

The Promise and Potential of Transformative Transit-Oriented Development in Gateway Cities

ACKNOWLEDGEMENTS

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The Promise and Potential of Transformative Transit-Oriented Development in Gateway Cities

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Dear Friends:

For over a decade, MassINC has touted the unrealized potential of the state's Gateway Cities with frequent references to their many strengths. Existing transportation infrastructure has always been at the top of our list of untapped Gateway City assets, yet we have never sorted through a complex set of issues to understand what this potential actually amounts to, and what it would take to build to this strength.

With rising demand for both housing and commercial space in walkable, transit-connected neighborhoods (and grinding congestion raising alarms bells, as economic expansion barrels on in the eastern part of the state), we felt an increasingly urgent need to look at what's happening with Gateway City transit assets and what more could be done to activate them.

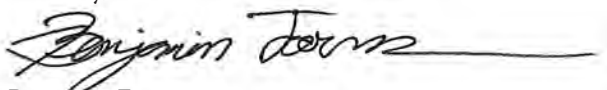
With generous support from the Barr Foundation, MassINC dissected these questions over the past 18 months. Together with Dan Hodge, a regular MassINC partner with experience in both economic development and transportation, we built a research team that included RKG Associates (a real estate development consultancy) and Kittelson & Associates (a transportation consulting firm). Together, our interdisciplinary team engaged local partners in both the public and private sector to devise a methodology and rigorously evaluate the promise and potential of transit-oriented development (TOD) in Gateway Cities.

This report is the product of our collaborative effort. In contrast to traditional MassINC studies, which generally identify and quantify imposing problems, this work largely focuses on gauging the magnitude of a potential opportunity. Our objective is to present policymakers with various scenarios and strategies for pursuing beneficial outcomes.

As always, the intention is not to be proscriptive, but rather, to stimulate further investigation and public debate. The pages that follow are chock-full of interesting data and analyses, but we hope that this write-up is only the beginning. We will make all of the models assembled by the project team available for others to download from our website. Cities can use these tools to estimate ridership and greenhouse gas implications of detailed TOD plans, and policymakers can vary assumptions to preform sensitivity analysis and model alternative scenarios.

At the end of a trying research endeavor, we have some measure of pride for the new insights revealed and some disappointment over limitations and unanswered questions. But invariably, we feel tremendous gratitude for our funders, who underwrite objective research, and all of the dedicated partners, who donate substantial time advising and informing the work. While they are too numerous to name here, we hope that they each recognize how much we value their individual contributions.

Sincerely,

A handwritten signature in black ink, appearing to read "Benjamin Forman", with a long horizontal line extending to the right.

Benjamin Forman

Executive Director

MassINC Gateway Cities Innovation Institute

table of contents

5	Executive Summary	
15	Chapter 1: Why Gateway City TOD Merits Serious Consideration	
23	Chapter 2: The Economics of Transformative Gateway City TOD	
29	Chapter 3: Estimating TOD Development Capacity at Optimal Buildout	
35	Chapter 4: Producing Optimal TOD in Gateway City Real Estate Markets	
47	Chapter 5: Assessing Rail Capacity to Support Gateway City TOD	
57	Chapter 6: Estimating the Potential Climate Benefits of Gateway City TOD	
65	Chapter 7: A State-Level Action Plan for Transformational Gateway City TOD	
73	Chapter 8: A Local Action Plan for Transformational Gateway City TOD	

ONLINE

[Appendix A TOD Buildout Methodology](#)

[Appendix B TOD Market Analysis](#)

[Appendix C Ridership and GHG Methodology](#)



Executive Summary

Gateway Cities can accommodate thousands of new housing units and thousands of new jobs on the vacant and underutilized land surrounding their commuter rail stations. This walkable, mixed-use urban land offers an ideal setting for transit-oriented development (TOD) to take hold.

Currently, Gateway City commuter rail stations get minimal ridership from downtown neighborhoods and few developers seek out this land for TOD. But changing economic forces may provide market-building opportunities that we should not overlook—funneling future development into transit-connected Gateway Cities could generate more inclusive and economically productive growth, reduce road congestion and greenhouse gas (GHG) emissions, increase housing supply, conserve open space, and improve quality of life in communities throughout the Commonwealth.

At this moment of profound demographic, economic, and technological change, it is difficult to quantify precisely this host of potential benefits. However, aggressively pursuing the promise of Gateway City TOD does not require a billion-dollar upfront bet. The transit network—along with the urban fabric to facilitate this form of development—already exists.

Governor Baker recently named an 18-member commission to examine the state's transportation assets and future mobility needs, including re-evaluating the role commuter rail plays before MassDOT issues the next long-term operating contract in 2022. While transportation leaders plan ahead, tools to spearhead redevelopment in Gateway Cities are in flux, with the Legislature considering end-of-session housing and economic development bills. At this important juncture, it is crucial to gain a more complete understanding of the opportunity Gateway City TOD presents.

To provide this information, MassINC assembled an interdisciplinary research team to construct detailed real estate and transportation models for four Gateway Cities (Fitchburg, Lynn, Springfield, and Worcester) with widely varying market contexts. Using parameters derived from these models, the

team then extrapolated to the full set of 13 Gateway Cities with current or planned commuter rail service (see Table ES-1).

Our analysis yields order-of-magnitude estimates to answer the threshold question: How much employment and population growth, increased transit ridership, and GHG emission reductions are possible, if Massachusetts were to realize the full potential of Gateway City TOD?

This executive summary presents five key findings from our research, and then briefly describes how, leveraging our models, state and local leaders can proceed apace with steps to nurture and test the market for Gateway City TOD and make measured progress toward its full potential, as rising demand warrants additional investment in station area development and transit service improvements.

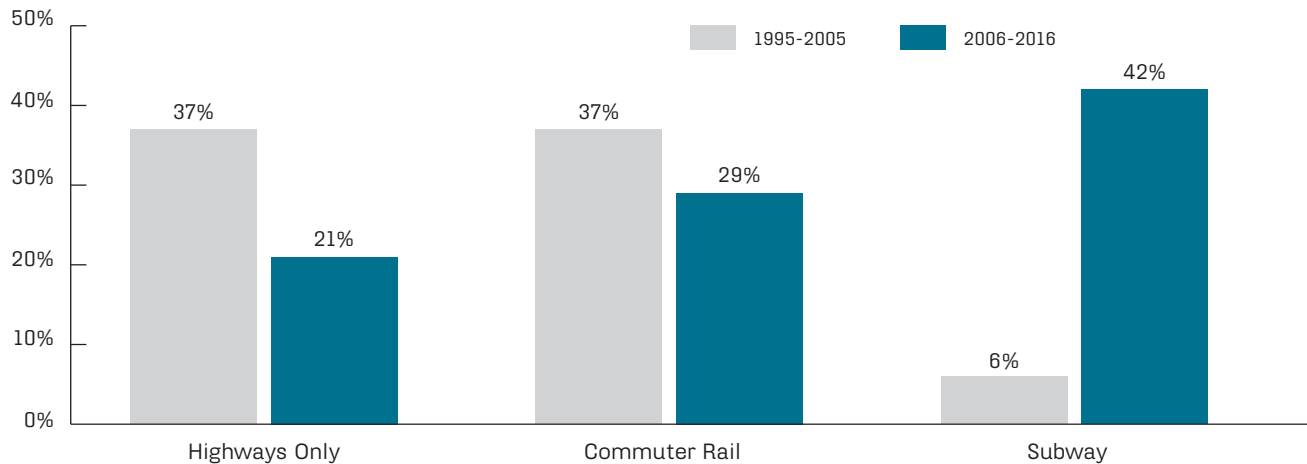
1. Changing economic forces provide fertile ground for Gateway City TOD.

To dispassionately weigh order-of-magnitude estimates for Gateway City TOD at its full potential, leaders must first assess the economic case, because market forces ultimately dictate land use, as well as the broader social and environmental benefits associated with transit and compact urban development.

Currently, real estate economics do not reflect demand for Gateway City TOD: station area rents are simply too low to support substantial rehab or ground-up new development. However, this could change markedly as the innovation economy continues to expand.

Innovative regional economies are driven by dense clusters of business activity, where workers in related industries can exchange knowledge and create new products and services. Economists call the force that fuels this phenomenon “agglomeration.” Because access to a large pool of workers with specialized skills is central to the development of agglomeration economies, the more transportation systems expand the potential pool of workers, the more competitive a region will become.¹

Figure ES-1: Share of State's Net Job Growth by Transportation Infrastructure



Source: Massachusetts Department of Unemployment Assistance, Economic Research Department data by municipality; calculations by MassINC

Note: Data aggregated at the municipal level based on stations and exit ramps within town boundaries.

In recent years, Greater Boston has seen the impact of rising returns to agglomeration with employer after employer migrating from locations along highway exit ramps to Boston's urban core, where robust transit service provides them with the widest possible labor market draw. Communities with high-frequency subway service accounted for 42 percent of all net job growth in Massachusetts between 2006 and 2016; this same set of communities generated just 6 percent of the state's net job growth during the previous 10-year period (Figure ES-1).

With the economy increasingly driven by agglomeration, and space to expand housing and commercial development in Boston increasingly scarce, a strengthening market for Gateway City TOD seems likely. If mixed-use TOD in Gateway Cities becomes a catalyst for improved regional mobility (with far more locations for both living and working up and down commuter rail corridors that are served by faster and more frequent trains), it could reshape the contours of the Commonwealth's economic geography and increase the state's overall competitiveness.

A growing body of evidence suggests a large center city connected to smaller cities allows regions to maximize benefits from agglomeration, while minimizing congestion and other inefficiencies that come with size.² This only occurs, however, when these smaller cities develop functional relationships

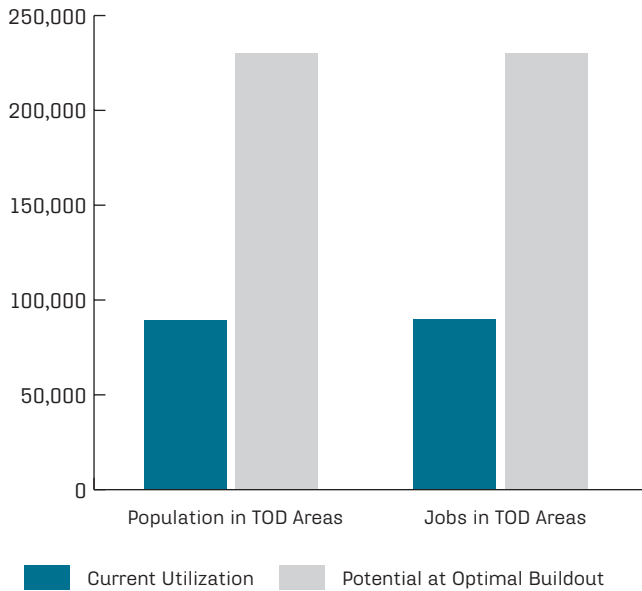
with the large core to "borrow size" (i.e., gain the productivity benefits such as skilled labor and connections to global cities that come with scale).³ Without these functional relationships, smaller cities tend to fall in the so-called agglomeration shadow, where the competitive advantage firms gain in the central city makes it difficult for others to compete nearby.⁴

At present, it is quite clear that an agglomeration shadow hangs over Gateway Cities and their regional economies. TOD coupled with improved transit service could move markets toward the borrowed size pattern, with larger and larger flows of workers moving quickly through congested metropolitan space to Gateway City economic centers tied to Boston's research and development activity, expert service providers, and global trade connections.

2. Gateway City station areas can accommodate a substantial amount of additional development.

If the pro-Gateway City TOD economic forces described above take shape, our models suggest the station areas in these cities have significant capacity to absorb more development, respecting their current scale and character. This additional capacity comes in three forms: infill on currently vacant sites; higher occupancy of underutilized buildings; and redevelopment on parcels where existing structures are significantly less dense than those nearby.

Figure ES-2. Growth in Population and Jobs in TOD Areas with Optimal Buildout, 13 Gateway Cities



Source: RKG Associates and MassINC calculations

Combined, these three forms of capacity present an opportunity to expand the volume of space in these downtown station areas by a range of 56 percent in Fitchburg to 225 percent in Lynn. Together, the 13 Gateway Cities with current or planned commuter rail service have an estimated 116 million square feet of additional development potential within a half-mile radius of their stations.

At “optimal buildout”—the term we use hereafter to describe maximum development at the current scale and full utilization of this real estate with a one-to-one mix of jobs and residents—these Gateway City TOD areas could house approximately 230,000 jobs and 230,000 residents. This represents a 157 percent increase over the current number of people working in these areas (139,825 additional jobs) and a 155 percent increase over the current number of residents living in them (140,358 additional residents).

To put this magnitude of potential development capacity into perspective, the job growth figure is equivalent to 70 percent of all net new jobs in Massachusetts since 2001, and the additional housing estimate is enough to accommodate over one-quarter of the projected population growth for Massachusetts statewide through 2035.

3. Gateway City TOD will produce a heavy stream of new riders; the commuter rail system has capacity to carry all of these additional passengers with limited marginal cost.

With conservative assumptions, our ridership model shows Gateway City TOD has the potential to generate large increases in rail passengers. At optimal buildout, daily boarding in Worcester increases by nearly 200 percent and Fitchburg’s ridership grows by 280 percent. Consistent with the exceptional development opportunity along the city’s waterfront, Lynn posts exponential ridership gains: at optimal buildout, the station would serve nearly 7,000 daily riders, ten times current levels.

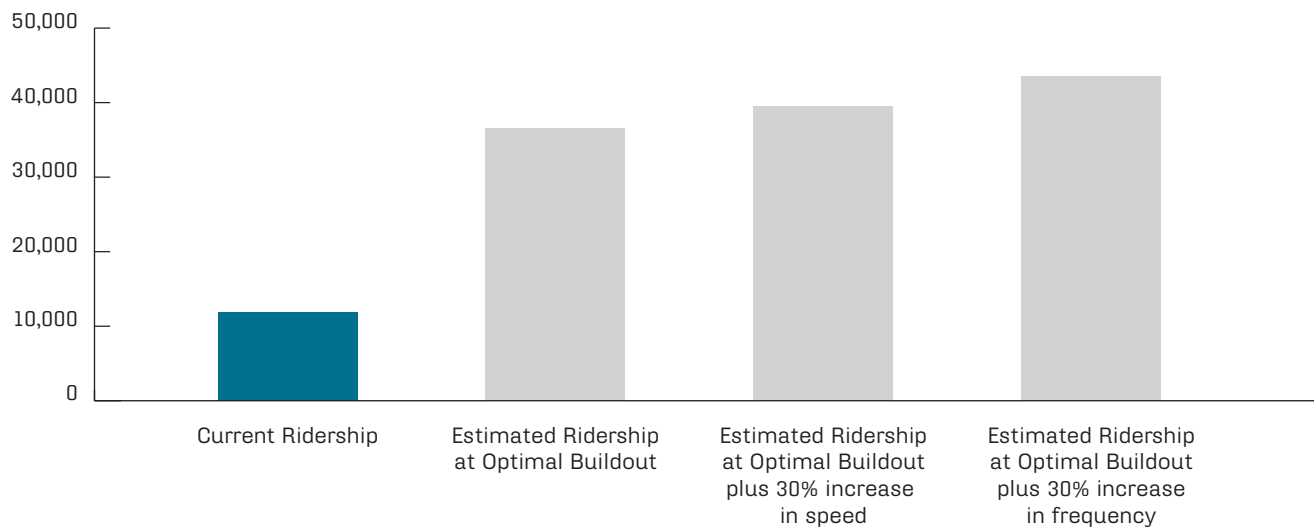
Combined, optimal buildout in the 13 Gateway Cities produces approximately 25,000 new daily passengers. At current fares, this level of ridership generates more than \$81 million in additional revenue annually for the MBTA.

Currently, most of the coaches that the MBTA owns are in use during peak service periods and most seats are occupied during a portion of these high-volume trips (based on the corridors we studied). But this is by design, as the agency maintains a fleet of coaches to accommodate the run with the most passengers on each line. With minor additions to capacity and service, such as replacing single-level coaches with bi-level coaches, the system can serve the estimated peak period TOD ridership with limited marginal cost.

Service enhancements, including more frequent headways (i.e., elapsed time between trains) and reductions in travel time, could generate even more ridership from Gateway Cities and other stops along these lines. This would undoubtedly require sizeable public investment. However, with Gateway City stations performing at their full potential, the cost-benefit proposition might balance out, justifying service enhancements that will improve mobility for all communities in these commuter rail corridors.

For instance, we estimate that without any additional development in Gateway Cities, a 30 percent increase in frequency leads to 4,500 additional daily boardings from these 13 stations; at optimal TOD buildout, a 30 percent increase in frequency generates over 7,000 new trips (Figure ES-3).

Figure ES-3: Estimated Ridership from Gateway Cities with Optimal TOD and Service Changes



Source: Kittelson Associates and MassINC calculations

4. Gateway City TOD can produce meaningful reductions in GHG emissions.

Transportation is a major and steadily growing contributor to GHG emissions in Massachusetts. Optimal TOD in Gateway Cities will produce a considerable shift in travel patterns relative to business-as-usual development scenarios, leading to a significant reduction in GHG emissions. In all four of the case study cities, our models show a large decrease in driving offset by a large increase in transit riding and walking (Figure ES-4).

Across the 13 Gateway Cities, optimal TOD within a half-mile radius of train stations has the potential to reduce vehicle commute trips by 16 percent and non-commute trips in vehicles by 24 percent. Total commuter and non-commuter vehicle miles travelled (VMT) falls by 37 percent and 43 percent, respectively, within TOD areas. The result is a 40 percent drop in GHG emissions—a reduction of roughly 800,000 metric tons annually.

Studies show travel impacts of TOD account for about 60 percent of the total GHG reduction from compact development; the home energy benefits associated with households occupying smaller residential units in multifamily buildings with shared walls represent approximately 40 percent of TOD's

GHG impact.⁵ Given our region's cold winter climate, however, the residential energy savings in Massachusetts may be more on par with the transportation reductions.⁶

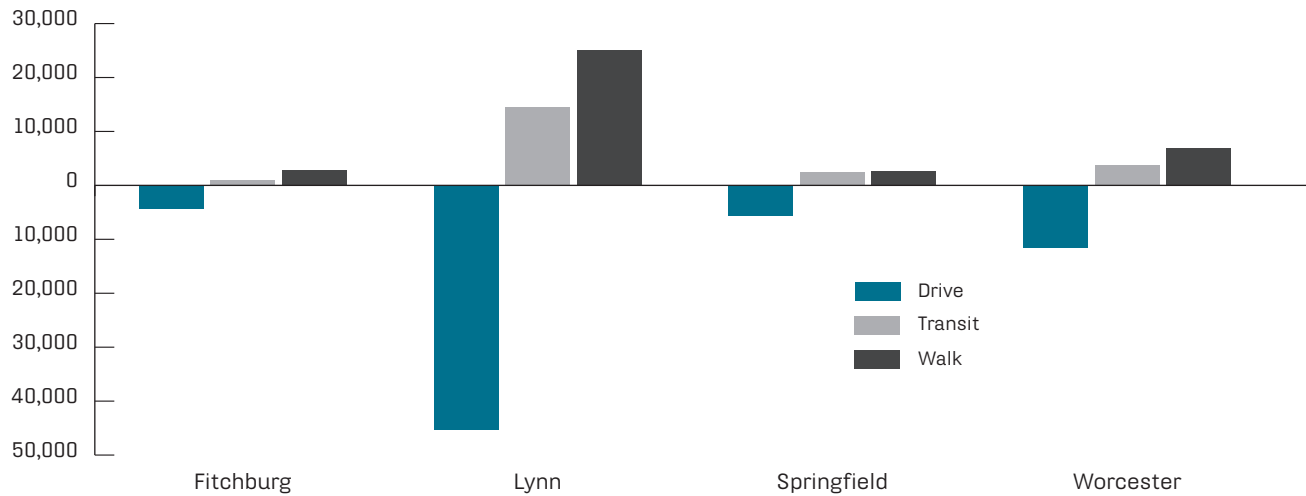
Assuming equivalent savings from home heating and cooling for a combined reduction of 1.6 million metric tons, optimal Gateway City TOD has the potential to offset \$126 million in GHG emissions annually.

5. Without a sound strategy, Gateway City real estate markets are unlikely to produce optimal buildout.

Using data from recent projects and detailed analysis of rents and land values, the research team built financial pro formas to test how far away the market is at present from generating three forms of development required to achieve optimal TOD buildout: mixed-use adaptive reuse, new mixed-use construction, and new commercial construction.

- **Mixed-Use Adaptive Reuse.** With the exception of Worcester, where rents are between \$1,500 and \$2,000 per unit, cash flows are too weak to refurbish older buildings and bring their systems up to code, assuming \$150 per square foot

Figure ES-4: Change in Daily Trips by Mode with Optimal TOD in Gateway Cities Compared to Business-as-Usual Development Patterns



Source: Kittelson Associates

(psf) construction costs. The estimated gap between revenue and development costs is largest in Springfield (43 percent), followed by Fitchburg (29 percent), and Lynn (19 percent).

- **New Mixed-Use Construction.** With slightly higher (\$175 psf) construction costs and new development drawing only modestly higher rent compared to adaptive reuse projects, pro forma models for this category produce essentially the same gap in Springfield (44 percent), Fitchburg (19 percent), and Lynn (24 percent). Worcester is the only city where new mixed-use projects are either at or approaching viability.
- **New Commercial Construction.** Pro formas for Class A office projects in Springfield and Worcester (larger economic centers with sufficient market data to constitute a model) also reveal financial gaps. With lower land acquisition costs, the estimated gap is narrower in Springfield than in Worcester (17 percent vs. 27 percent of development costs).

In addition to examining recent development projects, we also analyzed current local market conditions to gauge demand-drivers for TOD. In the four case-study cities, just 700 housing units are in the pipeline. Lynn accounts for more

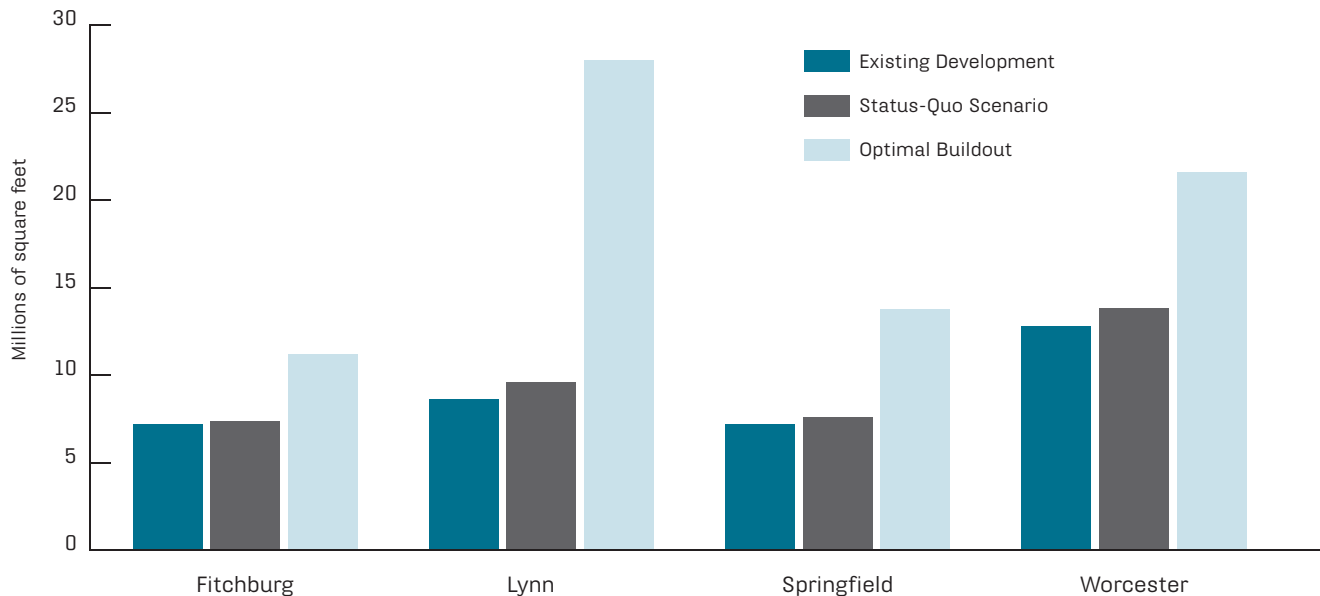
than half. Combining this pipeline with additional development needed to accommodate projected population and employment growth, we estimate a 12 percent increase in station area development over the next five years in Lynn. The other Gateway Cities are likely to draw far more modest levels of investment under status quo conditions (Figure ES-5).

Improvements in rail service could also help push rents up and close these gaps (many nationwide studies have shown increases in this range with the introduction of new rapid transit service), but gaps will likely remain in most Gateway Cities.⁷ To realize the promise of Gateway City TOD, Massachusetts will need a carefully honed strategy.

A Transformational Gateway City TOD Strategy

Massachusetts needs a Gateway City TOD strategy that measures up to its promise. At its core, this strategy must facilitate and coordinate public and private investment in both development and transit, balancing the responsibilities of the state with those of local communities. Below we summarize the contours of a comprehensive plan following these basic tenets.

Figure ES-5: Gross Square Feet of Development in TOD Districts, Status-Quo Scenario vs. Optimal Buildout



Source: RKG Associates and Hodge Economic Consulting

1. Facilitating and coordinating public and private investment in development:

- Adequately capitalize tools that can close financial gaps for catalytic projects.** Activating downtown Gateway City real estate markets that have endured decades of disinvestment will require an initial set of TOD projects at sufficient scale to generate mixed-use activity. Tools to close financial gaps in pioneering projects are the foremost priority. Without these tools, it will be difficult to alter the status-quo trajectory.

Massachusetts does have several programs to support housing development, but these tools are under-resourced. As result, they are difficult to utilize for Gateway City TOD projects, and the projects that do get built with them are often too small to generate activity that stimulates investment in neighboring properties. To remedy this problem, the state should devote additional resources to the Housing Development Incentive Program (HDIP) and MassHousing's Workforce Housing Program (WHP).

In order to foster vibrant downtown activity, Massachusetts also needs tools to generate equity investment in commercial and mixed-use development. While Massachusetts has fewer established models for financing commercial development in emerging markets, several promising options are within reach. They include the development of a state New Market Tax Credit (which 13 states have already adopted) or the creation of a tool to position Massachusetts for investors looking to utilize the new federal Opportunity Zone Tax Credit. The state could also look to provide more subordinate capital to private equity funds, such as the Healthy Neighborhoods Equity Fund (HNEF), which generates investment in mixed-use projects in transitional neighborhoods by sharing risk with private and philanthropic investors.

The state's economic development policymakers should convene a group of experts in community development finance and private equity to examine this diverse set of opportunities and recommend a path forward for financing commercial and mixed-use Gateway City TOD projects

Reference Guide to Gateway Cities with Current or Planned Commuter Rail Service

	DISTANCE TO BOSTON (RAIL MILEAGE)	NUMBER OF WEEKDAY INBOUND DEPARTURES	ONE-WAY FARE	POPULATION WITHIN 1/2-MILE OF STATION	JOBS WITHIN 1/2-MILE OF STATION	WEEKDAY RIDERSHIP
Attleboro	32	21	\$10.50	8,142	5,449	1,665
Brockton	20	12	\$8.25	8,568	6,839	778
Fall River*	51	6	NA	6,001	2,337	390
Fitchburg	54	17	\$11.50	6,603	4,137	516
Haverhill	33	15	\$10.50	8,592	4,112	576
Lawrence	26	15	\$10.00	10,288	5,885	722
Lowell	26	25	\$10.00	13,202	5,107	1,770
Lynn	12	27	\$6.75	9,033	11,568	662
New Bedford*	57	7	NA	5,538	3,046	480
Salem	17	34	\$7.50	3,837	7,422	2,122
Springfield**	25 (65)	12	NA	3,597	13,799	450
Taunton*	37	13	NA	3,713	1,139	420
Worcester	44	20	\$11.50	2,511	19,318	1,475

Source: ACS 2016 5-year estimates, ESRI Business Analyst, and MBTA

* Projections. See: "South Coast Rail Draft Supplemental Environmental Impact Report" (Boston, MA: Massachusetts Department of Transportation, January 2018).

**Inbound departures to Hartford (New Haven). The MassINC research team adjusted projected opening day ridership up to 450 from 350 based on a larger catchment area. See: www.nhhsrail.com

- **Provide sufficient state funding to carry out a land acquisition strategy.** With the tools to finance Gateway City TOD described above, interest in these markets from private developers will blossom. State resources will be needed to help communities steer this development activity to locations where projects can have maximal impact.

Massachusetts recently established the Commonwealth Site Readiness Fund (CSRF) to support land assembly for both downtown development and suburban office parks. This fund lacks the resources to serve both purposes. By directing additional capital to the CSRF for Gateway City TOD, the state can ensure that it gets the most return possible from far more substantial investments in rail infrastructure and Gateway City development.

- **Utilize the Transformative Development Initiative (TDI) to enhance local capacity and coordination.** The state has an obligation to invest only in communities that have done their part to develop and execute on a market-driven TOD plan. At the same time, we

must appreciate that communities face difficult internal challenges in this regard. Created by 2014 economic development legislation, MassDevelopment's Transformative Development Initiative (TDI) recognizes and responds to this reality. As state and local officials work together to coordinate investment around transit, there is an even higher imperative for thinking creatively about opportunities to augment and sustain the enhanced technical assistance that TDI uniquely offers.

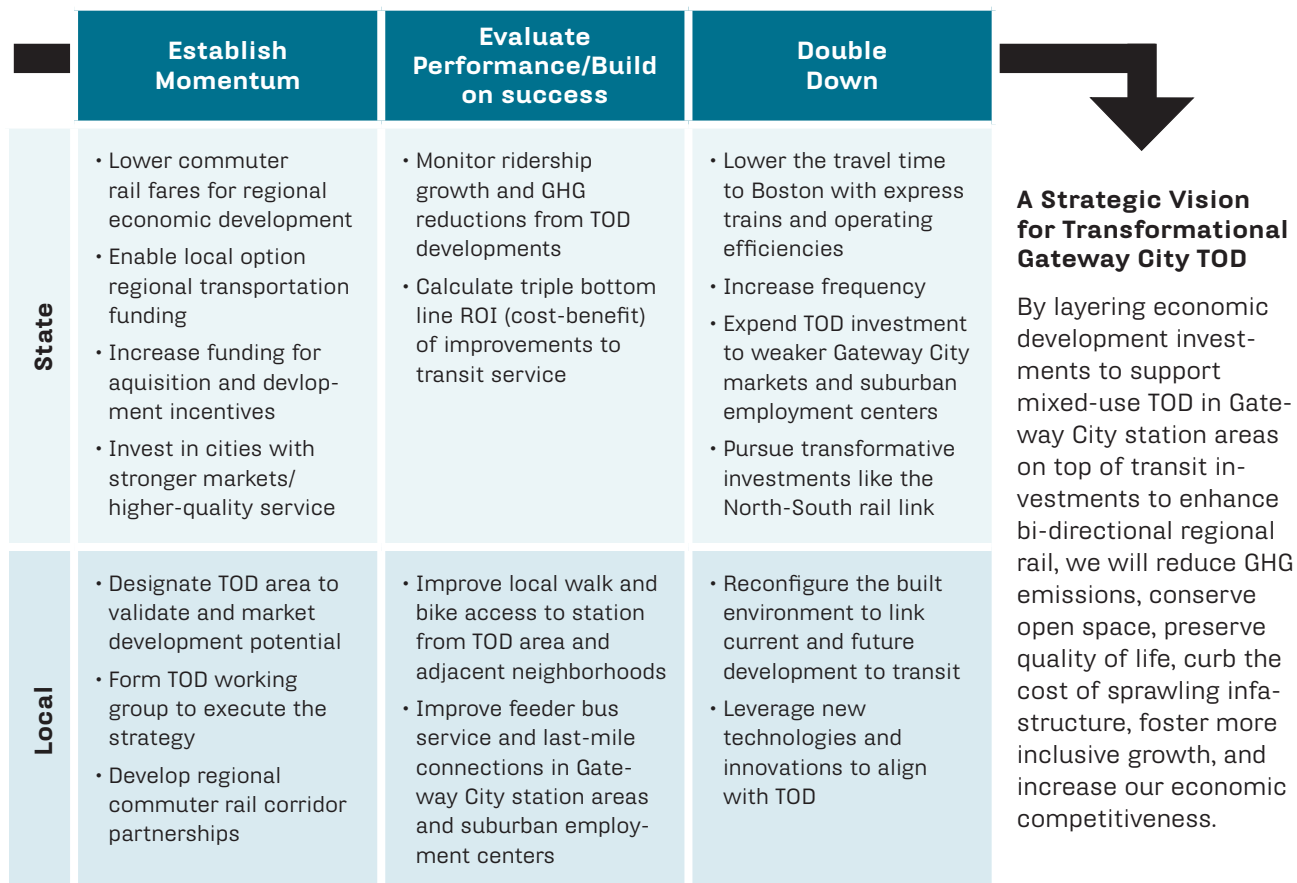
2. Facilitating and coordinating public investment in transit:

- **Lower commuter rail fares.** For TOD to occur in most Gateway Cities, a more rational fare structure is a prerequisite. Current fares are simply cost-prohibitive for most low- and moderate-income residents. In addition to the sound economic justice arguments, there is a compelling environmental argument for lowering commuter rail fares, *if* it is done with a location preference. For many riders, commuter rail supports decentralized growth and a larger carbon footprint; the opposite is true for those

that live and work near stations.

The state could reap the greatest benefit at the least cost by providing significantly lower commuter rail fares to these riders. While administering such a policy would present challenges, new automated-fare collection technology provides an opening to overcome these obstacles. Massachusetts is also in a unique position to adopt such a policy with an ideal revenue source to cover the agency's fare losses: auction payments from the Regional Greenhouse Gas Initiative (RGGI). In the near term, the MBTA would draw minimally on this limited pool of funds with few people commuting to and from Gateway City station areas. If Massachusetts moves forward with plans to institute a transportation sector cap-and-trade program, additional revenue will be available to subsidize the lower urban center fare as ridership grows along with development.

- **Empower regions to generate transportation revenue locally.** From electrification of rail lines to increase speed and reliability, to last-mile feeder bus service to improve access to office parks near suburban stations, Gateway City TOD and the associated ridership gains may provide a stronger basis for a variety of transit improvements in the future. To encourage communities to pursue a broader vision for Gateway City TOD and regional economic development, at this stage the how is more important than the *what*. Throughout the country, transformative transportation projects are happening where regional transportation agencies are empowered to advance projects by putting local option taxes before the voters in their jurisdictions. By passing pending legislation this session, Beacon Hill can give communities in Massachusetts this same possibility.

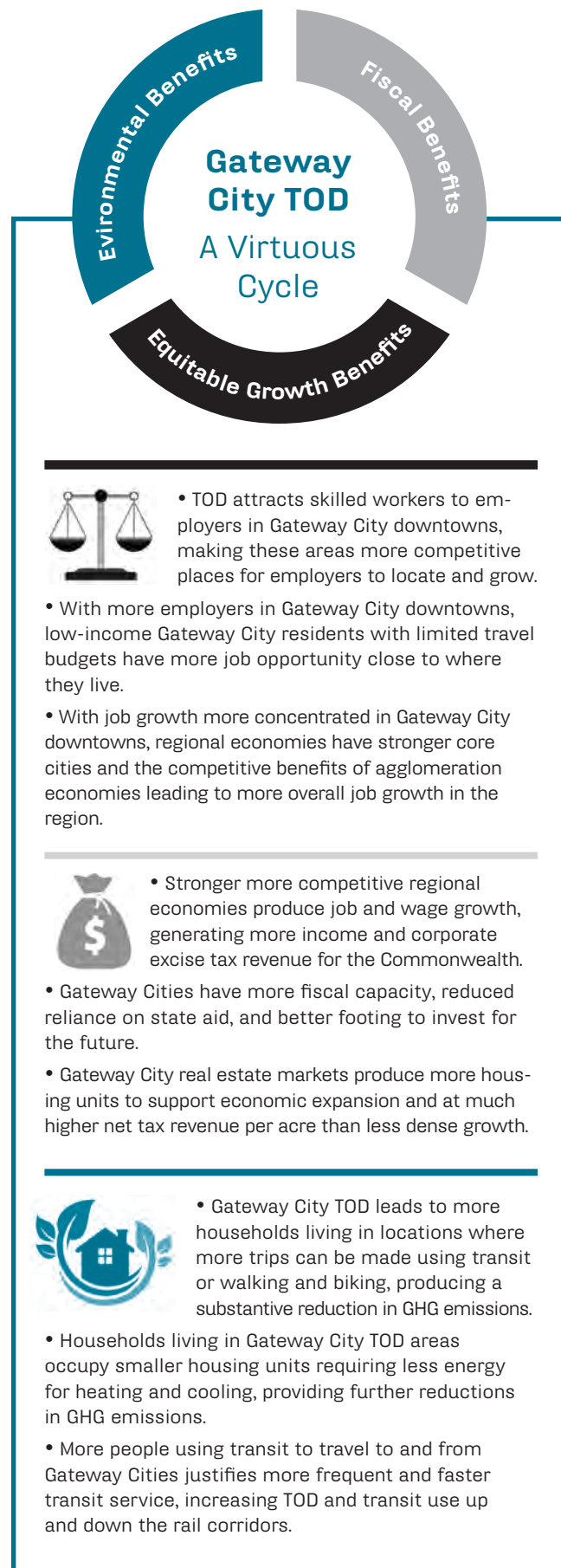


3. Balancing the responsibilities of the state with those of local communities:

While the state has a critical role to play delivering assistance and financial resources, and empowering regional agencies, success ultimately depends on effective action at the local level. Local vision and leadership are absolutely essential to nurturing relationships with developers and drawing private sector investment. Local vision and leadership are also vital to delivering improvements to the public realm to make station areas more inviting and accessible. And local vision and leadership are central to collaboration with regional partners to make commuter rail corridors more marketable and prosperous.

By taking these five actions, Gateway City leaders can show these various partners that they are serious about leading the way on transformational transit-oriented development:

1. Develop a TOD plan to encourage walkable, mixed-use development near rail and provide a more precise accounting of development potential in station areas and adjacent neighborhoods.
2. Form a TOD working group to implement the local TOD plan.
3. Develop parking strategies and facilities that align with the TOD plan.
4. Focus MassWorks infrastructure applications and Complete Streets Grants on projects that will spur redevelopment in TOD areas.
5. Collaborate with regional leaders and municipalities to create rail-focused economic corridors and governance models.





Chapter 1:

Why Gateway City TOD Merits Serious Consideration

Our strong economic performance of late belies how hard it will be to keep growing the Massachusetts economy in a manner that benefits all.

In many corners of the state, the economic base is still eroding, with young workers and entrepreneurs migrating to Boston and other large cities in search of opportunity.⁸

At the same time, Greater Boston is quietly running out of land: accommodating future commercial development in the region will only get tougher; housing the workers Boston area businesses need to expand presents an even more intractable problem.⁹

Absent an aggressive response to these distinct challenges, the Massachusetts economy will perform sluggishly as the population ages, and the gains that we do see will continue to skew heavily toward those with advantages. Following this course is certain to intensify the state's fiscal issues, making it harder to deliver the investments in human capital and infrastructure that the economy needs to remain globally competitive.

Gateway Cities present an opportune response to these thorny growth problems. Eastern Massachusetts Gateway Cities offer a reservoir of development potential to meet demand in Greater Boston. And Gateway Cities that anchor regional economies in other parts of the state provide leverage to generate more geographically-balanced growth.

Gateway Cities are also socioeconomically diverse, which means that regardless of where they lie, growth that occurs within their borders disperses more evenly among those striving for economic opportunity in our Commonwealth. Directing more growth

to Gateway Cities is also likely to conserve open space, preserve quality of life, and reduce the costs of sprawling infrastructure.

The unique opportunity Gateway Cities present is increasingly accepted. It is no longer a strategic question of whether our older industrial cities have a role to play in the future, but rather, it has become a tactical question of how we unlock the full potential of these historic urban centers.

Over the past decade, policymakers approached this question tentatively. Previous MassINC research shows state funds have flowed into Gateway Cities to resurface downtown sidewalks, upgrade streetlights, and green public parks. Modest public investment has gone to programs to spur business development. Although quite limited, the public sector has also led more direct efforts to stimulate reinvestment in downtown real estate, which depreciated for more than a generation, while these cities sat in limbo with uncertain futures. By a wide margin, however, K-12 school facilities and state office buildings have received the largest share of public investment in Gateway Cities.¹⁰

This finding speaks to the absence of a more robust plan to catalyze private sector growth. The market's tepid response is equally telling; Gateway Cities have seen significantly less private investment in the current real estate cycle than during the previous one, even as demand for both residential and commercial real estate in walkable, mixed-use urban neighborhoods has risen throughout the US.

If authentically-urban Gateway City real estate has similar intrinsic value, then unlocking this potential is a matter of

positioning the market to overcome decades of disinvestment. We must be strategic and calculating with our approach. Public dollars are limited and the number of Gateway Cities requiring attention will tend to make any effort diffuse. Given the way in which the Commonwealth's economy is evolving, transit-oriented development (TOD) presents a potentially promising place to pinpoint scarce resources.

Cultivating Old Rail Lines as Shoots for New Growth

Most Gateway Cities have existing rail connections, some dating back over a century to a time when these mill towns were industrial powerhouses in their own right. Today, these underutilized lines provide veins for Gateway City regions to tap into the dynamism of the Boston and New York metro areas, and alternatively, to give these hot economies access to urban land ripe for dense development.

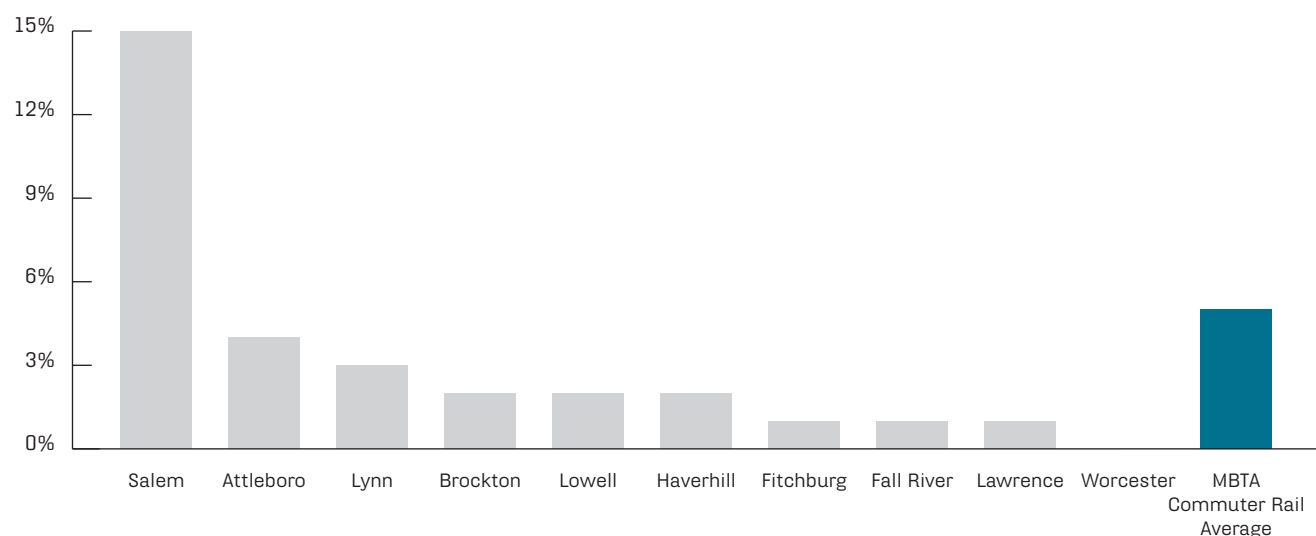
While Massachusetts is far from having a clear policy establishing inter-city passenger rail as a serious regional economic development strategy, state capital spending suggests incremental movement in this direction. Numerous investments have been made in recent years to upgrade rail lines and improve service. The list includes the acquisition of Worcester Line freight rail rights to enable express commuter rail service

to Boston; improvements on the Fitchburg Line to enhance commuter rail scheduling and increase speed; the development of a new commuter rail service from New Haven to Springfield; restoration of Amtrak service north of Springfield to Holyoke, Northampton, and Greenfield; and efforts to extend commuter rail to Fall River, New Bedford, and Taunton.

Absent other changes, these transit investments are unlikely to generate strong returns. For starters, service tends to be expensive, slow, and unreliable. And MBTA commuter rail is still mostly oriented toward carrying suburban residents to office jobs in downtown Boston. There has been no concerted attempt to build reverse commute ridership so that Gateway City employers can draw from their rail corridors' labor force. With talent moving only in one direction, our regional transit assets tend to reinforce geographically unbalanced growth.

Addressing these service limitations with the long-term aim of creating a more dynamic relationship between regional urban centers may offer a resourceful strategy to catalyze private investment in Gateway Cities, but the state cannot upgrade passenger rail without also considering how it will ensure that weak Gateway City real estate markets produce optimal development as they revive. When it comes to generating ridership and all of the associated benefits, the form and function of development in station areas is just as important as the operation of the rail itself.

Figure 1-1: Share of Workers Living within a Half-Mile of MBTA Station Commuting to Work by Rail



Source: ACS 2016 5-year estimates

Creating a New TOD Paradigm for Gateway Cities

Across the country, TOD is leading to more efficient, productive, and sustainable growth in major cities like Boston. Developers working in these markets have learned how to partner with the public sector to assemble a complementary mix of uses around transit assets, creating cohesive, pedestrian-friendly environments that generate as much value as possible for the public transit system, private landholders, and the regional economy more broadly.

Census figures show just how far Gateway Cities are from getting this form of development to take hold. Despite the walkable nature of these communities, Gateway City stations are currently among the lowest-performing in the system when it comes to drawing commuters within walking distance of a station (Figure 1-1); on average, only one out of every 50 Gateway City commuters living within a half-mile of an MBTA station takes the train to work.

While data at the workplace level are unavailable, given the extremely low flow of commuters travelling from Boston outward or inter-zone from other stations along the line, it is almost certain that an even smaller proportion of those employed near Gateway City stations ride the train to work.¹¹

By no means is this unusual; in the US, successful TOD in smaller cities served by commuter rail lines is rare. The few examples tend to be in affluent communities with wealthy households that can pay expensive fares and inject disposable income into Main Street businesses. And generally these places have long been choice communities with high real estate values, which makes financing the first set of TOD projects a much simpler proposition.

The Transformative Promise of Gateway City TOD

If Massachusetts can breakout with a new paradigm that responds to the barriers present in our Gateway Cities, it could have transformative power. Consider these interwoven, economic, fiscal, and environmental benefits of Gateway City TOD:

Equitable Economic Growth Benefits

- TOD will attract more skilled workers to employers in Gateway City downtowns, making these areas more competitive places for employers to locate and grow.
- With more employers in Gateway City downtowns, low-income Gateway City residents with limited travel budgets will have more job opportunities near where they live.
- With job growth more concentrated in Gateway City downtowns, regional economies will have stronger core cities and the competitive benefits of agglomeration economies. Over time, this will lead to more job growth overall and more regional employment opportunities for residents of Gateway Cities and nearby communities.
- Dense infill will produce more housing to support labor market growth. With more homes near strong transit service, employers connected to transit will have a larger labor shed (i.e. they can access a larger number of potential workers when filling jobs). This will lead to efficiencies and competitive advantage, particularly in a dynamic innovation economy with high job churn.

Fiscal Benefits

- Strong and competitive regional economies will produce job and wage growth, generating more income and corporate excise tax revenue for the Commonwealth.
- Creating value through TOD in Gateway Cities will increase the fiscal capacity of these communities, reducing their reliance on state aid.
- Transformation of weak Gateway City real estate markets with TOD will help the state produce more housing units sooner, facilitating overall economic and fiscal growth, and providing much higher net tax revenue per acre than business-as-usual growth that is more geographically spread out and costly to sustain.

Environmental Benefits

- Gateway City TOD will lead to more households living in locations where more trips can be made using transit, walking or biking. Compared to those living in less dense locations, residents living in Gateway City TOD areas who do travel in cars will not need to drive as far

to reach many of their destinations. The reduced auto travel mileage will produce a substantive reduction in GHG emissions.

- Compared to those living in less dense locations, households living in Gateway City TOD areas will have smaller housing units with more shared walls, requiring less energy for heating and cooling, providing further reductions in GHG emissions.
- More jobs and population in urban centers will justify more frequent and faster service along regional rail lines, increasing TOD and transit use up and down the rail corridors.

A Timely Look at the Potential for Gateway City TOD

Over the coming months, policymakers in Massachusetts will be looking hard at a variety of issues that could dictate the future of Gateway City TOD.

Governor Baker recently named an 18-member commission to examine our long-term transportation needs and report out by the end of the year. MassDOT is building a rigorous framework for evaluating prospective transportation investments through Focus 40. Recently, the advocacy group TransitMatters set the stage for thinking about investments to facilitate Gateway City TOD, in a report calling for a transition from our outmoded suburb-to-city commuter rail system to a more frequent and faster bi-directional “regional rail” model.¹² MassDOT has already initiated a major study to think anew about how it can best manage the commuter rail network—including more in-depth analysis of many of the bold strategies TransitMatters has put forward—before entering the next long-term operating contract in 2022.

While transportation leaders plan for the future, tools to spearhead redevelopment in Gateway Cities are also in flux, with new community reinvestment provisions in the federal tax bill and the Legislature considering end-of-session housing and economic development bills.

Against this backdrop, valuable lessons from the initial roll-out of MassDevelopment’s Transformative Development Initiative (TDI) are emerging. Born out of MassINC research and concerted effort from the Gateway Cities Legislative

Caucus, with very modest resources, TDI works to facilitate the kind of district-scale redevelopment and placemaking activity that is at the core of good TOD—8 of the initial 10 TDI districts have current or planned transit service.¹³

At this crossroad, this report offers an objective look at whether there are opportunities and models for deploying TOD as a driver of Gateway City renewal and regional economic development. Our hope is that these findings will spark dialogue and creative thinking among local officials, as well as state transportation and economic development leaders crafting integrated strategies to support future growth.

We continue with a theoretical look at the economics of TOD in various Gateway City contexts (Chapter 2). We then probe deeper, asking and answering four threshold questions, including:

1. How much capacity do Gateway City station areas have to absorb additional development, respecting their current scale and density? (Chapter 3);
2. Can Gateway City real estate markets produce optimal levels of development in these station areas? (Chapter 4);
3. Does the commuter rail system have capacity to support significant new ridership from Gateway City TOD? (Chapter 5); and
4. How large are the potential climate benefits of Gateway City TOD? (Chapter 6).

To delve into these questions, we constructed detailed real estate and transportation models for four case-study cities with varying market contexts (Fitchburg, Lynn, Springfield, and Worcester). Using parameters derived from these models, we then extrapolated to the full set of 13 Gateway Cities with current or planned commuter rail service. Driven by this in-depth analysis, the concluding sections offer a range of actions that state and local leaders (Chapter 7 and Chapter 8, respectively) can take to catalyze transformative transit-oriented development in Gateway Cities.

Reference Guide to Gateway Cities with Current or Planned Commuter Rail Service

	DISTANCE TO BOSTON (RAIL MILEAGE)	NUMBER OF WEEKDAY INBOUND DEPARTURES	ONE-WAY FARE	POPULATION WITHIN 1/2-MILE OF STATION	JOBS WITHIN 1/2-MILE OF STATION	WEEKDAY RIDERSHIP
Attleboro	32	21	\$10.50	8,142	5,449	1,665
Brockton	20	12	\$8.25	8,568	6,839	778
Fall River*	51	6	NA	6,001	2,337	390
Fitchburg	54	17	\$11.50	6,603	4,137	516
Haverhill	33	15	\$10.50	8,592	4,112	576
Lawrence	26	15	\$10.00	10,288	5,885	722
Lowell	26	25	\$10.00	13,202	5,107	1,770
Lynn	12	27	\$6.75	9,033	11,568	662
New Bedford*	57	7	NA	5,538	3,046	480
Salem	17	34	\$7.50	3,837	7,422	2,122
Springfield**	25 (65)	12	NA	3,597	13,799	450
Taunton*	37	13	NA	3,713	1,139	420
Worcester	44	20	\$11.50	2,511	19,318	1,475

Source: ACS 2016 5-year estimates, ESRI Business Analyst, and MBTA

* Projections. See: "South Coast Rail Draft Supplemental Environmental Impact Report" (Boston, MA: Massachusetts Department of Transportation, January 2018).

**Inbound departures to Hartford (New Haven). The MassINC research team adjusted projected opening day ridership up to 450 from 350 based on a larger catchment area. See: www.nhhsrail.com

The Potential of Gateway City TOD: Delivering more equitable access to economic opportunity in Massachusetts

A major challenge with the current TOD paradigm in the US is that it is pricing low-income households out of urban neighborhoods that have strong transit service and proximity to growing job centers. While Massachusetts is exceptionally committed to affordable housing production, we have not been immune to this problem.

Recent Census figures show that more than a quarter of residents pushed out of Boston neighborhoods to Gateway Cities lack access to a vehicle. They must now find their way around in communities where local bus transit service is limited and high fares make commuter rail cost-prohibitive.

A Gateway City TOD paradigm that responds to this challenge with service improvements and affordable fares could provide low-income residents in eastern Massachusetts Gateway Cities with connections to employment opportunities in Boston, where they are likely to earn better pay.

Gateway City residents who do commute into Boston for employment earn approximately 30 percent more compared to residents employed locally with similar levels of education. While occupational data are more limited, the few comparisons we can make by looking at the most common professions show that even when working the same kind of job, Gateway City residents who commute to Boston are able to earn a “wage premium” of approximately 20 percent (Figures 1-2 and 1-3).

Currently, very few Gateway City residents make this trip. Only a fraction of those who do make this trip use the train (Figure 1-4).

Getting more Gateway City residents to jobs in Boston is not the only way that this strategy could lead to more equitable economic development. Gateway City TOD could also stimulate more employment growth directly in these inclusive cities, where jobs would be more accessible to low-income households. For generations, Gateway City residents had thousands of good jobs within walking distance to their neighborhoods. Proximity to work was key to making these communities places where low-income households could gain their footing and climb up into the middle class.

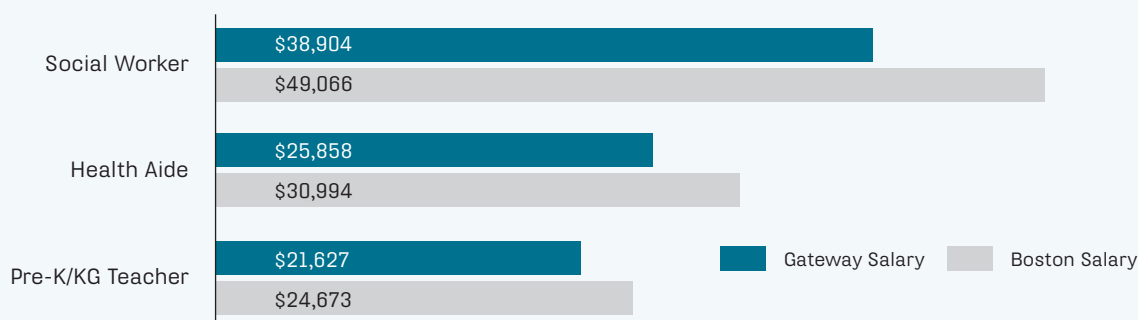
With job growth in Gateway City regions occurring mostly in the suburbs over the past several decades, low-income residents (many of which lack a vehicle) find it increasingly difficult to commute to good jobs. A large body of research demonstrates how this has adversely impacted their employment outcomes.¹⁴ Labor force participation is one of the best ways to gauge the magnitude of the problem. Even in this relatively strong economy, Gateway City labor force participation rates are running 5 to 10 percentage points below the state average. This equates to a net loss of 40,000 potential workers across the Commonwealth’s Gateway Cities.

Figure 1-2: Percent Difference in Average Wage, Gateway City Residents Working in Boston Compared to Gateway City Residents Working in Gateway Cities by Educational Attainment



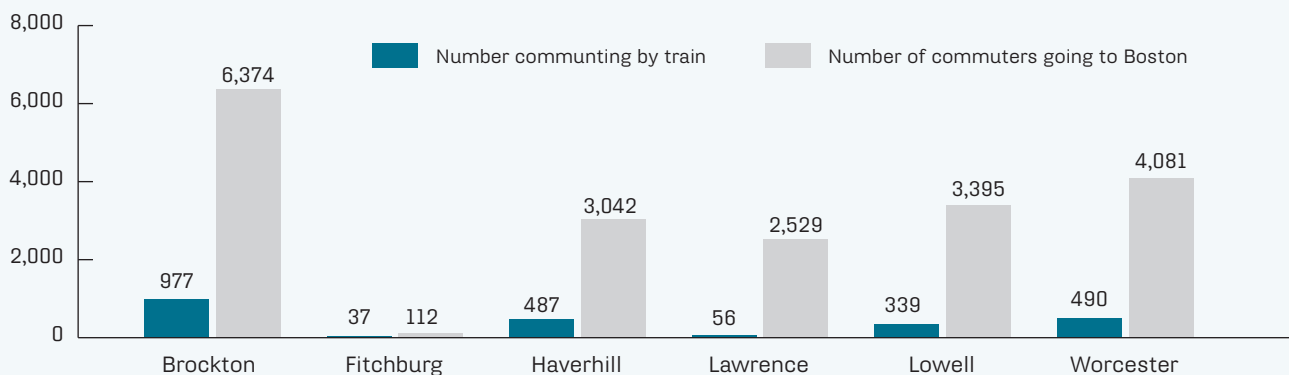
Source: ACS PUMS 2016 5-year sample

Figure 1-3: Gateway City Resident Annual Wages by Selected Occupations and Place of Work



Source: ACS PUMS 2016 5-year sample

Figure 1-4: Number of Gateway City Residents Commuting to Boston by Mode



Source: Census LEHD 2015



Chapter 2:

The Economics of Transformative Gateway City TOD

Gateway City TOD ultimately rests on economics; market forces drive land use, and the broader social and environmental benefits associated with transit and compact urban development. To dispassionately weigh the full suite of benefits Gateway City TOD *could* produce, leaders must first assess the economic case.

At first blush, the economic fundamentals are decidedly against TOD projects in Gateway Cities. Rents are too low to support residential development in station areas and there is generally even less demand for commercial space in Gateway City downtowns. However, there are signs that policies to foster TOD could tap into powerful market forces taking shape, leading to positive economic, environmental, and social benefits for the Commonwealth. In this chapter, we consider this evidence to assess the economic rationale for a Gateway City TOD strategy in both Greater Boston and the Pioneer Valley.

I. Greater Boston

Evaluating the potential for Gateway City TOD from the perspective of the Greater Boston economy begins with appreciating just how well the region is performing at present. On a composite index compiled by *The Economist*, the region is the 19th most competitive in the world; Boston falls in the fifth position on AT Kearney's Global Cities Outlook index; as measured by per capita production, Boston ranks seventh

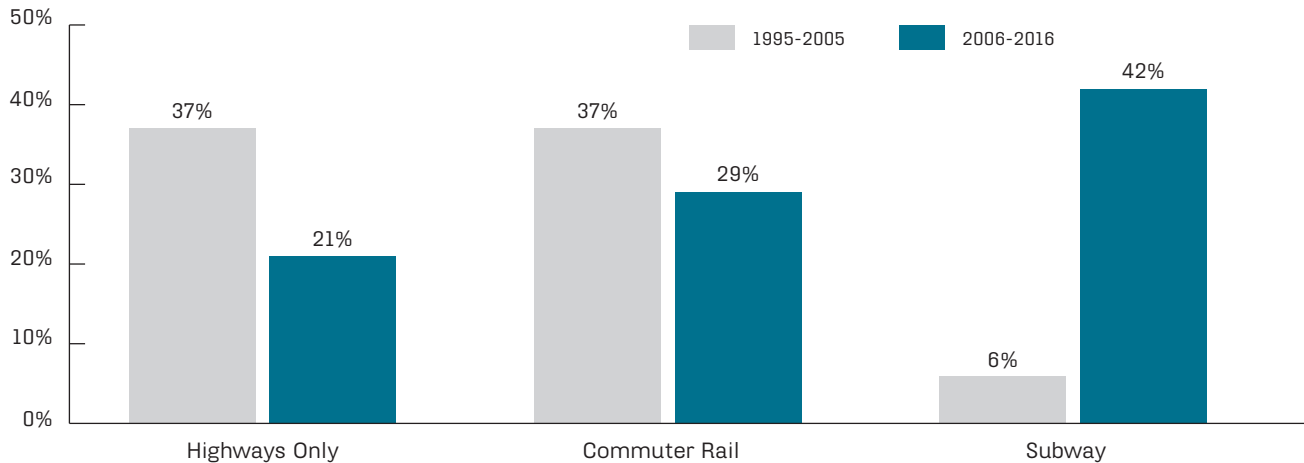
among the world's largest 300 metro areas.¹⁵ To retain this competitive position amid increasing global competition for advanced knowledge industries, we must address very real concerns about the region's ability to accommodate future growth—the region will need more skilled labor and more productive locations for business expansion. These two needs form the basis for future TOD markets in Gateway Cities.

Increasing the Effective Size of the Labor Market

Boston's success, and the success of global cities in an increasingly urbanized world, is attributable to what economists call "agglomeration economies." Most Boston-area leaders are familiar with research by Harvard economist Ed Glaeser and others demonstrating how these forces are created by packing people and related businesses in dense clusters, where they can exchange knowledge and innovate.¹⁶ However, as powerfully illustrated in a recent report from A Better City, we often take for granted the extent to which achieving the enviable agglomeration economies found in Kendall Square, the Longwood Medical Area, and the Seaport District is fundamentally a function of transportation.¹⁷

Innovative regional economies depend on a large pool of workers with specialized skills that employers can draw from to meet their needs at any given point in time. The more transportation systems expand the potential pool of workers, all else being equal, the more competitive a region becomes.¹⁸

Figure 2-1: Share of State's Net Job Growth by Transportation Infrastructure



Source: MA Department of Labor and Workforce Development

Note: Data aggregated at the municipal level based on stations and exit ramps within town boundaries.

In recent years, we have seen the impact of rising returns to agglomeration in our innovation economy. Employer after employer has migrated to Boston's urban core, where robust transit service provides them with the widest possible labor market draw. Figure 2-1 shows just how dramatic the swing to employment growth in these locations has been over the past decade. Communities with high frequency subway service accounted for 42 percent of all net job growth in Massachusetts between 2006 and 2016; this same set of communities generated just 6 percent of the state's net job growth during the previous 10-year period.

Residential growth in areas with strong subway service was crucial to supporting employment growth in these locations. In 1996, communities served by subways accounted for just 7 percent (707 units) of all new housing permitted in Massachusetts; in 2016 they produced one-third of all new residential units in the state (4,121 units).

While these communities generally remain pro-growth, continuing to expand near transit in the inner core will be difficult. Assessor's data assembled by the Metropolitan Area Planning Council (MAPC) show that there are just 150 acres of developable residential land within a half-mile radius of MBTA subway stations. MAPC projections suggest the region will need as many as 233,000 new housing units to accommodate anticipated growth through 2030.¹⁹

Redevelopment of existing structures at higher densities could certainly produce additional housing in these locations, but this would likely mean costly construction on top of already pricey land, making it extremely difficult to expand housing supply for working families.

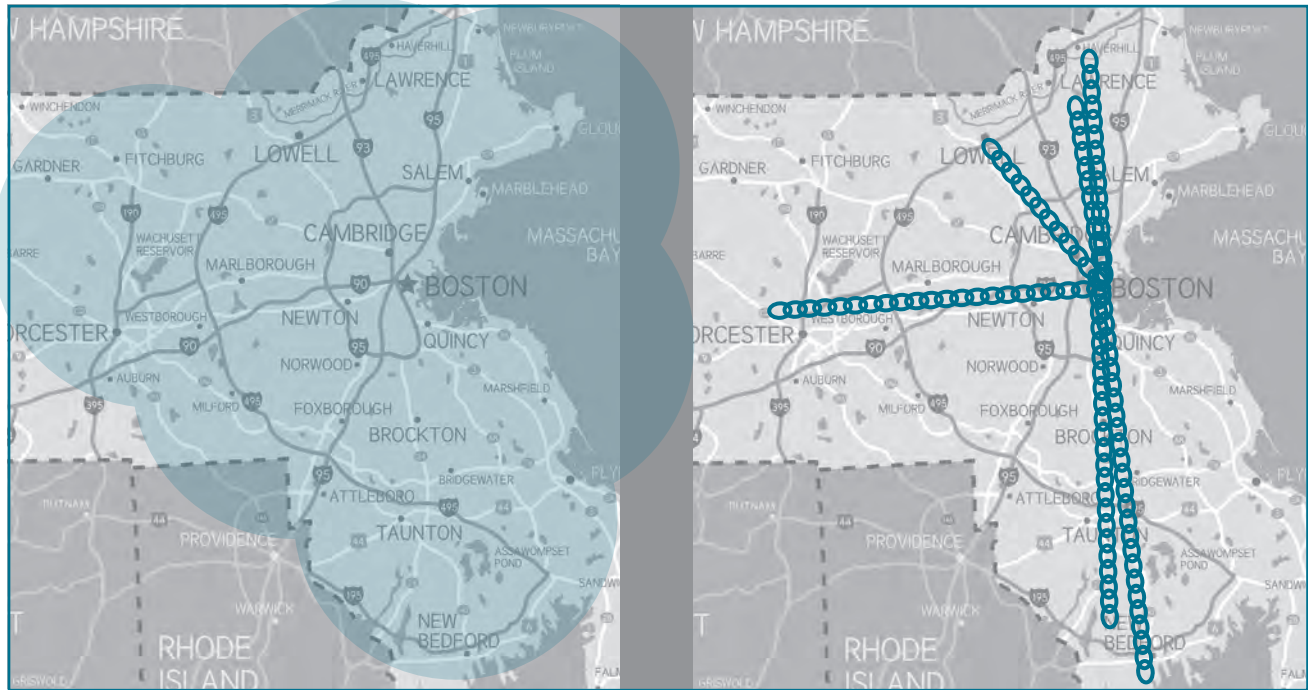
With the economy increasingly driven by agglomeration and thick labor markets full of workers with diverse skill sets, a strengthening market for residential housing in Gateway Cities near transit seems likely.

Supporting the growth of competitive business clusters with linkages to Boston

Finding room to grow emerging new industries is arguably an even more pressing challenge for Greater Boston. Recent expansion in Assembly Square, Cambridge Crossing (Northpoint), and the Seaport District have all been unique opportunities. While others remain (Allston, Suffolk Downs), sites to cluster future commercial growth around housing and strong multi-modal transportation infrastructure are increasingly scarce in the region's core.

All large regions face this dilemma. Those that can nimbly accommodate commercial development outside of their central cities—but not so far away that they lose all connectivity to the core—have greater rates of new business formation. By

Gateway Cities lie in the “agglomeration shadow” of Boston; TOD/regional rail could position them to get out from under it by “borrowing size.”



expanding employment in new growth sectors and diversifying their economies, these regions are also better positioned to adapt to changing economic forces.²⁰

Boston is challenged in this regard, and once again, opposition to housing production is the primary culprit. In the most competitive larger regions, as business growth moves out of the core to locations that lack transit, workers will choose to live near their place of work to make their commute more manageable. This pattern of decentralized growth doesn't work well in Greater Boston because so many communities are resistant to new housing, making it difficult for employees to reduce their commute by residing close to their place of work.

Herein lies the economic argument for a Gateway Cities response to this condition: A growing body of evidence suggests a large center city connected to smaller cities allows regions to maximize benefits from agglomeration, while minimizing congestion and other inefficiencies that come with size.²¹ For this to occur, however, these smaller cities

must develop functional relationships with the large core to “borrow size” (i.e., gain access to the skilled labor, R&D, and connections to global cities that come with scale).²² When these functional relationships are not present, smaller cities tend to fall in the “agglomeration shadow,” where the competitive advantage gain in the central city makes it difficult for others to compete nearby.²³

At present, this concept of a shadow that limits economic competitiveness is more descriptive of Gateway City markets. This is particularly evident in commuting patterns, one important measure of economic integration. Fewer than 1 in 10 residents from Lawrence and Lowell commute to the Boston area for work, and only about 1 out of 20 make this trip from Gateway Cities in central Massachusetts and along the South Coast. Labor exchange in the opposite direction is even weaker; Boston and Cambridge residents make up an extremely small share of workers at businesses located in Gateway Cities.

Over time, improved transit service that moves people quickly through congested metropolitan space to regional

cities with ties to Boston's research and development activity, expert service providers, and global connections could lead to a strong commercial TOD market in Gateway Cities.

II. The Pioneer Valley

The Pioneer Valley offers a sharp contrast to Boston. While the metropolitan area has a long history of manufacturing prowess, its economic pulse has slowed as its traditional industrial clusters lose strength. Despite a strong set of “eds and meds” to serve as anchors, outmigration of skilled workers, an aging population, and increasing concentrations of poverty put its economic future in jeopardy.²⁴ For years, the state has struggled to find a sound economic strategy to counter these forces. Transit-oriented development enabled by a new Union Station in Springfield and 2018 upgrades to rail service connecting the Pioneer Valley to Connecticut and the New York metro area may provide a new opening.

With approximately 50,000 entrepreneurial startups annually and 500,000 businesses, the New York metro area has about five times as much business activity as Greater Boston.²⁵ The passenger rail service set to begin this year to increase from six to 12 roundtrips each day will give Springfield a much more robust connection to Hartford, New Haven, and New York. While the Connecticut cities have also struggled with decades of disinvestment, they continue to anchor highly productive regional economies with a strong set of institutional employers.

With agglomeration forces continuing to gain strength, new rail services could help to centralize future growth in these transit-connected urban centers. Such an outcome would be extremely beneficial for the Pioneer Valley (which is also working with state leaders to increase rail service north of Springfield to Holyoke, Northampton, and Greenfield). The tendency is often to discount the benefits of agglomeration in small regions with less high-tech and venture capital, yet research suggests otherwise—smaller regions actually generate more incremental growth when they centralize development in their core.²⁶

Given the relative weakness of the broader regional economy, it is likely that rail and TOD policies will need to be combined with a more robust economic development effort to generate momentum in these markets. The UK's North-

Transportation for Regeneration in Northern England

In order to increase productivity and fuel economic growth in the North of England, the UK has embarked on the ambitious **Northern Powerhouse Project**. Transportation improvements are a central component of this strategy to drive investment into the region's core cities. New high speed rail lines will cut the journey from London to Manchester in half (from just over 2 hours to just over one hour), and take nearly an hour off the trip from London to Leeds (from 2 hours 20 minutes to 1 hour 28 minutes). Through the **Great North Rail Project**, the UK has already made dramatic improvements to rail service connecting northern cities, investing \$400 million to electrify service between Leeds, Manchester, and Liverpool.²⁷ In total, \$100 billion in public investment will focus on creating closely integrated cities, labor markets, and industry supply chains to boost economic competitiveness. This includes creating or expanding a number of large university-based applied research institutes and workforce development initiatives in related industries.

ern Powerhouse Project (see sidebar) is an example of an ambitious effort to coordinate transportation and economic development investments to build new agglomeration economies and fuel regional economic growth.

Pursing Gateway City TOD amidst a Great Deal of Uncertainty

While Gateway City TOD presents an alluring opportunity, planners and policymakers devising a program to harness this transformative power must cautiously factor a range of interrelated scenarios, including changing demographics, employer location preferences, and transportation technology. Across all three of these dimensions, considerable disruption is likely.

We are already starting to feel demographic fluctuations as baby boomers begin their exodus from the workforce. If these older households migrate to warmer, lower-cost states en masse, it will open up new housing for younger households. However, if most of these retirees choose to stay in Massachusetts, it will put added pressure on the state's already tight housing stock.

At the other end of the spectrum, household formation is another important unknown. In the years since the Great Recession, young workers have been living at home longer, reducing demand for housing. While the economy has improved dramatically, housing in Boston is increasingly out of reach.

The availability of desirable and affordable housing in Gateway Cities with strong transit service (a major preference for millennials) could bring more of these young residents back into the market, while providing an attractive option for boomers looking to downsize their homes and remain in Massachusetts.²⁸

Changing employer location preferences is also an important consideration. Boston absorbed an extremely outsized share of new jobs over the past decade. If we continue to squeeze more jobs into the core, it will place a higher premium on locations connected to the city by heavy rail lines. This pattern might also foreshadow increasing employer interest in walkable, transit-served locations outside of the Boston core, as opposed to the business-as-usual pattern of commercial development clustering outside of Gateway Cities in suburban office parks.

Innovations in travel looming on the horizon may have the most powerful role shaping the market for Gateway City TOD. Most anticipate the arrival of autonomous vehicle (AV) technology in the coming decade. In the relatively near future, AVs may or may not replace private vehicle ownership, free urban land currently used for parking, and generate significant reductions in congestion along urban roadways.

How innovative transport plays out for Gateway Cities could ultimately depend on what these communities do in the interim. Gateway Cities removed their streetcar systems around the time of the Great Depression and ever since they have been auto-centric. This has taken a toll on their pedestrian environment, particularly where urban renewal projects upended traditional street grids. Many Gateway Cities are working to reverse this damage and restore a strong sense of place at the street level, but they face formidable obstacles, particularly when residents often continue to strongly back burdensome parking requirements and other planning decisions that favor vehicle travel.



BROCKTON

Chapter 3:

Estimating TOD Development Capacity at Optimal Buildout

With a sound economic argument for pursuing a Gateway City TOD strategy, the first threshold question we must answer is: *How much untapped capacity do Gateway City station areas have to absorb additional development?*

To consider this question, we first need a common understanding of what “at optimal buildout” looks like. We believe the answer is development that reflects the current scale and character of each Gateway City with a mix of uses that fully capitalize on the transit asset.

In this chapter, we present granular estimates of the additional TOD development capacity in Gateway City TOD areas at this optimal state, beginning with our four case-study cities and then extrapolating out to the other nine Gateway Cities outside of the existing MBTA service area, with either current or planned commuter rail service (see Appendix A for a complete methodology).

I. Optimal Buildout Estimates for the Case-Study Cities

Analysis of development capacity demonstrates a large amount of untapped potential in each city’s TOD area. At maximum buildout and full utilization, the volume of space in these downtowns increases by a range of 56 percent in Fitchburg to 225 percent in Lynn (Figure 3-1). In total, this represents nearly 40 million square feet of net new space to accommodate growth across these four Gateway Cities.

To put this figure into context, it is roughly twice the volume

of the proposed TOD development at Suffolk Downs, which is slated for 160-acres of entirely new ground-up construction.²⁹

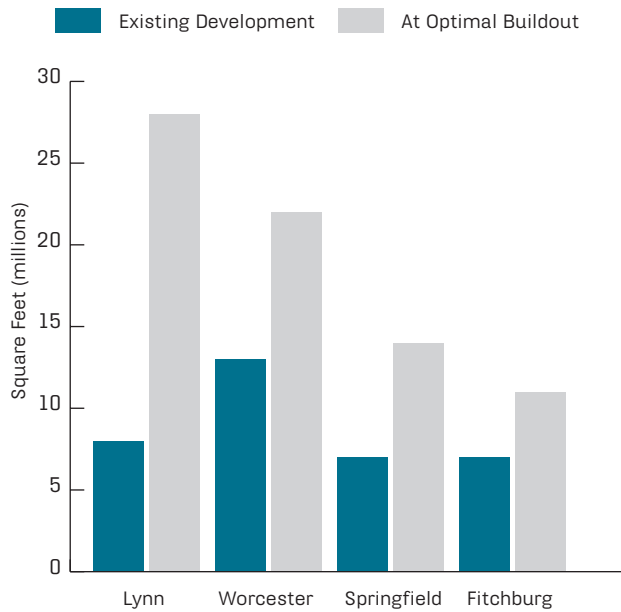
Sources of Additional Development Capacity

As shown in Figure 3-2, three different sources contribute to the additional development capacity:

1. **Infill:** Each TOD district has a number of sites that are currently vacant. This includes some parcels utilized for surface parking, as well as land where older buildings once stood that now offer prime redevelopment opportunities.
2. **Higher occupancy:** These TOD districts generally have a number of underutilized buildings. Some of these properties are closed and not fit for occupancy, while others have some first-floor retail and mostly vacant upper stories.
3. **Redevelopment:** Respecting the current neighborhood fabric, there are many opportunities to increase density on underdeveloped parcels in these districts. An example would be changing a site with single-story retail and parking to a four-story mixed-use building with internal parking, first-floor retail, and upper-floor residential.

While there is significant variation across the case-study cities, redevelopment is the largest source of growth in all four TOD areas. The redevelopment opportunity is especially strong in Lynn, where large parcels of land near the downtown and along the waterfront are encumbered with vastly undersized structures relative to the highest and best use for these sites. Each city also possesses vacant land for infill; opportunities for ground-up

Figure 3-1: Existing Development vs. Capacity at Optimal Buildout, Case-Study Cities



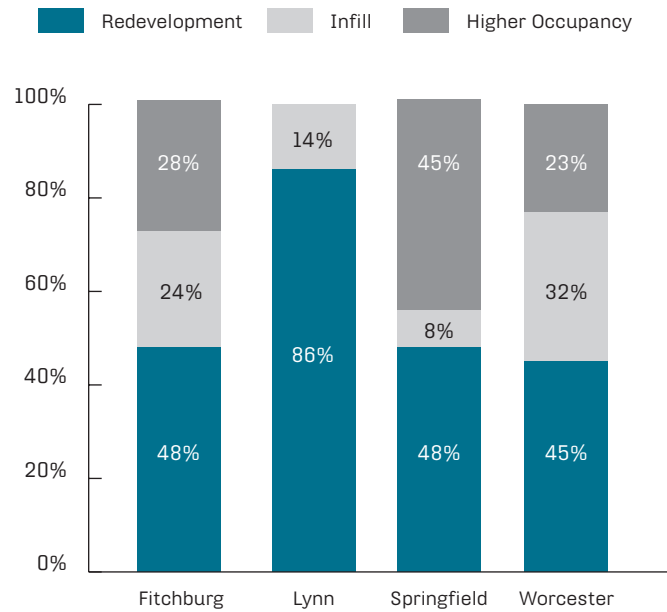
Source: RKG Associates and Hodge Economic Consulting

development on these sites are particularly prevalent in Fitchburg and Worcester, where vacant land accounts for 24 percent and 32 percent of the additional development capacity, respectively. With the exception of Lynn, these downtown TOD areas have significant vacancy, particularly in the upper stories of older commercial buildings. In Springfield, improving the current building stock for higher utilization represents nearly half (45 percent) of the estimated additional development capacity.

Factors that Lead to Variation in Additional Development Capacity

The variation in total development capacity in each city is partially driven by the boundaries of the TOD areas (See maps p.33). In Springfield (190 acres) and Worcester (290 acres), interstate highways bisect the land within walking distance to the station, creating a considerable barrier to development and thereby reducing the effective size of the TOD district. Fitchburg's TOD area encompasses 340 acres, which most closely reflects a standard half-mile radius with an extension to the west along Main Street. Lynn's TOD area is significantly larger at 525 acres. This is the result of incorporating the waterfront into the district, which

Figure 3-2: Additional Development Capacity by Source of Growth, Case-Study Cities



Source: RKG Associates and Hodge Economic Consulting

sits just beyond a half-mile radius. (Commuter rail ferry service presents a unique argument for integrating this area into the TOD district; given the exceptional opportunity for concentrated development in the waterfront, it is also likely that waterfront projects will come with efforts to strengthen linkages to the station.)

Existing land use is also a major factor in the variation in development capacity across cities (Table 3-1). Since each estimate is designed to reflect the existing character of the community, the maximum potential is limited by the district's current density. In Fitchburg, low-density residential development represents more than one-third of the district's acreage, and even the building stock around the station tends to be lower density relative to larger Gateway Cities like Springfield and Worcester.

From churches and courthouses to the campuses of public colleges and local hospitals, these regional cities also have many institutions on tax-exempt land in their downtowns. Although a share of these tax-exempt lands represent developable property held by the cities and redevelopment authorities, institutional uses presenting barriers to TOD are also common. In these instances, we have removed the properties from our estimates.

Table 3-1: Land Use within TOD Area, Case-Study Cities

Land Use	FITCHBURG		LYNN		SPRINGFIELD		WORCESTER	
	SF Land	%	SF Land	%	SF Land	%	SF Land	%
Low-Density Residential	5,020,789	34%	1,348,985	6%	195,546	2%	361,072	3%
High-Density Residential	1,041,917	7%	1,038,596	5%	243,700	3%	820,628	7%
Commercial	2,708,028	19%	8,265,385	37%	3,005,601	36%	5,760,482	46%
Industrial	1,556,461	11%	2,843,383	13%	522,886	6%	1,753,725	14%
Exempt	2,988,932	21%	7,950,184	35%	3,871,980	47%	2,623,893	21%
Other/Unallocated	1,246,816	9%	1,155,521	5%	473,396	6%	1,131,327	9%
Total	14,562,816	100%	22,602,054	100%	8,313,109	100%	12,451,127	100%

Source: Assessor data for each city, compiled by RKG Associates

Table 3-2: Population and Jobs in TOD Areas at Optimal Buildout, Case-Study City Estimates

City	Existing Conditions		Net New at Optimal Buildout		Total at Optimal Buildout		Percent change in residents	Percent change in jobs	Share of additional capacity residential	Share of additional capacity commercial
	Population	Jobs	Population	Jobs	Population	Jobs				
Fitchburg	6,603	4,137	6,869	9,335	13,472	13,472	104%	226%	63%	37%
Lynn	9,033	11,568	24,708	22,173	33,741	33,741	274%	192%	72%	28%
Springfield	3,597	13,779	13,005	2,803	16,602	16,602	362%	20%	92%	8%
Worcester	2,511	19,318	23,505	6,698	26,016	26,016	936%	35%	89%	11%

Source: RKG Associates and Hodge Economic Consulting

Translating Additional Development Capacity into Population and Job Growth at Optimal Buildout

We apportion the additional development capacity so that each station area has an optimal mix of jobs and residents, which studies indicate is somewhere around one-to-one for a TOD district functioning as a mixed-use regional economic center.³⁰ Staying true to this formula, we estimate the four districts could collectively accommodate approximately 68,000 new residents and 41,000 new jobs.

While the additional development capacity allows for significant growth in the number of residents and jobs in the TOD areas, the population growth is more dramatic (Table 3-2). This is especially true in Worcester, where the population expands by a multiple of ten, while the number of jobs grows by just one-third. Fitchburg is the one outlier; the city's TOD districts must add two new jobs for every additional new resident in order to achieve optimal buildout.

It is also worth noting that getting to optimal buildout requires

even more lopsided focus on residential development, given that each resident consumes more than twice as much space as each worker. In Springfield and Worcester, residential growth consumes about 90 percent of the additional development capacity. Even in Fitchburg, where job growth outpaces population growth, accommodating the residential growth requires two-thirds of the additional development capacity.

II. Estimating the TOD Potential for All Gateway Cities at Optimal Buildout

To provide rough estimates of the TOD potential across all Gateway Cities, we draw from the four case-study cities, averaging the ratio of current utilization to potential at optimal buildout and then applying this ratio to the existing development pattern within a half-mile radius of the stations in the other nine Gateway Cities (Table 3-3).³¹

This methodology likely leads to overestimating potential capacity in cities like Salem, where the market is relatively strong

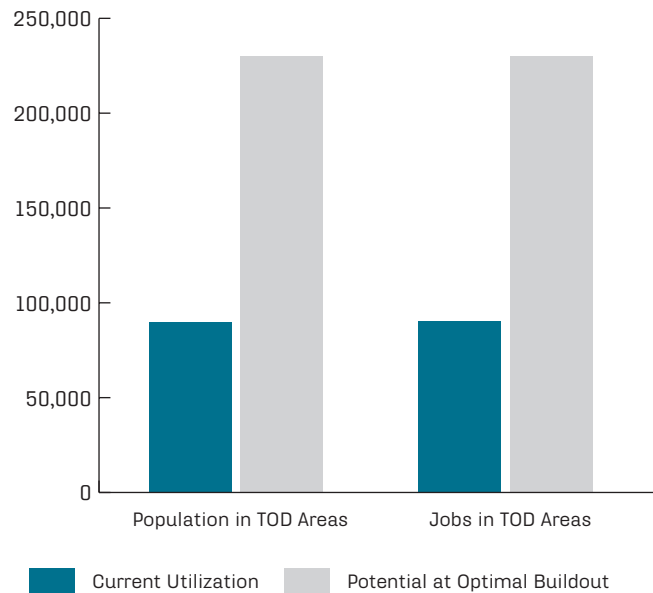
and significant infill has occurred in recent years (see box p. 43). Conversely, the approach may underestimate the growth potential in cities like Brockton, where the market is weaker, or New Bedford, where there are exceptionally large parcels for development adjacent to the planned rail station.

Combined, our analysis shows that TOD areas in the 13 Gateway Cities with current or planned rail service have 116 million square feet of additional development capacity within a half-mile radius of their stations. With optimal development, these Gateway City TOD areas could house approximately 230,000 jobs and 230,000 residents (Figure 3-3). This represents a 157 percent increase over the current number of workers in these areas (139,825 additional jobs) and a 155 percent increase over the current number of residents living in them (140,358 additional residents).

To put this magnitude of potential development capacity into perspective, the job growth figure is equivalent to 70 percent of all net new jobs in Massachusetts since 2001; the additional housing estimate is enough to accommodate over one-quarter of the projected population growth for Massachusetts statewide through 2035.³²

In sizing up the TOD potential of Gateway Cities, it is also important to consider the total development capacity of these areas, in addition to their ability to host additional development. By and large, those working and living in these station areas today are not utilizing the rail service. If these districts became more transit-oriented, over time, some per-

Figure 3-3: Growth in Population and Jobs in TOD Areas at Optimal Buildout, All Gateway Cities



Source: RKG Associates and Hodge Economic Consulting




centage of this existing space would transition to uses that take greater advantage of the rail, generating the accompanying productivity, environmental, and quality-of-life benefits.

As we examine the financial feasibility and other challenges to optimal Gateway City TOD in the chapters that follow, we will explore this question in greater detail.

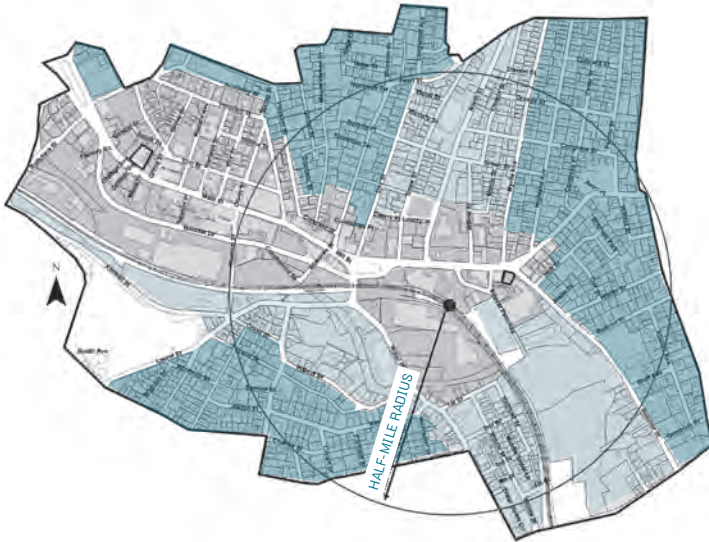
Table 3-3: Population and Jobs in TOD Areas at Optimal Buildout, Approximations for Other Cities

City	Existing Conditions		Net New at Optimal Buildout		Total at Optimal Buildout		Percent change in residents	Percent change in jobs	Share of additional capacity residential	Share of additional capacity commercial
	Population	Jobs	Population	Jobs	Population	Jobs				
Attleboro	8,142	5,449	4,711	7,404	12,853	12,853	58%	136%	63%	37%
Brockton	8,568	6,839	3,381	5,110	11,949	11,949	39%	75%	72%	28%
Fall River	6,001	2,337	10,704	14,368	16,705	16,705	178%	615%	92%	8%
Haverhill	8,592	4,112	(210)	4,270	8,382	8,382	-2%	104%	89%	11%
Lawrence	10,288	5,885	20,272	24,675	30,560	30,560	197%	419%	72%	28%
Lowell	13,202	5,107	14,011	22,106	27,213	27,213	106%	433%	72%	28%
New Bedford	5,538	3,046	9,611	12,103	15,149	15,149	174%	397%	72%	28%
Salem	3,837	7,422	9,289	5,704	13,126	13,126	242%	77%	72%	28%
Taunton	3,713	1,139	501	3,075	4,214	4,214	13%	270%	72%	28%

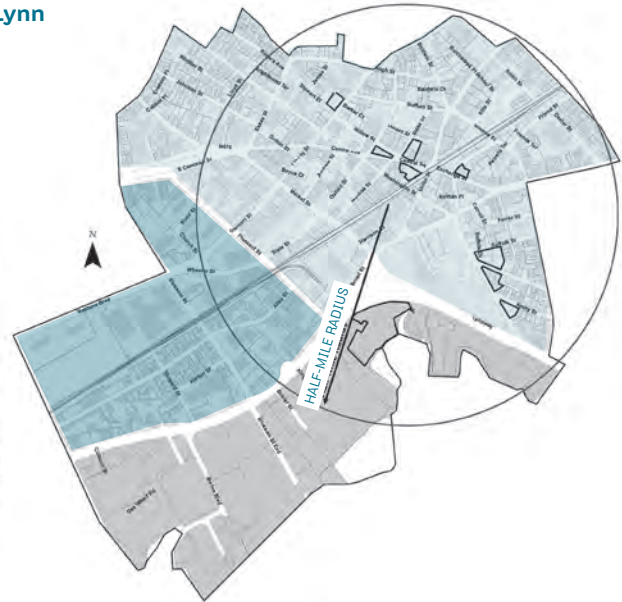
Source: Assessor Data for each city, compiled by RKG

Average FAR	Fitchburg	Lynn	Springfield	Worcester
	1.00	2.30	1.67	1.66
	0.60	1.25	1.20	1.14
	0.42	0.35	0.68	-

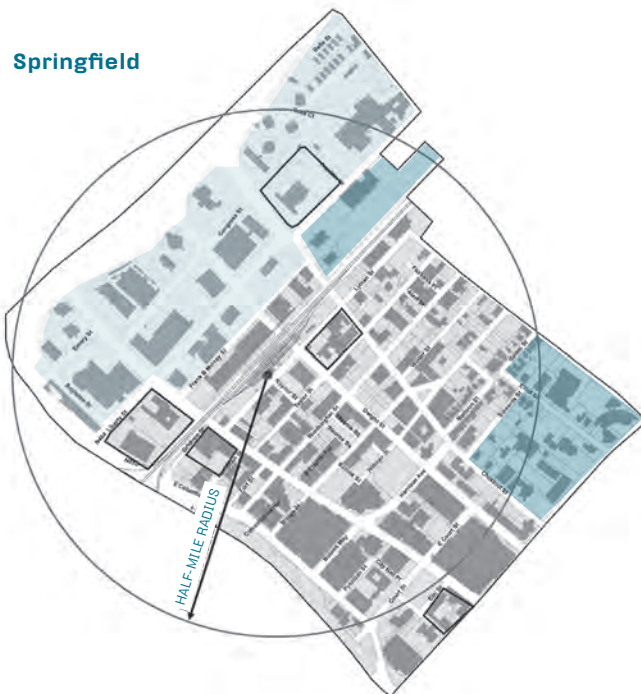
Fitchburg



Lynn



Springfield



Worcester



The maps above depict the TOD districts defined by the MassINC research team with input from local stakeholders. To develop estimates of capacity for additional development, respecting existing development patterns, we calculated floor area ratios (FAR) for sub-neighborhoods within the district and assumed redevelopment and infill in each of these areas would occur at the current average density. Because the Lynn waterfront is largely undeveloped, we assumed that at optimal buildout it would take the relatively high density form of the neighboring Revere waterfront. It is notable that the average FARs for all of these TOD areas are relatively low (and significantly lower than current zoning allows). In this regard, the optimal buildout estimates are conservative.



Chapter 4:

Producing Optimal TOD in Gateway City Real Estate Markets

Gateway City station areas have a significant volume of untapped development potential. So now we must ask the second threshold question: *Can Gateway City real estate markets actually produce optimal levels of development in these station areas?*

To explore this question, we present market data for the station areas and hypothetical project pro formas that test the financial feasibility of various TOD opportunities. We also estimate TOD production relative to the optimal buildout scenarios, assuming business-as-usual growth patterns. These models help deepen our understanding of the obstacles current market dynamics present.

I. Current Market Conditions in Gateway TOD Areas

Over the past year, we undertook an in-depth assessment of the real estate markets in the four case-study cities (see Appendix B). We also examined recent transit-oriented development projects across all Gateway Cities and surveyed their residents (see box, p. 43). This work led us to three high-level takeaways:

1. While Gateway City station areas generally have sizable population levels, this population tends to be much lower-income than the average Gateway City resident. This means TOD-area residents have limited means to support downtown businesses and riding commuter rail is cost-prohibitive.

On average, each of the Gateway City station areas are home to roughly 7,300 residents. Remarkably, Worcester has the smallest station area population with around 2,300 residents. At the other end of the spectrum, Lowell has nearly 13,000 residents residing within a half-mile of the commuter rail.

The income and purchasing power of these residents is critical to TOD since they represent an important segment of the market for retail, restaurants, and other small businesses that make living and working in walkable downtowns with transit attractive. Area residents who can walk to work are also an important component of the potential workforce for employers locating in TOD areas looking for access to skilled workers.

In many Gateway Cities, people living within a half-mile of the station have significantly lower incomes than the overall population (Figure 4-1). This disparity is especially large in Springfield and Lynn, where annual household incomes near the stations are around \$20,000. At this income level, discretionary expenditure is roughly 40 percent lower than more typical Gateway City households earning \$50,000 annually. For instance, households with annual income around \$20,000 spend just \$4 per day on food away from home.³³

With current commuter rail fare structures, these low-income households are simply unable to make use of the transit asset. There is almost perfect correlation between station area ridership and station area household incomes. Salem—the only Gateway City station area where significant TOD has occurred—is the only community where income is higher near

the station. In Attleboro, the next-highest income and ridership levels, TOD activity is beginning to take hold.

In other Gateway Cities, TOD has largely come in the form of new affordable housing development. Without a change in fare policy, the long-term deed restrictions on these projects actually undermine the state's investment in transit by taking away parcels ideally positioned to produce high-levels of ridership.

2. Concentrated poverty in station areas depresses rents, making it more difficult to build more housing.

Another key indicator of development conditions is the gross average apartment rent per month in the TOD areas. In vibrant cities, downtown apartment rents are as high (if not higher) than citywide averages. In most Gateway Cities, the exact opposite is true, with rents on average 20 percent lower in the station areas. At about half the citywide average, rents in Lynn's TOD area are especially low. Soft market conditions are also reflected in vacancy rates. Across the Gateway City station areas, vacancy rates average 11 percent—about one-third higher than the citywide averages and roughly two-

and-one-half times the residential vacancy rate in Boston.

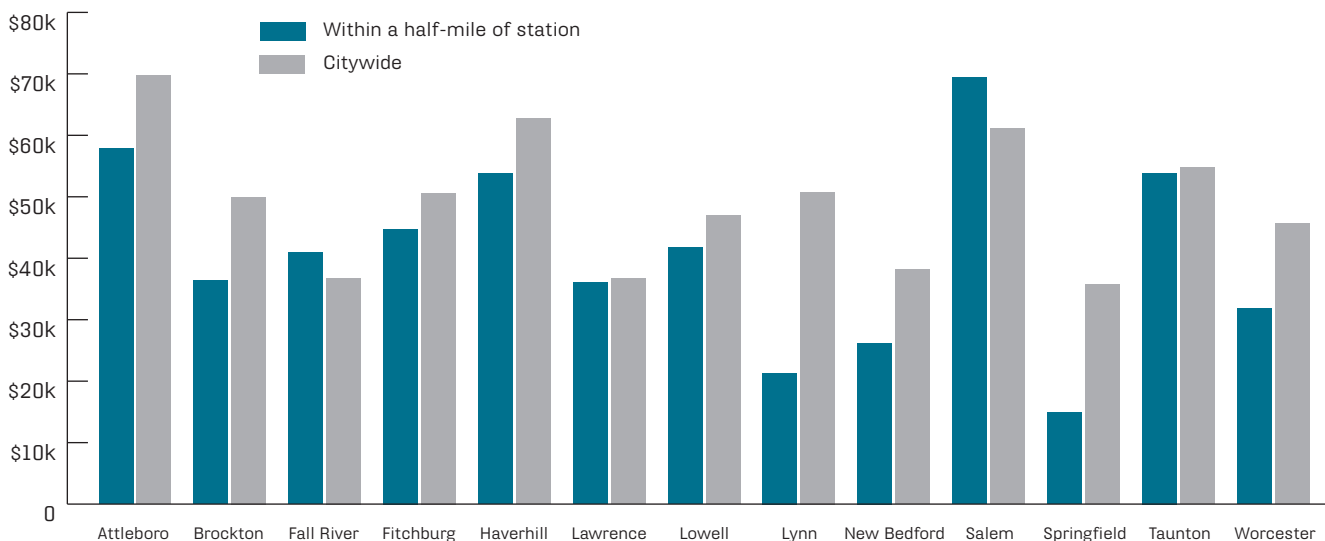
In Attleboro and Salem, two markets where poverty is notably lower around the stations, apartment rents within a half-mile of train stations are actually slightly higher than citywide averages. The transit assets are providing value and these cities are drawing mixed-use TOD projects.

3. Although Gateway City station areas have impressive job concentrations, this is predominately institutional employment. The office market is extremely weak in most of these cities.

Assessing the strength of commercial markets in Gateway City stations areas is more difficult as there are no reliable real estate data available at this sub-city scale. The most notable figures we have are job counts and commercial property valuations from assessor's data. On average, there are about 7,000 jobs within a half-mile of the Gateway City stations. The range is wide, from just over 1,100 in Taunton to nearly 20,000 in Worcester.

Workers within the station areas are, however, disproportionately employed by institutions, such as hospitals and government agencies. The market for private office space is much

Figure 4-1: Median Household Income – Within a Half-Mile of Station and Citywide



Source: ACS 2016 5-year ESRI estimates

smaller, as reflected in commercial property values. On average, the assessor's data show commercial property within the TOD area is valued at \$33 per square foot, with Salem at the high end (\$41/SF) and Brockton at the lower end (\$23/SF). To put this range into perspective, Class B office space in downtown Boston is currently trading at nearly \$500 per square foot.³⁴

II. Development Feasibility (Gap Analysis)

Using data from recent projects and detailed analysis of rents and land values, we built detailed financial pro formas for hypothetical projects in the four case-study cities. These models give us a more complete understanding of the market's ability to generate the three forms of development required to achieve optimal buildout: mixed-use adaptive reuse; new mixed-use construction; and new commercial construction.

The pro formas compare development costs (acquisition and predevelopment expenses, construction expenses, and the developer's return) to a property's discounted cash flow (value of rent and proceeds from sale collected over time).³⁵ When development costs exceed cash flow, the project has a

"gap" that makes it economically infeasible without subsidy.

To determine how viable these three categories of TOD are in the four case-study cities, we looked at how large these gaps are at both current market rents and rents that are 20 percent higher. This hypothetical analysis was not intended to imply that improved rail transit service will raise property values by 20 percent—though many nationwide studies have shown increases in this range from introducing new rapid transit service.³⁶ Rather, the 20 percent increase offers a reasonable benchmark, if targeted TOD, placemaking, and development initiatives successfully generate momentum in these depressed markets.

Mixed-Use Adaptive Reuse

With high vacancy rates, there are many opportunities to improve or repurpose the existing building stock in the TOD areas. In some instances, the change is dramatic, such as converting an old church or courthouse to apartments with ground-floor retail. Other projects simply involve improving existing office space or housing to serve a higher-tier market to increase occupancy and fetch higher rents.



An iconic building blocks from the Fitchburg station. The building's five upper stories have been vacant for years.

In Gateway Cities, most adaptive reuse opportunities lean toward the more intensive end of the spectrum. We modeled small to midscale projects in this category with between 40 and 80 housing units, 8,000 square feet of space for commercial tenancy, and construction costs at \$150 psf. With the exception of Worcester, where rents are between \$1,500 and \$2,000 per unit, cash flows are too weak to make these projects economically feasible. The estimated gap between revenue and development costs is largest in Springfield (43 percent), followed by Fitchburg (29 percent), and Lynn (19 percent).

A 20 percent increase in rents closes this gap perfectly in Lynn, and makes the Fitchburg project viable with an internal rate of return (IRR)—a key financial metric developers must have at 10 percent minimum to go forward with a project—over 11 percent. Nevertheless, the pro forma for the Springfield project still shows a sizeable gap (26 percent).

While it can be a difficult opportunity to find, buildings with

modern systems that need a light refresh to draw stronger (but not necessarily upper-end TOD rents) are more economically viable. With construction costs at \$80 psf, lower-cost adaptive reuse projects pencil out favorably in all four markets. A recent real-world example is the Silver Brick lofts in downtown Springfield. In the softest of the four markets, the new owners of this apartment building successfully remodeled the units keeping construction costs near \$50 psf, achieving full occupancy with rents ranging from \$1,000 to \$1,500.

New Mixed-Use Construction

Gateway City TOD districts have many vacant sites with potential for mixed-use infill development (i.e., housing units on top of commercial space for retail and services). With higher \$175 psf costs and new construction drawing only modestly higher rents compared to adaptive reuse projects, pro forma models for this category produce essentially the same gap in Fitchburg (19 percent), Lynn (24 percent), and Springfield (44 percent).

Table 4-1: Summary of Pro-Forma Results

Category/City	Gap	IRR with 20% Rent increase	Construction Costs (\$/SF)	Base Rent Range
MIXED-USE ADAPTIVE REUSE				
Fitchburg	29%	10%	\$150	\$930-\$1,550
Lynn	19%	11%	\$150	\$1,100-\$1,875
Springfield	43%	-5%	\$150	\$1,100-\$1,450
Worcester	0%	17%	\$150	\$1,556-\$2,173
MIXED-USE ADAPTIVE REUSE: LOW-COST				
Fitchburg	0%	32%	\$80	\$830-\$1,450
Lynn	0%	30%	\$80	\$990-\$1,685
Springfield	0%	22%	\$80	\$994-\$1,349
Worcester	0%	29%	\$80	\$1,440-\$1,955
MIXED-USE NEW CONSTRUCTION				
Fitchburg	19%	13%	\$175	\$1,025-\$1,550
Lynn	24%	10%	\$175	\$1,320-\$1,920
Springfield	44%	-6%	\$175	\$1,200-\$1,600
Worcester	0%	21%	\$175	\$1,880-\$2,400
NEW COMMERCIAL CONSTRUCTION				
Springfield	17%	14%	\$150	\$25/SF
Worcester	27%	10%	\$150	\$23/SF

Source: RKG Associates

Worcester is the only city where new mixed-use projects are at or approaching viability. The model for a 120-unit, higher-end apartment building with first-floor retail produces a 13.6 percent IRR with rents ranging from \$1,880 to \$2,400. Such a building would be similar to the new 145 Front at City Square project, which came online this year and is starting to lease up.³⁷

A 20 percent increase in rents makes the gap just about disappear in Lynn, and the Fitchburg project tops out with an IRR over 12 percent. But again, the pro forma for the Springfield project still shows a persistently large gap (27 percent).

New Commercial Construction

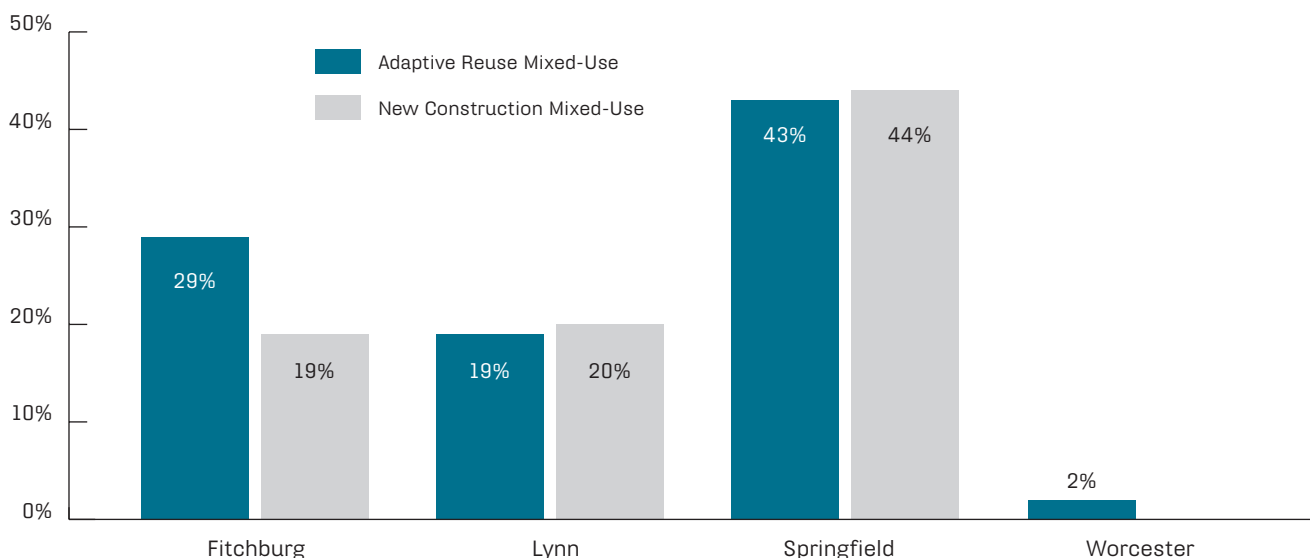
To gauge viability for commercial TOD, we built pro formas for Class A office projects in Springfield and Worcester, larger economic centers with sufficient market data to constitute a model. With lower land acquisition costs, the estimated gap is lower in Springfield than in Worcester (17 percent vs. 27 percent of development costs). If the market improved in

these cities, whereby rents increased 20 percent reaching \$28 psf and above, the gap closes completely with the IRR surpassing 14 percent in Springfield.

Key Takeaways from Development Feasibility Analysis

- There is significant variability across Gateway City markets. Worcester's relative strength seems to be driven by regional economic activity clustering in the core along with a surge of positive momentum in the downtown area. In Springfield, the regional economy is slow-growing, more decentralized, and still at the early stages of drawing private developer interest. For smaller, more residential communities like Fitchburg and Lynn, the variation between them is primarily driven by proximity to Boston.
- Project gaps narrow across the board, as rents rise 20 percent—an encouraging fact. Yet it is important to remember that this scenario holds land values constant. Property holders and speculators are likely to expect larger returns

Figure 4-2: Financing Gap – Incentive/Subsidy as Share of Development Costs



Source: RKG Associates

with transit service improvements. This process of adjusting expectations could slow down buildout as owners and developers negotiate and expectations fall into line with market realities.

- Lynn has the closest proximity to Boston of these four cities. The pro formas indicate that building larger-scale, mixed-use development projects in Lynn still requires substantial gap financing. While there are encouraging signs of renewed downtown activity in Springfield and Fitchburg, spurring greater private redevelopment or new construction will likely require a stronger set of public subsidies and gap-financing tools.

III. Near-Term TOD Development under Status Quo Conditions

To evaluate the market's potential to produce TOD in the near-term, we cataloged permitted projects in the pipeline in these TOD areas, as well as future demand for residential and commercial real estate in these locations, based on growth projections for the local and regional economies. This information forms the basis for our model of likely production in the near term (through 2021) under status-quo conditions.

Development Projects in the Pipeline

Approximately 700 housing units are currently permitted for the TOD areas in the four case-study cities; at the moment, no office space is planned for these TOD districts. With projects totaling 553 units, the majority of anticipated residential development is in Lynn. The current pipeline contains fewer than 100 units in Fitchburg and Springfield. Worcester has recently experienced a spate of development in the TOD area (e.g., 81 units at Edge at Union Station and 230 units at 145 Front at City Square), but the near-term pipeline identified just 40 additional units.

Local and Regional Growth Drivers

Projections show Lynn will have the fastest employment growth over the next five years, with the region's job base increasing by 5.3 percent between 2016 and 2021; growth projections are significantly more modest for Fitchburg and Worcester (each 3.8 percent), as well as Springfield (3 percent). At these regional rates, assuming demand increases proportionally in the city's TOD areas, projected space needs

to accommodate growth are modest, ranging between just over 12,000 sf per year in Fitchburg to just under 81,000 sf per year in Worcester (Table 4-2). This growth, however, is unlikely to contribute much to the office market. In each of these regions, jobs in the healthcare and social-assistance sector represent about one-third of the projected employment growth, and the majority of net new space.

Population forecasts show slightly weaker growth in demand for housing in these cities through 2021. Estimates suggest Worcester will experience the most growth, with the number of housing units rising by just over 2.5 percent, followed by Fitchburg, Lynn, and Springfield (Table 4-3).

Retail is a third source of potential energy for TOD development. While online retailing is placing considerable pressure on this real estate segment, there is increasing interest in urban retailing as large chains look for new markets and small entrepreneurial/craft-oriented businesses look for unique urban environments to compete for consumer spending. Even with relatively low household incomes, retail analysis shows that there is considerable leakage in Fitchburg and Lynn with restaurants and bars. These cities are also undersupplied with clothing stores, book stores, and home furnishing stores. (See Appendix B.)

Status-Quo Development Estimates

Taking into account pipeline projects and projected demand, we estimate likely development in the TOD areas under status-quo conditions. These estimates assume TOD areas capture their current shares of local population and employment, which may produce conservative figures if these downtown areas are gaining strength relative to the city overall. Lynn will experience the most development, increasing gross square footage in the TOD area by 12 percent. This is followed by Worcester (8 percent), Springfield (6 percent), and Fitchburg (2 percent).

On average across the four cities, the status-quo estimates suggest Gateway City TOD areas will produce just 26 percent of their population potential at Optimal Buildout (Figure 4-3) and 38 percent of their job potential (Figure 4-4). Apply these ratios to all 13 Gateway Cities with regular transit service, and we fall short of optimal TOD by approximately 170,000 residents and 140,000 jobs.

Our analysis of current market conditions and future growth pressures under the status-quo scenario suggests Gateway

Table 4-2: Estimated Annual Square Feet of Space Needed by Sector, 2016-2026

	FITCHBURG	LYNN	SPRINGFIELD	WORCESTER
OFFICE				
Information	(60)	108	(906)	(609)
Finance/Insurance	365	1,137	4,856	5,263
Real Estate	145	258	1,630	834
Professional/Technical	719	824	2,976	7,847
Administration/Waste Services	523	753	3,300	5,330
Subtotal	1,691	3,080	11,856	18,665
INSTITUTIONAL				
Health Care/Social Assistance	8,338	29,605	42,594	49,988
Subtotal	8,338	29,605	42,594	49,988
COMMERCIAL				
Arts and Entertainment	74	135	327	764
Retail Trade	1,052	2,099	3,403	5,876
Accommodations/Food Services	1,844	1,482	2,817	4,771
Other excluding Public Admin.	202	996	1,165	2,316
Subtotal	3,171	4,711	7,712	13,727
INDUSTRIAL				
Construction	384	560	765	2,555
Manufacturing	(2,578)	(16,883)	(18,130)	
Wholesale Trade	(215)	3,850	834	8,487
Transportation/Warehousing	1,401	2,297	9,180	15,742
Subtotal	(1,007)	(10,176)	(7,350)	(1,772)
TOTAL ANNUAL SF	12,194	27,220	54,811	80,608

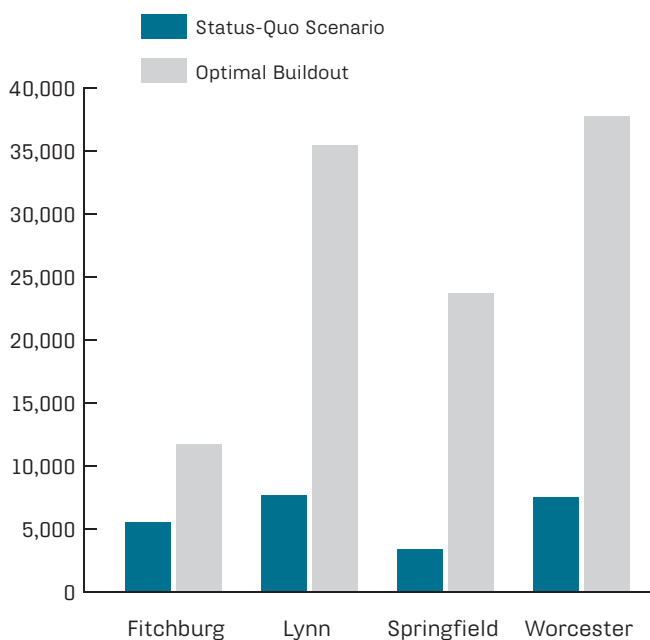
Source: RKG Associates

Table 4-3: Annual Household Demand for Housing, 2016-2021

Household Projections	FITCHBURG	LYNN	SPRINGFIELD	WORCESTER
2016	15,565	34,521	57,466	70,206
2021	15,934	35,047	57,826	71,987
5-year growth in households	369	526	360	1,781
Average annual change	74	105	72	356
Five-year change, %	2.37%	1.52%	0.63%	2.54%

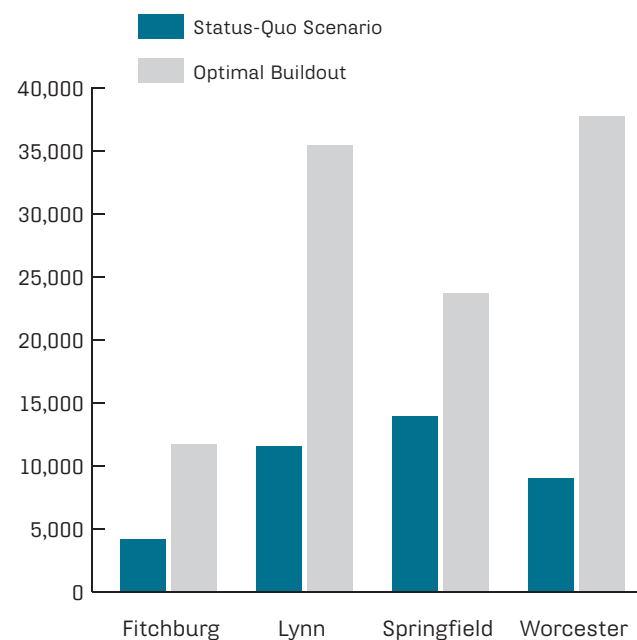
Source: Alteryx, US Census, and RKG Associates

Figure 4-3: Population in TOD Districts, Status-Quo Scenario vs. Optimal Buildout



Source: RKG Associates and Hodge Economic Consulting

Figure 4-4: Jobs in TOD Districts, Status-Quo Scenario vs. Optimal Buildout



Source: RKG Associates and Hodge Economic Consulting

City station areas are unlikely to strengthen sufficiently to generate optimal development. Yet with smart development policies and transit improvements capturing the momentum of growing agglomeration economies, it seems plausible that we could reverse this picture.

In the chapters that follow, we estimate the associated travel and environmental impacts of Gateway City TOD based on optimal buildout potential. As leaders evaluate TOD policies and balance them against other investments, they will need to monitor the performance of early projects and other related growth trends in order to determine our trajectory toward meeting the full potential of Gateway City TOD.

The Emergence of Gateway City TOD

Over the past decade, there have been TOD projects in Gateway Cities and more are on the way. To better understand the market for TOD, we examined several of these projects. Their performance highlights the opportunities and the challenges of Gateway City TOD given current market and rail service conditions.

Attleboro – Renaissance Station North

- *What it looks like:* Constructed by Crugnale Properties in 2014, Renaissance Station is a mixed-use project across the street from the Attleboro Station on land previously owned by the MBTA. Located 15 minutes from Providence and 45 minutes from Boston, this \$11.5 million project includes 80 new housing units. There is also 4,000 sf of first-floor retail/restaurant space.
- *How it got built:* Attleboro created an urban renewal plan focused on the redevelopment of publicly-owned land near the train station and adopted a series of zoning changes. The city also initiated infrastructure improvements, including a \$5.5 million MassWorks grant and a \$1.2 million Gateway City grant for a riverfront walk, brownfield clean-up, and a walk/bike path to enhance the quality of life and pedestrian environment.
- *How it performs:* The developers report full occupancy of the residential units with one-bedrooms renting at \$1,400 per month. A phase 2 is planned.

Haverhill – Haverhill Lofts and the Cordovan at Haverhill Station

- *What they look like:* With both MBTA and Amtrak service, Haverhill's downtown station area was one of the first to see TOD. In 2006, Beacon Communities began work on two residential mill redevelopments in the station area: Haverhill Lofts, 32 market-rate loft-style apartments zoned for live/work use, and the Cordovan, a 146-unit mixed-income development with apartments ranging from studios to two-bedrooms.
- *How they got built:* Financing for the redevelopment of the market-rate Haverhill Lofts included both state and federal historic tax credits, along with private equity and debt. Funding the mixed-income Cordovan project required state and federal historic credits, Low Income Housing Tax Credits, a HOME loan from the city, and a MassHousing loan, in addition to private equity and debt. The city was an active partner, working with Beacon and negotiating relief from parking requirements to a parking ratio of 1.26 per unit.
- *How they perform:* Both buildings have had strong rental performance. With similar units each around 1,000 sf throughout the building, rents at Haverhill Lofts are approximately \$1,500 to \$1,600 per month. Rents at the Cordovan range from \$1,500/month for a 650 sf one-bedroom to \$1,800 for a 1,200 sf two-bedroom. Market-rate studio apartments command up to \$1,400 per month. More residential development has followed, including JM Lofts (18 units), Hamel Lofts (305 units), Harbor Place (80 units), and the Hayes at Railroad Square. While the station has seen some ridership growth, very few riders walk to the station, and surveys of residents of the Beacon properties show very low ridership, with most respondents noting that fares are cost-prohibitive.

Lawrence – Riverwalk Properties

- *What it looks like:* Riverwalk Properties is one of the largest Gateway City mill redevelopment projects in Massachusetts. Started in 2003 by Lupoli Companies, this multi-year, multi-phase redevelopment project now totals over 3.5 million sf of building space and about \$220 million in private investment with 200 housing units; 2 million sf of office, industrial and flex use; 60,000 sf of retail; and 20,000 sf of restaurant (including Salvatore's). Located across from the MBTA commuter rail station and near an interchange with I-495 along the Merrimack River, this redevelopment project has been expanding gradually over time.
- *How it got built:* Riverwalk Properties has benefited from a \$6.5 million MassWorks grant that significantly upgraded Merrimack Street with a mix of streetscape, lighting, signals, turning lanes and pull-offs. In addition to private equity, Lupoli Companies has used state and federal historic tax credits, and partnered with MassDevelopment on different aspects of project development, including the use of New Market Tax Credits (NMTTC) to help fund the NxStage medical office building.
- *How it performs:* Riverwalk Lofts is fully occupied with the average unit renting at \$1,300 per month. But like the Haverhill developments, survey data show very few residents ride transit due in part to high fares.

Lowell – Thorndike Exchange

- *What it will look like:* Led by Lupoli Companies, Thorndike Exchange includes the adaptive reuse of an existing mill building next to the train station (Phase 1) and construction of a new residential building (Phase 2). The Phase 1 project includes 62 market-rate units and is slated to open soon. The planned Phase 2 (the new building) will include another 96 units, 12,000 sf of restaurant and patio space, and up to 15,000 sf of office space.
- *How it is getting built:* Thorndike Exchange is utilizing the Housing Development Incentive Program (HDIP) tax credit. A \$2 million MassWorks grant to widen Thorndike Street and provide an improved pedestrian connection to the Hamilton Canal District also helped facilitate the project.
- *How it performs:* Phase one is pre-leasing with one-bedrooms listing between \$1,750 and \$2,150 per month and two-bedrooms listing at between \$2,350 and \$3,050 per month.

Salem – Derby Lofts and Beyond

- *What they look like:* RCG was an early developer of TOD projects in Salem. RCG's first project in Salem was Derby Lofts. Built in 2001, the building includes 55-condo units with 13,000 sf of ground-floor retail. RCG has also completed mixed-used rental projects at 155 Washington Street and 26 New Derby Street in Salem.
- *How they got built:* RCG's development properties have been primarily financed through private equity and loans along with historic tax credits. Salem received a MassWorks grant to perform utility relocations and street realignment, which were necessary to advance development.
- *How they perform:* Like the other TOD development, demand is strong for the rental units. And it is particularly encouraging to note that these units are generating substantial ridership. Salem has the highest ridership in the MBTA system for those living within a half-mile radius, and these units are drawing an even higher level of ridership. Survey data show nearly one-third of residents ride the train regularly and another one-quarter ride at least a couple of times each month.

Lessons learned from these seven TOD projects:

- Most projects benefited from MassWorks infrastructure grants to help improve the physical environment for redevelopment. MassWorks applications are led and submitted by the city; developers frequently mentioned that local efforts to win this grant funding was critical to enabling private investment.
- Gateway City TOD projects often require developers willing to invest in unproven markets with a vision of the upside potential. For these early developments, it was critical to allow the developer some flexibility in terms of the housing units, and whether to include commercial space (e.g., in Haverhill they decided to focus retail on other nearby streets). In terms of scale, many of these projects are 35 to 100 housing units.
- The location of the train station and the physical integration with downtown areas has a big impact on the likelihood of TOD projects. This is generally a positive in Salem, Haverhill, and Attleboro. In Lowell the train station is far-removed from most mill development properties. In Lawrence, the train station is near Riverwalk Properties but is unconnected to the traditional downtown.
- Positive TOD experiences create momentum leading to more redevelopment, as developers like RCG built on early success in Salem to develop a series of projects over the past 10 years. Lupoli Companies started in Lawrence with Riverwalk Properties, expanded the project over time, and is now developing projects in multiple Gateway Cities, including Thorndike Exchange in Lowell.
- Actual rail ridership for people living in these projects is often modest. Based on Census data and surveys MassINC distributed to tenants of these projects, a minority of the tenants use commuter rail on a frequent basis. This varies by location but relates to a few factors: 1) some of these projects (e.g., Riverwalk in Lawrence) have and promote their accessibility to interstate highways; 2) many Gateway Cities are at the end of commuter rail lines and face a lengthy commute to Boston; and 3) the cost of commuter rail is a major detriment for low- and moderate-income residents.



LEFT: The Cordovan at Haverhill Station, a mixed-income TOD project developed by Beacon Communities.

RIGHT: A rendering of Thorndike Exchange with a new bridge connecting the development to the Lowell commuter rail station in the background.



NORTH STATION

EXIT

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Chapter 5:

Assessing Rail Capacity to Support Gateway City TOD

If the challenging market conditions are surmountable, Gateway City TOD has the potential to concentrate a large number of residents and workers near existing rail infrastructure. In this chapter, we ask and answer the third threshold question: *Does the current commuter rail system have capacity to support the significant new volume of riders Gateway City TOD could produce?*

We present a model for estimating the ridership impacts of Gateway City TOD, and then examine current capacity constraints within the commuter rail system. We also explore how service improvements could influence Gateway City ridership, with and without optimal TOD.

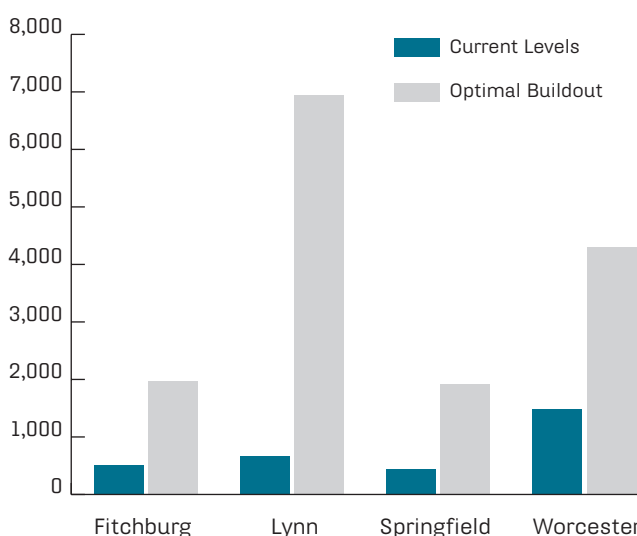
I. Ridership Implications of Gateway City TOD

The development estimates presented in Chapters 3 and 4 provide important measures to think about the potential of TOD in Gateway Cities. But now we must evaluate how much ridership this real-estate development and related economic activity—residents, jobs, and visitors—will generate. To produce these estimates, we built a model that takes into account a variety of factors in each station area, including employment and population densities, the percentage of zero-car households living near the station, and measures of station access, such as the number of parking spaces and the quality of bus feeder service (see Appendix C for complete methodology).

Case-Study City Estimates

Figure 5-1 shows the Optimal TOD scenario will generate substantial new ridership in each of the case-study cities. Demonstrating the strong untapped potential in these markets, TOD development triples ridership in Springfield and Worcester, and Fitchburg's ridership increases by nearly a factor of four. Consistent with an especially large redevelop-

Figure 5-1: Commuter Rail Daily Boardings, Current Levels vs. Optimal Buildout



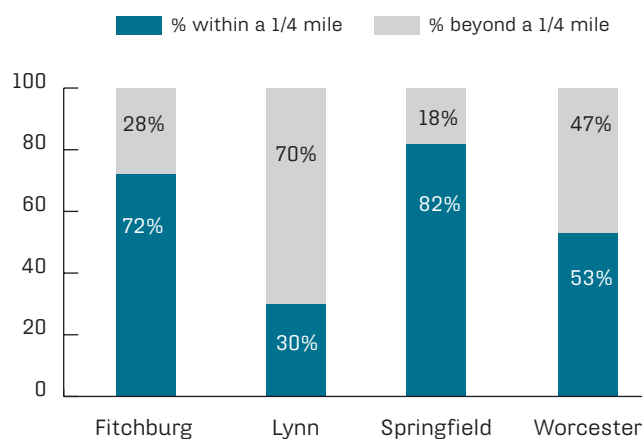
Source: Kittelson Associates and Hodge Economic Consulting

Note: Existing ridership is from 2014 MBTA data for Fitchburg, Lynn, and Worcester. For Springfield, this represents estimated ridership in 2018, once the New Haven-Hartford-Springfield commuter rail service commences.

Table 5-1: Transit Capture Rate Assumptions

TRIP	LESS THAN 1/4 MILE	1/4 TO 1/2 MILE	AVG. ACROSS 1/2 MILE RADIUS
Residential (Work)	17.0%	8.5%	12.8%
Residential (Non-Work)	3.5%	1.8%	2.6%
Office	4.0%	2.0%	3.0%
Retail	5.0%	2.5%	3.8%

Source: Kittelson Associates

Figure 5-2: Share of Ridership Increase from Within and Beyond ¼ Mile of Rail Stations

Source: Kittelson Associates and Hodge Economic Consulting

opment opportunity, Lynn's estimated ridership gains are exponential. At full buildout, the estimates show the station serving nearly 7,000 daily riders, ten times current levels.

Transit capture rates (the percentage of travelers utilizing transit to make their journey) are a key variable in our model. We assume that less than 13 percent of households living within a half-mile of the station will utilize transit to make their commute, and only 3 percent of those working within the TOD area will ride the train to work (Table 5-1). These ratios come from research looking at the current capture rates of commuter rail systems in the US, which have generally failed to produce true transit-oriented development in urban centers. In this sense, our figures likely systematically underestimate the potential of

Gateway City TOD to produce ridership, though the significant distance to Boston for some Gateway Cities may dampen the capture rate. Certainly, significantly higher capture rates than these are possible; on residential work commutes, Salem already outperforms our capture rate by 30 percent.

A look at the assumptions also demonstrates the importance of proximity to the station; properties within a 1/4 mile of the station produce twice as many riders as those located between 1/4 and 1/2 mile out. This creates variation across our case-study cities based on where they are able to accommodate the most new growth. In both Fitchburg and Springfield, the vast majority of TOD opportunity lies within a 1/4 mile. For Worcester, the ridership gain is near even between these two areas, which implies greater development opportunity beyond a 1/4 mile, given the lower capture rates in the outer zone. Much of the new development in Lynn is near the waterfront, well beyond the 1/4-mile boundary. However, if this area is well-served by ferry service in the future, transit ridership could rise considerably; in this regard, our projections for Lynn may actually be even more conservative than the others. On the other hand, a significant portion of the estimated rail ridership may actually end up being served by commuter ferry.

Extrapolating to All 13 Gateway Cities

To generate an order of magnitude ridership estimate for all 13 Gateway Cities with transit service, we calculate the average net new ridership per million square feet of station area real estate at optimal buildout in the four case-study cities.³⁸ Applying this measure of TOD yield to the additional nine Gateway Cities with rail transit service, we estimate the TOD ridership potential of the state's Gateway Cities is approximately 25,000 additional daily riders at optimal buildout. At current fares, this level of ridership would generate more than \$81 million annually for the MBTA.

II. Current Capacity Constraints on Commuter Rail

As new Gateway City TOD projects come online, additional riders will slowly flow into the system. There must be excess capacity today in order for the rail system to absorb these future riders without large financial outlays in rail operations capacity.

Table 5-2: Estimated Ridership and Fare Revenue at Optimal Buildout

STATION	CURRENT RIDERS	ESTIMATED NEW RIDERS	TOTAL RIDERS	MONTHLY PASS	NET NEW REVENUE (\$M)
Attleboro	1,665	1,169	2,834	\$327	\$5
Brockton	778	1,087	1,865	\$253	\$3
Fall River	390	1,520	1,910	\$353	\$6
Fitchburg	516	1,450	1,966	\$353	\$6
Haverhill	576	762	1,338	\$327	\$3
Lawrence	722	2,780	3,502	\$308	\$10
Lowell	1,770	2,475	4,245	\$308	\$9
Lynn	662	6,280	6,942	\$208	\$16
New Bedford	480	1,378	1,858	\$353	\$6
Salem	2,122	1,194	3,316	\$234	\$3
Springfield	450	1,471	1,921	NA	NA
Taunton	420	383	803	\$327	\$2
Worcester	1,475	2,823	4,298	\$353	\$12
Total	12,026	24,773	36,799		\$81

Source: Kittelson Associates and Hodge Economic Consulting

Table 5-3: Rail Capacity at Optimal Buildout during Peak Period compared to Existing Conditions

STATION	EXISTING MAX TRAIN LOAD	EXISTING CAPACITY	NEW PEAK PERIOD RIDERSHIP FROM MAX TOD SCENARIO	ADDITIONAL PASSENGER CAPACITY NEEDED	PARKING (UTILIZATION)
Fitchburg	2,027 passengers	2,022 seats	483 passengers	488 seats (One additional double-decker coach per train)	Currently 20% of 400 available spaces No parking capacity concerns
Lynn	1,960 passengers	2,088 seats	1,478 passengers	1,350 seats (Add 2-3 double-decker coaches per train)	Currently 21% of 965 available spaces No parking capacity concerns
Springfield*	--	756 seats	333 passengers	--	Currently 25% of 377 available spaces No parking capacity concerns
Worcester	3,203 passengers	3,204 seats	1,187 passengers	1,186 seats (Converting all trains to 8 double-decker coaches increases capacity by 1,116 seats)	Currently 50% of 500 available spaces No parking capacity concerns

*Springfield commuter rail service is scheduled to begin in 2018. Information was not available to determine peak loading characteristics for CT Rail service to Hartford and New Haven.

Source: Kittelson Associates

Table 5-4: Ridership Impacts from 30% Improvements in Frequency and Speed

STATION	CURRENT RIDERS	INCREASE FREQUENCY (.38 ELASTICITY)	INCREASE SPEED (.17 ELASTICITY)	OPTIMAL TOD RIDERSHIP	INCREASE FREQUENCY (.19 ELASTICITY)	INCREASE SPEED (.085 ELASTICITY)
Attleboro	1,665	633	283	2,834	538	241
Brockton	778	296	132	1,865	354	159
Fall River	390	148	66	1,910	363	162
Fitchburg	516	196	88	1,966	374	167
Haverhill	576	219	98	1,338	254	114
Lawrence	722	274	123	3,502	665	298
Lowell	1,770	673	301	4,245	807	361
Lynn	662	252	113	6,942	1,319	590
New Bedford	480	182	82	1,858	353	158
Salem	2,122	806	361	3,316	630	282
Springfield	450	171	77	1,921	365	163
Taunton	420	160	71	803	153	68
Worcester	1,475	561	251	4,298	817	365
Total	12,026	4,570	2,044	36,799	6,992	3,128

Source: Kittelson Associates and Hodge Economic Consulting

Currently, every coach the MBTA owns is in use during peak service periods, with only one spare set on each side (north and south), and most seats on these trains are filled during a portion of the trip. This is by design, as the agency maintains a fleet of coaches to accommodate the run with most passengers on each line. Yet there are a number of ways that the system could carry many more riders with relative ease (Table 5-3). By replacing single-level coaches with double-deckers, our analysis shows the system can serve the estimated peak period TOD ridership in all four of the case-study cities.³⁹ (In addition, the system has abundant capacity to serve reverse commute passengers and passengers travelling in either direction during non-peak periods.)

Of course, this level of increased ridership will not happen overnight, and the operations of our commuter rail ten or 20 years from now could be quite different than today. Below we consider longer-term regional rail innovations, where one defining feature is the improved ability to run trains more frequently, which would provide more overall capacity to absorb new ridership.

III. Generating Additional Ridership with Service Enhancements

The order of magnitude estimates above suggest Gateway City TOD at optimal buildout could increase the MBTA's entire commuter rail ridership by about 25 percent on its own. Service enhancements could generate even more ridership from Gateway Cities and other stops along the line. This would undoubtedly require significant investment. However, with our densely populated urban centers contributing to ridership at a higher level, the cost-benefit proposition might balance out—especially when accounting for environmental and other ancillary benefits—justifying service enhancements that will improve mobility for all communities in the commuter rail corridor.

Below we use our ridership model to examine the relative gains associated with increasing frequency, reducing travel time, and improving station connectivity with feeder bus service. Then we briefly catalog the obstacles that must be overcome in order to make these service improvements. (See Appendix C for the methodology and assumptions for this analysis.)

Increasing Train Frequency and Reducing Travel Time

Increasing train frequency (or headways) and reducing the time it takes for the train to reach its destination will lead to more ridership. All else being equal, studies consistently show that commuter rail systems will generate more new riders by adding more trains than they will by reducing travel time. Our model shows a 30 percent increase in frequency generates a 38 percent increase in ridership, whereas increasing speed (i.e., reducing travel time) by 30 percent boosts ridership by just 17 percent.

Applying these elasticities to current conditions, we estimate a 30 percent increase in frequency will lead to more than 4,500 additional daily boardings from Gateway City stations; in comparison, a 30 percent increase in speed will net just over 2,000 additional riders.

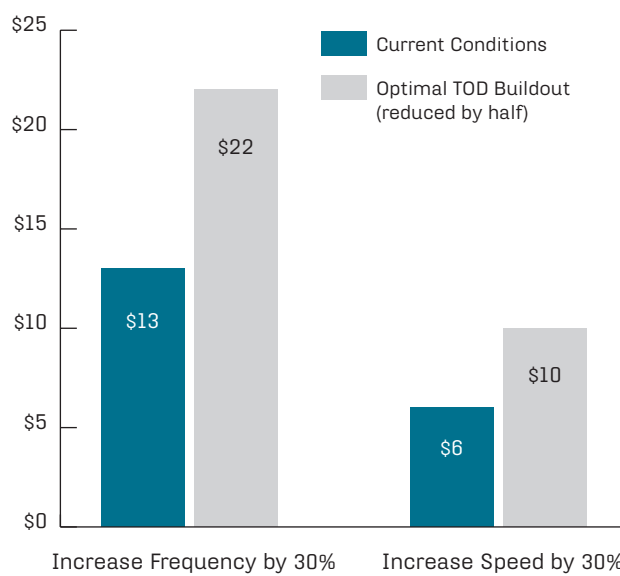
With optimal TOD buildout, service changes can induce ridership from a significantly larger stock of real estate. However, assuming these buildings are transit-oriented by design, the effect of service improvements may be more muted. Even if we reduce the elasticities by half, the ridership gains from Gateway Cities at optimal TOD buildout would still be substantial: nearly 7,000 riders from a 30 percent increase in frequency and over 3,000 with a 30 percent boost in speed. At current fares, the frequency improvements with optimal TOD bring in an estimated \$22 million in additional revenue, whereas greater speeds nets approximately \$10 million annually (Figure 5-3).

These back-of-the-envelope estimates would benefit greatly from more sophisticated modelling. Elasticities are rarely linear (i.e., distant locations like Fitchburg and New Bedford may get greater relative benefit from reduced travel times to Boston), and cross-elasticities and other dynamic effects are possible.⁴⁰ Our simple estimates treat these two forms of enhanced service as independent from one another, while there is likely some interaction between the two. For instance, increased frequency *and* speed may induce some commuters to travel by rail, while other commuters may make opt to take transit if there is simply more frequency *or* faster speed.

Feeder Bus Service

MBTA ridership surveys show a strikingly small fraction of Gateway City rail commuters take a bus to get to the station (Figure 5-4). This is despite the fact that a number of bus transit hubs are located at or adjacent to rail stations (e.g., Fitchburg, Lowell, Springfield, and Worcester). While this

Figure 5-3: Estimated Revenue (in millions) from Service Improvements, Current vs. Optimal Buildout



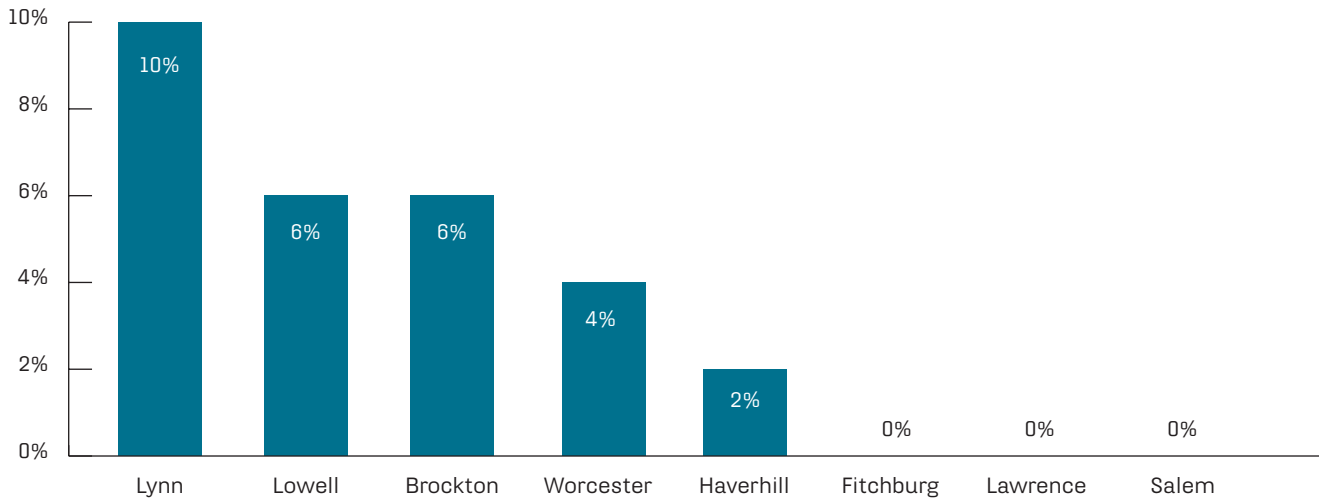
Source: Kittelson Associates and Hodge Economic Consulting

could be a function of poor feeder bus service, the more likely culprit is a combination of those living in surrounding neighborhoods not being able to afford commuter rail passes, current scheduling not meeting the needs of many Gateway City workers, and current train travel being too slow to make commutes requiring a local bus connection manageable.

Our model suggests a 30 percent increase in feeder service nets fewer than 100 new riders across the four case-study cities.

This is an area where more research looking at interaction effects could be particularly helpful. For instance, faster service could make improved local bus feeder service more consequential. Similarly, TOD in Gateway Cities and other employment centers along commuter rail corridors would open up more destinations short of a trip all the way to Boston. As a result, a local bus-to-train journey would become more feasible. Finally, fare reductions, particularly for low-income riders, could also mean more commuters from Gateway City neighborhoods making use of transit via feeder buses. (To incentivize bus-to-rail connections, the MBTA could allow for transfers where rail passengers get credit for their bus fare to lower the cost of the rail ticket.)

Figure 5-4: Share of Commuter Rail Riders Accessing Station via Feeder Bus



Source: MBTA Rider Surveys, 2016-2017

Barriers to Improving Service

There are many ways to achieve the hypothetical 30 percent increase in frequency and 30 percent increase in speed. They include:

- Running more express trains to Boston with fewer station stops to reduce travel time;
- Adding more trains during off-peak travel periods;
- Increasing the efficiency of boarding with level-platforms and additional doors on coaches;
- Improving signalization and freight rail routing; and
- Converting to electric locomotives that accelerate faster.

The MBTA is currently undertaking an ambitious Commuter Rail Vision planning effort that will shed more light on these issues and provide more in-depth information for leaders contemplating Gateway City TOD. But several barriers to service improvements are already well understood.

The most prominent barrier is track capacity at Boston's terminal stations. Currently, both North and South Station are at capacity during the peak hour. North Station has two additional tracks (11 and 12) that will be connected to the existing tracks (1–10) once the Charles River drawbridge is re-

placed. This project is currently out for bid and will provide considerably more capacity to serve the six Gateway Cities north and northwest of Boston. South Station requires new track in order to accommodate more trains. While funding and implementation details are not yet certain, this project is recommended in the latest state rail plan, and MassDOT received a Federal Railroad Administration grant for planning and design. Additional track capacity at South Station is key to the South Coast rail extension upon which TOD in three Gateway Cities is contingent, as well as proposed increases in passenger rail service west to Worcester and Springfield.

Operating commuter rail on tracks shared by freight rail has been a major barrier to improving performance in Massachusetts and throughout the US. Over the years, MassDOT has been slowly chipping away at this problem by acquiring rights from freight carriers and double-tracking choke points. Signal spacing is one way freight rail continues to impinge on commuter rail speed. Currently, the system must space signals every three miles to accommodate the length of a freight train plus its stopping distance. This limits the headways possible at each station. With commuter and freight rail sharing track, the only remedies are reducing the speed of freight trains (e.g., the MBTA currently imposes a 5 mph speed reduction where CSX

Table 5-5: Current Capacity and Operational Issues by Commuter Rail Route

STATION	SPEED/FREQUENCY CONSTRAINTS	OTHER ISSUES
Fitchburg	<ul style="list-style-type: none"> • Peak period frequency constrained by North Station platform capacity • Speeds limited west of Ayer by freight traffic 	<ul style="list-style-type: none"> • Dispatching control west of Littleton/I-495 maintained by Pan Am Railways
Lynn	<ul style="list-style-type: none"> • Peak period frequency limited by upstream single-track sections (Salem tunnel) • Peak period frequency constrained by North Station platform capacity 	<ul style="list-style-type: none"> • 12 trains per day currently pass through Lynn without stopping
Springfield	<ul style="list-style-type: none"> • Double tracking northern section of Connecticut in Windsor area is not funded • Operations at Union Station could be improved with wye track related to current back-up maneuver 	<ul style="list-style-type: none"> • 12 of the 17 round-trip trains between New Haven and Hartford will connect to Springfield • Future east-west rail is an opportunity to add more train service to/from Springfield
Worcester	<ul style="list-style-type: none"> • Frequencies limited at Worcester's Union Station due to platform configuration • Express service trains constrained by double-track section • Peak period frequency constrained by South Station platform capacity 	<ul style="list-style-type: none"> • Planned upgrades at Worcester station will allow for increased frequencies • MBTA adding third track between Route 128 and Framingham; planning additional third track upgrades over next few years

and Pan Am freight trains use track owned by the MBTA) or running smaller freight trains in these segments.

Last, it must be noted that the funding model or lack thereof for regional transit authorities (RTAs) and transportation management associations (TMAs) presents a barrier to expanded feeder service to MBTA stations. A number of communities in greater Boston are starting to improve bus transit and shuttle services to and from stations, including efforts to support reverse commute options in Maynard and Westborough. As the technology advances, automated self-driving vans offer the potential to provide more robust service at far lower costs. If we can develop more flexible and reliable funding streams, there should be opportunities in the future to generate substantial new ridership through feeder services to help with first- and last-mile connections.

Moving from “Commuter Rail” to “Regional Rail”

The MBTA commuter rail system serves 175 communities with 388 route miles over 14 lines. Although ridership is far higher on Boston’s rapid transit system, the commuter rail delivered over 729 million passenger miles in 2014, 20 percent more than the 605 million passenger miles offered by the Blue, Orange, and Red lines combined. These figures demonstrate the major contribution commuter rail provides in connecting regional economies and reducing vehicle travel and congestion.

However, as the map of the Worcester Line west of Route 128 on the opposite page depicts, our current mode of planning and building around the commuter rail has failed to create nodes of regional economic activity. Most of the region’s jobs fall along the highway exit ramps and interchanges, such as the crossroads where I-495 meets Route 20 and Route 9.

We define commuter rail corridors as locations within three miles of a station. Across the lines serving Gateway Cities, the majority of jobs (62 percent) within this 3-mile buffer fall beyond a 1-mile radius of the station. Roadways have clearly exerted more pull over employers, and often the highways are just beyond the reach of rail, making it difficult to create true multimodal destinations.

Fortunately, this is not always the case; each corridor has significant concentrations of rail-accessible jobs to build upon. West of Natick, more than 80,000 jobs are located within one mile of a commuter rail station (see the dark grey circles in Figure 5-5). Together, the Gateway City commuter rail corridors have close to 400,000 jobs within a mile of the station (Table 5-6).

With help from regional economic development organizations like the 495/MetroWest Partnership, companies in these suburban locations are increasingly looking to the rail lines as a strategy to attract and retain skilled workers. To connect these businesses to workers, RTAs are running new shuttle services to complete first- and last-mile connections for commuters between rail stations and local employers.

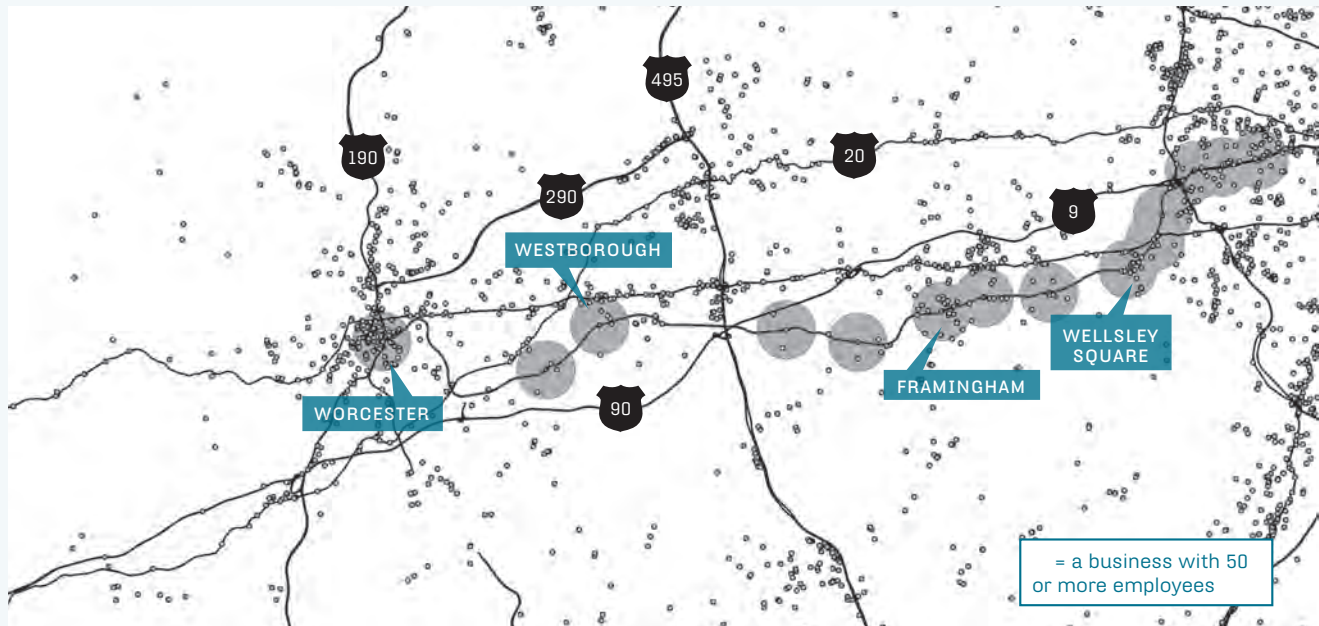
At present, most of these shuttle services offer just one or two picks-ups each day during the morning and the afternoon rush hour, and they tend to be geared more toward commuters travelling from Boston than Gateway Cities. However, as the examples below illustrate, they foretell a future in which improved rail service, combined with efforts to enhance connectivity between stations and regional employment centers, will lead to more dynamic mobility and job opportunity for those living within a commuter rail corridor.

Table 5-6: Employment in Gateway City Rail Corridors (within 3 miles of a station)

CORRIDOR	NUMBER OF JOBS			SHARE OF JOBS		
	>1 mile	1/2 - 1 mile	<1/2 mile	>1 mile	1/2 - 1 mile	<1/2 mile
Fitchburg Line (Concord North)	93,244	37,020	19,698	62%	25%	13%
Haverhill Line (Wakefield North)	127,270	32,082	26,825	68%	17%	14%
Lowell Line (Winchester North)	80,428	38,301	20,401	58%	28%	15%
Middleborough Line (Randolph South)	51,406	13,348	19,162	61%	16%	23%
Newburyport/Rockport Line (Lynn North)	70,033	39,868	39,812	47%	27%	27%
Providence Line (Stoughton South)	43,517	13,431	12,582	63%	19%	18%
Worcester Line (Natick West)	167,054	48,240	32,242	67%	19%	13%
Total Jobs	632,952	222,290	170,722	61%	22%	18%

Source: ESRI Business Analyst

Figure 5-5: Worcester Line Job Centers



Source: ESRI Business Analyst

Westborough Station. Sanofi-Genzyme and many other major employers offer thousands of jobs in Westborough just 12 miles east of downtown Worcester. Driving this distance with morning traffic takes a half hour or more. Via public transit, this is a 17-minute train ride from downtown Worcester, followed by a 15-minute ride on the Worcester Regional Transit Authority shuttle, which transports workers from the Westborough MBTA station to jobs near the Route 9/I-495 interchange.

Southborough Station. Boston Scientific's campus in Marlborough is 17 miles from downtown Worcester. Driving straight out on I-290, this is a 25-minute journey. Taking public transit requires a 38-minute train ride to the Southborough station, followed by a 20-minute bus ride on the MetroWest Regional Authority shuttle (MWRTA).

Framingham Station. The 26 miles from Worcester to Staples, one of the largest employers in Framing-

ham, is about 40 minutes by car at rush hour. On public transit, it requires a 40-minute train ride followed by 15 to 20 minutes on the MWRTA commuter shuttle.

Littleton Station. With the newly-adjusted schedule on the Fitchburg Line to facilitate reverse commuters, the towns of Littleton and Westford are in the process of implementing a new shuttle program connecting IBM and Juniper Networks' employees to and from the Littleton MBTA rail station. This service aims to encourage those living in Boston to commute out, but the shuttle's schedule will also be synchronized with inbound trains, making it an option for residents of downtown Fitchburg as well. For \$3.25, passengers can ride from Fitchburg to the Littleton Station in less than 30 minutes, about the same time as required to make this 20-mile journey by car. The Shuttle ride is another 10 minutes to IBM in Littleton and 15 minutes to Juniper Networks in Westford.



Chapter 6:

Estimating the Potential Climate Benefits of Gateway City TOD

Compared to business-as-usual development patterns, Gateway City TOD will concentrate new growth in mixed-use areas that generate less travel in passenger vehicles and more walking, biking, and transit riding. Households will also forego larger housing units to live in vibrant urban neighborhoods with strong transit service, resulting in less home energy use for heating and cooling.

Our final task is to estimate the GHG emission reductions that Gateway City TOD has the potential to produce through these travel and home energy use impacts, providing policy-makers with an order of magnitude estimate of the potential benefits to the climate. (Appendix C provides our complete methodology for the analysis presented below.)

I. Travel Impacts

Combining travel data for each city with data gleaned from research examining how TOD projects influence travel patterns, we first estimate the change in trips by travel mode under the optimal TOD redevelopment scenario, for both the four case-study cities and all 13 Gateway Cities with current or planned commuter rail service.

Case Study City Estimates

As shown in Figure 6-1, the change in daily trips by mode with optimal TOD buildout leads to a considerable shift in travel patterns compared to business-as-usual development patterns. Across the four case-study cities, optimal buildout in TOD areas will lower auto trips by almost 67,000, with 22,000

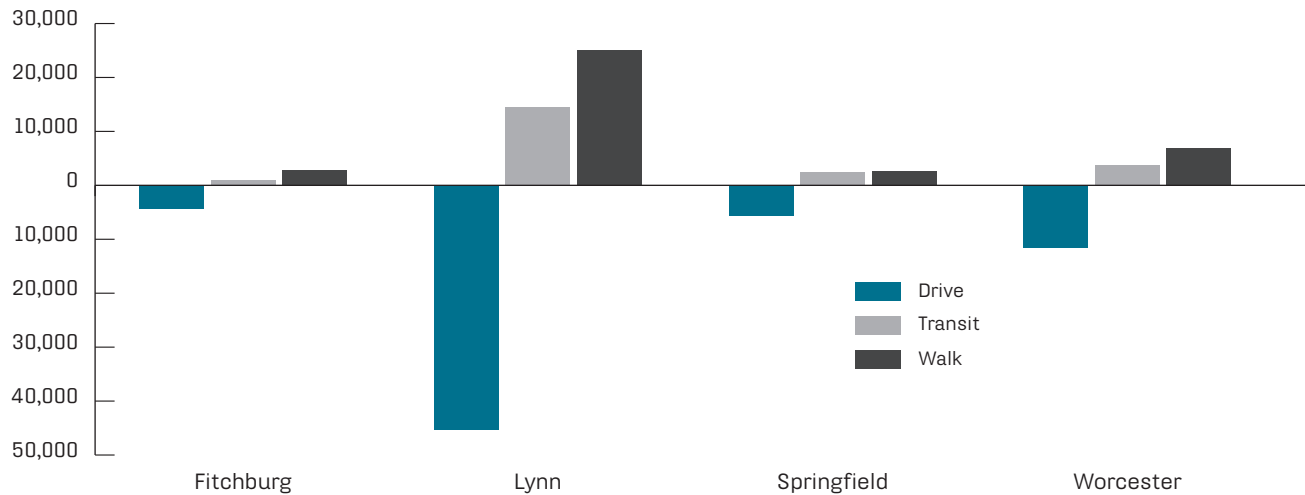
more transit trips and 37,500 more walking trips.

This shift to transit, walking, and biking has large impacts on vehicle miles travelled (VMT). Reduced VMT from TOD is primarily due to fewer auto trips, but TOD can also lower the average trip length for auto travel. For example, a household may still use a car for grocery shopping, but living downtown, the supermarket is more likely to be just a short ride away. The reductions associated with optimal TOD are quite different for commute versus non-commute trips (Figure 6-2). TOD produces a larger shift from driving to transit use for work trips, while TOD generates more walking versus driving for non-commute trips (shopping, leisure, etc.). These combined forces—more transit use for getting to work, significantly more walking, and fewer and shorter auto trips for other activities—lower VMT by 380 million miles per year under the optimal buildout scenario, compared to development that is spread out based on existing citywide patterns.

While the reduction in GHG emissions this reduction in vehicle travel produces is somewhat offset by increased emissions from rail and bus transit operations required to handle the additional ridership, the net impact of Gateway City TOD on transportation-sector emissions is still large. Together, optimal TOD in the four case-study cities reduces GHG emissions by 156,000 metric tons annually.

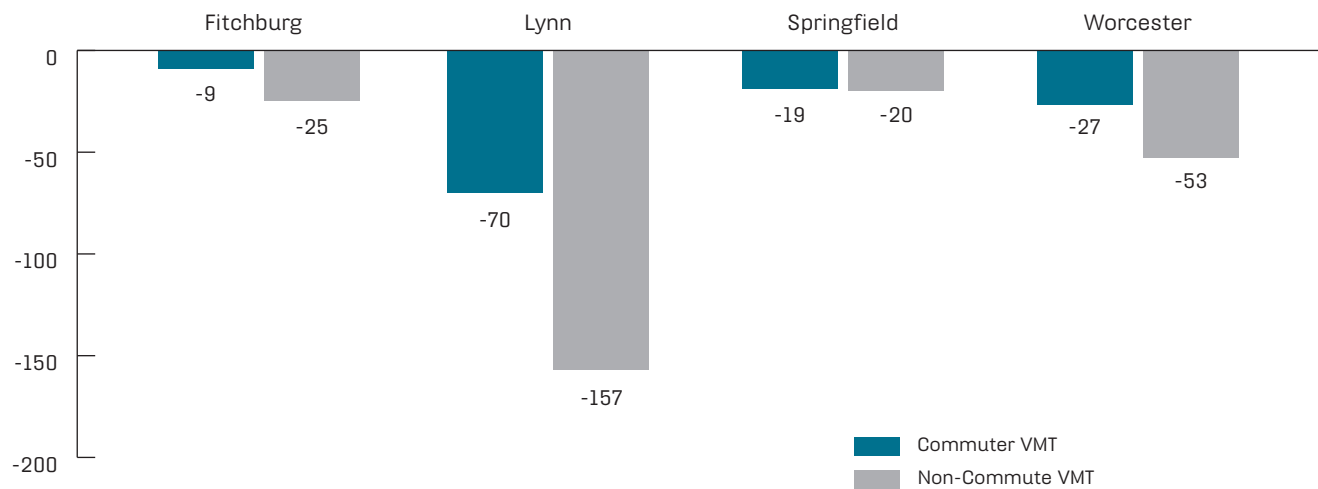
Across the four cities, the annual GHG emissions reduction from the business-as-usual scenario ranges from 36 percent in Fitchburg to 51 percent in Lynn. This variation is the result of both differences in the volume of new development

Figure 6-1: Change in Daily Trips by Travel Mode, Business-as-Usual vs. Optimal Buildout



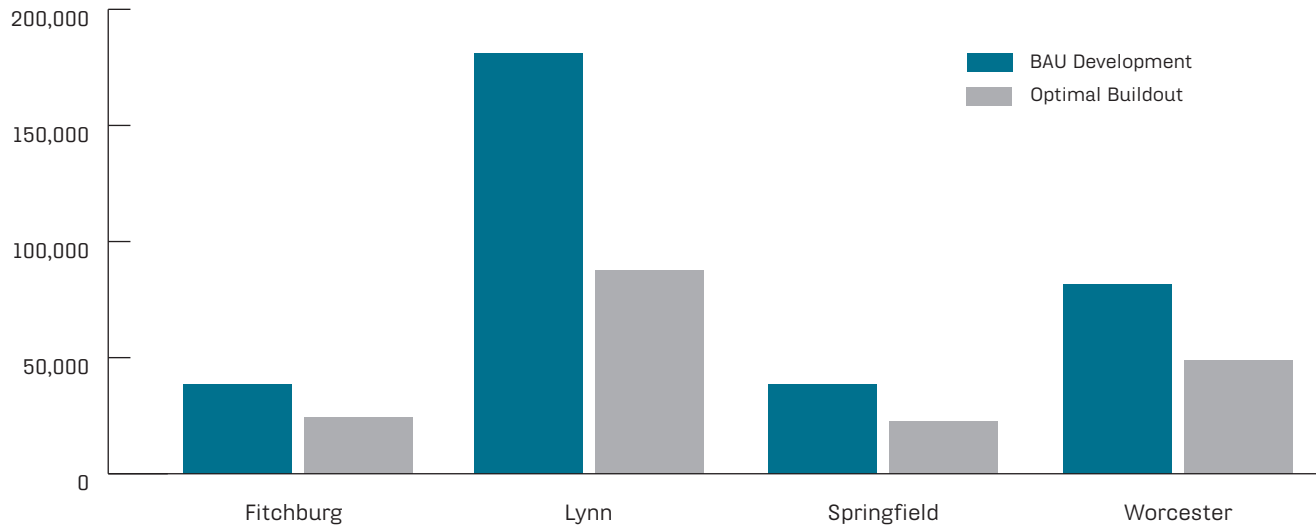
Source: Kittelson Associates

Figure 6-2: Reduction in Commute and Non-Commute Vehicle Miles Traveled (VMT) at Optimal Buildout (millions of miles)



Source: Kittelson Associates

Figure 6-3: Metric Tons of Annual Passenger Vehicle GHG Emissions, Optimal Buildout vs. Business-as-Usual (BAU)



Source: Kittelson Associates

and how sharply TOD travel patterns contrast with the business-as-usual condition. In Fitchburg, TOD actually leads to the biggest percentage shift to transit, but the total volume of development is relatively small, which moderates the potential gain as compared to the other cities.

Extrapolating to all 13 Gateway Cities

We can extend this analysis to all 13 Gateway Cities by inputting the estimates of additional development capacity at optimal buildout presented in Chapter 3. Across the 13 Gateway Cities with commuter rail (or planned commuter rail), optimal TOD within a half-mile radius of train stations has the potential to reduce vehicle commute trips by 16 percent and non-commute trips in vehicles by 24 percent compared to business-as-usual patterns. Commuter and non-commuter VMT falls by 37 percent and 43 percent, respectively. The end result is a 40 percent drop in GHG emissions—a reduction of roughly 800,000 metric tons annually.

While this estimate has far less precision at the individual city level, it offers an upper-bound order of magnitude estimate of the potential of policies aimed at lowering GHG by stimulating TOD in Gateway Cities.

II. Home Energy Use Impacts

Studies show that the GHG emission reductions attributable to the travel impacts of TOD account for more than half the total; the home energy benefits associated with households occupying smaller residential units in multifamily buildings with shared walls represent approximately 40 percent of TOD's impact.⁴² However, given our region's cold winter climate, the residential energy savings in Massachusetts are likely to be more on par with the transportation reductions.⁴³

Using assessor's data, we attempted to model the variation in dwelling size and format (i.e., how many units and shared walls) in Gateway City TOD areas relative to other locations in these cities and regions. Unfortunately, the data were not precise enough to produce accurate measures in many communities. For an order of magnitude estimate, given the number of studies and fairly consistent findings across them, we believe it is reasonable to assume the heating and cooling impacts from Gateway City TOD at optimal buildout will be roughly equivalent to the 800,000 metric-ton annual reduction generated by changing transportation patterns.

III. GHG Emissions Reduction Benefits in Context

To make these findings more relatable, we can convert the estimated annual emissions reduction into more commonly understood metrics. For instance, if Gateway City TOD can reduce GHG emissions from the transportation sector by 800,000 metric tons, it will be equivalent to:⁴⁴

- Reducing oil consumption by 187,245 barrels;
- Planting 951,091 acres of forest to sequester carbon;
- Supplying carbon-free electricity to 121,027 homes; and
- Offsetting GHG emissions valued at \$63 million.

Assuming equivalent savings from home heating and cooling, the total gains from optimal Gateway City TOD will be equivalent to:

- Reducing oil consumption by 375,489 barrels;
- Planting 1,902,181 acres of forest to sequester carbon;
- Supplying carbon-free electricity to 242,053 homes; and
- Offsetting GHG emissions valued at \$126 million.

Table 6-1: Estimated Transportation Sector GHG Emission Reductions, Optimal Buildout vs. Business-as-Usual (BAU)

	VMT (in millions)									Metric Tons of GHG		
	Commute			Non-Commute			All Vehicle Trips					
	BAU	TOD	% Change		TOD	% Change	BAU	TOD	% Change	BAU	TOD	% Change
Attleboro	166	110	-34%	146	83	-43%	312	193	-38%	128,663	79,577	-38%
Brockton	114	70	-39%	100	57	-43%	214	127	-41%	88,012	52,291	-41%
Fall River	338	232	-31%	302	170	-44%	641	402	-37%	263,620	165,448	-37%
Fitchburg	37	25	-33%	57	35	-39%	93	59	-37%	38,541	24,482	-36%
Haverhill	83	55	-33%	63	36	-43%	146	91	-37%	60,012	37,572	-37%
Lawrence	521	316	-39%	472	283	-40%	992	599	-40%	408,425	246,564	-40%
Lowell	474	296	-37%	416	241	-42%	890	538	-40%	366,161	140,594	-62%
Lynn	205	112	-45%	234	101	-57%	439	213	-52%	180,958	87,767	-51%
New Bedford	280	187	-33%	253	144	-43%	533	331	-38%	219,320	136,381	-38%
Salem	122	71	-42%	123	79	-36%	244	150	-39%	100,786	61,791	-39%
Springfield	59	35	-40%	35	20	-45%	94	55	-42%	38,699	22,602	-42%
Taunton	66	47	-29%	52	29	-44%	118	76	-36%	48,849	31,468	-36%
Worcester	95	60	-37%	103	59	-43%	198	118	-40%	81,581	48,879	-40%
Total	2,559	1,617	-37%	2,356	1,335	-43%	4,915	2,952	-40%	2,023,628	1,216,151	-40%

Source: Kittleson Associates and Hodge Economic Consulting

Budding Gateway City Ridership

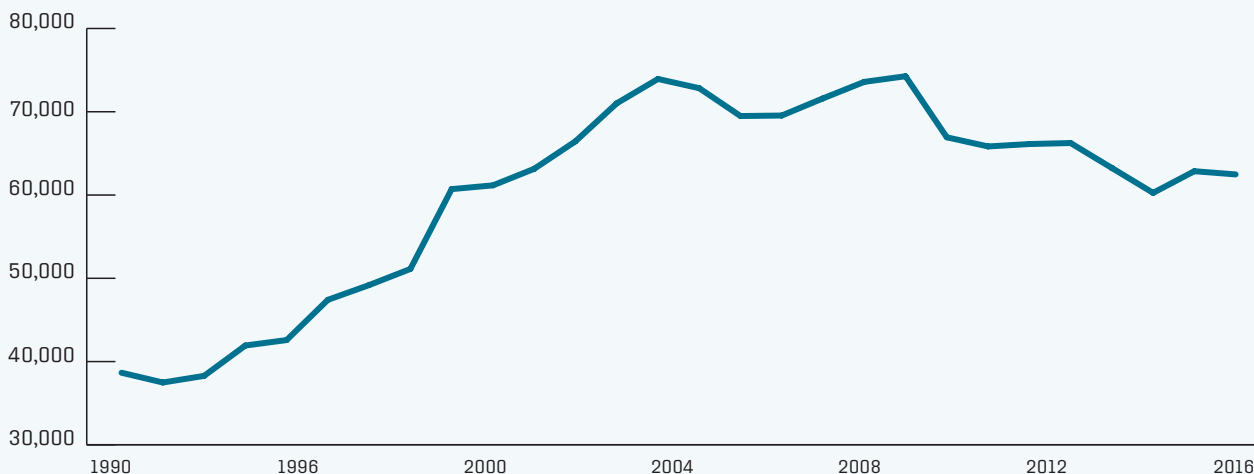
Over the past few decades, commuter rail ridership has ebbed and flowed. Rising in the 1990s and 2000s—as the system reestablished service to Plymouth on the Old Colony Line, extended service from Attleboro down to Providence, and added the Greenbush Line to Scituate—and waning in recent years, with relatively low gas prices, new work-from-home employer policies, deterioration in service, and substantial increases in fares and parking fees.

While some of the ridership decline may be related to new methods of counting, there clearly has been some loss in ridership, or at least stagnation in growth. This is particularly notable when juxtaposed with employment trends. From 1990 to 2003, commuter rail ridership increased by 91 percent even though employment growth in Boston was flat. The number of jobs in Boston expanded by almost 15 percent from 2010 to 2016. Despite these gains, commuter rail ridership fell by 6 percent over this period.

Interestingly, Gateway City stations have showed signs of life in recent years (Figure 6-5). Between 2007 and 2013, the most current individual station data available, ridership from the 12 MBTA Gateway City stations grew by 34 percent. In contrast, ridership from the other stops on Gateway City lines increased by just 4 percent. With the exception of Brockton, every Gateway City station gained significant ridership and all of them outperformed the other stations on their lines. Worcester's 41 percent gain is particularly impressive, given that these ridership figures predate Express Service and the redevelopment occurring now around Union Station.

In thinking about these trends and the potential for Gateway City TOD, it is also important to recognize that at current levels of development, several Gateway Cities are already approaching or beyond the recommended 60 units of urban intensity in their station areas (population plus jobs per acre) to support frequent transit service; with optimal TOD, all Gateway Cities with the exception of Taunton will surpass this threshold (Figure 6-6).⁴¹

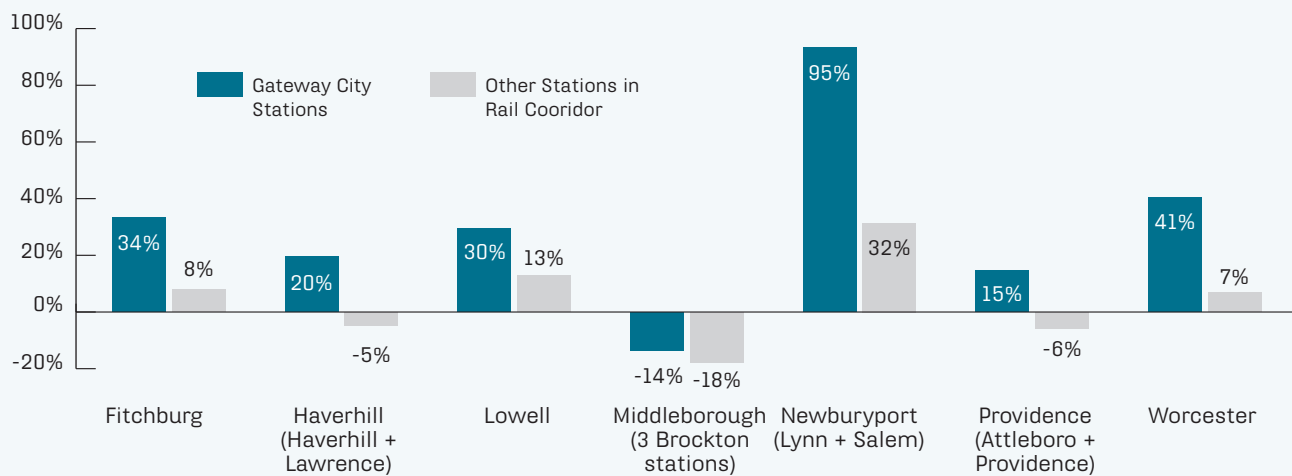
Figure 6-4: MBTA Commuter Rail Ridership 1990 to 2017 (average weekday Inbound boardings)



Source: MBTA and Hodge Economic Consulting

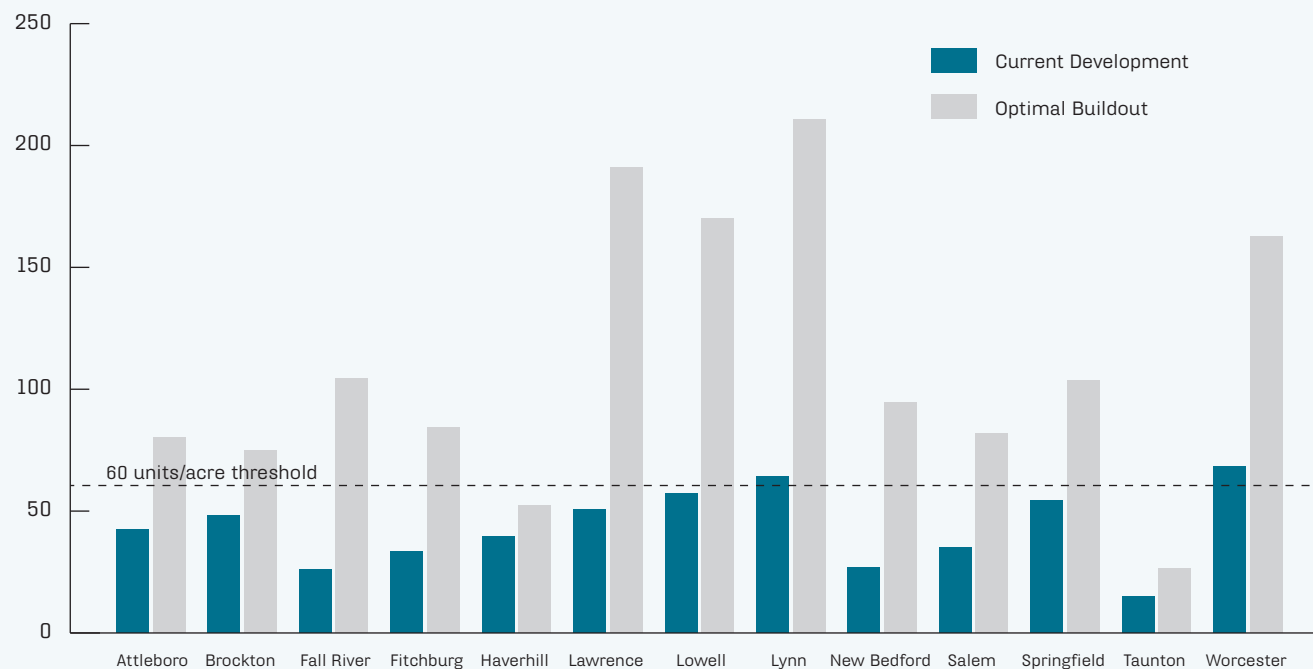
Note: Data from 1990 to 2013 is for fiscal years, data for 2014 is estimated based on trends, and data for 2015 to 2017 is downloaded from the MBTA Performance Dashboard. Part of the recent decline may be attributable to new methods of estimating ridership. State officials also caution about the overall reliability of commuter rail ridership data.

Figure 6-5: Percent Change in Riders, Gateway City Stations vs. Other Stations in Rail Corridor, 2007 to 2013



Source: MBTA Ridership and Service Statistics, Fourteenth Edition (2014)

Figure 6-6: Jobs and Population per Acre, Current Development and at Optimal Buildout



Source: Census ACS 2016 5-year estimates and ESRI Business Analyst



Chapter 7:

A State-Level Action Plan for Transformational Gateway City TOD

With an intentional strategy and careful execution at both the state and local levels, Massachusetts has a real opportunity to catalyze growth through Gateway City TOD that is good for the economy, the environment, and quality of life.

Delivering on the promise of Gateway City TOD will require investments in both station area development *and* transit service. From a fiscal standpoint, the state is positioned to be the largest beneficiary of such investment. More development in Gateway Cities will increase tax valuation and reduce the need for local aid. Better connectivity to jobs for those with limited means will increase earnings and reduce state expenditure on subsidized health insurance, child care, and other social safety net services. More housing will enable population and job growth, filling state coffers with income and corporate excise taxes.

Perhaps most important, Gateway City TOD could help balance economic development, both geographically and across the income distribution. By a nearly two-to-one margin, polling shows Massachusetts residents want state leaders to prioritize expanding the economy in ways that are equitable, versus simply producing as much additional growth as possible.⁴⁵

How state leaders go about this task is an open-ended question. The public is highly skeptical that state government can accomplish “transformational,” particularly when it comes to transportation. Residents often have more trust in their local governments to deliver, although local governments lack both capacity and spending power.

By building local partnerships and carefully layering modest investment in development on top of modest investment in existing transit assets, the recommendations outlined below will allow the state to overcome these obstacles with incremental progress toward truly transformational Gateway City TOD.

Development Investments

1. Adequately capitalize tools that can close financial gaps for catalytic projects in Gateway City station areas.

Activating downtown Gateway City real estate markets that have endured decades of disinvestment will require an initial set of TOD projects at sufficient scale to generate mixed-use activity. Tools to close financial gaps in pioneering projects are the foremost priority. Without these tools, it will be difficult to alter the status-quo trajectory.

Massachusetts does have several programs to support housing development, but these tools are under-resourced. As result, they are difficult to utilize for Gateway City TOD projects and the projects that do get built with them are often too small to generate activity that stimulates investment in neighboring properties. To remedy this problem, the state should devote additional resources for Gateway City TOD projects to the Housing Development Incentive Program (HDIP) and MassHousing’s Workforce Housing Program (WHP).

HDIP is ideally suited to serve as a workhorse for the infill and redevelopment opportunities marbled throughout the Gateway City TOD areas. The credit provides flexible equity for both ground-up new construction and adaptive reuse by subsidizing up to 25 percent of development costs. The only limitation is that the program is capped at just \$10 million annually. Currently, there are pending applications for approximately 16 projects totaling \$26.5 million. Increasing the volume of credits available, as well as the \$2 million per project cap, would allow a number of Gateway City TOD projects to move forward immediately.

The state could also increase the power of HDIP by working to couple it with a recapitalization of the WHP. MassHousing

established this \$100 million fund in 2016, in part, to fill an identified void for underwriting large-scale transit-oriented projects, both new construction and adaptive reuse. To meet underserved demand for middle-income housing, MassHousing requires that units financed with this very low interest subordinated debt be affordable to households with incomes between 60 and 120 percent of AMI for a minimum of 30 years.

Providing public funds at this middle-income band can close financial gaps, while assuaging concerns that projects financed with subsidies that require income-restrictions will lead to further concentrations of poverty in Gateway City station areas. So far, these funds have been difficult to deploy in Gateway Cities because the fund's \$100,000 per unit cap

Making a Major Investment in Pioneer Valley R&D

Rail investment and a refurbished Union Station, along with the new casino and MBTA subway car manufacturing facility, all provide important contributions to the Springfield economy. But the Pioneer Valley needs heartier support from the state to execute a 21st-century economic development strategy. The region's size and distance from Boston make it a true second metropolitan area for Massachusetts—so it must have its own strong economic center, R&D, and agglomeration activity to succeed in a global innovation economy.

With an enviable precision manufacturing legacy, and a large collection of colleges and universities, the Pioneer Valley should be in a position to build such an economy, but Massachusetts's tendency to rely on the strength of private institutions in and around Boston to create R&D spinoff has held the region back.

The Baker Administration has worked creatively to leverage Boston's R&D prowess for broader regional economic development, committing \$100 million to the Massachusetts Manufacturing Innovation Institute. This investment has provided critical matching funds to help UMass, MIT, and other higher education institutions win six federal funding grants through the National Network for Manufacturing Institutes. MIT is now working with Quinsigamond Community College on advanced fabrics and photonics, UMass-Lowell and WPI on robotics, and UMass-Lowell and UMass-Medical on biopharma.

It is telling that Springfield is absent from this activity. This is a function of both UMass-Amherst's below-average R&D and commercialization presence for a university of its size, and the flagship campus' remote location.

Positioning Springfield and the Pioneer Valley to compete for R&D activity that leads to commercialization and economic development spinoff will require a sizeable investment along the lines of the state's long-term commitment to UMass-Medical in Worcester, New York's investment in the Colleges of Nanoscale Science & Engineering in Albany, and the institutional investments planned as part of the UK's \$10 billion Northern Powerhouse Project.

Over the years, there have been several discussions about establishing a major academic research institute in Springfield, but these conversations haven't led to a viable idea. With new transportation connections and positive signs that TOD is starting to take hold throughout the Springfield-New Haven corridor, it is time to revisit this concept and look carefully at how a transit-oriented downtown Springfield R&D center could stimulate 21st-century growth up and down the Pioneer Valley.

is insufficient to close financial gaps in weak Gateway City markets. The five projects that have closed in Gateway Cities contain other subsidy streams and lean more toward affordable housing developments for low-income residents, with a smaller slice of middle-income housing.

By recapitalizing WHF and substantially increasing HDIP so that these two funding streams can complement one another in larger projects, Massachusetts could ignite a series of mixed-income residential projects at significant scale to breathe more life into these station areas.

Closing financial gaps in commercial and mixed-use projects is more difficult. In contrast to new housing, which will almost always lease up, even in relatively weak housing markets, filling commercial space in soft markets is extremely challenging. For this reason, very few tools have been designed to serve this niche. The absence of a financing program to rebuild downtown commercial markets has been identified numerous times in the past, including in a review of TOD development financing gaps conducted by the Metropolitan Area Planning Council in 2012, and more recently by a 2016 task force convened by the Federal Reserve Bank of Boston.⁴⁶

The federal New Markets Tax Credit (NMTC) is one of the few tools available to play this role, but Gateway City projects have struggled to make use of it because these dollars are limited and Gateway City developers often lack the sophistication to utilize this complex program. There are also structural limitations. For instance, most NMTC investors prefer to exit the deals at the end of the seven-year compliance period over which the tax benefits are distributed; commercial Gateway City TOD projects often require a longer time horizon to generate an income stream.

Thirteen states have tried to make the federal NMTC more powerful by creating a complementary credit at the state level. As more national and regional development entities seek out opportunities in Gateway Cities (and more Gateway City developers gain the sophistication to use this tool), a state NMTC may prove valuable. Alternatively, Massachusetts could look to capitalize on the new federal Qualified Opportunity Zones (QOZ) Tax Credit. While regulations must be written and a market must form, the QOZ credit could address some of the NMTC limitations. Investors must wait 10 years before they get maximum tax benefit, which could make it a vehicle for getting more patient equity into Gate-

way City projects. There also seems to be recognition that the transaction process must be less complex than the NMTC in order for Opportunity Zones to have a powerful impact on smaller cities and rural areas.

As policymakers look at opportunities to draw private equity into Gateway City TOD projects, they should also analyze a homegrown remedy. In 2015, the Massachusetts Housing Investment Corporation and the Conservation Law Foundation came together to fill investment voids in Boston and the Gateway Cities by building the \$22 million Healthy Neighborhoods Equity Fund (HNEF). HNEF generates investment in mixed-use projects in transitional neighborhoods by distributing risk at different thresholds among public, private, and philanthropic investors. To date, the fund has supported mostly Boston-area projects. In the future, it is possible that a blended fund like this could have greater impact in weaker Gateway Cities markets with the public sector providing a larger layer of first-loss equity.

To sort through recent experience and all of the options for financing commercial and mixed-use Gateway City TOD projects, the state's economic development policymakers should convene a group of experts in community development finance and private equity.⁴⁷

2. Increase state funding for land acquisition.

It would be foolhardy to make significant long-term investments in rail, only to have real estate markets make durable investments around it in the short term that do not take full advantage of this costly public infrastructure. For a fraction of the capital expenditure we have made (or will make) on rail, the state can put in place a more muscular land acquisition program that responds to various opportunities, while aligning the interests between municipalities and the state, so that both parties maximize their benefits with optimal development.

The need for such a program is urgent because Gateway Cities are ill-positioned to assemble land and hold it until the right development opportunity surfaces. Municipal governments and economic development entities in these communities simply lack cash to purchase parcels. State partners must be able to make flexible resources available to these communities so that they can assemble land and carry out their TOD plans.

The Commonwealth Site Readiness Fund managed by MassDevelopment meets this exact need. Capitalized with \$15 million in the 2016 economic development bill, these flexible resources can help with site assembly and other pre-development costs for both commercial and mixed-use projects. To date these dollars have mostly supported efforts to reposition, market, and expand industrial parks, but the enabling legislation specifically includes downtown revitalization as an intended use.

So far the capital budget has allocated \$4 million for expenditure (\$1.5 million in FY 17 and \$2.5 million in FY 18). With such modest resources to meet the state's needs for both industrial park expansion and downtown revitalization, the awards have mostly been small pre-development grants. Recognizing the resource limitation, MassDevelopment's funding guidelines explicitly call for a focus on small-scale acquisitions. Fulfilling the promise of a Gateway City TOD strategy will require a more substantial allocation of resources to the Commonwealth Site Readiness Fund.

There are also instances where Gateway Cities require relatively short-term (less than three years) acquisition funds. In these situations, the city generally has a viable project

partner, but the private developer cannot afford to hold the property through site assessment, design, and permitting, because debt financing is unavailable to them until after the project closes. Securing the property with more costly investor equity in a risky market widens project financing gaps considerably.

Lending funds, such as the Equitable Transit-Oriented Development Accelerator Fund (ETODAF) created by Boston LISC, The Boston Foundation, and the Hyams Foundation in 2014, can meet short-term acquisition needs. However, like the Healthy Neighborhoods Equity Fund described above, ETODAF's heavy reliance on private dollars has made its risk profile too conservative for most Gateway City contexts. In the future, the state could move to draw more private lending into riskier Gateway City projects by providing a larger share of top-loss reserve when supporting funds like these.

3. Increase local capacity and coordination.

Providing these strong public subsidies to private developers must be done with extreme care and foremost consideration placed on generating a return on the taxpayer's dollar. The state has an obligation to invest only in communities

How do we fund these investments?

As outlined above, local options taxes adopted by voters through ballot initiatives along with proceeds from RGGI auctions could cover transportation improvements.

The state could fund the economic development investments outlined above by sunseting less-effective programs and transferring resources to this strategy. Since 2006, Massachusetts has devoted nearly \$1 billion to the Film Tax Credit program, a figure that dwarfs most other economic development investments.

A 2012 legislative commission on tax expenditures called on the state to

regularly review the use of tax credits, limiting their use to those that have a clearly articulated public policy purpose *and* can demonstrate that they are highly effective at achieving this outcome.

The film tax credit cannot meet these tests. Favoring this single industry is not a compelling public policy purpose, and since its inception, there has never been an independent review of the credit that found it was highly effective. To the contrary, regular analyses conducted by the Department of Revenue show that it has consistently been a net loss for taxpayers. For every dollar expended, the state has

netted just 14 cents in revenue.⁵⁰

With the leverage state spending to support urban revitalization in Gateway Cities would generate from private and federal investment, the construction activity alone would easily surpass what little economic contribution the film tax credit provides. Factor in the sustained long-term benefits that come with greater and more inclusive economic development and GHG reductions, and trading the film tax credit for the investments outlined above would produce a return for taxpayers several orders of magnitude greater.

that have done their part to develop and execute on a market-driven TOD plan. At the same time, we must accept that communities face very real internal challenges in this regard.

Taking land off the tax rolls in order to assemble parcels and attract development is fraught with difficulty in cities that perpetually struggle to employ a sufficient number of teachers, police officers, and firefighters. Sacrificing parking in economically fragile downtown commercial districts that are still overwhelmingly oriented toward vehicle travel is often an extremely tough sell. Gateway Cities have very limited economic development and planning staff, which makes it even more difficult to overcome these obstacles and lay the groundwork for complex TOD.

Created by 2014 economic development legislation, MassDevelopment's Transformative Development Initiative (TDI) recognizes and responds to these realities. The program provides cities with mid-career professionals to organize redevelopment activities within a tightly-defined district for three years (in 8 of 10 initial Gateway Cities, the TDI district overlaps with current or planned station areas). Serving as a liaison between the state and the city, these on-the-ground TDI Fellows are able to organize communities around a common vision for the targeted district and help leaders reach consensus on difficult issues and execute their strategies.

To date, MassDevelopment has done yeomen's work implementing this program. The TDI Fellows they have recruited are highly regarded by local officials. Program staff have worked tirelessly to coordinate with other state agencies, and they are collecting data to evaluate progress in the districts, as well as the performance of the initiative overall.

As state and local officials work together to coordinate investments around transit, there is an even higher imperative for this model. The Governor's 2016 economic development legislation included a \$50 million bond authorization for TDI. The majority of these funds are still available for the program to draw down. While these dollars are intended for direct equity investments in projects, consistent with the complex nature of TOD, funding TDI planning and staffing in these districts over a longer time horizon would be an appropriate use of these capital dollars. (The resources described above could then provide the equity necessary for predevelopment and other development activities.)

As MassDevelopment considers how to best deploy TDI resources to increase capacity and coordination in TOD projects, it should also explore different support models, such as creating a dedicated position to liaise across local districts and state agencies on issues related to complete streets and transportation planning.

Transportation Investments

1. Lower commuter rail fares.

For TOD to occur in most Gateway Cities, a more rational fare structure is an absolute prerequisite. Current fares are simply cost-prohibitive for most low- and moderate-income residents. In addition to the sound economic justice arguments, there is a compelling argument for lowering commuter rail fares, if it is done with a location preference. For many riders, commuter rail supports decentralized growth and a larger carbon footprint; however, for those that live and work near stations, the opposite is true.

The state could reap the greatest benefit at the least cost by providing significantly lower commuter rail fares to these riders. While administering such a policy would present challenges, these can be overcome with technology. For instance, using GPS geo-fencing, a fare-payment application could make the lower rate available to those who spent the day (or previous evening) within a mile of the station area. The MBTA is already moving to put the foundation for this technological capability in place with all-electronic payment on commuter rail scheduled to commence by 2020.

Massachusetts is also in a unique position to adopt such a policy with an ideal revenue pot to cover the fare losses: auction payments from the Regional Greenhouse Gas Initiative (RGGI). In the near term, the MBTA would draw minimally on this pool of funds with few people commuting to and from station areas. As ridership grows along with development over the long term, additional revenue will be available to subsidize the lower fare for urban centers, if we follow California and develop a cap-and-trade program for our transportation sector.

Massachusetts is already seriously exploring this path through the Transportation and Climate Initiative of the Northeast and Mid-Atlantic States; the Senate's pending climate change bill includes authorizing language to facilitate a transportation-sector carbon exchange.

In addition to generating revenue to support transit, by pricing carbon emissions from vehicle travel, a cap-and-trade approach for the transportation sector can help ensure that emission reductions generated by Gateway City TOD are not eroded by additional travel induced by lower congestion on roadways.

2. Empower regions to generate transportation revenues locally.

The most transformative transportation projects in the US are occurring in states that allow regional transportation agencies to raise funds with local option taxes. In 2016 alone, voters went to the ballot box to weigh in on \$250 billion in proposed projects; nearly 70 percent of them won their approval.

With the federal government now contributing less than one-quarter of annual spending on rail and transit in the US, and state budgets increasingly hamstrung by healthcare costs, local ballot initiatives are increasingly how regional economies make the transit investments that support growth. If a federal infrastructure plan comes to fruition, it is likely that regional transportation financing will become even more important (a key component of the Trump Administration's infrastructure proposal is prioritizing federal investments for projects that provide substantial local revenue). In a recent report, researchers at the Brookings Institution implored states to recognize the reality of the new federal relationship, writing:

States must be willing to let cities, counties, and regional governments experiment with different taxation schemes. If constituents don't like a local tax regime, they'll vote with their feet by leaving the region or demanding changes. But states should not preempt localities to even compete for new revenues and the resultant improvements to local transportation infrastructure. States could help build more long-term economic competitiveness by allowing their localities to either increase or authorize access to general-option taxes.⁴⁸

In several previous reports, MassINC recommended the adoption of regional ballot initiatives.⁴⁹ Local leaders from both Boston and the Gateway Cities strongly embrace this approach. And polling consistently shows that voters also favor providing a local option to pay for necessary transpor-

tation investments. In 2016, enabling legislation passed in the state Senate; a similar bill is pending this session. Given the time lag required to develop a responsible regional transportation vision and pass a ballot initiative to implement the plan, Massachusetts can ill-afford more delay.

A regional approach would be particularly well-suited to improving service in commuter rail corridors. The residents of communities that fall along these lines would disproportionately benefit from service that allows them to commute more easily to a larger number of employers in their regions, whether they are travelling on the rail or along the roadways. As the figures in Table 7-1 illustrate, with very modest local option taxes (supplementing state funding), regions could generate sufficient revenues to support faster and more frequent commuter rail service.

This revenue-generating approach could also produce more stable funding for regional transportation agencies (RTAs). The current funding model for these agencies is fundamentally broken, as they all receive shares of a single line item in the state budget, which is prone to rising and falling independent of the actual need locally. Similarly, the state has struggled to find predictable funding streams for smaller Transportation Management Associations. These public-private partnerships provide critical last mile service to suburban employment centers and have a vital role to play in the ultimate success of Gateway City TOD.

With regional revenue, communities will be empowered to make decisions about their needs and ability to pay for them, independent of the broader statewide political considerations that have hamstrung them in the past.

Table 7-1: Estimated Revenue by Commuter Rail Corridor

	0.16% PAYROLL TAX		0.5-CENT/MILE VMT TAX		1-CENT SALES TAX	
	ANNUAL REVENUE	WEEKLY COST/ EMPLOYEE	ANNUAL REVENUE	WEEKLY COST/ REGISTERED VEHICLE	ANNUAL REVENUE	WEEKLY COST/ PERSON
Core	\$119,220,663	\$2.88	\$17,177,794	\$0.88	\$121,972,336	\$2.74
Fitchburg	\$33,383,968	\$2.44	\$18,081,428	\$1.04	\$37,270,506	\$1.61
Foxboro	\$4,191,544	\$2.10	\$3,091,078	\$1.16	\$5,078,749	\$1.52
Franklin	\$9,696,718	\$1.80	\$8,821,314	\$1.06	\$12,899,785	\$1.22
Greenbush	\$12,440,857	\$1.75	\$10,020,908	\$0.99	\$16,814,310	\$1.17
Haverhill	\$23,850,336	\$1.93	\$20,524,913	\$1.03	\$30,382,281	\$1.05
Kingston/Plymouth	\$5,409,290	\$1.50	\$9,653,274	\$1.15	\$8,080,539	\$0.79
Lowell	\$22,948,538	\$2.27	\$12,534,982	\$0.99	\$26,634,456	\$1.52
Middleborough/Lakeville	\$6,702,552	\$1.54	\$8,407,093	\$1.11	\$9,821,251	\$0.89
Needham	\$3,356,754	\$2.74	\$1,258,563	\$0.95	\$3,521,781	\$1.96
Newburyport/Rockport	\$19,168,930	\$1.59	\$19,599,754	\$0.95	\$27,556,959	\$0.89
Providence/Stoughton	\$6,548,363	\$1.64	\$7,816,049	\$1.12	\$9,237,526	\$1.08
South Coast	\$13,740,437	\$1.45	\$18,276,146	\$1.06	\$20,972,533	\$0.90
Worcester	\$41,799,951	\$2.08	\$23,178,789	\$1.04	\$50,912,060	\$1.56

Note: Sales tax revenue potential for each corridor estimated by apportioning the FY 2019 consensus revenue estimate to each corridor based on each corridor's share of state payroll and employment. Core includes Boston, Brookline, Cambridge, and Somerville.

Source: US Bureau of Economic Analysis Regional Economic Accounts, Metropolitan Area Planning Council vehicle registration data set, and FY 2019 budget documents

Connecticut Pursues the Promise of the New Haven-Hartford-Springfield Line

With leadership from the state of Connecticut, smaller cities to the south have been busy funding, planning, and implementing TOD along the New Haven Metro-North commuter line, the CTfastrak bus rapid transit (BRT) corridor, and the New Haven-Hartford-Springfield commuter rail line. Since 2014, Connecticut's Office of Policy and Management has funded 11 TOD planning grants. With a 2015 grant from the Federal Transit Administration, Connecticut DOT has supported efforts to advance TOD near four new and two relocated New Haven-Hartford-Springfield commuter rail stations. With \$15 million in new grant awards announced in December 2017, the state is also helping with infrastructure and land acquisition to enable TOD. These early TOD planning, pre-development, and infrastructure efforts are spurring mixed-use development projects in small to medium-sized cities and towns on the Hartford Line. For example, the Meriden Commons is a new 75-unit mixed income project with first floor retail described as being "steps from Meriden's train station and across from the Meriden Green park."





Chapter 8:

A Local Action Plan for Transformational Gateway City TOD

While the state has a critical role to play delivering assistance, success ultimately depends on effective action at the local level. Local vision and leadership is absolutely essential to nurturing relationships with developers and drawing private-sector investment. Local vision and leadership are also vital to delivering improvements to the public realm to make Gateway City stations more inviting, accessible, and marketable (to emphasize this point, we saved our last bit of analysis for this concluding chapter, see box p. 75).

The following are five actions we offer that local leaders can undertake independent of state-level policy. By moving with urgency on these items, Gateway Cities can signal to the state (and their private-sector partners) that they are serious about pursuing transformational transit-oriented development.

1. **Develop a station area TOD plan.** Most Gateway Cities have master plans, downtown housing studies, and urban renewal plans, but few have prepared market-driven plans for transit-oriented development. TOD plans are must-have documents to guide focused efforts to encourage walkable, mixed-use development near rail and market the potential to prospective investors.

Without new policy, the state can help cities fund these planning processes and even guide the work with assistance from TDI Fellows. But it is incumbent on local leaders to make TOD plans a first-order priority. TOD plans from all 13 Gateway Cities will give us a more precise understanding of the opportunity in these station

areas, as well as adjacent neighborhoods with strong (or potentially strong) linkages.

2. **Form a TOD working group to implement the plan.** A TOD plan can help determine appropriate zoning and development policies, but concerted effort is often required to adopt these provisions. A TOD working group can carry out this task. Over a sustained period, a working group can also help communicate the city's vision and priorities with prospective developers and ensure consistent follow-through across agencies.
3. **Develop parking strategies and facilities that align with TOD.** Parking is almost always a key area of concern for local businesses. Successful TOD districts emphasize the experience of people and the ability to walk between housing, jobs, retail, entertainment, restaurants, and other activities. As Gateway Cities concentrate new development near train stations and plan for automated vehicle technology, they must be extremely strategic about investments in long-lived parking structures.

Specific ideas for municipalities to consider include: (a) undertaking a parking master plan to generate data on current parking capacity and utilization, as well as specific ideas about where, why, and how to add more parking to meet future needs; (b) proactively seeking shared-use parking structures (for residents and workers, which tend to need parking at different times) to minimize required parking; (c) examining the conversion of surface lots for

future TOD; and (d) ensuring rail stations support walkable TOD rather than “park and ride” development.

4. **Focus MassWorks infrastructure applications and Complete Streets Grants on projects that will spur redevelopment in TOD areas.** The case studies of successful TOD projects in Gateway Cities provide compelling evidence about how important MassWorks infrastructure grants are to private development. Similar to the examples presented in this report, cities should proactively identify opportunities to leverage these infrastructure dollars to increase station access and unlock TOD, and then work with private developers in a supportive role through the application process.

Creating strong bike, pedestrian, and wayfinding access to and from train stations is a critical leadership role for local communities to ensure that we are creating *transit-oriented* development rather than *transit-adjacent* development. Local planning and public works leaders should prioritize TOD areas when applying for MassDOT’s Complete Streets Grants and similar opportunities from other funding partners.

5. **Collaborate with regional leaders and municipalities to create rail-focused economic corridors and governance models.** Implementing a modern commuter rail system with greater frequency and bi-directional service is underpinned by the idea that commuters (and travelers in general) will use rail more often if there are

many destinations and attractions along rail corridors. Local leaders have an important role to play thinking regionally and partnering with other communities to create economic corridors that link uses such as housing, employment, education, health care, and retail.

Gateway City leaders have a particular opportunity to consider rail-corridor travel when marketing their cultural and recreational opportunities. In Philadelphia, monthly subway pass holders can ride commuter rail on weekends for free in order to visit outlying communities. This kind of thinking could invigorate local Gateway City markets.

The Fitchburg Line Working Group—which includes communities from Concord west to Fitchburg—offers a model for how neighboring municipalities in a commuter rail corridor can start working together to further common interests. In the near term, these partnerships have a particularly important role to play collaboratively advancing the regional ballot legislation described in the previous chapter. They can also work together to devise and advocate for new approaches to governing regional rail service. Harnessing the revenue-raising power of regional ballot legislation and an improved governance structure could help Massachusetts move from a top-down/state-driven approach that has failed to generate local action resulting in optimal station—area land use, to a model that provides communities with strong incentives to ensure that station-area development maximizes return on public transportation assets.

Estimating the Ridership Impact of Station Access Improvements

Up until recently, the commuter rail's ridership model with respect to Gateway City stations relied almost entirely on large parking garages so commuters could conveniently park and ride. This practice just introduces congestion in downtown areas that can ill-afford more vehicles, especially when the vehicle trips contribute very little to downtown economic activity. A TOD approach to generating ridership would focus much more heavily on those accessing urban stations by walking, biking, and riding feeder buses.

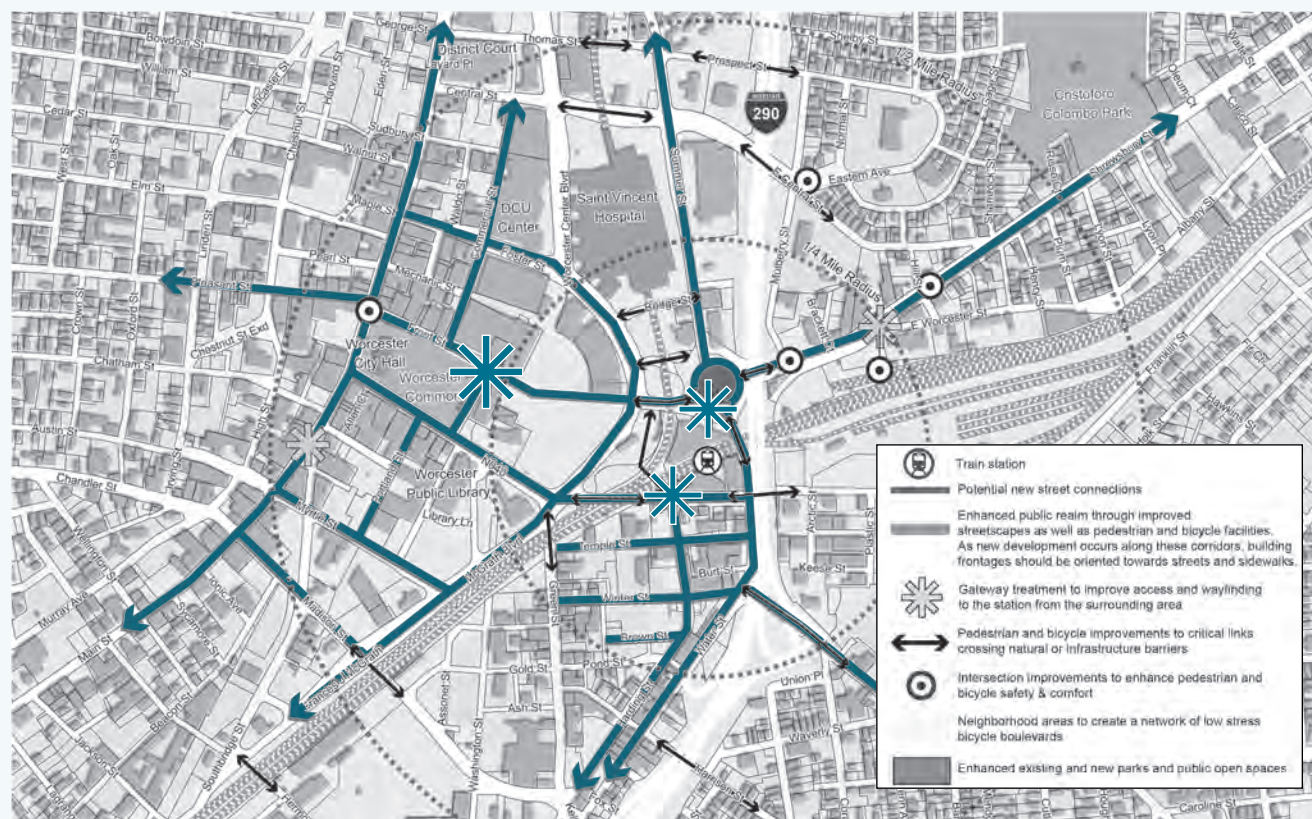
To understand how improvements in this context could increase ridership, we conducted site visits to each city, reviewed relevant plans and project documents for station area access, and undertook GIS analysis to identify current strengths, challenges, and possible projects to improve station area access.

As portrayed in the map below, this analysis found numerous opportunities to increase station access,

including adding new streets to the grid, enhancing streetscaping and increasing retail frontage to make the environment more attractive for pedestrians, improving intersections to increase safety and comfort for those walking and biking, and adding wayfinding for visitors traveling to and from the station.

With optimal TOD buildout, independent of other changes, our model shows these improvements could increase daily ridership from around 500 riders in Springfield to over 3,000 riders in Worcester. Relative to optimal buildout with station access improvements, the ridership gains range from just over 10 percent in Lynn to over 80 percent growth in Worcester. These estimates indicate the powerful influence local planning decisions have for station performance. Detailed station area access maps for Fitchburg, Lynn, and Springfield are available for download at massinc.org.

Figure 8-1: A Station Access Plan for Worcester



Endnotes

- 1 Shlomo Angel and Alejandro Blei. "The Productivity of American Cities: How Densification, Relocation, and Greater Mobility Sustain the Productive Advantage of Larger US Metropolitan Labor Markets." *Cities* 51 (2016).
- 2 Evert Meijers and Martijn Burger. "Spatial Structure and Productivity in US Metropolitan Areas" *Environment and planning A* 42.6 (2010).
- 3 Roberto Camagni and Roberta Capello. "Second-Rank City Dynamics: Theoretical Interpretations Behind their Growth Potentials." *European Planning Studies* 43 (2015).
- 4 Evert Meijers and Martijn Burger. "Stretching the Concept of 'Borrowed Size'." *Urban Studies* 54.1 (2017).
- 5 For instance, one recent study found a 10 percent increase in density in US metro areas reduces household travel CO2 emissions by 4.8 percent and residential energy use by 3.5 percent). See: Sungwon Lee and Bumsoo Lee. "The Influence of Urban Form on GHG Emissions in the US household Sector." *Energy Policy* 68 (2014).
- 6 Edward Glaeser and Matthew Kahn. "The Greenness of Cities: Carbon Dioxide Emissions and Urban Development." *Journal of urban economics* 67.3 (2010): 404-418.
- 7 Mohd Faris Dziauddin and others. "Estimating the Effects of Light Rail Transit (LRT) System on Residential Property Values Using Geographically Weighted Regression (GWR)" *Applied Spatial Analysis and Policy* 8.1 (2015); Robert Cervero and Michael Duncan. "Transit's Value-Added Effects: Light and Commuter Rail services and Commercial Land Values" *Transportation Research Record: Journal of the Transportation Research Board* 1805 (2002); Daniel Baldwin Hess and Tangerine Maria Almeida. "Impact of Proximity to Light Rail Rapid Transit on Station-Area Property Values in Buffalo, New York" *Urban Studies* 44.5-6 (2007); Keith Bartholomew and Reid Ewing. "Hedonic Price Effects of Pedestrian-and Transit-Oriented Development." *Journal of Planning Literature* 26.1 (2011).
- 8 Economists have been sounding this alarm for well over a decade. The disparate growth trend between Boston and the rest of the state was the genesis of MassINC's first Gateway Cities report (*Reconnecting Massachusetts Gateway Cities: Lessons Learned and an Agenda for Renewal*, 2007). For more recent analysis, see: Alan Clayton-Matthews and Robert Nakosteen. "The Economic Evolution of Massachusetts: Current Trends and Future Challenges" *MassBenchmarks* 19(2) (2017).
- 9 This challenge has also been well-articulated and well understood. For the most recent example, see: Barry Bluestone and others. "Greater Boston Housing Report Card: 2017" (Boston, MA: The Boston Foundation, 2017).
- 10 Dan Hodge and others. "Rebuilding Renewal: An Analysis of State Investment in Gateway Cities and a Work Plan for Delivering Transformative Development" (Boston, MA: MassINC, 2016).
- 11 While the MBTA does not collect detailed reverse commute and inter-zone ridership figures, a 2012 memo estimated that about 5 percent of all outbound trips (roughly 5,000 weekday riders) occurred during the AM peak. A significant portion of this flow is attributable to students travelling to suburban private schools and colleges and some night workers returning home. Throughout the day, just 4.5 percent of trips were inter-zone (i.e. passengers board and exit outside of the Boston core); reverse commuters to Gateway Cities could potentially represent some fraction of this inter-zone flow. See: http://www.ctps.org/data/html/studies/transit/2012_MBTARailPassengerCounts/MBTARailPassengerCountResults.html
- 12 "Regional Rail for Metro Boston" (TransitMatters, 2018).
- 13 See: Alan Mallach and others. "Transformative Development: Strategic State Policy for Gateway City Growth and Renewal" (Boston, MA: MassINC, 2013).
- 14 Proximity to jobs is associated with higher rates of employment and less reliance on public assistance. Proximity also reduces job searches and spells of joblessness, particularly for African-American and female workers, which is important in an economy with significant churn. See: Daniel Immergluck, "Job Proximity and the Urban Employment Problem: Do Suitable Nearby Jobs Improve Neighbourhood Employment Rates?" *Urban Studies* 35, no. 1 (1998); Scott W. Allard and Sheldon Danziger, "Proximity and Opportunity: How Residence and Race Affect the Employment of Welfare Recipients," *Housing Policy Debate* 13, no. 4 (2002). Laurent Gobillon and Harris Selod, "Spatial Mismatch, Poverty, and Vulnerable Populations," in *Handbook of Regional Science* (New York: Springer, 2012); Fredrik Andersson and others, "Job Displacement and Duration of Joblessness: The Role of Spatial Mismatch," National Bureau of Economic Research Working Paper 20066 (2014).

- 15 "Hot spots 2025: Benchmarking the Future Competitiveness of Cities" *The Economist* (2013); "Global Cities 2017" A.T. Kearney (2017); *Global Metro Monitor 2014* (Washington, DC: Brookings Institution, 2015).
- 16 For example, see: Edward Glaser. *Agglomeration Economies* (Chicago, IL: The University of Chicago Press, 2010).
- 17 Richard Dimino and others. "The Transportation Dividend: Transportation and the Massachusetts Economy" (Boston, MA: A Better City, 2018).
- 18 Shlomo Angel and Alejandro Blei. "The Productivity of American Cities: How Densification, Relocation, and Greater Mobility Sustain the Productive Advantage of larger US metropolitan labor markets." *Cities* 51 (2016).
- 19 Tim Reardon and Meghna Hari. "Population and Housing Demand Projections for Metro Boston" (Boston, MA: Metropolitan Area Planning Council, 2014).
- 20 Bumsoo Lee and Peter Gordon. "Urban Structure: Its Role in Urban Growth, Net New Business Formation and Industrial Churn." *Région et Développement* 33 (2011).
- 21 Evert Meijers and Martijn Burger. "Spatial Structure and Productivity in US Metropolitan Areas" *Environment and planning A* 42.6 (2010).
- 22 Roberto Camagni and Roberta Capello. "Second-rank city dynamics: Theoretical interpretations behind their growth potentials." *European Planning Studies* 43 (2015).
- 23 Evert Meijers and Martijn Burger. "Stretching the Concept of 'Borrowed Size'." *Urban Studies* 54.1 (2017).
- 24 Lynn Browne and others. "Towards a More Prosperous Springfield, Massachusetts: Project Introduction and Motivation" (Boston, MA: Federal Reserve Bank of Boston, 2009).
- 25 Arnobio Morelix and others. "The Startup Activity Index: Metropolitan Area and City Trends" (Kansas City, MO: Ewing Marion Kauffman Foundation, 2017).
- 26 Camagni and Capello (2015).
- 27 "High Speed North" (London: National Infrastructure Commission, 2016); "The Northern Powerhouse: One Agenda, One Economy, One North" (London: Department for Transport, 2015).
- 28 According to a 2015 ULI/MassINC Polling Group survey, transit was the most important factor for Millennials choosing where to live and work. See "What Millennials Want" (Boston, MA: Urban Land Institute, 2015).
- 29 "Suffolk Downs: Expanded Environmental Notification Form/Expanded Project Notification Form" (Boston, MA: HYM Investment Group, November 30, 2017).
- 30 Robert Cervero and Reid Ewing. "Travel and the Built Environment: A Meta-Analysis" *Journal of the American Planning Association* 76.3 (2010); Robert Cervero and Michael Duncan. "Which Reduces Vehicle Travel More: Jobs-Housing Balance or Retail-Housing Mixing?" *Journal of the American Planning Association* 72.4 (2006); Robert Cervero and Reid Ewing, Reid. "Travel and the Built Environment: A Synthesis." *Transportation Research Record: Journal of the Transportation Research Board* 1780 (2001).
- 31 The average is .52 with a standard deviation of .12. Excluding, Lynn the average is .59 with a standard deviation of .05. While Lynn does represent an outlier toward more development potential, the other three cities have circumstances that significantly restrict buildout (highways in Springfield and Worcester, significant low-density residential fabric in Fitchburg). Furthermore, it is likely that other Gateway Cities will have major infill opportunities like Lynn (large tracts of formerly industrial land for infill, very dense mill development for higher occupancy, etc.). Overall, the average from this set of four cities seems representative of the range across all Gateway Cities.
- 32 MassINC calculation of growth in all jobs using ES-202 data from Massachusetts Executive Office of Labor and Workforce Development. For population projection, see Henry Renski and others. "Long-term Population Projections for Massachusetts Regions and Municipalities" (Hadley, MA: UMass Donahue Institute, 2015).
- 33 Bureau of Labor Statistics, Consumer Expenditure Survey, 2015-2016. Table 3103.
- 34 See <http://www.lpcboston.com/wp-content/uploads/2017/07/Q2-2017-Boston-Market-Report-web.pdf>.

- 35 Within each of these categories, we assume developers will move forward with projects that generate an internal rate of return (IRR) of 10 percent or more. IRR is a measure of earnings on each dollar invested over a given period of time. While 10 percent is an industry standard, the assumption is somewhat liberal given the additional risk associated with these markets. However, this additional risk is offset to a degree by the availability of lower cost debt through financial intermediaries supporting community and economic development in low-income neighborhoods.
- 36 Mohd Faris Dziauddin and others. "Estimating the Effects of Light Rail Transit (LRT) System on Residential Property Values Using Geographically Weighted Regression (GWR)" *Applied Spatial Analysis and Policy* 8.1 (2015); Robert Cervero and Michael Duncan. "Transit's Value-Added Effects: Light and Commuter Rail services and Commercial Land Values" *Transportation Research Record: Journal of the Transportation Research Board* 1805 (2002); Daniel Baldwin Hess and Tangerine Maria Almeida. "Impact of Proximity to Light Rail Rapid Transit on Station-Area Property Values in Buffalo, New York" *Urban Studies* 44.5-6 (2007); Keith Bartholomew and Reid Ewing. "Hedonic Price Effects of Pedestrian-and Transit-Oriented Development." *Journal of Planning Literature* 26.1 (2011).
- 37 <http://www.telegram.com/news/20180226/tenants-sign-up-for-new-luxury-apartments-in-downtown-worcester>
- 38 This figure ranges from a high of 177 riders per million square feet in Lynn to 62 riders per million square feet in Springfield. The average across the four cities is 110 riders per million square feet.
- 39 The wiring for double-decker coaches can accommodate a maximum electrical load of nine cars; currently, the longest trainset is eight-cars.
- 40 For instance, see Todd Litman. "Understanding Transport Demands and Elasticities How Prices and Other Factors Affect Travel Behavior" (Victoria, BC: Victoria Transport Policy Institute, 2017).
- 41 See: Peter Newman and Jeffrey Kenworthy. "Urban Design to Reduce Automobile Dependence" *Opolis* 2.1 (2006).
- 42 For instance, one recent study found a 10 percent increase in density in US metro areas reduces household travel CO2 emissions by 4.8 percent and residential energy use by 3.5 percent). See: Sungwon Lee and Bumsoo Lee. "The Influence of Urban Form on GHG Emissions in the US Household Sector." *Energy Policy* 68 (2014).
- 43 Edward Glaeser and Matthew Kahn. "The Greenness of Cities: Carbon Dioxide Emissions and Urban Development." *Journal of Urban Economics* 67.3 (2010): 404-418.
- 44 Emissions equivalencies are from the U.S. Environmental Protection Agency: <https://www.epa.gov/energy/greenhouse-gas-equivalencies-calculator> and dollar estimates of the value of GHG is \$74 per metric ton at optimal buildout by 2040 per U.S. Department of Transportation guidance for benefit-cost analysis: https://www.transportation.gov/sites/dot.gov/files/docs/Tiger_Benefit-Cost_Analysis_%28BCA%29_Resource_Guide_1.pdf
- 45 Curt Nickish. "Majority Of Mass. Voters Want Economic Gains To Be Shared Evenly, WBUR Poll Finds" WBUR (June 15, 2015).
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- 47 This approach is also consistent with recommendations from experts in the field. See: Bruce Katz and Jeremy Nowak. "Guiding Principles for Opportunity Zones" (The Governance Project, 2018).
- 48 Adie Tomer and Joseph Kane. "Localities will Deliver the Next Wave of Transportation Investment: Federal and State Policy-makers Can Do More to Support Local Efforts" (Washington, DC: Brookings Institution, 2018).
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- 50 This revenue figure cover the period 2006 through 2014, the most recent DOR analysis of the results of the program. See: "Report on the Impact of Massachusetts Film Industry Tax Incentives through Calendar Year 2014" (Boston, MA: Massachusetts Department of Revenue, 2016).

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