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# Hub and Spoke

CORE TRANSIT CONGESTION AND THE FUTURE OF  
TRANSIT AND DEVELOPMENT IN GREATER BOSTON



**Urban Land  
Institute**

**Boston**

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Northeastern University  
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## EXECUTIVE SUMMARY

Far less publicized than the recent bad news about the financial crisis at the Massachusetts Bay Transportation Authority (MBTA) has been some very good news: ridership is up. These additional riders, however, are filling the MBTA's rush hour trains and straining the aging system's capacity. This success brings with it even greater financial challenges: how will the MBTA serve its growing ridership?



Transit-oriented development, which concentrates homes and businesses near T stations and encourages transit use, has helped fuel this ridership growth. The T's "hub and spoke" travel pattern concentrates ridership — and congestion — in the core of the system, so the success of TOD anywhere along the commuter rail and rapid transit lines depends on the capacity of the MBTA to accommodate additional riders in the core. The Boston District Council of the Urban Land Institute prepared this report in order to better understand core transit capacity and congestion in the MBTA system in anticipation of development trends and ridership growth.

### *How fast is the MBTA's ridership growing?*

Over the past two decades, MBTA ridership has risen at an average annual rate of 1.2%. Growth accelerated in the past five years, with trips increasing at an average annual rate of 2.9% between 2006 and 2011. 2012 is off to a strong start: April 2012 marked the fifteenth consecutive month in which year-over-year ridership increased — and the third straight month that average weekday ridership exceeded 1.3 million.

### *How will real estate development trends affect future MBTA ridership?*

Three real estate development trends have contributed to the recent rise in MBTA ridership and are likely to continue generating riders: transit-oriented development, more intensive use of existing built space in urban core neighborhoods, and promotion of transit use by regulators, building owners and employers in transit-served locations. Interest in TOD is being driven both by growing demand for homes and workplaces near transit and by state, regional and local smart growth policies. A just-released report by the Metropolitan Area Planning Council identifies the potential for 75,000 new residential units and commercial space for 130,000 new jobs near MBTA rapid transit and commuter rail stations by 2035.

### *How much additional ridership should the MBTA plan to accommodate over the next decade?*

Based on three ridership scenarios developed for this report, the MBTA is likely to serve a minimum of 420 million unlinked trips annually, and potentially as many as 500 million, within a decade. This rate of ridership growth translates to an increase in average weekday ridership from 1.3 million trips currently, to 1.4 - 1.7 million weekday trips by 2021. The MBTA should therefore plan to serve an additional 100,000 to 367,000 more daily riders within ten years.

### *Which MBTA rapid transit lines are congested?*

The MBTA system has limited capacity to accommodate growing ridership. This report proposes a three-tiered approach to identifying problematic congestion levels, and assesses existing and forecast congestion under this system. Unacceptable levels of congestion and potential capacity constraints were found on portions of the Green, Orange and Red Lines and the waterfront portion of the Silver Line bus rapid transit line — on every part of the rapid transit system except for the Blue Line.

#### **MBTA CONGESTION**



The waterfront portion of the Silver Line bus rapid transit system is rated as **congested**.



The Orange Line from North Station to Downtown Crossing, the C and D branches of the Green Line and portions of the Red Line are rated as **highly congested**.



The Green Line central subway (from Copley to Government Center) and portions of the Red Line are rated as **over capacity**. South Station is also operating above its design capacity for commuter rail and Amtrak trains.

### *Where are the congestion “hot spots” in the Boston/Cambridge core?*

The MBTA's congestion problems raise concerns that future transit-oriented development could be impeded by lack of capacity. Taking into consideration current and projected transit and land use patterns, this report identifies fourteen rapid transit station areas in the Boston/Cambridge core, as well as the Silver Line stations in the Seaport, as areas of concern. These stations cluster into roughly five congestion “hot spots”: Downtown Boston, Back Bay, Longwood Medical Area, the Seaport and Kendall Square. Because of the “hub and spoke” nature of the MBTA transit system, transit congestion in these core locations can affect future transit-oriented development along the outer “spokes” of the system as well.

### *How should the Massachusetts Department of Transportation and MBTA address core transit congestion?*

Core transit congestion is a problem born of both success and failure: success in attracting a growing ridership and catalyzing transit-oriented development, and failure to invest enough in the regional transit system to provide the capacity needed to meet the growing demand for transit.

Congestion relief has long been a priority for highway spending — it is past time to recognize that addressing congestion is equally important for the transit system. Ensuring sufficient capacity to meet ridership demand without unacceptable levels of congestion will require both better planning and more investment. MassDOT and the MBTA should create a core congestion assessment and management system and use this information to put a price tag on the investments needed for congestion relief and increasing core capacity. The Commonwealth of Massachusetts then needs to find the resources and make the investments necessary to ensure that the MBTA can continue to serve a growing ridership, anchor transit-oriented development in cities and towns throughout greater Boston and support a prosperous regional economy.

## INTRODUCTION: HUB AND SPOKE

Far less publicized than the recent bad news about the financial crisis at the Massachusetts Bay Transportation Authority (MBTA) has been some very good news: ridership on the T is up, substantially and consistently. As of April 2012 ridership has increased for fifteen consecutive months, rising to 1.37 million riders on an average weekday. While MBTA ridership has been growing steadily for some time, the pace of growth has accelerated over the past five years as gasoline and downtown parking prices increased, fares remained stable and state employment growth resumed coming out of the recent recession.

These additional riders are increasingly filling the MBTA's s rush hour trains and straining the aging system's capacity to meet both current and future demand. The transit system's success in attracting new riders brings with it even greater financial challenges: how will the MBTA serve its growing ridership?

The Boston District Council of the Urban Land Institute, supported by a grant from the Urban Land Institute's 75th Anniversary Urban Innovation Fund, and its local funding partners, sponsored this report in order to better understand the MBTA's lesser known, but no less real, crisis: core transit congestion. The MBTA's nearly 300 commuter rail, rapid transit, trolley and bus rapid transit stations anchor varied neighborhoods filled with existing and potential residential, commercial, retail and institutional development. Transit-oriented development — vital to greater Boston's economic prosperity and environmental sustainability — depends on the ability of the MBTA to serve the riders generated by both existing development and by projects in the region's planning and development pipeline.

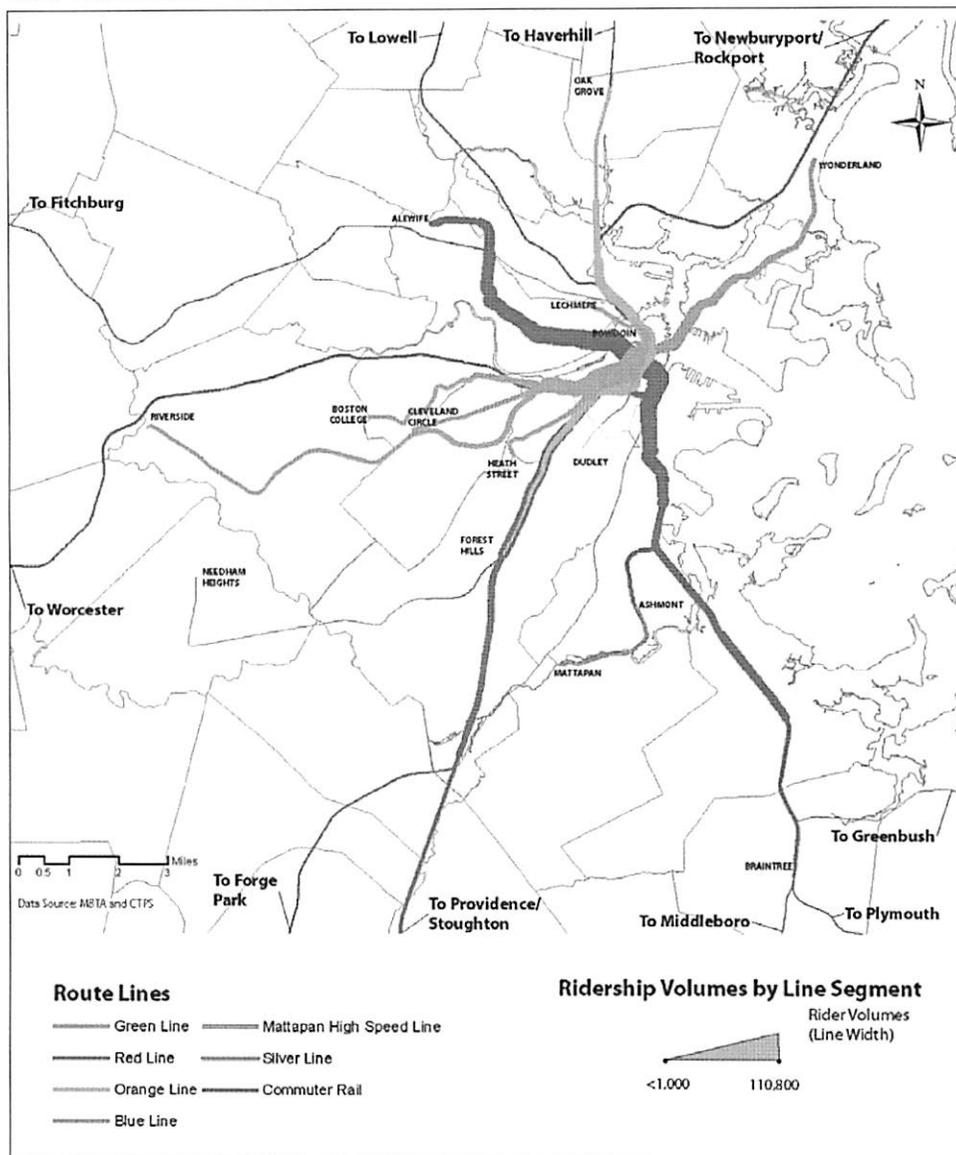
While the potential for transit-oriented development exists throughout the MBTA system, riders tend to travel from most of those stations toward the core or "hub" of the MBTA's "hub and spoke" transit system. Four rapid transit lines serving eleven communities, and fourteen commuter rail lines serving 79 cities and towns funnel riders into Boston and Cambridge. While Boston's urban core may or may not be the hub of the universe — as Oliver Wendell Holmes so famously asserted in the 19th century — it is unquestionably the hub of the regional transit system. As illustrated in the map below (prepared for a 2010 report by the Boston Metropolitan Planning Organization's Congestion Management Process) ridership volume is substantially greater in the core. The twenty busiest subway stations in Boston and Cambridge — roughly one in ten of the stations in the combined subway and commuter rail system — handle approximately half of all daily boardings. (MBTA Blue Book 2010).

The T's "hub and spoke" travel pattern concentrates ridership — and congestion — in the core of the system. This report therefore examines whether the aging and increasingly crowded hub of the MBTA system can accommodate projected future ridership, posing and answering the following questions:

- ❑ How fast is the MBTA's ridership growing?
- ❑ How will transit-oriented development and other real estate development trends affect future MBTA ridership?
- ❑ How much additional ridership should the MBTA plan to accommodate over the next decade?
- ❑ Which rapid transit lines are capacity-constrained?
- ❑ Where are the congestion "hot spots" in the Boston/Cambridge core where growing ridership demand and capacity constraints may combine to affect key locations for future transit-oriented development?
- ❑ How should the Massachusetts Department of Transportation and the MBTA address the problems of constrained capacity and core transit congestion in order to ensure that the regional transit system can support robust economic development over the next decade?

### MBTA RIDERSHIP VOLUME

While Boston's urban core may or may not be the hub of the universe — as Oliver Wendell Holmes so famously asserted in the 19th century — it is unquestionably the hub of the regional transit system.



# RISING RIDERSHIP

The Massachusetts Bay Transportation Authority, known locally as the T, serves 175 communities with a population of almost 4.7 million people spread over 3,200 square miles. The MBTA's integrated transit system includes 14 commuter rail lines, 4 subway lines and over 180 bus routes as well as bus rapid transit, trackless trolleys, ferries and a paratransit system. (MBTA Blue Book 2010).

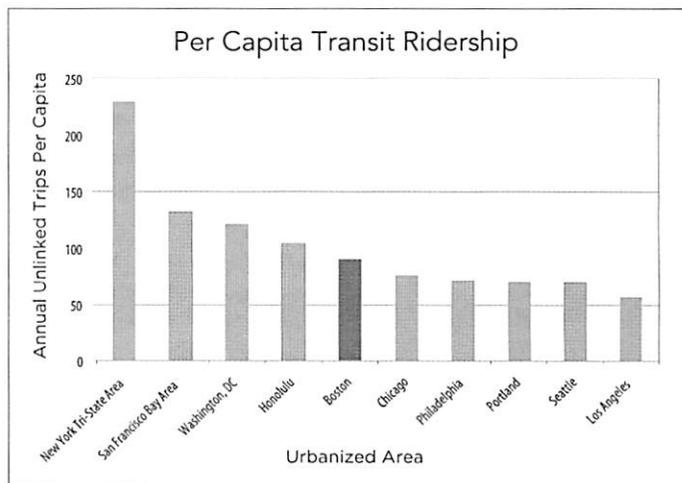
Boston is one of the top five metropolitan areas in the United States for transit ridership. In 2010, the last year for which the American Public Transportation Association compiled comparative data from the Federal Transit Administration's National Transit Database, the MBTA was the fifth largest transit system in the United States, when measured by the total number of unlinked passenger trips served annually<sup>1</sup> (APTA Fact Book 2011). And when per capita transit use is the metric, as shown in Figure 1, Boston also ranks fifth nationally.

Like transit systems across the country, the MBTA has continued to grow its ridership even in the face of the persistent predictions that transit was a dying transportation mode. Six years ago, when the Urban Land Institute's Boston District Council and Northeastern University's Dukakis Center for Urban and Regional Policy last teamed up to examine transit and transit-oriented development in metropolitan Boston, that *On the Right Track* report acknowledged that "transit ridership has declined in recent years." But the report noted a number of trends "that point toward a future of growing demand for higher quality transit." That prediction, and others like it, has proven correct — ridership has grown steadily and the rate of increase has accelerated.

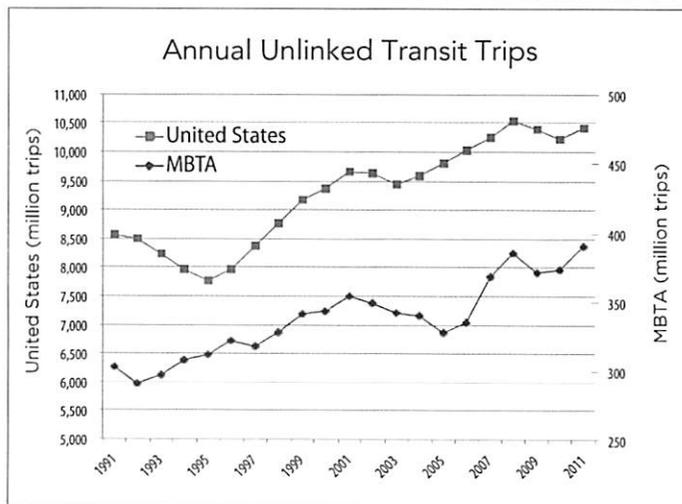
Transit ridership has actually been growing modestly but steadily for the past two decades, both nationally and on the MBTA. 2011 marked the sixth consecutive year that Americans took more than 10 billion trips on public transportation. The 2011 total of 10.4 billion trips was the second highest annual ridership recorded since 1957, according to the American Public Transportation Association.

As shown in Figure 2, the MBTA's ridership over the past two decades roughly parallels the national increase in ridership, rising at an average annual rate of 1.2% between 1991 and 2011. Ridership growth on the MBTA has accelerated during the past five years, with trips increasing at an average annual rate of 2.9% between 2006 and 2011. And 2012 is off to a strong start: April 2012 marked the fifteenth consecutive month in which year-over-year ridership on the MBTA increased and the third straight month that average weekday ridership exceeded 1.3 million. Between January 2007 and April 2012 — with fares remaining unchanged and the retail price of gasoline in Massachusetts rising from \$2.26/gallon to \$3.86/gallon — MBTA ridership rose at more than twice its longer-term historical average of increasing just over one percent per year.

**FIGURE 1**  
U.S. METROPOLITAN AREAS RANKED BY PER CAPITA TRANSIT RIDERSHIP



**FIGURE 2**  
TRANSIT RIDERSHIP TRENDS FOR THE U.S. AND MBTA



<sup>1</sup> "Unlinked trips" are the number of times passengers board public transportation vehicles. Passengers are counted each time they board vehicles, no matter how many vehicles they use to travel from their origin to their destination.