors



Source: AECOM

URBAN RAIL WOULD PROVIDE SHORTER TRAINS AND HIGHER FREQUENCIES ON SELECTED CORRIDORS WITHIN THE INNER CORE— A HYBRID OF COMMUTER RAIL AND RAPID TRANSIT SERVICE FOR GROWTH CLUSTERS THAT ARE NOW UNDER-SERVED.

With multimodal connections at West Station and Back Bay, this service could be an exceptionally versatile asset for Newton, Allston-Brighton, Kendall, and the Longwood Medical Area.¹²⁰

Regional rail would provide enhanced peak and reverse-peak service to communities both inside and outside the Inner Core, where 85% of daily commuter rail trips currently originate.¹²¹ Regional rail service would address two distinct goals. One is the need to increase inbound commuter ridership, reducing regional traffic congestion by diverting more Hub-bound commuters from car to train. Beyond system reliability, the key ingredients include additional park-and-ride capacity and trip-shortening semi-express service that skips stations served by urban rail.

The other goal is to support growth in historic city and town centers served by commuter rail, particularly in Gateway Cities and Regional Urban Centers, through more frequent two-way service and stronger “first-mile/last-mile” connections to the station. A full 30% of daily

commuter rail trips currently originate in these 16 communities. Better service will bring new opportunities to grow in synergy with the Inner Core.

- **Make bus transit more rapid.** A key strategy to align transit with growth in the Inner Core is to deliver bus service of greater capacity, speed, and reliability. This involves dedicated bus lanes, full-fledged bus rapid transit (BRT) corridors, or hybrid variations of the two. The Silver Line Gateway, now under construction, has many BRT features. It will link South Station, the Seaport District, the Airport, and Chelsea, where 60 acres of underutilized land surround the new multimodal hub. It will place commuter rail passengers from Lynn, Salem, and Beverly in the labor shed of the Seaport and Airport—all at a cost of under \$85 million. Because it was able to use existing off-street rights-of-way, the Silver Line Gateway is not a literal template for other projects, but it demonstrates the power, in a regional development context, of rapid, high-capacity bus service.¹²²



Box District Station under construction on Silver Line Gateway, Chelsea

The BostonBRT initiative is promoting BRT projects that demonstrate two principles: on the one hand, the pursuit of the “Gold Standard” (dedicated lanes, platform-level boarding, off-board fare collection, sheltered stations, and smart bus technology); on the other, the value of customized solutions reflecting local conditions and involving the host municipalities, which control most public streets.¹²³ A range of rapid bus and dedicated lane solutions are available, incorporating those “Gold Standard” features that are physically feasible in a given corridor. Several proposed examples, drawn from the *BostonBRT Report*, the City of Boston’s *Go Boston2030 Plan*, and other sources, illustrate the range and versatility of a rapid bus/BRT strategy. Each example would address mobility constraints affecting multiple Transit Growth Clusters, and each could be implemented in stages.¹²⁴

- A service, or an integrated set of services, connecting Sullivan, Lechmere, Kendall, West Station, the Longwood Medical Area, and Ruggles. While there are a variety of routing options, key building blocks include a priority bus corridor between Lechmere and Kendall, the Grand Junction river crossing, and the dedicated transit easement along Ruggles Street.¹²⁵
- A mix of BRT and bus priority lanes connecting the Silver Line Gateway hub in Chelsea, Everett’s Lower Broadway and waterfront districts, and the Orange Line at Malden Center or Sullivan Square.¹²⁶
- BRT service on Blue Hill Avenue, with two branches: Mattapan to Dudley (where it would join an enhanced Silver Line to Downtown); and Mattapan to the Longwood Medical Area via Egleston Square and Roxbury Crossing.¹²⁷
- BRT services from Forest Hills to Readville via Hyde Park Avenue and to Roslindale Village via Washington Street.
- A rapid bus linking North Station, South Station, and the Seaport District.

THE BEST BRT SOLUTIONS ARE UNIQUE—CUSTOM-DESIGNED TO FIT THEIR COMMUNITIES.

BOSTONBRT INITIATIVE
(THE BARR FOUNDATION)



Some of these opportunities involve corridors that the MBTA has designated as Key Bus Routes, characterized by high ridership and high frequency schedules.¹²⁸ Even where BRT or dedicated lane solutions are not feasible, the improvement of Key Bus Route performance through traffic signal prioritization and improved passenger amenities is essential.

This entire range of enhanced bus strategies takes advantage of a key operational investment the MBTA is already undertaking. Under Automated Fare Collection 2.0, to be implemented by 2020 through a public-private partnership, on-board cash payments will be eliminated and passengers will be able to board buses at all doors. The anticipated benefits include a 10% improvement in bus travel times.¹²⁹ Non-cash fare media and all-door boarding are among the basic ingredients of BRT and other levels of bus service enhancement. The MBTA is also working with cities and towns to improve on-street operations, another primary drag on everyday bus performance.

- **Use the harbor.** Water transportation to, from, and within Boston Harbor is an underutilized asset. While there has been significant public and private investment in ferry terminals, and scheduled services are operated by the MBTA, the Harbor Islands National Recreation Area, and others, there is not a harborwide ferry system.¹³⁰

Ferries are not a frill. A larger and more durable set of routes, seamlessly connected to the MBTA's landside transit system, would directly support development in several Transit Growth Clusters: the Seaport District, Downtown Boston, the Mystic/Malden Rivers Corridor, the East Boston Waterfront, and the Lynn Waterfront. Ferry service is integral to sustainable transportation to and from the Seaport and the Everett Waterfront.

At the time of this report, initiatives are underway for two new privately-funded services: one connecting the Seaport to North Station, and the other connecting the Wynn Casino to Long Wharf and the Seaport. Boston Harbor Now, with the support of MassDOT, has undertaken a harbor-wide ferry planning initiative, with a goal of establishing three new, sustainable ferry routes.¹³¹ These complementary efforts should be coordinated, driven to successful implementation, integrated with MBTA service, and expanded.



FIGURE 24: Existing and Potential Ferry Sites



Source: AECOM



CONCLUSION



CONCLUSION

The essential and historic transit orientation of the 164-community Metro Boston region and its 20-community Inner Core is, in large part, what enables our regional economy to thrive, helping to create efficiencies and productivity that support a concentrated, knowledge-based economy. It also supports social equity by reducing commuting costs for workers faced with increasingly high housing costs. This productivity is what helps keep the economy of Metropolitan Boston resilient and robust.

The sustainability of current and projected growth is not impervious to change, and indeed is at risk because investment in the regional transit system is not keeping pace with the mobility needs of businesses and workers. The region finds itself at an inflection point where stagnation is unthinkable, the status quo untenable, and the need for strategic investment unmistakable. Three key takeaways emerge from the data analysis and from a review of private sector investment patterns.

REGIONAL GROWTH IS ROBUST AND HIGHLY TRANSIT-ORIENTED

Many states are fortunate to have one or more regional engines to drive their economies. In Massachusetts, that engine is Metropolitan Boston, which provides 74% of the state's jobs, houses 78% of its population, and generates 84% of its gross domestic product. Metro Boston's economic efficiency and productivity are tied to its public transit system, which pumps billions of dollars' worth of quantifiable transportation benefits into the regional economy year after year, currently amounting to \$11.4 billion in annual economic benefits. Those benefits represent 3% of Metropolitan Boston's annual gross domestic product, and translate into an average annual gain of \$6,700 *per household* across the metro region.

Metro Boston's housing and jobs are disproportionately clustered around transit and disproportionately concentrated in the Inner Core. Where these concentrations converge—at transit-rich locations in the Inner Core—development activity is surging, and future development potential is, in some cases, even greater. These “Transit Growth Clusters” illustrate how market interest, supportive public policy, physical capacity, and transit can combine to support robust development and a rich mix of activities.

Compared to the region as a whole, Transit Growth Clusters provide better job access, more affordable commuting, less daily driving, and reduced environmental impacts. These patterns are not new; they reflect our region's historic, community-centered character and its choice, over a century and a half, to invest in transit and to organize land use around that investment.

The regional economy is projected to continue growing between now and 2040—potentially by 10% between 2010 and 2030, and by 13% from 2010 to 2040. Over half of that predicted growth—and almost all of the growth in the labor force population—is expected to occur in the Inner Core, where transit, land use, and mobility converge. A secondary growth front consists of Gateway Cities and Regional Urban Centers, located outside the Inner Core but connected to Boston, in most cases, by rail.

METROPOLITAN BOSTON IS AT A TIPPING POINT

This growth is by no means guaranteed. The transportation infrastructure required to sustain it is at a tipping point. Despite record levels of MBTA ridership and a 10% ridership gain since 2010, there has been virtually no increase in MBTA service, and the physical condition of the system has continued to deteriorate, a condition encapsulated in a State of Good Repair backlog now estimated by the MBTA at \$7.3 billion.

Even the places best positioned to generate transit-oriented growth are hindered by the reliability and capacity issues of the Red, Orange, and Green Lines and the limited connectivity of the Blue Line; commuter rail service of limited frequency and convenience; infill station opportunities that have not yet been realized; bus service impacted by overcrowding, traffic-induced delays, or both; an absence of high-quality cross-connections between radial transit and commuter rail corridors; and challenging first-mile and last-mile connections to stations beyond walking distance.

It is not surprising that even as transit ridership has grown, so has use of the roadway system. Boston and the region are ranked among the most traffic-congested places in the country. There is not a highway-building or a highway-expanding solution to this congestion problem. The costs in land, dollars,



and environmental impacts would be prohibitively high. So too are the costs to the region's quality of life, as people increasingly seek more sustainable mobility solutions. While we must maintain, replace, and operationally refine our roadway network, there are no plausible highway expansion scenarios of meaningful scale that would respond to our economic needs or regional values. And while Metropolitan Boston has embraced Transportation Network Companies and other shared mobility services, these are a complement to fixed-route public transit, not a replacement for it. The one unambiguous mobility response to maintaining current growth and sustaining projected growth is strategic investment in public transportation.

STRATEGIC INVESTMENTS ARE NEEDED TO KEEP OUR EDGE

The MBTA has made a commitment to pursue its massive State of Good Repair backlog aggressively, as a first priority, and for an extended period of years. This commitment must be met, and the challenges of getting large volumes of capital investment dollars “out the door” must be overcome. The MBTA's State of Good Repair strategy for the Red and Orange Lines—highlighted by the complete replacement of their superannuated fleets and an overhaul of their signal systems over the next five years—is expected to result not only in greater reliability, but in significantly shorter headways and greater rush hour capacity. Much of the region's current, planned, and potential transit-oriented development depends directly or indirectly on the Red and Orange Lines

achieving those outcomes. The same is true of the Green Line, where the need for a comparable strategy combining State of Good Repair investments with enhanced peak hour capacity (most probably by running three-car trains) is widely recognized.


There is also a need for service enhancements in the Inner Core that are thoughtful, selective, and growth-driven. At this time, the MBTA is undertaking two projects involving new or extended rapid transit corridors. The Green Line Extension, soon to enter its main phase of design and construction, and the Silver Line Gateway, whose principal phase is approaching completion, are well conceived and badly needed. Beyond delivering those two projects, this report calls for the MBTA to embark on a series of growth-driven investment strategies. They include:

- entering into public-private partnerships to deliver new stations like the success stories at Assembly Square and Boston Landing;
- reimagining and repositioning our commuter rail system to provide *urban rail* service in the Inner Core and *regional rail* service to Gateway Cities and other Regional Urban Centers;
- creating dedicated bus lane and bus rapid transit services, within and between development corridors burdened by congested streets and slow-moving traditional buses;
- giving passenger ferries a bigger role in the Inner Core transit picture, especially for Downtown, the Seaport District, East Boston, and the Everett waterfront.

By and large, these strategies involve investments within the existing MBTA footprint, changing how some rail and bus corridors operate rather than adding new ones. The required capital investments can be undertaken incrementally, a corridor at a time, and they can in a variety of circumstances attract private or local participation. But these strategic, focused service enhancements are essential to how regional growth is expected to occur over the next quarter-century.

Robust, sustainable growth requires that people can reach their jobs, schools, and other destinations of daily life reliably and efficiently. It requires that commuters be able to avoid gridlock and that those who cannot afford to own a car do not need one to get to work. Without a comprehensive investment strategy combining State of Good Repair, enhanced throughput capacity on the rapid transit backbone, and strategic service enhancements targeted on areas of growth, our regional economy could fall far short of our needs and expectations in short term and in the decades to come.

The future lies beyond our vision, but not beyond our control. History teaches lessons, data support conclusions, and tangible on-the-ground experience informs public policy decisions. Transit is the historic mobility underpinning of Metropolitan Boston, especially its dynamic Inner Core. The data overwhelmingly point to the region's essential transit orientation as a central factor in the durability and resilience of its economy. The transit benefits to the region—benefits worth on average \$6,700 per Metro Boston household every year—power our regional economy by enhancing productivity and efficiency. Vibrant Transit Growth Clusters are visible proof of the power of transit to attract private sector investment, bringing with it a level of job growth, housing growth, and labor market connectivity that is the envy of many other regions nationally. The path forward is clear, and it begins with the recognition that a highly functioning transit system is at the core of Metro Boston's future.



WE HAVE THE CHANCE, THROUGH STRATEGIC INVESTMENT IN OUR TRANSIT SYSTEM, TO CONSOLIDATE OUR RECENT ECONOMIC GAINS AND ENSURE FUTURE PROGRESS.

ENDNOTES

- 1 Sources: US Census Data; Massachusetts Department of Labor, ES-202 Data Base; US Department of Commerce, Bureau of Economic Analysis; Metropolitan Area Planning Council. The population and jobs figures are from 2015; the GDP figures are from 2014.

For purposes of this report, unless otherwise indicated, “Metropolitan Boston” is the grouping of 164 Massachusetts cities and towns used by MAPC in its regional planning and projections and by the Central Transportation Planning Staff for its regional travel demand model. (See MAPC, *MetroFuture* (2008); *Growing Station Areas: The Variety and Potential of Transit Oriented Development in Metro Boston* (2012; <https://www.mapc.org/resource-library/growing-station-areas-the-variety-and-potential-of-tod>); and *Population and Housing Demand Projections* (2014; <https://www.mapc.org/learn/projections>). This metropolitan boundary is shown in Figure 1 (page 2). (2008, http://www.mapc.org/wp-content/uploads/2017/08/MetroFuture_Goals_and_Objectives_1_Dec_2008.pdf); The 164-community metro region is larger than MAPC’s statutory planning district (101 cities and towns), but smaller than the US Census Bureau’s Boston Metropolitan Statistical Area (MSA), which includes all of Suffolk, Middlesex, Essex, Norfolk, and Plymouth Counties, as well as Rockingham and Strafford Counties in New Hampshire (US Census, 2010).
- 2 Source: Moody’s Analytics.
- 3 Ibid.
- 4 Reported by Transportation for Massachusetts: <http://www.t4ma.org/acs>
- 5 Metropolitan Area Planning Council, www.regionalindicators.org (2017); and US Census Bureau as reported in *Boston Globe*, March 29, 2017.
- 6 <http://inrix.com/press-releases/los-angeles-tops-inrix-global-congestion-ranking>
- 7 The assessment of service levels and demand is in: MAPC, *Metro Boston Regional Indicators; Transportation: Staying on Track* (2017); www.regionalindicators.org.

Notwithstanding the long-term increase in MBTA ridership since 2000, it was reported in late 2017 that daily ridership has actually declined slightly in the three years since peaking in 2014. The decline of about 3.6% occurred during a period that included the exceptional winter of 2015, as well as a fall in gasoline prices, continued growth in ride- and bike-sharing alternatives, and a similar downward trend in many transit systems across the country. Green Line and commuter rail ridership is reported to have held steady during this period, with the decline concentrated on the other rail transit lines and the bus system. The decline was also more pronounced on weekends than on workdays. (See, among other reports, <https://commonwealthmagazine.org/transportation/mbta-ridership-downward-trend>).
- 8 To measure the MBTA’s regional economic benefits, this report developed an model reflecting current economic, land use, and transportation conditions. As explained more fully in Technical Appendix A, the model estimates the benefits of the MBTA—as it exists and operates today—by simulating what would happen if its 1.3 million weekday trips had to be accommodated through driving and other means. This “no MBTA” scenario is not put forward as a plausible outcome; rather, it is an analytic device for isolating the benefits of existing MBTA operations. Specific benefits such as hours of automobile travel time avoided are “monetized” (translated into dollar values) by applying standard factors described in Technical Appendix A.
- 9 MassBenchmarks, *Transportation in Massachusetts: Economic Impacts, Finance and Investment Choices* (2015); <http://www.donahue.umassp.edu/business-roups/economic-public-policy-research/massbenchmarks/massbenchmarks-journal-2015-v17i2>.

See also: The Boston Foundation, in partnership with the Massachusetts Competitive Partnership and A Better City, Inc., *The Cost of Doing Nothing: The Economic Case for Transportation Investment in Massachusetts* (2013; <http://www.abettercity.org/docs/The%20Cost%20of%20Doing%20Nothing%20Final%20with%20TOC.pdf>). A precursor of this current study, *The Cost of Doing Nothing* demonstrated the importance of a highly functional multimodal transportation system (highways, transit, and freight) to the statewide economy.
- 10 Technical Appendix A, Section 5, Tables 19–20, Scenario 2. This analysis is described in greater detail in Chapter 1 of this report and in endnotes 35 and 36.
- 11 MAPC, *Growing Station Areas: The Variety and Potential of Transit Oriented Development in Metro Boston* (2012 *loc.cit.*). Property valuation: AECOM analysis. Note also the high valuation premium attributed to “walkable urban places”—most of them served by rail transit—in Christopher Leinberger and Patrick Lynch, *The WalkUP Wakeup Call: Boston* (by LOCUS Development, 2015); <https://smartgrowthamerica.org/resources/the-walkup-wakeup-call-boston>); see endnote 47 of this report.

- 12 The Inner Core Subregion is defined by MAPC (<https://www.mapc.org/get-involved/subregions>). Further discussion is provided in Chapter 1 of this report, endnote 49, and Technical Appendix B. A 21st community, Needham, is a member of two subregion organizations (the Inner Core Committee and the Three Rivers Inter-local Committee), but MAPC does not include Needham in the Inner Core Subregion for statistical purposes.
- 13 MAPC, DataCatalogue: Population (<http://databrowser.mapc.org/Demographics/Population>).
- 14 Gateway Cities are officially designated by the Commonwealth and are a focus of state development policy. Regional Urban Centers are a community type category designated by MAPC. For detailed discussion, see Chapter 1 of this report and endnote 61.
- 15 MAPC, MetroFuture (2008); Growing Station Areas: *The Variety and Potential of Transit Oriented Development in Metro Boston* (2012; *loc. cit.*); and Population and Housing Demand Projections (2014; *loc. cit.*). Between now and 2030, while the Inner Core is projected to generate over half of Metropolitan Boston's population growth, Regional Urban Centers are the next-fastest growing set of communities, and the only other set of communities with expected growth in the labor force. With 13 Regional Urban Centers and three additional Gateway Cities served by downtown rail stations, the growing transit propensity of current and future development, even on the outer spokes of the system, is significant for the Regional Urban Centers and for the Inner Core. This strategic relationship is discussed in detail in Chapter 1.
- 16 Christopher Leinberger and Patrick Lynch, *The WalkUP Wakeup Call: Boston* (by LOCUS Development, 2015; *loc. cit.*).
- 17 The methodology for estimating the development capacity of each Transit Growth Cluster is described in Chapter 2 of this report, endnote 72, and Technical Appendices C and C1.
- 18 The development estimates and methodology are documented in detail in Technical Appendices C and C1. For specific development projects, the sources are official public documents (including Massachusetts Environmental Policy Act filings and certificates, Boston Planning and Development Agency filings, and posted filings or decisions by local authorities in other municipalities). The MAPC development projects database MassBuilds (<http://www.massbuilds.com>) provided helpful backup. The estimate of jobs for each project (other than those for which a specific jobs number was provided in a submittal) was calculated by applying employee-per-square-foot factors for specific uses. For large-scale sites not yet in the formal planning process, estimates were prepared based on acreage and conservative assumptions with respect to floor area ratio and the split of residential and non-residential buildout
- 19 The methodology for creating the job shed, labor shed, affordability, and automobile use metrics is described in Chapter 2 of this report, endnote 82, and Technical Appendix C, Table 2, pp. C-5-6.
- 20 Mobility issues in each of the 24 illustrative Growth Clusters are addressed in detail in Technical Appendix C.
- 21 The modeling analysis predicts \$430 million in net annual benefits by 2030, when State of Good Repair investments would be largely completed. These benefits (measured in travel time, travel cost, crash avoidance, and emissions reduction) assume the population and employment growth used in the Central Transportation Planning Staff regional demand model, but do not reflect a disproportionate attraction of new development to a more reliable rail transit system. See Chapter 3 of this report and Technical Appendix A for a more detailed description of the analysis.
- 22 The MBTA designates 15 of its busiest bus routes as "Key Bus Routes." Each operates at a high frequency, seven days a week, to meet passenger demand along high-density corridors. Service operates every 10 minutes or better during weekday peak periods, every 15 minutes or better during weekday midday, and every 20 minutes or better during off-peak periods. (http://old.mbta.com/about_the_mbta/t_projects/default.asp?id=19047).
- 23 See the description of the 164-community Metropolitan Boston region in endnote 1. The corresponding metropolitan boundary is shown in Figure 1, page 2.
- 24 This analysis rests on a regional model reflecting current economic, land use, and transportation conditions to measure the MBTA's regional economic benefits. As explained more fully in Technical Appendix A, the model estimates the benefits of the MBTA—as it exists and operates today—by simulating what would happen if its 1.3 million weekday trips had to be accommodated through driving and other means. The simulation model was based on the Federal Transit Administration's Simplified Trips on Project Software (STOPS) forecasting tool (version 1.50). The STOPS model used in this project was previously developed and calibrated as part of the Federal Railroad Administration's NEC FUTURE study in 2014. The Central Transportation Planning Staff (CTPS) of the Boston Region Metropolitan Planning Organization provided demographic projections and automobile travel times, both of which were used as inputs into the STOPS model.
- The methodology and analysis are described in detail in Technical Appendix A. As a brief summary: the estimation of the regional economic benefits of today's MBTA system under typical operating conditions was achieved by comparing existing travel behavior (the "Baseline Scenario") to a hypothetical scenario in which the same travel demand must be accommodated with the MBTA removed ("Scenario 1"). A second version of the "no MBTA" scenario was also analyzed, in which the MBTA is eliminated and the zonal distribution

- of population is allowed to shift, as households are assumed to adjust their places of residence to seek shorter drives to work and thus mitigate increased congestion and commute travel time (“Scenario 2”). The quantified and monetized impacts of Scenarios 1 and 2 are very similar, and unless otherwise indicated, references in the text of this report to the regional benefits of existing MBTA operations are based on Scenario 1. Specific benefits such as hours of automobile travel time reduced or crashes avoided are “monetized” (translated into dollar values) by applying standard factors provided by the US Department of Transportation.
- The Baseline and the scenarios described above were modeled for years 2015 and 2030. The 2015 results utilize current CPTS population and employment estimates and patterns and report values in 2015 dollars. The 2030 results are also reported in 2015 dollars for comparison purposes. What distinguishes the 2030 results from those in 2015 is that 2030 demographics (population and employment) underpin the estimates, capturing the benefits or costs incurred in the larger 2030 Boston economy.
- 25 There is no proposed “no MBTA” alternative. Hypothetically “removing” MBTA service from the model while holding other conditions constant is an analytic methodology used to isolate the impacts of transit.
 - 26 Technical Appendix A, Table 2.
 - 27 Technical Appendix A, Table 21, Scenario 1.
 - 28 Beyond the monetized value of travel time savings, there is evidence that the sense of personal well-being is enhanced as well (see, for example, <https://www.theguardian.com/news/datablog/2014/feb/12/how-does-commuting-affect-wellbeing>). Employers who value transit proximity are motivated, in part, by the likely effect on worker productivity.
 - 29 Technical Appendix A, Table 21, Scenario 1.
 - 30 The direct benefit of crashes avoided is an estimated \$435 million; the added benefit of avoided crash-related congestion is \$206 million. Technical Appendix A, Table 21, Scenario 1. On an annual basis, use of the MBTA prevents about 3,500 property damage crashes, 1,300 crashes involving injuries, and 19 involving fatalities.
 - 31 The FY18 MBTA operating budget is \$1.989 billion (Fiscal Management Control Board).
 - 32 Technical Appendix A, Section 3, Table 2. The 6% difference is in the context of all daily trips in the entire 164-community region. The transit mode share for peak commutes within the Inner Core is much higher.
 - 33 Technical Appendix A, section 4.4. As emission standards improve, the emission impacts of automobile use (and consequently the emission reduction benefits of transit use) will decline somewhat.
 - 34 Technical Appendix A, Table 23. The 2030 estimate is in 2015 dollars, and thus does not reflect inflation. It assumes that the current MBTA system is operating in 2030, with regional population and employment having grown as the Central Transportation Planning Staff currently projects.
 - 35 See Technical Appendix A, Section 5, Tables 18–19, Scenario 2. The highway analysis estimates the additional lane mile capacity that would be required to maintain the region’s overall highway volume-to-capacity ratio if transit were hypothetically removed. The additional lane miles are calculated by functional class (interstate, arterial, collector, and local) and monetized in 2015 dollars using Federal Highway Administration standards for cost estimation by lane mile in each class.
 - 36 See Technical Appendix A, Section 5, Table 20, Scenario 2. The parking analysis predicted that approximately 402,000 additional spaces would be needed at the destination end of linked work trips if transit were not available. At an average gross area of 325 square feet per space, this yields roughly 130 million square feet of space, or 3,000 acres. The estimated cost assumes a mix of above- and below-ground garages and is based on the RS Means average cost per square foot for garages, which is conservatively low. Land costs are excluded.
 - 37 Source: Moody’s Analytics.
 - 38 Texas Transportation Institute, “2015 Urban Mobility Scorecard,” Texas A&M University; cited in Mass-Benchmarks, *Transportation in Massachusetts: Economic Impacts, Finance and Investment Choices* (2015; <http://www.massbenchmarks.org/publications/issues/vol17i2/vol17i2.pdf>).
 - 39 The data cited in this and the following paragraph: <http://inrix.com/press-releases/los-angeles-tops-inrix-global-congestion-ranking>.
 - 40 Boston is thus not unique in suffering serious and worsening traffic congestion despite a legacy transit system. Chicago and San Francisco are legacy transit regions as well. Without their existing transit systems, these three metro regions would be far less competitive; the Bay Area and Chicago are in the midst of major reinvestment programs and, in the Bay Area’s case, expansion programs.
 - 41 MassBenchmarks, *Transportation in Massachusetts: Economic Impacts, Finance and Investment Choices* (2015; *loc. cit.*).
 - 42 Christopher Leinberger and Patrick Lynch, *The WalkUP Wakeup Call: Boston* (by LOCUS Development, 2015; <https://smartgrowthamerica.org/app/uploads/2016/08/walkup-wake-up-call-boston.pdf>).

- 43 This total represents the number of stations listed in the 2014 MBTA Blue Book for the north and south commuter rail systems; the Red, Orange, Blue, and Green Lines; the Green Line Extension; the Mattapan Trolley Line; and the Silver Line (including all of its Logan Airport stops). Deducted from the total are commuter rail stations outside the 164-municipality Metro Boston region; stations with two or more transit lines are counted only once (https://d3044s2alrsxog.cloudfront.net/uploadedfiles/About_the_T/Panel/MBTARidershipandServiceStatistics2014.pdf).
- 44 These percentages, based on 2010 census data, are from MAPC, *Growing Station Areas: The Variety and Potential of Transit Oriented Development in Metro Boston* (2012; *loc. cit.*). A more recent MAPC analysis indicates that 709,900 people live within a half-mile of Orange Line stations alone—15% of the 2015 metro regional population <https://macdc.org/sites/default/files/research/Orange%20Line%20Opportunity%20Corridor%20Brochure.pdf>.
- 45 MAPC, http://www.regionalindicators.org/topic_areas/2#land-use-and-transportation.
- The WalkUP report cited above found that Walkable Urban Places and Walkable Neighborhoods—occupying 5.6% of the metro region’s land area—contain 40% of its population, 41% of its employment, and 35% of its real estate valuation. These place types are generally, but not universally, served by transit. Christopher Leinberger and Patrick Lynch, *The WalkUP Wakeup Call: Boston* (by LOCUS Development, 2015; <https://smartgrowthamerica.org/app/uploads/2016/08/walkup-wakeup-call-boston.pdf>), p. 9.
- 46 The \$160 million is the aggregate differential between the existing property tax yield of station-area real estate and its hypothetical yield without the valuation premium attributed to transit. This estimate is conservative, in that it does not take into account the degree to which the station-area development in question might not have occurred in the host municipality at all but for transit. Of the total, approximately \$111 million is attributed to rapid transit stations, \$49 million to commuter rail stations (Technical Appendix A, section 7).
- 47 Christopher Leinberger and Patrick Lynch, *The WalkUP Wakeup Call: Boston* (by LOCUS Development, 2015; <https://smartgrowthamerica.org/app/uploads/2016/08/walkup-wakeup-call-boston.pdf>). The walkable urban premium over drivable suburban is 37% as a weighted average across product types, 134% for office, 54% for residential apartments. Most but not all of the defined “walkable urban development” is served by transit.
- 48 Center for Neighborhood Technology, *The New Real Estate Mantra: Location Near Public Transportation*; commissioned for the American Public Transportation Association and the National Association of Realtors; 2013 (<http://www.apta.com/resources/statistics/Documents/NewRealEstateMantra.pdf>).
- 49 The 20 communities of the Inner Core Subregion are as follows; those that are also part of the MTA “original 14” are italicized: *Boston, Brookline, Cambridge, Somerville, Watertown, Belmont, Arlington, Newton, Waltham, Medford, Malden, Melrose, Chelsea, Revere, Winthrop, Everett, Quincy, Milton, Saugus, Lynn*. Technical Appendix B presents in detail the composition of the Inner Core Subregion and the associated population and employment data summarized in this report. A 21st community, Needham, is a member of two subregion *organizations* (the Inner Core Committee and the Three Rivers Inter-local Committee), but MAPC does not include Needham in the Inner Core Subregion for statistical purposes.
- 50 The system-wide ridership numbers by mode cited in this and the following paragraph are 2015 data reported in Massachusetts Bay Transportation Authority (MBTA), *Focus 40* (<https://www.mbtafocus40.com>).
- 51 The MBTA designates 15 of its busiest bus routes as “Key Bus Routes.” Each Key Bus Route operates at a high frequency, 7 days a week, to meet passenger demand along high-density corridors. Service operates every 10 minutes or better during weekday peak periods, every 15 minutes or better during weekday midday, and every 20 minutes or better during off-peak periods (http://old.mbta.com/about_the_mbta/t_projects/default.asp?id=19047).
- 52 In Boston, the great majority of the City’s land area and population is within a five- or ten-minute walk of a rapid transit station, commuter rail station, or Key Bus Route stop (although there are significant exceptions in parts of Roxbury, Dorchester, South Boston, and West Roxbury). (City of Boston, *Vision and Action Plan: GoBoston 2030*, 2017; <https://www.boston.gov/news/go-boston-2030-vision-and-action-plan-released>.) If regular MBTA bus routes are included, the transit footprint is even more extensive.
- 53 Population data for 2015 are US Census estimates, accessed through the MAPC Data Catalogue (<http://databrowser.mapc.org/datasets/56>).
- 54 Jobs data for 2015 are from the Massachusetts Department of Labor, ES-202 Data Base, accessed through the MAPC Data Catalogue (<http://databrowser.mapc.org/datasets/127?max=5550&min=5500>).
- 55 MAPC Data Catalogue: Population by Decade (1970–2010) and US Census estimates for 2015 (<http://databrowser.mapc.org/datasets/56>); US Census for 1900, 1950. See Technical Appendix A for a more detailed time series. By comparison, Chicago, Philadelphia, Detroit, Cleveland, Baltimore, Milwaukee, Buffalo, St. Louis, and Cincinnati have fewer people today than they did in 1980 and have lost population throughout this 35-year period.
- 56 Source: MassINC analysis ES-202 data (from Executive Office of Labor & Workforce Development).

- 57 MAPC, ES-202 Data (from Executive Office of Labor & Workforce Development). As of 2017, data are available for all years between 2001 and 2015.
- 58 The Tremont Street Tunnel between Park and Boylston Street, today the central link of the Green Line, opened in 1898; the downtown-East Boston Tunnel, which today carries the Blue Line under the Harbor, opened in 1904.
- 59 Massport agreement with Conservation Law Foundation, May 2017 (<https://www.clf.org/blog/clf-and-massport-logan-airport-parking>).
- 60 Massport, *Logan Environmental Data Report 2014: Chapter 5, Ground Access* (2015; http://massportcac.org/wp-content/uploads/2016/09/2014_EDR_Web_Version_file1-compressed.pdf).
- 61 The commuter rail Gateway Cities outside the Inner Core are: Haverhill, Lawrence, Lowell, Attleboro, Brockton, Salem, Fitchburg, Leominster, and Worcester. (The latter three are outside the metropolitan region; there are also 2,100 daily boardings in Providence.) The proposed South Coast Rail project, serving Taunton, Fall River, and New Bedford, would add three more Gateway Cities, also outside the metropolitan region, to the rail system. There are six Gateway Cities within the Inner Core Subregion: Chelsea, Malden, Lynn, Quincy, Everett, and Revere; the first four are currently served by commuter rail. The seven Regional Urban Centers that have commuter rail service and are not also Gateway Cities are: Newburyport, Gloucester, Beverly, Woburn, Framingham, Franklin, and Norwood.
- For an overview of Gateway Cities and related policy and development initiatives, see MassInc (<https://massinc.org/our-work/policy-center/gateway-cities/about-the-gateway-cities>).
- 62 In the LOCUS Developers' *WalkUP* report, those Walkable Urban Places not located in the Inner Core are located in "regional urban centers," including the downtowns of several commuter rail cities: Attleboro, Brockton, Beverly, Gloucester, Salem, Newburyport, Fitchburg, Worcester, Framingham, Haverhill, Lawrence, Lowell, and Norwood, and the three to be served by South Coast Rail. Christopher Leinberger and Patrick Lynch, *The WalkUP Wakeup Call: Boston* (by LOCUS Development, 2015; <https://smartgrowthamerica.org/app/uploads/2016/08/walkup-wakeup-call-boston.pdf>), p. 17.
- 63 The regional model described in endnote 24 was adjusted by allowing a percentage of the population to find more convenient places to live—that is, places that would provide shorter trips to work and thus mitigate, if only at the margin, the exacerbated highway congestion and longer drive times. See Technical Appendix A, Section 2.3, Scenario 2. As described previously, the entire transit system—not only commuter rail—is hypothetically removed. For outlying communities, this means that the option of driving or taking a feeder bus to a "collector" rapid transit station like Oak Grove, Wellington, Riverside, Alewife, Quincy Adams, or Braintree is unavailable as well. The 2,727 Transportation Analysis Zones (TAZ) defined by the Central Transportation Planning Staff are the building blocks of the regional transportation demand model. The analysis calculates, for each TAZ, an Employment Access Factor (EAF) reflecting the average travel time from the TAZ in relation to all of the others, weighted by the amount of employment in each TAZ. The time- and distance-based decision algorithm then allows a share of population "flow," in gravity-like fashion, to the nearest TAZ with an acceptable (EAF).
- 64 The maps in Technical Appendix A, Section 2.3 (Figures 1 and 2) compare the population distribution for the Baseline Scenario (i.e., existing conditions) and Scenario 1 with the estimated redistribution for Scenario 2.
- 65 MAPC, *Population and Housing Demand Projections* (2014).
- 66 MAPC, *Growing Station Areas: The Variety and Potential of Transit Oriented Development in Metro Boston* (2012; *loc. cit.*); and MAPC, *Metro Boston Regional Indicators: Transportation: Staying on Track* (2017); www.regionalindicators.org. The regional housing unit demand (329,000 in the Stronger Region scenario) is in MAPC, *Population and Housing Demand Projections* (2014; *loc. cit.*).
- 67 The next three paragraphs and Figure 13 are compiled from MAPC, *Population and Housing Demand Projections* (2014, *loc. cit.*).
- 68 A Better City and Northeastern University's Dukakis Center for Urban and Regional Policy; *The State of the Built Environment* (2016; <http://www.abettercity.org/docs-new/A%20Better%20City-%20State%20of%20the%20Built%20Environment.pdf>), p. 39. The Inner Core percentage is for MAPC's 16 Inner Core communities, which do not include Lynn, Quincy, Saugus, and Milton. This difference does not materially affect the comparison of the Inner Core, Regional projections.
- 69 MAPC, *Population and Housing Demand Projections* (Boston), summary chart on final page (<ftp://ftp.mapc.org/projections/Municipal%20PDF%20Reports/Boston.pdf>).
- 70 The LOCUS Developers' *WalkUP* report concludes that "the future is materializing on the less than six percent of the region's land" represented by "walkable urban development"—most of it served by transit and located in the Inner Core. In the last three real estate cycles (1992–2000, 2001–2008, and 2009–present), the share of the region's income development (office, hotel, retail, and multi-family rental) occurring in walkable urban settings has grown from 27% to 49%. Christopher Leinberger and Patrick Lynch, *The WalkUP Wakeup Call: Boston* (by LOCUS Development, 2015; *loc. cit.*, p. 8.

- 71 *Ibid.*
- 72 In Boston, all six of the key neighborhood expansion opportunities identified in the City's Imagine Boston 2030 master plan are included: Allston Yards (in the Allston-Brighton Rail Corridor Growth Cluster); Sullivan Square (Mystic/Malden River); Suffolk Downs (Suffolk Downs/Wonderland); Widett/Newmarket (South Bay Corridor); Fort Point Channel (Seaport); and Readville (Hyde Park Villages). Also included are as are the City's two transit-oriented housing priority corridors: "JPRox" (Lower Southwest Corridor/Egleston) and Dorchester Avenue (South Bay Corridor) (<https://imagine.boston.gov/imagine-boston-plan>).
- 73 The Hub includes the five economic development "hot spots" identified in the 2012 *Hub and Spokes* study (Northeastern University's Dukakis Center for Urban Policy and Urban Land Institute) ([http://www.abetter-city.org/docs/06.2012%20-%20Final%20Hub%20and%20Spoke%20Report%20\(00422379\).pdf](http://www.abetter-city.org/docs/06.2012%20-%20Final%20Hub%20and%20Spoke%20Report%20(00422379).pdf)): Downtown Boston, Back Bay, the Longwood Medical Area, Kendall, and the Seaport. This study adds the South Bay Corridor, which adjoins Downtown and the Seaport and has a strong Red Line connection with those two Clusters and Kendall.
- 74 The development estimates and methodology are documented in detail in Technical Appendices C and C1. For specific development projects, the sources are official public documents (including Massachusetts Environmental Policy Act filings and certificates, Boston Planning & Development Agency filings, and posted filings or decisions by local authorities in other municipalities). The MAPC development projects database (MassBuilds, <http://www.massbuilds.com>) provided helpful backup, and served as a primary source when other documentation was unavailable. The estimate of jobs for each project (other than those for which a specific jobs number was provided in a submittal) is calculated by applying employee-per-square-foot factors for specific uses. For large-scale sites not yet in the formal planning process, estimates were prepared based on site acreage and conservative assumptions with respect to site coverage and floor area ratio. The estimated square footage was divided hypothetically between residential and employment (generally office) use.
- 75 These estimates differ from those provided by MAPC (see endnote 66 above) on page 26, although they fall in the same order of magnitude. The MAPC estimates are for all half-mile station areas in the MBTA rail system, while the Transit Growth Clusters represent a subset of stations (in most cases, multiple stations in close proximity to one another) in the Inner Core. The Transit Growth Clusters include many of the Inner Core's densest, most active development "hot spots." The estimate of the Transit Growth Clusters' future potential development capacity is based, as explained in endnote 74, on conservative assumptions of site coverage and floor area ratio.
- 76 For detailed mapping, description, and analysis of the six Transit Growth Clusters included in The Hub, see Technical Appendix C, pp. C-7-39. The estimated development capacity is documented in Technical Appendix C1.
- 77 For detailed mapping, description, and analysis of the four Transit Growth Clusters included in the Near North Shore strategic corridor, see Technical Appendix C, pp. 40-60. The estimated development capacity is documented in Technical Appendix C1, p. 5.
- 78 For detailed mapping, description, and analysis of the three Transit Growth Clusters included in the North strategic corridor, see Technical Appendix C, pp. C-60-73. The estimated development capacity is documented in Technical Appendix C1, p. 6.
- 79 For detailed mapping, description, and analysis of the five Transit Growth Clusters included in the Charles River Corridor, see Technical Appendix C, pp. C-74-89. The estimated development capacity is documented in Technical Appendix C1.
- 80 For detailed mapping, description, and analysis of the four Transit Growth Clusters included in the Southwest Neighborhoods Corridor, see Technical Appendix C, pp. C-90-107. The estimated development capacity is documented in Technical Appendix C1.
- 81 The "Brain Train" forum: National Association of Industrial and Office Parks (NAOIP), *The Brain Train: The Red Line's Effect on Real Estate* (March 1, 2016). For detailed mapping, description, and analysis of the two Transit Growth Clusters included in Red Line Outer Markets strategic corridor, see Technical Appendix C, pp. C-108-115. The estimated development capacity is documented in Technical Appendix C1.
- 82 The data base used to construct these two metrics is the Center for Neighborhood Technology's (CNT) All Transit data base, which provides data on jobs, workforce, and other economic indicators (<http://alltransit.cnt.org>) for any location linked to Google Maps. For each station in a Transit Growth Cluster, the Job Shed (number of jobs located within a 30-minute transit trip and a quarter-mile walk) and Labor Shed (number of workers living within a 30-minute transit trip and a quarter-mile walk) was constructed by averaging the results for the census blocks converging at the station site. For the full methodology, see Technical Appendix C, pp. C-5-6, Table 2) and <http://alltransit.cnt.org/methods>. The regional average values are for the 101-municipality MAPC region rather than the 164-municipality metro region used elsewhere in this report.

- 83 Brookings, *The Growing Distance Between People and Jobs in Metropolitan America* (2013; https://www.brookings.edu/wp-content/uploads/2016/07/Srvy_JobsProximity.pdf). Another Brookings study describes the emerging shift in the orientation of US and UK urban transportation analysis from traffic to mobility to accessibility, with the latter's implications for job access and workforce equity. A desired range of daily work trip times of 20 to 40 minutes is suggested; this is consistent with the 30-minute-plus-walk transit commute on which CNT's job and labor estimates are based. *Moving to Accessibility: Developing a Common Narrative on Urban Accessibility* (2017; <https://www.brookings.edu/wp-content/uploads/2017/01/overview-digital.pdf>).
- 84 The Partners HealthCare and Vertex Pharmaceutical headquarters were relocated or consolidated from other transit locations. Partners seriously considered only two sites, both on the Orange Line (Ruggles and Assembly); Vertex, in expanding its headquarters, moved from Kendall to the Seaport, staying in the Red Line corridor.
- 85 MAPC, *The Dimensions of Displacement: Baseline Data for Managing Neighborhood Change in Somerville's Green Line Corridor* (2014; http://www.mapc.org/wp-content/uploads/2017/11/Housing20Workshop202_11_14.pdf).
- 86 University of California at Berkeley (Chapple et al.) and University of California at Los Angeles (Loukaita-Sideris et al.), *Developing a New Methodology for Analyzing Potential Displacement* (2017; http://www.urbandisplacement.org/sites/default/files/images/arb_tod_report_13-310.pdf).
- 87 In 2017, MassDOT and the MBTA adopted *Transit-Oriented Development Policies and Guidelines* that require affordable housing in joint development projects (those undertaken on MassDOT or MBTA property) and strongly advocate for such policies on other station-area land (https://www.mass.gov/files/documents/2017/10/17/TOD_Policy.pdf).
- 88 The data source is CNT's Housing+Transportation Index, which provides housing and transportation data (actual and modeled) for location linked to Google Maps (<http://htaindex.cnt.org>). For the full methodology, see Online Technical Appendix C, pp. C-5-6, Table 2.
- 89 The housing-versus-commuting cost comparison was generated by <http://htaindex.cnt.org>. Based on the affordability of commuting and large transit job sheds, the Smart Growth America report *Foot Traffic Ahead* ranked Metro Boston the third most socially equitable metro region in the country. (<https://www.smartgrowthamerica.org/app/legacy/documents/foot-traffic-ahead-2016.pdf>)
- 90 Boston Planning & Development Agency, from US Census, American Communities Survey, 2011-2015.
- 91 The data source for household car ownership and VMT is MAPC's Station Area Data Base, which compiles a variety of actual and modeled data for the half-mile radius around each rapid transit or commuter rail station (<http://tstation.info/#search>). For the full methodology, see Technical Appendix C, pp. C-5-6, Table 2. The regionwide averages are for the 101-municipality MAPC region.
- There is a documented correlation between income, housing type, and transit use; lower-income households and rental households are more likely to use transit (see <http://www.northeastern.edu/dukakiscenter/wp-content/uploads/2013/10/ES-final-10-17-13.pdf>). However, even in Transit Growth Clusters it should not be assumed that the availability of transit automatically diverts higher-income households from automobile commuting. The availability and pricing of parking at both the home and work ends of the commute, and the availability and pricing of ride-sharing alternatives, presumably influence this discretionary budgetary and lifestyle choice.
- 92 Reported by Transportation for Massachusetts: <https://www.t4ma.org/acs>. This increase in the transit/pedestrian/bicycle mode share has occurred alongside the growth in vehicles miles traveled and highway congestion; regional growth has driven greater transit and automobile use.
- 93 LMA: Medical Area Service Corporation (MASCO), 2013 *Data Presentation* and interview in December 2017; Seaport: A Better City, MassDOT, MBTA, Massport, Boston Redevelopment Authority, et al., *South Boston Waterfront Sustainable Transportation Plan* (2015, https://www.massdot.state.ma.us/Portals/17/docs/Studies/SBostonWaterfrontFullReport_jan2015.pdf); Kendall: employment, <https://www.kendallsq.org/ksq> and mode share, Kendall Square Mobility Task Force, Presentation of June 23, 2015 (http://www.cambridgema.gov/CDD/Projects/Transportation/~/_media/9BD7653F27B94D23905C060CC51B704A.ashx).
- 94 *Ibid.*
- 95 From <https://www.massdot.state.ma.us/Portals/17/docs/KendallSquare/DisBoards101515.pdf>.
- 96 <http://www.brooklinema.gov/DocumentCenter/Home/View/7152>.
- 97 The Commons at Forest Hills (<http://www.bostonplans.org/getattachment/b9231be2-203d-4f7e-8404-82bfd3980f5a>).
- 98 <http://www.bostonredevelopmentauthority.org/projects/development-projects/clippership-wharf>.
- 99 The five communities are Malden, Melrose, Everett, Chelsea, and Arlington. MAPC, *Metro Boston Perfect Fit Parking Initiative* (2017); http://perfectfitparking.mapc.org/uploads/FINAL_Metro%20Boston%20Perfect%20Fit%20Parking%20Initiative%20Report_2-3-17.pdf.

- 100 MBTA, *Focus40: The State of the System Report: Rapid Transit* (2015). All Focus40 documents cited here may be accessed at <https://www.mbtafocus40.com>.
- 101 MBTA, *Focus40 (loc. cit.): The State of the System Report: Bus* (2015).
- 102 MBTA, *Focus40 (loc. cit.): Capacity Gap Analysis* (Draft, 2016).
- 103 MAPC, *Metro Boston Regional Indicators; Transportation: Staying on Track* (2017; www.regionalindicators.org).
- 104 MBTA, *Focus 40 (loc. cit.): Passenger Priorities Survey* (2015).
- 105 The mobility challenges outlined in the following bullet paragraphs reflect the findings in Technical Appendix C (the detailed assessments of each Transit Growth Cluster).
- 106 <https://commonwealthmagazine.org/transportation/t-notes-blue-line-major-peak-concern>
- 107 MassDOT, 2018-2022 Capital Investment Plan Update (<http://massdot.maps.arcgis.com/apps/MapSeries/index.html?appid=dea0a851b5dd4285a3bf985c8d91e6e0>) and MBTA, Fiscal Management and Control Board, Second Annual Report, 2016 (http://www.mbta.com/uploadedfiles/About_the_T/Board_Meetings/Final%2012.13.2016%20FMCB%20Second%20Annual%20Report.pdf).
- 108 The modeling assumed, based on a 2012 analysis by the Central Transportation Planning Staff (CTPS), that bringing the rail transit system to a State of Good Repair (*without increasing physical capacity*) would attract a ridership increase of 6%. See Technical Appendix A, Table 24, Scenario 3A. All 2030 modeling results are in constant 2015 dollars, to avoid counting inflation in the value of the transportation benefits. 2030 is an appropriate year from which to look “back” at the impact of an intensified, multi-year State of Good Repair investment program currently getting underway.
- 109 *Ibid.*
- 110 MBTA, Fiscal Management and Control Board, Second Annual Report, 2016 (*loc. cit.*). The program includes \$729 million for the Red and Orange vehicles as well as \$498 million of related infrastructure work, such as improvements to the Wellington and Cabot Yards.
- 111 <http://www.cambridgema.gov/CDD/Projects/Transportation/~media/C7942C92FA4B4551B7DD54B1D831CE5B.ashx>. The originally planned State of Good Repair project would have replaced the Red Line’s Number 1 and Number 2 fleets, while overhauling the Number 3 fleet. By replacing the 134 Number 3 cars now, and thereby deploying a single vehicle type with new signal technology, the MBTA is able to take advantage of the vehicle replacement to increase throughput and capacity.
- 112 <http://www.cambridgema.gov/CDD/Projects/Transportation/~media/DA08688CB00544F2A6D28E3D6F5819D6.ashx>; http://www.mbta.com/uploadedfiles/About_the_T/Board_Meetings/StateoftheOrangeLine61616.pdf.
- 113 [http://www.mbtafocus40.com/mbta-today; State of the System: Rapid Transit and State of the Service: Green Line](http://www.mbtafocus40.com/mbta-today;StateoftheSystem:RapidTransitandStateoftheService:GreenLine).
- 114 The effective capacity of the rapid transit system is also constrained by the ability of the downtown stations to process large volumes of passengers, whether arriving at their destination or transferring between lines. The modernization of State Street, and more recently of Government Center, addressed two complex, high-volume destination and transfer points.
- Two larger capital projects originally proposed in the 1990s would, if built, alleviate the volume of transfers in the downtown stations. (i) The Red Line-Blue Line Connector, by creating a new direct transfer point at Charles MGH, would reduce transfers at State, Government Center, Downtown Crossing, and Park Street. Some of the original demand for the Red-Blue Connector has been addressed by the Silver Line, which provides Red Line passengers with a single-transfer ride directly to the Airport terminals. Moreover, the Silver Line Gateway extension to Chelsea, opening in 2018, will provide a single-transfer connection from the Blue Line to the Seaport District and South Station. However, the Silver Line subway has capacity issues of its own, and the anticipated development of Suffolk Downs and Wonderland will over time introduce numerous additional subway transfers into State, Government Center, Downtown Crossing, and Park Street, and may thus create more demand for the Red-Blue Connector.
- (ii) Silver Line III, the proposed extension of the Silver Line subway from South Station to Dudley, would create direct Silver Line transfers to and from the Green Line (at Boylston) and the Orange Line (at Chinatown). By avoiding the need for Seaport-bound users of the Green and Orange Lines to use the Red Line as part of their trip, Silver Line III would reduce transfers at Park Street, Downtown Crossing, and South Station while facilitating regional connections to the Seaport District (*South Boston Waterfront Sustainable Transportation Plan*, 2015, *loc. cit.*). The extended version of Silver Line III would proceed beyond Boylston and connect with the Washington Street Silver Line to Dudley. These projects, while not currently included in MBTA and MassDOT plans, remain potential long-term options.
- 115 *South Boston Waterfront Sustainable Transportation Plan*, 2015 (*loc. cit.*).
- 116 MassDOT, *Everett Transit Action Plan* (<https://www.massdot.state.ma.us/Portals/17/docs/Everett/FinalReportEnglish.pdf>).

- 117 A related opportunity lies in the enhanced use of commuter rail stops that already exist at four Inner Core rapid transit stations but currently generate minimal ridership. Located at Forest Hills, Ruggles, Malden Center, Quincy Center, and JFK/UMass, these stops could become a found resource in conjunction with transit-oriented development. The MBTA is currently implementing a commuter rail platform at Ruggles that will support station area development as well as shuttle connections to the Longwood Medical Area. At Quincy Center, the MBTA and the City of Quincy have selected a developer for the station grounds and air rights, with the expectation that the project will include developer-funded station improvements. As a destination, this project could benefit from the commuter rail stop.
- 118 While discussion initially focused on diesel multiple units (DMUs), consideration may also be given to electric multiple units (EMUs), the more common technology in the US. While EMU service requires electrification, its rolling stock is generally less expensive.
- 119 Riverside Station is the terminus of the D Branch of the Green Line. It is also a former commuter rail stop, and still has a track connection to the Framingham-Worcester Line.
- 120 Routing some trains from West Station to North Station, via the Grand Junction railroad, has been proposed in the past; if feasible, this option would make the urban rail service even more versatile.
- The urban and regional rail strategy outlined here will eventually require an expansion of track capacity at South Station. The South Station Expansion Project, which would add seven tracks and expanded concourse and circulation facilities, is a MassDOT and MBTA priority. The feasibility of the proposed North South Rail Link (NSRL) is being evaluated by MassDOT; if viable as a long-term option, it is a potential enhancement to an urban/regional rail system.
- 121 Ridership breakdown in this and the following paragraph compiled from 2013 station-by-station figures reported in the *MBTA Bluebook, 2014 Edition (loc. cit.)*. The commuter rail Gateway Cities outside the Inner Core are: Haverhill, Lawrence, Lowell, Attleboro, Brockton, Salem, Fitchburg, Leominster, and Worcester. There are also four commuter rail Gateway Cities within the Inner Core: Lynn, Quincy, Chelsea, and Malden. The seven Regional Urban Centers that have commuter rail service and are not also Gateway Cities are: Newburyport, Gloucester, Beverly, Woburn, Framingham, Franklin, and Norwood.
- 122 The Silver Line's existing crowding and headway issues must be addressed; these include the aging of the dual-powered vehicles, which are no longer manufactured in the US, and the circulation bottleneck at D Street. (ABC, *South Boston Waterfront Sustainable Transportation Plan*, 2015, *loc. cit.*).
- 123 See <https://www.barrfoundation.org/blog/a-call-for-cities-to-lead-the-way-to-better-transit>.
- 124 The Barr Foundation's *Boston BRT Report* (<http://www.bostonbrt.org/the-brt-report>) identified five corridors as particularly promising, including Sullivan/Kendall/LMA/Ruggles, Readville/Forest Hills, and Mattapan/Dudley. In *GoBoston 2030* (https://www.boston.gov/sites/default/files/document-file-03-2017/go_boston_2030_-_7_projects_and_policies_spreads_1.pdf), the City envisions a number of rapid bus and BRT corridors, including Mattapan/LMA and Forest Hills/Roslindale Village. Several variations of a North Station/South Station/Seaport rapid bus have been suggested, including in the *South Boston Waterfront Sustainable Transportation Plan* (2015, *loc. cit.*).
- 125 <http://www.cambridgema.gov/CDD/Projects/Transportation/~//media/3C8D89FFAF6E4EAC88E4621FE5EE6B1E.ashx>
- 126 <http://www.massdot.state.ma.us/Portals/17/docs/Everett/EverettSeptOpenHousePresEng.pdf>.
- 127 See: <https://www.massdot.state.ma.us/Portals/49/Docs/BusLane20160513%20.pdf>; and *GoBoston 2030's "Go Crosstown" scenario* in http://goboston2030.org/futures_survey.
- 128 The MBTA designates 15 high-volume, high-frequency bus routes as "Key Bus Routes." See endnote 22 for further description.
- 129 https://d3044s2alrsxog.cloudfront.net/uploadedfiles/About_the_T/Board_Meetings/1.%20AFC2%20Policy%20Board%20Oct2016%20-TO%20POST.pdf and <https://www.mbta.com/news/2417>.
- 130 Downtown Boston has existing, recent, or proposed ferry connections to Hingham (a major MBTA commuter service), Charlestown (a frequent cross-harbor shuttle), Salem, East Boston, Winthrop, Lynn, Hull, and Quincy.
- 131 Boston Harbor Now. <http://www.bostonharbornow.org/what-we-do/work/water-transportation/water-transportation-study>.

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33 Broad Street, Suite 300
Boston, MA 02109
617.502.6240
www.abettercity.org