

Is it time to expand water transportation in Greater Boston?

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1. Executive Summary

The MBTA offers the most significant commuter ferry option for coastal area residents around Boston. It is a fundamental piece of a diverse network of passenger ferries that occupy a unique place in the Commonwealth's transportation system. Many of these ferries are valuable engines for tourism and other industries, providing connections to the many islands off the Massachusetts coast and shuttling residents and tourists alike to areas with limited accessibility. Others provide residents who live along the coast with a reliable alternative to using personal vehicles or commuter rail.

Providing commuter service is the most significant public purpose of ferries in Massachusetts, and over the last five years in particular there has been considerable debate about the future of water-based transportation options in Greater Boston. A 2012 policy discussion focused on T reform, for instance, was the catalyst for a number of proposals concerning the future of the MBTA ferry. These included a proposal to transfer operations to the Massachusetts Port Authority (Massport), as well as one to eliminate the public subsidy for ferry service altogether. In spite of these initiatives, management of the service has remained unchanged since 2012.

Neither the recent political conditions surrounding the future of the ferry service nor questions about a new governance structure are the focus of this report. Instead, this paper offers a closer look at the MBTA ferry, its performance as a transit mode and how it compares to other ferry operators nationwide. These items can help inform the ongoing debate concerning water-based transportation options in Greater Boston and the merits of augmenting area service options. A number of Greater Boston municipalities have started or expressed interest in starting their own ferry services, and in shaping future MBTA commuter ferry policies. Information regarding the efficiency of the T's ferry service and its performance relative to peer operators outside Massachusetts might offer useful insights for this discussion.

As the Bay State's largest ferry operator and the only one running year-round commuter boat service, the MBTA is the principal public body ensuring that Boston-area coastal commuters have access to reliable water-based transportation. With over 1.3 million trips per year¹, the ferry makes up a very small percentage of T ridership, but the service fills an important niche in Massachusetts' ecosystem of transit options.

By a number of measures, the ferry is one of the most cost-effective modes at the MBTA. According to the most recent data available (2015), the fare recovery ratio for ferry service is 68 percent, the highest of any MBTA service mode. The T ferry likewise has the highest fare revenue per passenger mile and unlinked trip, and has the best on-time performance of any of the Authority's transit options. This is at least in part a

function of the ferry's separation from Greater Boston's congested arteries and not having to rely on the aging infrastructure that often creates issues for the T's various rail services. The ferry is also one of the most popular transit modes among its users, largely due to service reliability.²

This report also includes an analysis of the total net subsidy for the MBTA ferry relative to other agency modes using data on operating expenses, capital expenses, debt service and fare revenues from 2002 to 2015. The analysis shows that the MBTA ferry required by far the least capital investment over this timeframe and the second lowest total net subsidy per passenger mile. According to this analysis, between 2002 and 2015 the MBTA ferry service's (FB's) total net subsidy was \$0.41 per passenger mile, making it the second least expensive of the MBTA's major transit modes, which include heavy rail (HR), light rail (LR), commuter rail (CR), combined bus service (MB/RB) 3 and trolleybus (TB), over this timeframe. Commuter rail had the lowest subsidy per passenger mile at \$0.38. As explored later in this report, two central reasons for this are that debt service costs on capital spending for ferry service are low compared to other modes, and that, compared to other modes, a much higher portion of the ferry's operating costs are covered by fare revenues.

Ferry service is cost effective compared to other MBTA modes, notwithstanding the fact that operating expenses per vehicle mile and revenue hour—two commonly used performance indicators of service efficiency used by agencies nationwide—are relatively high. Based on 2015 data for the seven MBTA modes examined, the ferry had the highest operating expense per vehicle revenue mile, which measures how much a mode costs to run per mile of service, and the highest operating expense per vehicle revenue hour (cost per hour of service).⁴ When measured by operating expenses per passenger mile, the T ferry is below the average of the group of seven MBTA modes analyzed. In terms of operating expense per unlinked passenger trip, another commonly used transit performance metric to gauge service efficiency, the ferry was the second most expensive mode at the MBTA in 2015—commuter rail was the most expensive by this measure. Measured in terms of unlinked trips per vehicle revenue mile, ferry service was fourth, right in the middle of the modes analyzed. In unlinked trips per vehicle revenue hour, the ferry was also fourth, and under the system-wide average.

The analysis shows that the MBTA ferry required by far the least capital investment over this timeframe and the second lowest total net subsidy per passenger mile.

Also included in this paper is a comparison of the MBTA ferry's cost effectiveness, performance and governance compared to other ferry operators nationwide. As this analysis illustrates, by some efficiency measures the MBTA ferry is a cost-effective operation relative to the peer group selected for comparison. By two service measures of effectiveness the MBTA ferry is the worst performer out of a peer group of six agencies. This paper also offers a comparison of the MBTA ferry's capacity, passengers per hour and other data on service consumption and efficiency relative to peers. Among the peer group identified as suitable for comparison through use of the Integrated National Transit Database Analysis System's (INTDAS') peer selector tool, the MBTA ferry is the only water transportation commuting service run by an agency that operates more than two modes of service. By this measure, the number of vehicles the T has in service is more than 14 times the number operated by the next largest agency. The method for determining these peers is described in more detail later in this report.

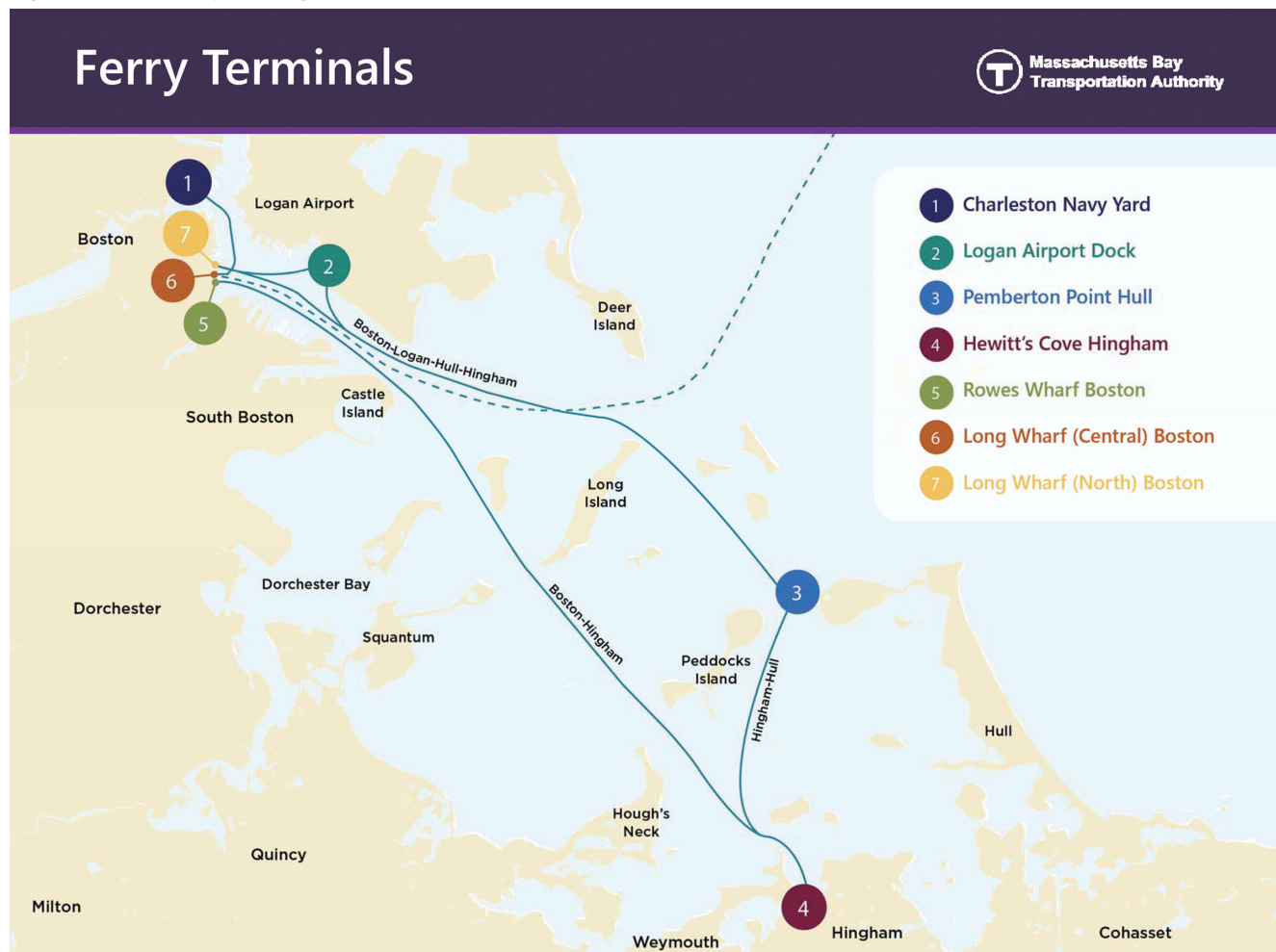
2. The MBTA's commuter ferry service

2.1 Infrastructure and service characteristics

The MBTA ferry operates 160 weekday one-way trips across 38 miles of service route between Hingham, Hull, Logan Airport, Charlestown and downtown Boston (Fig. 1).⁵ Between the two vessels owned by the T and those owned by operator Boston Harbor Cruises, the service had approximately 5,000 weekly boardings and annual ridership of 1.34 million in 2015, a slight increase from 2014, when ridership was 1.31 million.⁶ The majority of these trips are on the Hingham-Rowe's Wharf route, or F1 route, which carries more than 3,150 daily passengers on its exclusively weekday service. To put these numbers in perspective, in 2014 the entire MBTA system had daily ridership of 1,297,650, with annual ridership of almost 390 million.⁷⁽⁸⁾ Put differently, the MBTA's ferry service made up 0.32 percent of system-wide ridership that year.

The fare for a one-way trip using the MBTA ferry can range between \$3.50 and \$18.50, depending on the route. Inner

Figure 1. MBTA Ferry Landings



Source: MBTA 2015 State of the Service: Water Transportation

Harbor Ferry service—which runs between the Charlestown Navy Yard and Long Wharf in downtown Boston—is \$3.50 per ride and \$84.50 for a monthly pass. The commuter ferry from Hingham/Hull to downtown Boston is \$9.25 per ride and \$308 for a monthly pass. Ferry service from Hingham/Hull to Logan Airport is the same monthly fare but costs an additional \$9.25 for individual trips. For comparative purposes, a single ride fare for MBTA bus and rapid transit service is \$2.25 as of July 1, 2016, and a monthly pass is \$84.50.⁹

Among all the MBTA's transit modes, the ferry has by far the fewest capital assets and dedicated infrastructure. The MBTA's ferry service properties consist of seven terminals, two of which are located in the inner harbor (Charlestown Navy Yard and the Logan Airport Dock), two in suburban locations (Hull and Hingham), and three terminals in downtown Boston. The majority of ferry service infrastructure is leased and not owned by the MBTA. This includes all maintenance facilities, which are owned and managed by outside contractors.¹⁰ The MBTA itself owns two of the ferries that run service, while the rest of the fleet is owned by Boston Harbor Cruises (BHC). The MBTA notes in a 2015 state of the service report on water transportation that BHC owns 11 of the 13 vessels listed, and further notes that the MBTA is in the process of acquiring and putting into service two new vessels in 2017, doubling the agency's vessel ownership.¹¹⁽¹²⁾ By contract, BHC operates all ferry service, insures and maintains all water vehicles and is paid a monthly subsidy based on a formula of the fixed cost per trip multiplied by number of trips in a given month.¹³ The T ferry's low maintenance costs relative to other modes can largely be attributed to the arrangement whereby BHC manages all maintenance by contract.¹⁴ The Authority's ferry service-related assets make up a very small portion of the T's overall holdings, which consist of more than 3,000 vehicles, 250 stations, 846 miles of track, 20 miles of tunnels and 22 maintenance facilities.¹⁵

2.2 Other water-based transportation services and expansion of commuter ferry options in Greater Boston

These figures do not include ferry service between Boston and other municipalities that operate their own service and have separate agreements with private operators. Salem, for instance, has a contract with Boston Harbor Cruises for seasonal routes.¹⁶ Winthrop ran a similar service to Rowes Wharf by agreement with BHC from 2010 to 2012. Due to declining funding for this service, however, in 2013 a new operator started running the route without subsidy.¹⁷ Winthrop did not have service in 2014–2015, but in 2016 the town purchased a new ferry vessel to run the ferry route itself with some service to Squantum Point in Quincy.¹⁸

The City of Quincy has its own history of ferry service and was once served by the MBTA ferry, though the MBTA's ferry terminal located in Quincy's Fore River Shipyard was shuttered in October 2013 due to water damage. The MBTA later sold the property to a developer in July 2014 after deciding against facility repairs.¹⁹ The former Quincy/Hull – Long Wharf route has since been replaced with a different route with service from Hingham — Long Wharf and stops in Hull and Logan Airport. In August 2016 a 90-day trial ferry program brought service back to Quincy, adding the city as a service connection to select trips on the Winthrop-Rowes Wharf route managed by the town of Winthrop.²⁰ The pilot was started with the possibility of extension, but the service was discontinued October 30, 2016. Earlier this year, Quincy secured a grant of \$292,800 from the Massachusetts Seaport Economic Council for future ferry service.²¹

The City of Lynn, just north of Boston, had summer ferry service through Boston Harbor Cruises in 2014 and 2015, but in 2016 this service was suspended in the absence of state funding.²² The Baker administration later decided to fund the service, and as of June 2017, the seasonal service has continued to run and will resume until September 22 this year.²³ Support to keep the ferry service going was largely bolstered by a \$4.5 million grant from the Federal Transit Administration awarded to Lynn in April 2016 to purchase a passenger vehicle and support ferry service between Lynn and Boston.²⁴

There are a variety of other operators that run water taxis and other forms of service on various routes along Massachusetts' coastline without routes to or from Boston. These include service between New Bedford and Oak Bluffs and all ferry service between Cape Cod and Martha's Vineyard/Nantucket, which is operated by the Steamship Authority.²⁵

Though most of the municipal initiatives mentioned above have only been realized recently, community interest in ferry service has been around for much longer. A look back into history reveals how Greater Boston once had a significantly more robust network of ferry routes. This history is well-illustrated in a 1989 report from the Boston Redevelopment Authority (BRA), which describes the 1880s as the “peak” of water-based connection between downtown Boston, Hull, Nantasket, Nahant, Plymouth, Gloucester, and other coastal settlements. With the rise of the automobile and construction of bridges and tunnels, however, the public utility of water transportation declined precipitously. Legislation to discontinue all ferry service in Boston was introduced in 1953, just after construction of the Tobin Bridge, and water-based transportation wouldn't gain momentum again for at least a decade.

Among all the MBTA's transit modes, the ferry has by far the fewest capital assets and dedicated infrastructure.

The Hingham–Boston route was established in 1977, though frequent MBTA-run harbor ferry service between Boston and Hingham only dates back to the spring of 1984 when it was included as part of a two-year initiative to expand transit options for the South Shore during the rebuilding of the Southeast Expressway.²⁶ Since then, the Hingham–Boston route has undergone a number of capital improvements and growth in ridership, in addition to an expansion of service to Logan Airport in 1985 with funding from Massport.²⁷ The MBTA started subsidizing ferry service between Hull and Long Wharf in Boston in 1997, though service on this route had until then been run by private operators since 1963. In 1998, the MBTA began subsidizing service to Hull as part of a route between Quincy, Logan Airport and Long Wharf in Boston, and in 2002 started funding service to and from Quincy.²⁸

A 1993 Environmental Impact Report conducted by the U.S. Federal Transit Administration (FTA) and the MBTA offers helpful additional information on past assessments of the need for water-based transportation options in Greater Boston. In particular, the report references a two-part Massport study on water transportation services. Phase one of the study, which examined potential outer harbor services, cited a “significant and growing South Shore market” for water transportation, while noting that service to the North Shore did not merit public subsidy at the time by virtue of “open sea operational problems,” as well as “competitive ground transit service.” Phase two assessed the feasibility of augmented inner harbor ferry services and to what degree these would require a subsidy.²⁹ Such a vision for a sophisticated network of ferry landings connecting inner harbor waterfront Boston neighborhoods has not yet been realized to date—though, as described below, the City of Boston has made it a priority transit project for future development.

As Greater Boston’s population has grown and congestion has worsened, many communities have started to consider water transportation as an alternative to vehicle commuting and rail service for improving mobility and mitigating access issues. A draft 2015 memorandum from the Boston Region Metropolitan Planning Organization shows that a number of Boston-area municipalities have expressed interest in starting their own ferry service. Eric Bourassa of the Metropolitan Area Planning Council refers to interest from Medford, Everett, Quincy, and Winthrop specifically, and further notes:

[I] believe that the MBTA wants to get out of the business of providing ferry service due to the cost. Alternatives for municipalities include doing their own contracting for ferry service, or coordinating together through a transportation management association-like entity. Municipalities might be able to leverage funding from businesses and mitigation funds from new developments to pay for ferry service.³⁰

As Bourassa’s comment suggests, a cohort of cities and towns that are part of the Inner Core Communities—a partnership of 21 Greater Boston municipalities with shared interest in improving transit in the region—are signaling a willingness to take the initiative in establishing their own ferry services. In the same memorandum, a representative of Somerville notes the city’s interest in starting a ferry operation to service Assembly Square—a project that could be accomplished either through support from the MBTA or via contracting directly with private vendors.³¹ A recent document published by the City of Boston’s Transportation Department also makes reference to an expansion of inner harbor ferry services as a priority transit project. As the document notes, through a partnership with Boston Harbor Now, MassDOT is leading efforts to determine the feasibility of at least one new route that would run between Fort Point and North Station; this would be in addition to connections to East Boston and Charlestown. The total estimated cost for the inner harbor ferry services would be \$21 million for new capital and infrastructure, with annual operating costs of \$1 million.³²

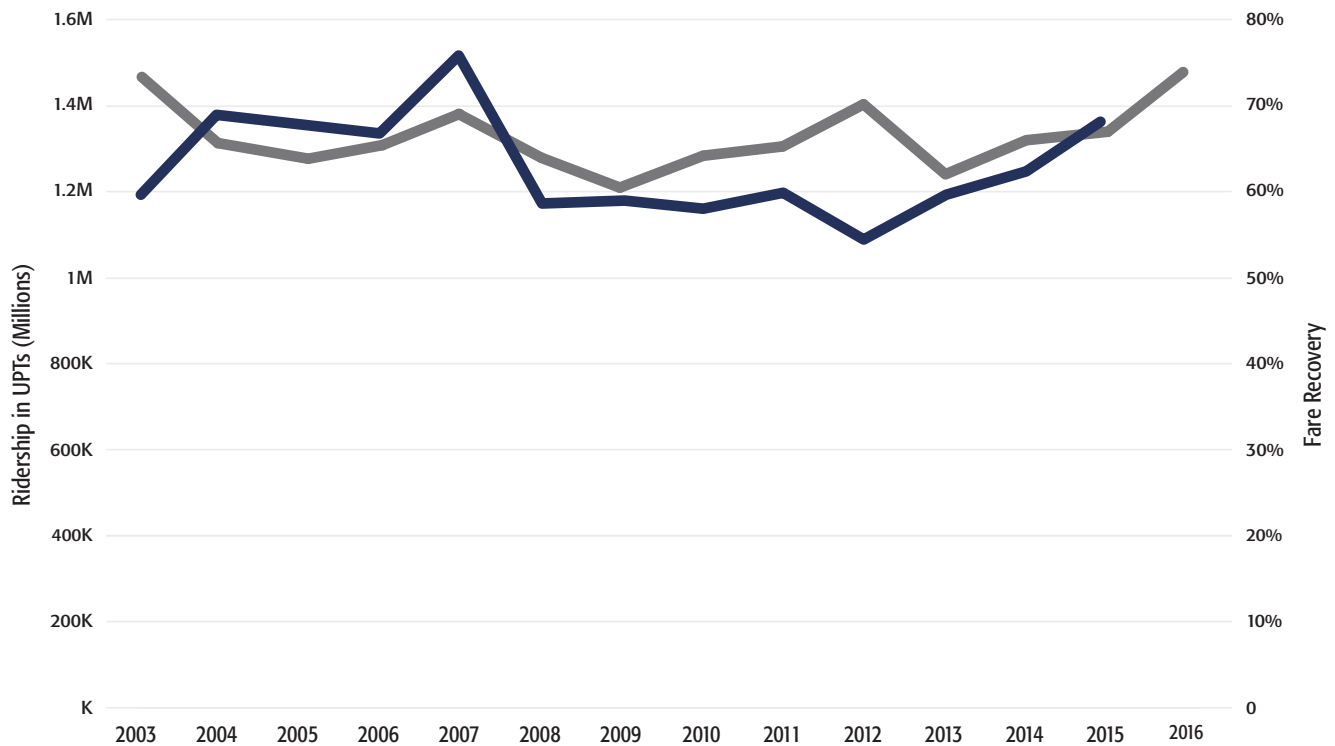
As Greater Boston’s population has grown and congestion has worsened, many communities have started to consider water transportation as an alternative to vehicle commuting and rail service for improving mobility and mitigating access issues.

2.3 Ridership and fare recovery

The ferry has both comparatively low ridership relative to other modes at the MBTA and the highest farebox recovery ratio—a measure of the degree to which passenger revenue covers the operating costs of service. In 2015, the ferry had a recovery ratio of 68 percent, meaning that for every dollar spent on operating ferry service that year, the mode generated 68 cents of revenue from users. The next two highest were heavy rail and commuter rail, with ratios of 62 and 47 percent, respectively, while bus³³ (24 percent) and trolleybus (19 percent) service had the lowest recovery ratios.³⁴⁽³⁵⁾

Both ferry ridership, as measured by unlinked passenger trips (UPTs), and fare recovery remained relatively unchanged from 2003 to 2015–2016 (Fig. 2)—2016 being the most recent year for which ridership data is available through the National Transit Database (NTD).³⁶ Ridership data available through the NTD for specific years during the first decade of frequent, all-day MBTA ferry service available is incomplete—but figures available through the MBTA Blue Book offer accurate numbers on ridership starting in FY 1986 (July 1, 1985 – July 1, 1986). The MBTA reported slightly over 272,500 passengers on the Hingham Commuter Boat in FY 1986—by FY 1991,

Figure 2. MBTA Ferry Ridership and Fare Recovery, 2003 – 2016



Source: National Transit Database, 2003–2016

Unlinked Passenger Trips

Fare Recovery Ratio

this had risen to 586,859. Combined service on the Hingham – Rowes Wharf route and Inner Harbor service between Charlestown and Long Wharf in 1991 was 782,676, and fluctuated between 694,000 and ~923,800 through FY 1996. Ridership in FY 1997, including MBTA service between Hull and Long Wharf started that year, was 955,098.³⁷ MBTA ferry service increased dramatically in FY 1999 to almost 1.28 million, which can largely be attributed to a FY 1997 agreement between the MBTA and Boston Harbor Cruises which galvanized a service war between other operators at that time.³⁸ Since 1999, ridership has fluctuated between 1.2 million and ~1.5 million trips per year, according to NTD data. In 2016, ferry ridership hit a historic high of 1.48 million trips.

The ferry is also the most reliable of all MBTA modes in terms of service performance.³⁹ This is at least partially attributable to the ferry's unique routes, which are not subject to the same issues that other types of service endure.

Buses, for instance, face significant obstacles to service performance in running on the clogged roadways in and around

Greater Boston. The urban layout of much of Boston consists of many narrow streets and choke points for road vehicles. The resulting terrain is one that exacerbates traffic at peak commuting hours and presents great challenges to consistent and reliable bus transit. Congestion is a critical issue for land-based transit in the Boston metro area generally—the

Texas A&M Transportation Institute's 2015 Mobility Scorecard ranked Boston sixth worst in the nation, with commuters spending an average of 64 hours in traffic annually.⁴⁰

Bus commuters also frequently encounter overcrowding and significant delays due to a shortage of available vehicles. The MBTA does not have a bus fleet large enough to meet its published schedule during peak hours. A 2015 review of MBTA bus

service found that all of the agency's 15 key bus routes — lines that carry higher volumes of passengers along dense corridors of Greater Boston—fail the agency's standards for crowding.⁴¹ A February 2017 document notes that approximately 65 percent of all T buses arrive on time and 30 percent suffer from crowding at peak times.⁴² The same document

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shares the results of an October 2016 customer satisfaction survey showing that just 30 percent of riders surveyed rated overall performance highly.⁴³⁽⁴⁴⁾

The three heavy rail lines also face separate performance issues compared to the MBTA ferry — these problems are largely due to the age of the active fleet and their use beyond serviceable years of operation. As an August 2015 MassDOT document points out, 55 percent of the T’s rapid transit fleet of 651 vehicles is beyond useful service life. While heavy rail vehicles are designed for a serviceable life of 26 years, the average age of the MBTA’s fleet is 32 years. Aging signal infrastructure, which will likewise require significant modernization to meet future demand, exacerbates delays and other performance issues resulting from age-related mechanical failures.⁴⁵

Ferry services like the MBTA’s face unique challenges relative to other modes, such as severe weather conditions and sharing maritime space with other commercial and government vessels. Ferry transit, however, is insulated from the problems facing bus and rail service. Passenger ferries can also make more efficient use of transit vehicles than land-based modes, and can significantly cut travel distances between two endpoints. The total span of the ferry route between Hull and downtown Boston, for instance, is roughly one third the driving distance between the two locations.⁴⁶ The Staten Island Ferry in New York is similarly a more efficient route with respect to overall distance. The service runs over just a five-mile route, significantly shorter than the 16-mile automobile trip.⁴⁷

The differential in travel times between taking MBTA ferry service and vehicle commuting is illustrative of the time efficiency that characterizes most urban U.S. ferry services when compared to driving to work. Direct route service from Hewitt’s Cove in Hingham to Rowe’s Wharf ferry terminal in downtown Boston takes 35–40 minutes, and direct service from Pemberton Point in Hull to Long Wharf in Boston takes between 20 and 25 minutes. Driving from these locations to downtown Boston, in contrast, can take anywhere from 45

min to 1 hour 20 min from Hingham and 55 min to 1 hour 40 min from Hull during peak commuting hours.⁴⁸

Even when route distances are similar, ferries can still dramatically curtail commuting times. One example of this is

the Vallejo Ferry in the San Francisco Bay Area, which runs scheduled trips between downtown Vallejo and San Francisco that typically take 55 minutes. In contrast, commuting the same distance between the cities on Interstate-80 can take up to 70 minutes during peak congestion hours.⁴⁹ As researchers point out in a *Journal of Public Transportation* study of ferries, passenger ferry routes offer “potentially faster and more reliable journey times, as they do not compete for road space on congested road networks.”⁵⁰

Ferry options can also serve as valuable connections to areas of cities beyond downtown neighborhoods for commuters who reside in locations far away from public transit stations along bus and subway routes, and otherwise lack access to large swathes of a metropolitan area. Reliable connections to other modes in cities offering ferry service, however, depends on well-developed surface-water transportation interfaces. Such links, which take the form of bus and rapid transit stops, parking lots and dedicated space for passenger waiting, ensure a seamless transition from ferry to other means of transportation.

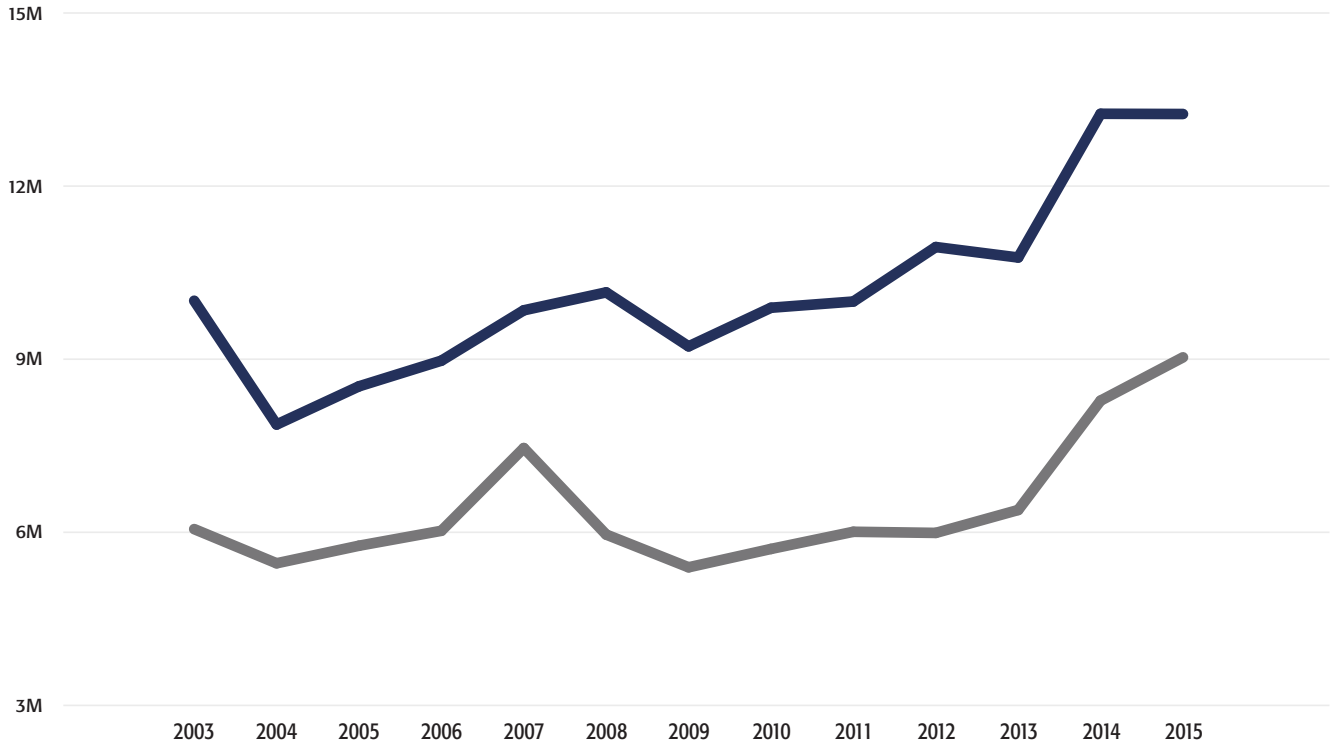
Boston provides an example. The proximity of Long Wharf, the landing area for the MBTA ferry in downtown Boston, to several subway stops provides additional linkage to other areas of Boston for commuters traveling from the South Shore. The Aquarium Blue Line stop sits just 500 feet from the wharf, and Government Center, a central Green Line connection, is just a half mile away. South Station and Haymarket stations, transportation hubs for both the Red and Orange Lines, respectively (as well as commuter rail), are also each less than a mile from Long Wharf. MBTA data provided to the Transit Cooperative Research Program (TCRP) shows that 10 percent of T ferry commuters transfer to a land-based mode.⁵¹

2.4 Subsidy and cost of operation

The MBTA ferry is different than other modes in terms of cost and funding structure. From 2003 to 2015, ferry fare revenues and total operating expenses generally rose and fell together (Fig. 3). Thus, over this timeframe net subsidy — the difference between operating expenses and revenues—did not see significant fluctuation, with a high of \$4.97 million in 2014 and a low of \$2.39 million in 2007 (Fig. 4). Since 2010, the MBTA’s net annual ferry service has been between \$4 million and \$5 million. The average annual net subsidy over the period examined is \$3.78 million. These figures are dwarfed by other modes with significantly higher ridership. The net subsidy for operating bus service last year, for instance, was \$224 million—the difference between \$105 million in revenue and total operating costs of \$329 million. By fiscal 2021, this figure is expected to rise to \$262 million.⁵²

Passenger ferries can also make more efficient use of transit vehicles than land-based modes, and can significantly cut travel distances between two endpoints. The total span of the ferry route between Hull and downtown Boston, for instance, is roughly one third the driving distance between the two locations.

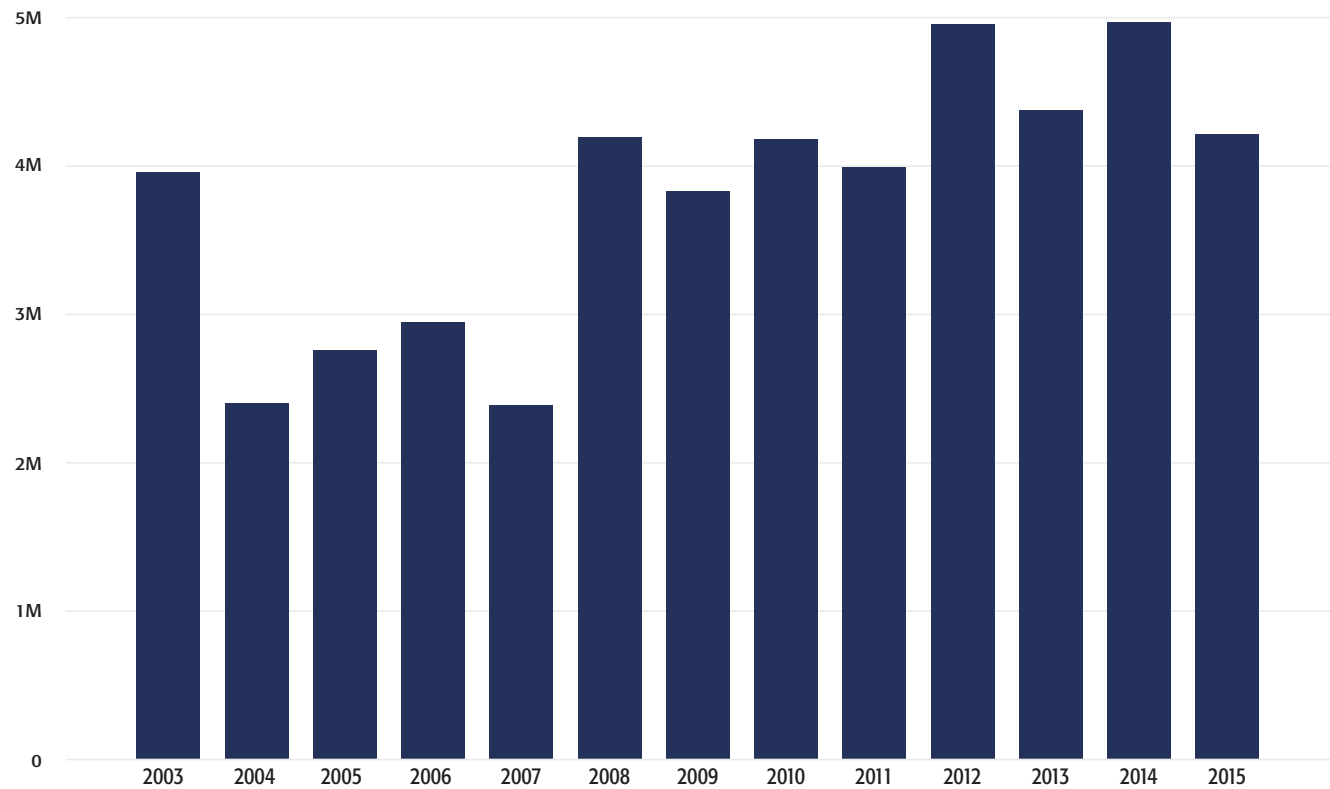
Figure 3. MBTA ferry fare revenues vs. total operating expenses (in USD), 2003 – 2015



Source: National Transit Database, 2003–2015

— Fare Revenues Earned — Total Operating Expenses

Figure 4. MBTA ferry net subsidy (in USD), 2003 – 2015



Source: National Transit Database, 2003–2015

2.5 Ferry compared to other MBTA modes by revenue and expenses

In gauging the ferry's performance relative to other modes at the MBTA, it is helpful to look at key indicators of service efficiency and cost effectiveness used by agencies nationwide. The following six metrics are reported in the NTD's annual agency profiles, and have consistently been used by the MBTA itself in agency presentations on modal performance.⁵³ The TCRP defines these measures as productivity ratios showing the number of units of transportation output over transportation input, or service consumed (e.g. number of vehicle revenue miles over passenger miles).⁵⁴ As the American Public Transportation Association points out in its 2013 Fact Book, any comparison of expenses by mode is "highly influenced by the measurement selected" and "each of these measurements is correct, but they are influenced by different characteristics of vehicle size and speed, and passenger trip lengths."⁵⁵ While not the most precise tools to exhaustively compare modes, these measures offer a helpful baseline in gaining general insights on the differences between these services with regard to their service efficiency and effectiveness.

Here the ferry is compared to six other MBTA modes using these measurements: commuter rail (CR), heavy rail (HR), light rail (LR), motorbus (MB), bus rapid transit (RB), and trolley bus (TB).⁵⁶⁽⁵⁷⁾ Commuter rail service is operated by Keolis under contract with the MBTA, heavy rail refers to the directly operated fixed route Red, Blue and Orange subway lines, motorbus bus refers to directly-operated conventional bus service using 40–60 foot vehicles, bus rapid transit refers to the Silver Line, and trolley bus refers to the trackless electric trolleys that run in mixed traffic in select Boston-area neighborhoods like Belmont and Watertown.⁵⁸

* **Operating expense per vehicle revenue mile:** Operating expenses divided by the total number of annual revenue miles, which refers to the amount of miles a vehicle is scheduled to travel while in service. By this metric, the ferry has the least efficient service relative to other modes of the T.⁵⁹ It cost \$58.62 per mile of service to run the ferries in 2015, compared to the next highest of \$40.35 for trolley bus, and slightly more than twice as high as the \$28.58 average across all modes examined.

- **Operating expenses per vehicle revenue hour:** Operating expenses over the total number of annual revenue hours, or the cost of running service for one hour. According to this indicator, the ferry service is also the least efficient among all MBTA modes: \$586.84 compared to the next highest of \$543.55 for commuter rail and the intermodal average of \$337.52.
- **Operating expenses per passenger mile:** Operating expenses over the total number of passenger miles, used to measure how much a mode costs to run per mile of service. As the Florida Department of Transportation

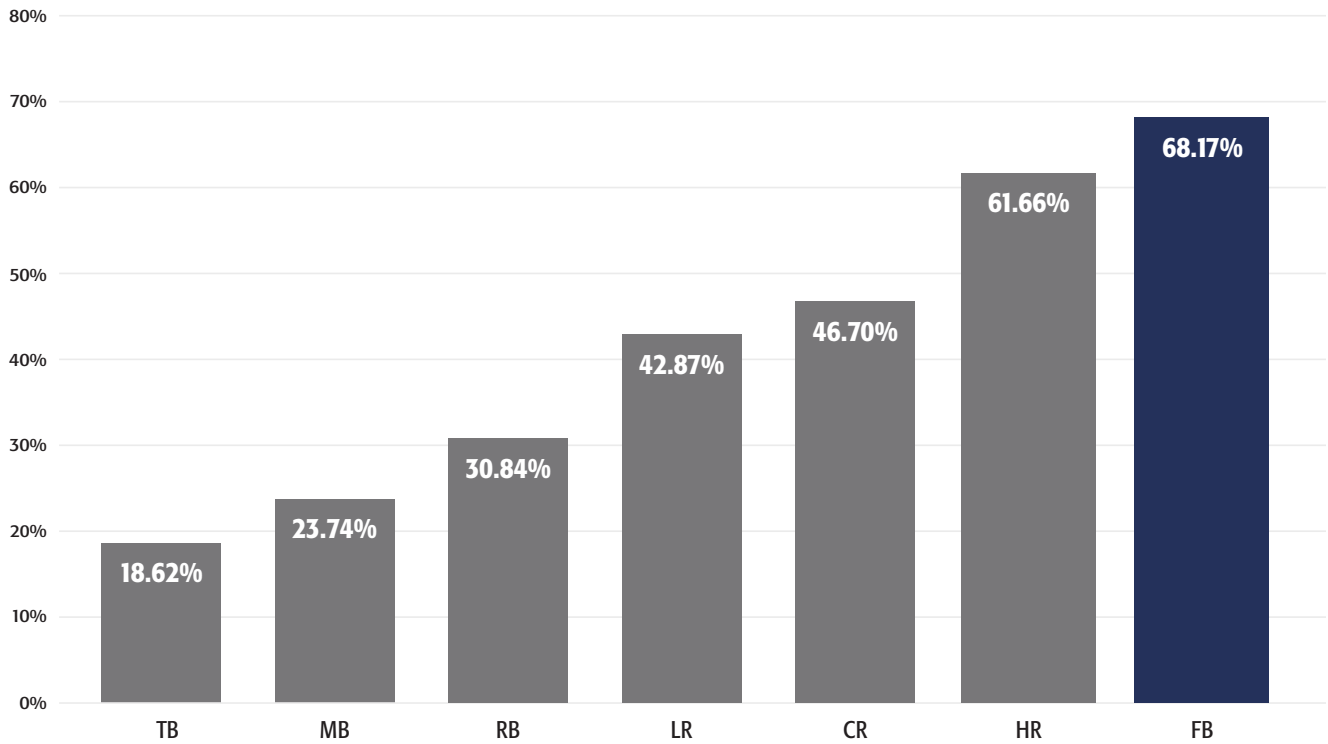
(DOT) notes, this metric offers valuable information to agencies by showing the impact that trip length can have on performance.⁶⁰ When measured in terms of this indicator, the cost of ferry service is below the average cost of service across all modes: \$1.15 per passenger mile, versus a system-wide average of \$1.34 per passenger mile. Commuter rail and heavy rail, both \$0.60 per passenger mile, were most cost-effective by this measure, while trolley was the least cost-effective with \$3.28 per mile.

- **Operating expense per unlinked passenger trip:** Operating expenses over annual ridership is a helpful measure in determining both service efficiency and level of demand for service. The ferry service ranks second highest in cost of service at the MBTA by this measure: \$9.88 per trip, versus the mode with the highest cost, commuter rail, which had operating expenses of \$12.31 per trip in 2015. By this metric, the ferry service was also more than twice as high as the system-wide average of \$5.67 per trip.
- **Unlinked trips per vehicle revenue mile:** The number of passengers boarding an MBTA vehicle on any mode over revenue miles. By this measure, the ferry ranks right in the middle of the group of seven modes, with 5.93 unlinked trips per revenue mile — slightly more service effective than both trolleybus and bus service, which operated at 5.64 and 5.61 unlinked trips per revenue mile, respectively. Commuter rail has the lowest service effectiveness according to this measure — just 1.5 trips per vehicle revenue mile — while light rail is the most effective mode by this measure, operating at a rate of 9.79 unlinked trips per vehicle revenue mile.
- **Unlinked trips per vehicle revenue hour:** The number of passengers boarding an MBTA vehicle on any mode per hour of transit service. When gauging service effectiveness by this measure, the ferry was again in the middle relative to other modes — 58.41 trips per vehicle revenue hour, which is below the system-wide average of 72.27. Heavy rail is the most service effective mode by this measure (125.66 trips per revenue hour), while commuter rail is the least (44.15 trips per revenue hour).

As mentioned above, in 2015 the MBTA ferry had the highest fare recovery ratio of all modes system-wide—68 percent versus an average of 37 percent across all modes (Fig. 5). The ferry service also had the highest revenues from passenger use as measured by passenger mile and unlinked passenger trip—two other ratios the NTD provides as metrics to use for comparative purposes (Figures 6-7). By

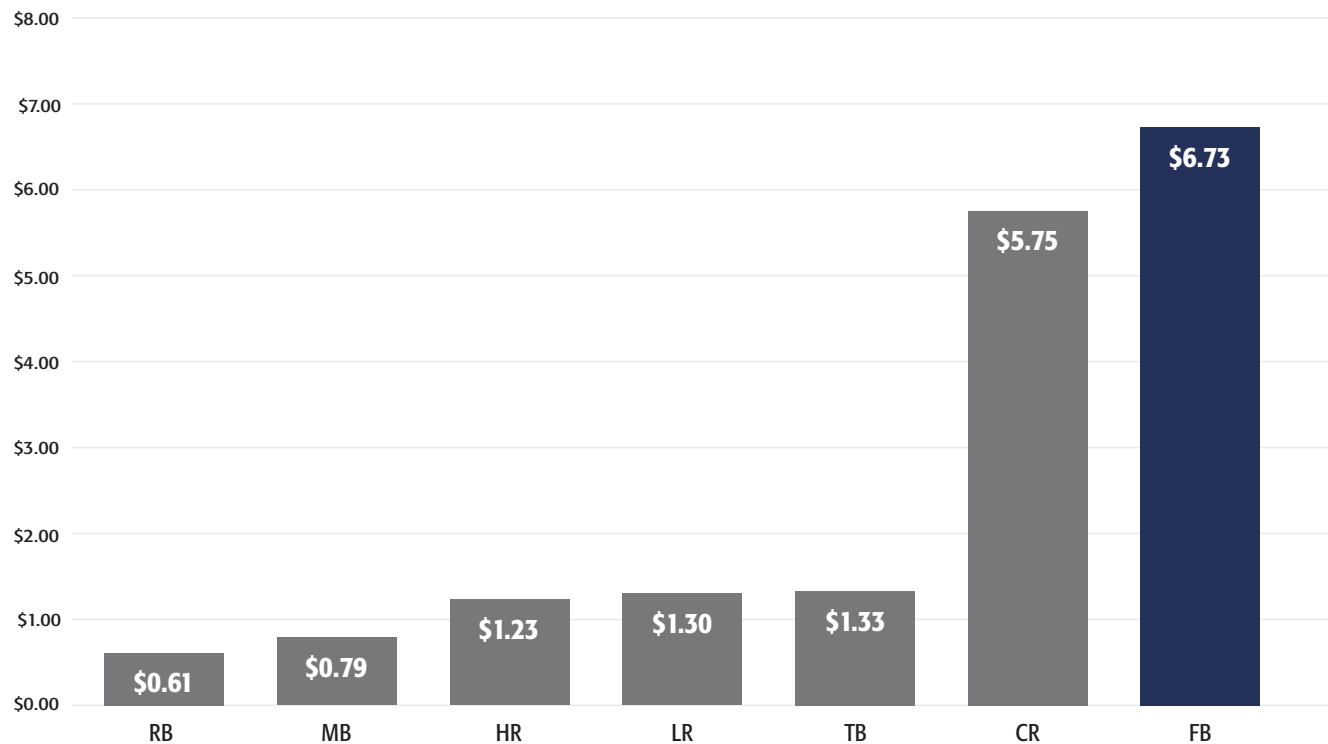
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Figure 5. Fare recovery ratio by MBTA mode, 2015



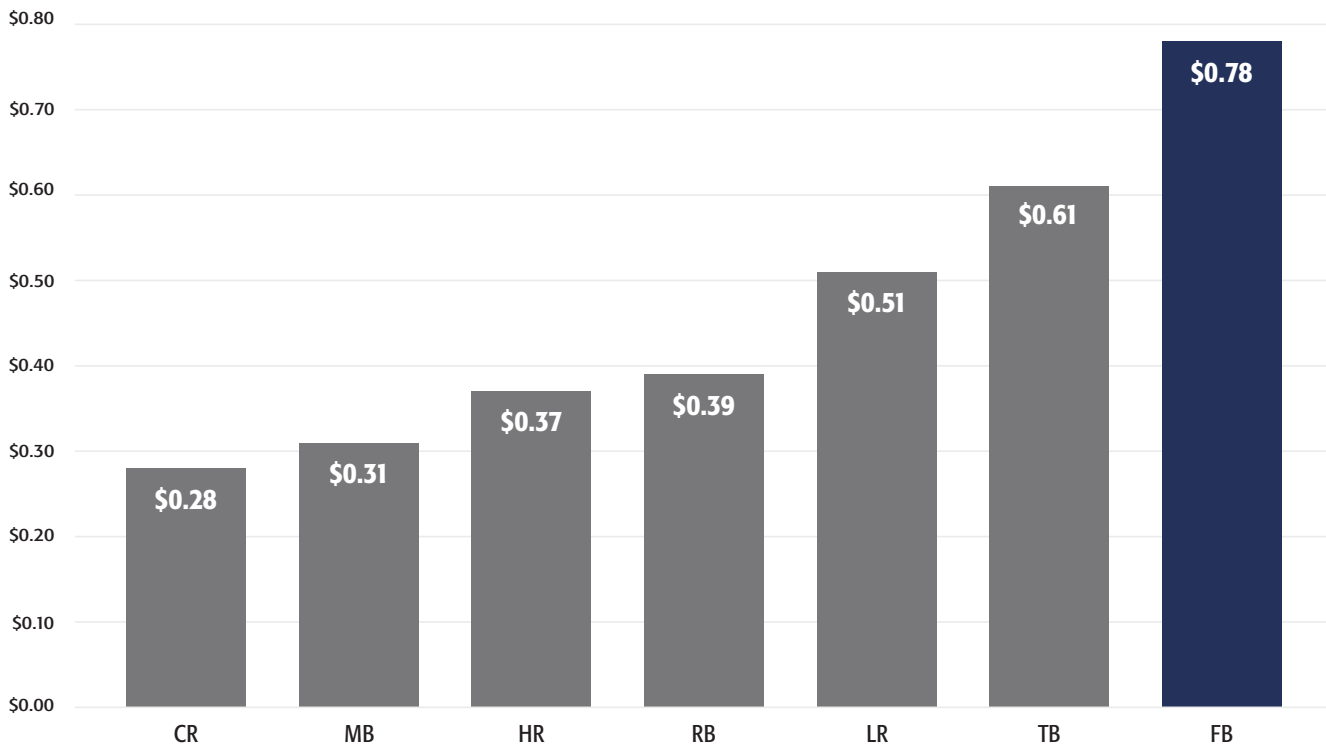
Source: 2015 National Database

Figure 6. Fare revenues per unlinked passenger trip (UPT) by MBTA mode, 2015



Source: 2015 National Transit Database

Figure 7. Fare revenues per passenger mile by MBTA mode, 2015



Source: 2015 National Transit Database

these measures, the MBTA ferry is far and away the most cost-effective mode in terms of revenue per unit of service consumption.

2.6 A closer look at net subsidy

To gain a more comprehensive picture of the cost effectiveness of the ferry relative to other modes, it is useful to examine more closely the net subsidy for each type of service: the total costs of each MBTA mode minus fare revenue. Subsidy in this instance refers to both the operating and capital expenses for each mode less fare revenue, per unit of service consumed; in other words, the total public money going towards paying for a mile of transit use by a single passenger once revenue is accounted for.

This formula builds on previous analysis the MBTA presented in late 2015, which sought to illustrate the “true economics... of each mode of transit” through a number of calculations using expenses, revenue and passenger trips.⁶¹ A central piece of the analysis shows operating deficit — or subsidy — per trip, which the MBTA defined as the difference between fully allocated operating expenses and operating revenues less fare and non-fare revenue over annual ridership, as measured by unlinked passenger trips. When compared by this measure, heavy rail had by far the lowest subsidy per trip — \$0.61 — while light rail and ferry service ranked second and third, with \$1.39/trip and \$1.57/trip, respectively. Heavy rail, light rail

and ferry service were all under the agency-wide average of \$2.07/trip, while bus service had a per-trip subsidy of \$2.86. Not including the RIDE, the T’s Demand Response (DR) service, which had a per trip subsidy of \$45.53, commuter rail had the highest subsidy per trip at \$5.75.

Building on this model, we sought to replicate the formula with several differences and additions, described below. The goal of these revisions is to provide a more comprehensive view of total cost of T ferry service over time compared to other modes.

1. The MBTA’s analysis focuses exclusively on FY2015, while the one that follows tracks expenses, revenue and service use over the period of 2002–2015.⁶² A central reason for this is that our analysis also includes capital spending, the details of which cannot be accurately or fairly captured by looking at a single year. In some years, the MBTA dedicated significantly more to capital improvement on buses while in others more went towards heavy rail, commuter rail, or other infrastructure. To determine more meaningful patterns of how the MBTA has invested in each mode, this analysis tracks aggregate spending over a longer timeframe.
2. To produce an apples-to-apples comparison of per-mode MBTA expenses, factoring in capital expenses, this analysis includes annual debt service expenses for the purchase of vehicles, signals, stations, and other capital expenditures. To do otherwise would be to overlook a substantial part

of the MBTA’s costs. In addition to operating costs, debt service expenses between 2002 and 2015 constituted an amount equal to 34.1 percent of those operating expenses.

The difficulty of including debt service expenses in a comparative analysis is that the neither the NTD nor the MBTA reports annual debt service expenses by mode. The NTD does, however, report annual capital expenditures by mode. Using these annual capital expenditures for comparative purposes, however, does not provide an accurate view of true capital costs because capital expenditures are typically financed through the issuance of long-term bonds, with principal and interest payments paid over many years. To include these annual debt service expenses by mode in the absence of reported data, we have computed a proxy estimate by attributing to each mode a percentage of total annual debt service expenses equal to the mode’s share of capital expenditures over the period from 1992 to 2015. For example, as shown in Figure 9, during that time period 37.9 percent of the MBTA’s capital expenditures were for commuter rail (CR) and 0.2 percent for ferry service (FB). For the purpose of our analysis, therefore, we attribute 37.9 percent of total annual debt service to commuter rail and 0.2 percent to ferry service, etc.

Figure 8. Percentage of total capital use by mode 1992 – 2015

Mode	Total Capital Use 1992 – 2015	Percentage by mode
CR	\$4,128,058,292	37.9%
DR	\$34,414,019	0.3%
FB	\$25,006,425	0.2%
HR	\$2,994,865,208	27.5%
LR	\$1,859,076,460	17.1%
MB	\$1,176,745,946	10.8%
RB	\$2,997,501	0.0%
TB	\$678,471,681	6.2%
TOTAL	\$10,899,635,532	100%

Source: NTD, 1992 – 2015; own calculations

3. Instead of unlinked passenger trips as the denominator value, passenger miles traveled (PMT) are used. While unlinked trips provide an instructive view of cost per unit of transit use, absent in any analysis using this measure for comparative purposes is consideration of the differences between distances of unlinked trips by mode. For instance, by the unlinked trip measure, a Green Line trip from Park Street to Kenmore Square of approximately two miles

Figure 9. Total net subsidy per passenger mile by mode, 2002 – 2015



Source: National Transit Database, 2015; MBTA State of the Service 2015

would be considered equivalent to the ~24-mile commuter rail journey from South Station to Framingham. In place of unlinked trips we use PMTs, which are the aggregate sum of the distances traveled by each passenger using a transit service. Use of this measure in lieu of unlinked trips helps mitigate issues that might arise from treating units of service consumption equally when they reflect significantly disparate distances.

- The formula employed in our analysis does not include non-fare revenues.

The following formula is used for this analysis:

$$\text{Net Subsidy} = \frac{((\text{OE} + \text{DSA}) - f)}{\text{PMT}}$$

- Where: OE = operating expenses
 DSA = debt service allocation by mode; i.e., annual debt service attributed to respective modes by percentage of total MBTA capital expenses by mode from 1992-2015
 f = fare revenue
 PMT = passenger miles traveled

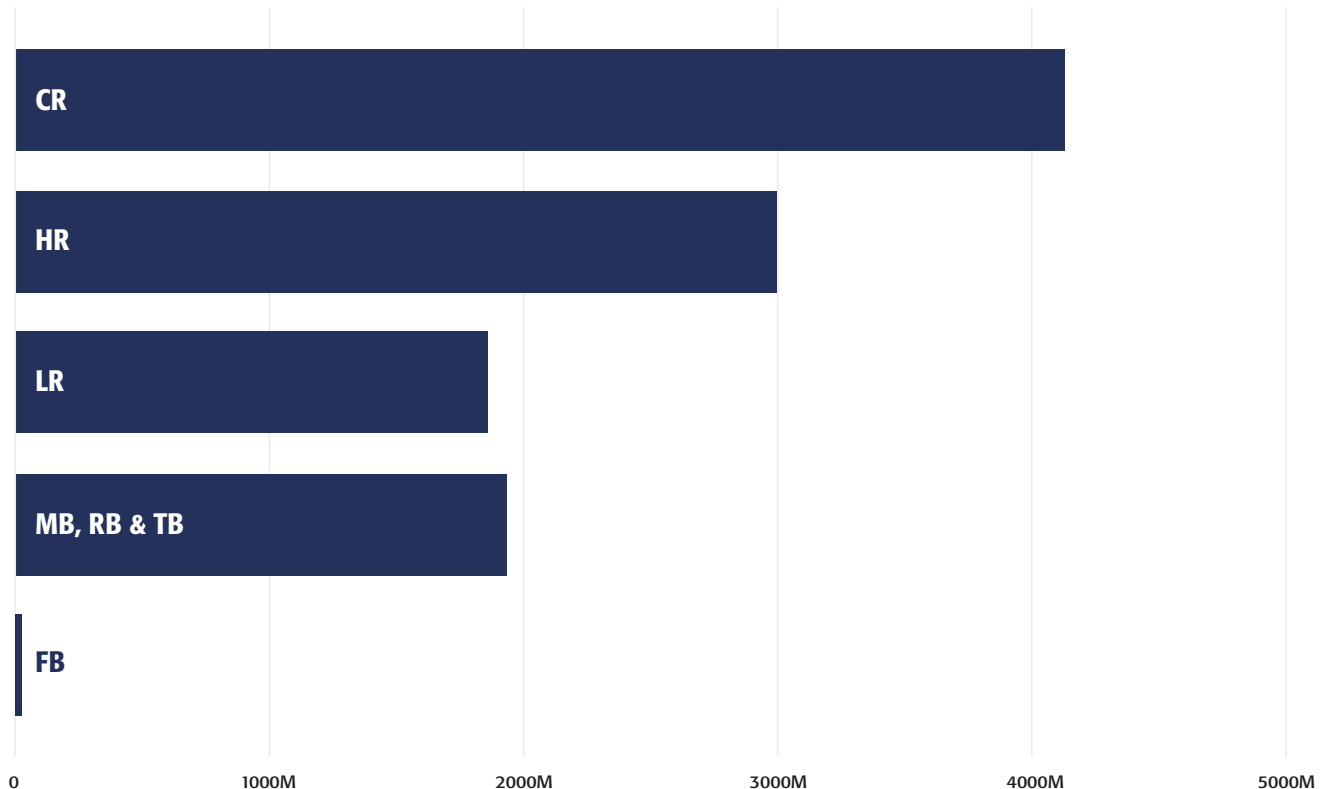
Over the 2002 – 2015 period, the MBTA ferry service’s (FB) total net subsidy was \$0.41 per passenger mile, making it the second least expensive of the MBTA’s major transit modes (Fig. 9).⁶³⁽⁶⁴⁾ For purposes of comparison, the MBTA’s cost

for ferry service was 61 percent less than that of bus service; which was \$1.05 per passenger mile, 43.4 percent less than that of light rail service on the Green Line; which was \$0.72 per passenger mile, and 92 percent less than that of trolleybus; which was by far the most expensive mode with \$5.04 per passenger mile over the period. Ferry service and heavy rail were approximately equivalent in total net subsidy, with a difference of just \$0.01 per passenger mile. The MBTA’s most cost-effective mode over the period examined was commuter rail, with \$0.38/passenger mile.

Two observations help to explain the cost-effectiveness of ferry service compared to other modes. The first is that ferry service has relatively few capital costs when compared to services that run on rail infrastructure and require significantly more facilities, as well as regular investment in other capital assets. Between 1992 and 2015, ferry service capital costs totaled \$25,006,425—an average of \$1,389,246 per year. By comparison, combined capital costs for commuter rail, heavy rail, light rail, and all forms of bus service over the same period were \$10.9 billion, which averages out to \$454.2 million per year (Fig. 10).

Over the 2002 – 2015 period, the MBTA ferry service’s (FB) total net subsidy was \$0.41 per passenger mile, making it the second least expensive of the MBTA’s major transit modes.

Figure 10. MBTA total capital costs by mode, 1992-2015 (in USD millions)



Source: 1992 – 2015 National Transit Database

The second observation is that, as explored above, the ferry service collects more than twice as much in fares per passenger mile and unlinked passenger trip than most other modes. The T ferry collected \$0.78 per passenger mile in 2015, while commuter rail collected \$0.28, bus service collected \$0.31, heavy rail collected \$0.37, and light rail collected \$0.51 per passenger mile. The ferry collected \$6.73 per unlinked trip, while heavy rail collected \$1.23, bus service collected \$0.79 and light rail collected \$1.30. Commuter rail was the only other mode to come close to the ferry on this measure, collecting \$5.75 in fare revenue per trip.

The findings above illustrate that the net subsidy of the MBTA ferry, when measured by both the T's method of operating expenses less revenue and a different approach factoring in capital expenses and debt service overtime, makes it competitive with the most cost-effective modes and, in some cases, significantly less expensive than other types of direct route service such as bus. Capital spending over time reveals that the ferry service is largely an "asset light" mode, with minimal need for capital investment relative to other types of transit service.

Given the limited resources currently available for more expensive transit projects, the above analysis suggests that additional water-based transportation options might represent low-cost investment opportunities to expand access to public transportation for underserved areas both within Boston and along the coast. The net subsidy ferry service requires, as well as the its comparatively minimal capital investment needs and maintenance costs, present a more fiscally feasible channel to augment existing public transportation service relative to extending rapid transit or light rail.⁶⁵ By this reasoning, expanding ferry services and subsequent improvements in accessibility could also be a less expensive initiative to drive economic development in municipalities that currently have limited transportation infrastructure.

3. How does MBTA ferry service compare to other agencies?

In gaining a more comprehensive understanding of the MBTA's ferry operations, it is helpful to compare the authority to other ferry services. Nationwide, there are hundreds of ferry service and water transportation operators serving a broad range of functions. The Bureau of Transportation

Statistics lists 128 ferry operators in their 2014 *National Census of Ferry Operators*.⁶⁶ The Central Transportation Planning Staff (CTPS), a branch of the local Boston Region Metropolitan Area Planning Council focused on transit, points out that, based on their own national review of trends in ferry service, there were approximately 270 ferry routes providing point-to-point service outside Massachusetts in 2013.⁶⁷ As the CTPS further notes, the vast majority of states—38—have "at least one point-to-point ferry route serving the general public."⁶⁸ Not all these operators run ferries that serve the commuting public, however.

In their national review, CTPS separates ferry operators into five categories: Island Ferries; River Ferries; Ferries across Lakes, Bays and Sounds; Water Taxis; and Commuter Ferries. The last category, commuter ferries—which make up 13 percent of the total group of operators the CTPS examined—is

the principal group of interest in this report.⁶⁹

A useful resource for starting our comparison is a July 2015 MBTA document which offers key pieces of information about the T's ferry service, including summary statistics on ridership, contracting arrangements with outside vendors, amenities, fares, performance, and fare recovery. The document shares a comparison to six other transit authorities using

2014 data, showing the MBTA was right in the middle of this peer group with regard to farebox recovery that year. As mentioned above, NTD data shows that 68 percent of MBTA ferry operating expenses were covered by fare revenues in 2015. This is an improvement from 2014, when fare recovery was 62 percent, as pointed out in the MBTA's state of the service report. As the T document further notes, this 2014 figure is within a range of ~6 percentage points of two peer groups with the most similar ratios that year, the East River Ferry in New York (64 percent) and the Golden Gate Ferry in San Francisco (58 percent), and just over 10 percentage points above the average of the group examined. The operator with by far the highest ratio in the group was the Hudson River Ferry, which had a 136 percent recovery ratio in 2014. It should be noted that this ferry service is run by a for-profit operator.

In preparing our assessment of the MBTA relative to other ferry services nationwide, we compared vehicle fleet, capacity, historical fare recovery ratio, ridership trends and several performance indicators for a group of five peer operators. This peer group was selected based on agency matches determined

The findings above illustrate that the net subsidy of the MBTA ferry, when measured by both the T's method of operating expenses less revenue and a different approach factoring in capital expenses and debt service overtime, makes it competitive with the most cost-effective modes and, in some cases, significantly less expensive than other types of direct route service such as bus.

through the Florida Transit Information System’s (FTIS’) Integrated National Transit Database Analysis System (INTDAS), which offers a web-based peer selection module enabling agency-to-agency comparisons. This peer-to-peer methodology can be used in both analysis of a transit agency’s system-wide operations and in examining individual modes.

3.1 Method

The INTDAS peer tool module selects matching agencies according to a likeness score that is calculated based on a number of different measures used to gauge similarity among agencies. The methodology employed on the web-based platform is described in the TCRP’s Report 141, “Methodology for Performance Measurement and Peer Comparison in the Public Transportation Industry”, which delineates and defines these measures. Included in overall assessment are factors like service area type, urban area population, total annual vehicle miles operated, and others. For most factors used in peer comparison, likeness scores are calculated based on the percentage difference between the target agency’s value and that of the potential peer. If a likeness score is “0”, the peer and target agency are a perfect match, or exactly alike. The higher the likeness score, the less similar two agencies are. The TCRP 141 notes the following score ranges and what they indicate about operator compatibility (Fig. 11):

Figure 11. Likeness score ranges for peer comparison

score < 0.5	Good match
0.5 < score < 0.74	Satisfactory match
0.75 < score < 0.99	Suitable for comparison with some differences ⁷⁰
score > 1.00	Unsuitable for comparison

In determining the peer group for our comparison to the MBTA ferry, we adjusted the likeness score assessment method to omit certain metrics that do not have application to an analysis of ferry service. The three factors not included in determination of peer groups are just below, with accompanying explanation for their omission⁷¹:

- **Rail operator (yes/no):** This factor was originally included in the TCRP’s method to account for how bus networks in systems that also operate rail service are often significantly different than in systems that do not have rail in that the rail routes substitute for what would otherwise be the busiest, most productive bus routes in the system. Accordingly, this factor has no application to ferry service.
- **Percent service demand-responsive:** As the TCRP report notes, this factor is only used in agency-wide and bus-mode comparisons.⁷² It thus does not provide useful numbers for ferry service comparison.

- **Distance:** We exclude this factor for peer comparison of ferry services on the same grounds that distance is not included in analysis for rail-mode-specific peer groups “due to the relatively small number of rail-operating agencies.” The TCRP notes: “Removing distance as a factor for these comparisons allows the general guidance on interpreting likeness scores to be applied more consistently.”⁷³ By this reasoning, there is not a sufficient number of ferry operators nationwide to make inclusion of distance useful for our purposes.

Factoring out the three measures mentioned above, the INTDAS peer selector determined five peers based on acceptable likeness scores for comparison:

- San Francisco Bay Area’s Water Emergency Transportation Authority (WETA);
- BillyBey Ferry Company, LLC of New York;
- Port Imperial Ferry Corporation dba NY Waterway of New Jersey;
- King County Ferry District (KCFD) of Seattle, WA;
- Golden Gate Bridge, Highway and Transportation District (GGBHTD) of the San Francisco Bay Area.

As the chart below (Fig. 12) shows, WETA (score = 0.45) is the best match and closest peer while the Golden Gate Bridge ferry is the least compatible peer (score = 0.81)—the remaining three are in the satisfactory range for comparative purposes. All five of these operators are included in the MBTA’s own comparison of other ferry systems in the July 2015 document referenced above, though their analysis also includes Washington State Ferry, which INTDAS’s peer selection tool did not determine to be a suitable peer for comparison.⁷⁴

Though this report looks at historic trends based on data from 2015 and earlier, a recent change in the New York ferry system should be noted. In December 2016, NY Waterway—which is run by parent company Port Imperial, another peer group in our analysis — announced that it would be acquiring BillyBey, LLC and all of its commuter ferry vessels.⁷⁵ For the purposes of our analysis and considering how recently this shift in ownership occurred, Port Imperial and BillyBey are broken out separately based on their unique service data going back to 2007.

For the analysis of historical trends, there were two agencies in the group for which historical NTD data on the measures of interest going back to 2007 were limited. Ridership data for

Figure 12. Ferry operator likeness scores for peer comparison

Agency	Score
WETA	0.45
Billy Bey, LLC	0.60
Port Imperial	0.70
KCFD	0.71
GGBHTD	0.81

the San Francisco Bay Area Water Emergency Transportation Authority (WETA) is only available through the NTD going back to 2011. For the King County Ferry District (KCFD), this data is available going back to 2009.

Figure 13. Location and urban area population by peer group

Operator	City	Primary Urbanized Area Population
Massachusetts Bay Transportation Authority	Boston, MA	4,181,019
Golden Gate Bridge, Highway and Transportation District	San Francisco, CA	3,281,212
Port Imperial Ferry Corporation dba NY Waterway	Weehawken, NJ	18,351,295
San Francisco Bay Area Water Emergency Transportation Authority	San Francisco, CA	3,281,212
BillyBey Ferry Company, LLC	New York, NY	18,351,295
King County Ferry District	Seattle, WA	3,059,393

Source: National Transit Database, 2015

3.2 Results of peer comparison

Out of the peer group that includes five other operators, the MBTA's average weekday ridership of 4,700 was the second lowest (measured by number of unlinked passenger trips) in 2015 (Fig. 14). This is significantly more than the the King County Ferry District, which had 1,737 trips per average weekday. The Port Imperial ferry had the highest weekday ridership, with 14,090 per average weekday. Out of the six operators, in 2015 the MBTA ferry's 8.3 mile distance per trip was the third longest. Both the New York ferries, Port Imperial and BillyBey, traveled an average of four miles per trip, while the Bay Area-based WETA traveled by far the longest distance per trip at 15.7 miles.

Figure 14. Unlinked Passenger Trips (UPTs) per average workday & average distance per trip (in miles) by peer, 2015

Operator	Unlinked Passenger Trips per average weekday	Average distance per trip (in miles)
MBTA	4,700	8.3
KCFD	1,737	5.2
BillyBey	6,300	4
WETA	6,606	15.7
GGHBTD	8,218	10.9
Port Imperial	14,090	4

Source: National Transit Database, 2015; MBTA State of the Service 2015

The MBTA and the Port Imperial ferry had the largest active ferry vehicle fleets in 2015, with 15 vessels each, according to the NTD (Fig. 15).⁷⁶ The operator with the next largest fleet was WETA (11 vessels), while BillyBey and the Golden Gate

Ferry operated six vessels each. The King County Ferry District operated a ferry vehicle fleet of 4 vessels in 2015. King County and the MBTA ferry are listed as the only operators in the peer group with an active fleet that includes leased vessels (one out of four and four of fifteen, respectively). As of 2015, the rest of the group owned their active fleets outright. Data from that year shows wide variability among the peer operators in total average capacity per vehicle, or the total capacity of each operator's vehicle fleet over the number of active vessels. The Golden Gate ferry had the largest average capacity at 523 per vehicle. This is significantly more than the next several, including the MBTA (275), WETA (257), and Port Imperial (286). BillyBey had by far the smallest average vehicle capacity with 114 passengers per vehicle.

Out of the peer group that includes five other operators, the MBTA's average weekday ridership of 4,700 was the second lowest (measured by number of unlinked passenger trips) in 2015.

Figure 15. Peer vehicle fleet characteristics and capacity, 2015

Operator	Active vehicle fleet	Owned active vehicles	Leased active vehicles	Total average capacity per vehicle
MBTA	15	11	4	275
KCFD	4	3	1	220
BillyBey	6	6	0	114
Port Imperial	15	15	0	286
GGHBTD	6	6	0	523
WETA	11	11	0	257

Source: National Transit Database, 2015

The MBTA ferry had the lowest number of passengers per hour in 2015 at 59.4. BillyBey had the second lowest with just under 82 passengers per hour, while the Golden Gate Ferry had the highest with ~181. In both fare revenue per trip and cost per passenger, the MBTA ferry was in the middle of the group (third out of six as ranked by lowest to highest fare revenue per trip and also third as ranked from highest to lowest in cost per passenger). By the NTD metric cost per hour, the T ferry was second least expensive ferry service to operate (\$86.84 per hour versus the Golden Gate Ferry's peer group high of \$2,152.25 per hour).

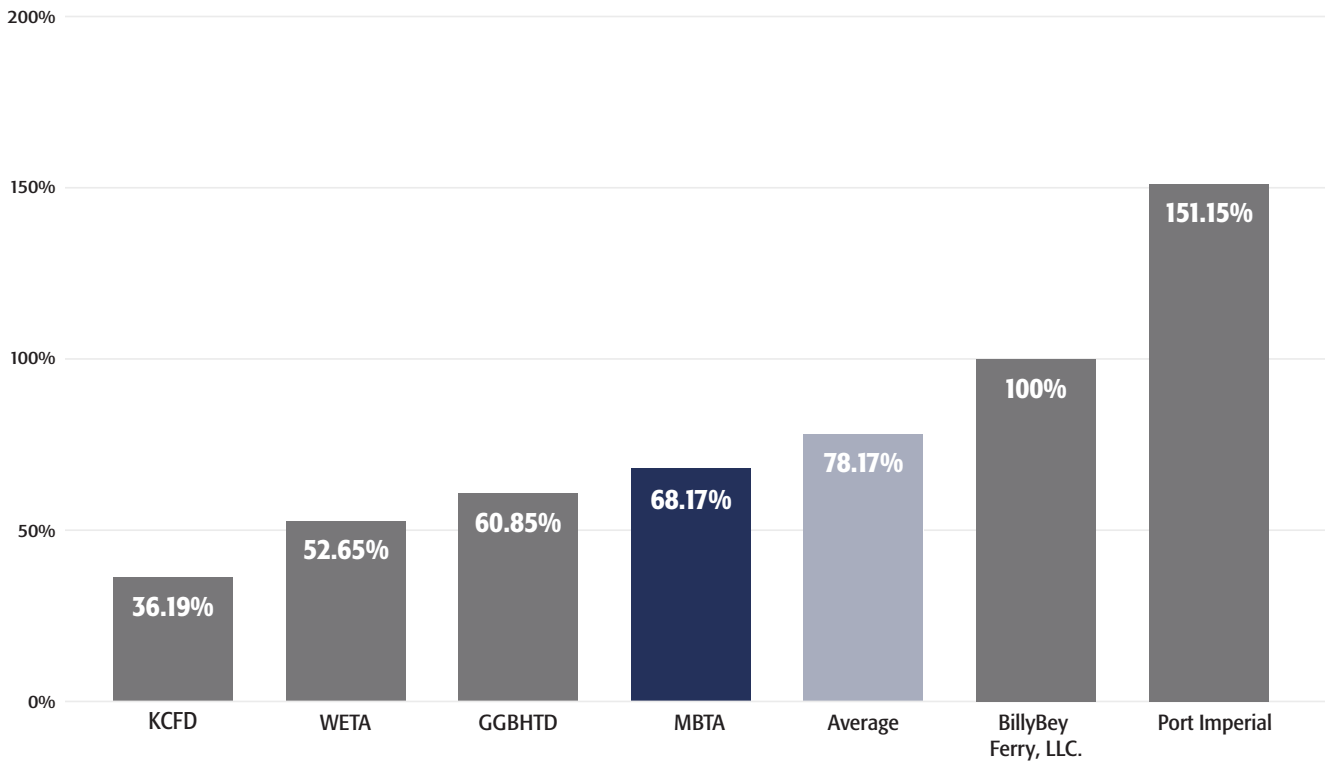
Figure 17 provides a visualization of the fare recovery ratios for the peer group agencies. As the chart shows, the MBTA is closest to the average and right in the middle of the pack when compared to other operators on this measure. The operator with the lowest fare recovery ratio is the King County Ferry District, which recovered 36.19 percent of total operating

Figure 16. Peer capacity per hour, revenues per trip, cost per hour/passenger

Operator	Passengers per Hour	Fare Revenues per UPT	Cost per Hour	Cost per Passenger
Massachusetts Bay Transportation Authority	59.4	\$6.73	\$586.84	\$9.88
Golden Gate Bridge, Highway and Transportation District	180.9	\$7.24	\$2,152.25	\$11.90
Port Imperial Ferry Corporation dba NY Waterway	150.6	\$9.71	\$967.43	\$6.42
San Francisco Bay Area Water Emergency Transportation Authority	136.5	\$6.43	\$1,666.88	\$12.21
BillyBey Ferry Company, LLC	81.8	\$7.08	\$579.38	\$7.08
King County Ferry District	103.0	\$3.85	\$1,095.08	\$10.63

Source: National Transit Database, 2015

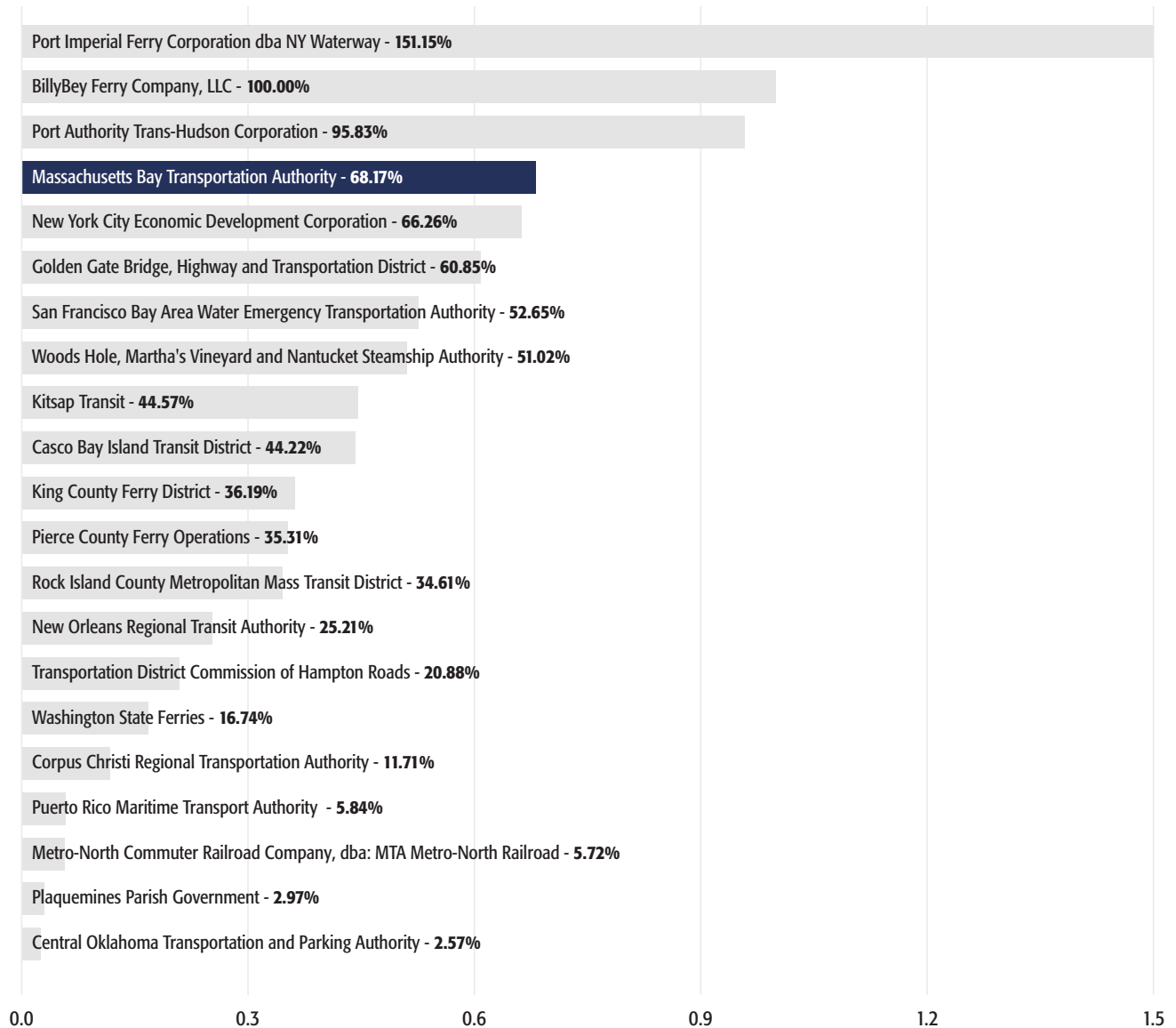
Figure 17. Peer fare recovery ratio, 2015



Source: 2015 National Transit Database

costs in 2015. The BillyBey and Port Imperial ferry services had ratios of 100 and 151.15 percent, respectively; figures that significantly bring up the group average (78.17 percent). As noted above, while the INTDAS peer selector lists BillyBey and Port Imperial as peers, they are both run as for-profit groups, and this is reflected in their recovery ratios. The average of the group when BillyBey and Port Imperial are excluded is 54.47 percent, which makes the MBTA's recovery ratio the highest among public operators.

Figure 18. Fare recovery ratio by ferry operator, 2015



Source: 2015 National Transit Database

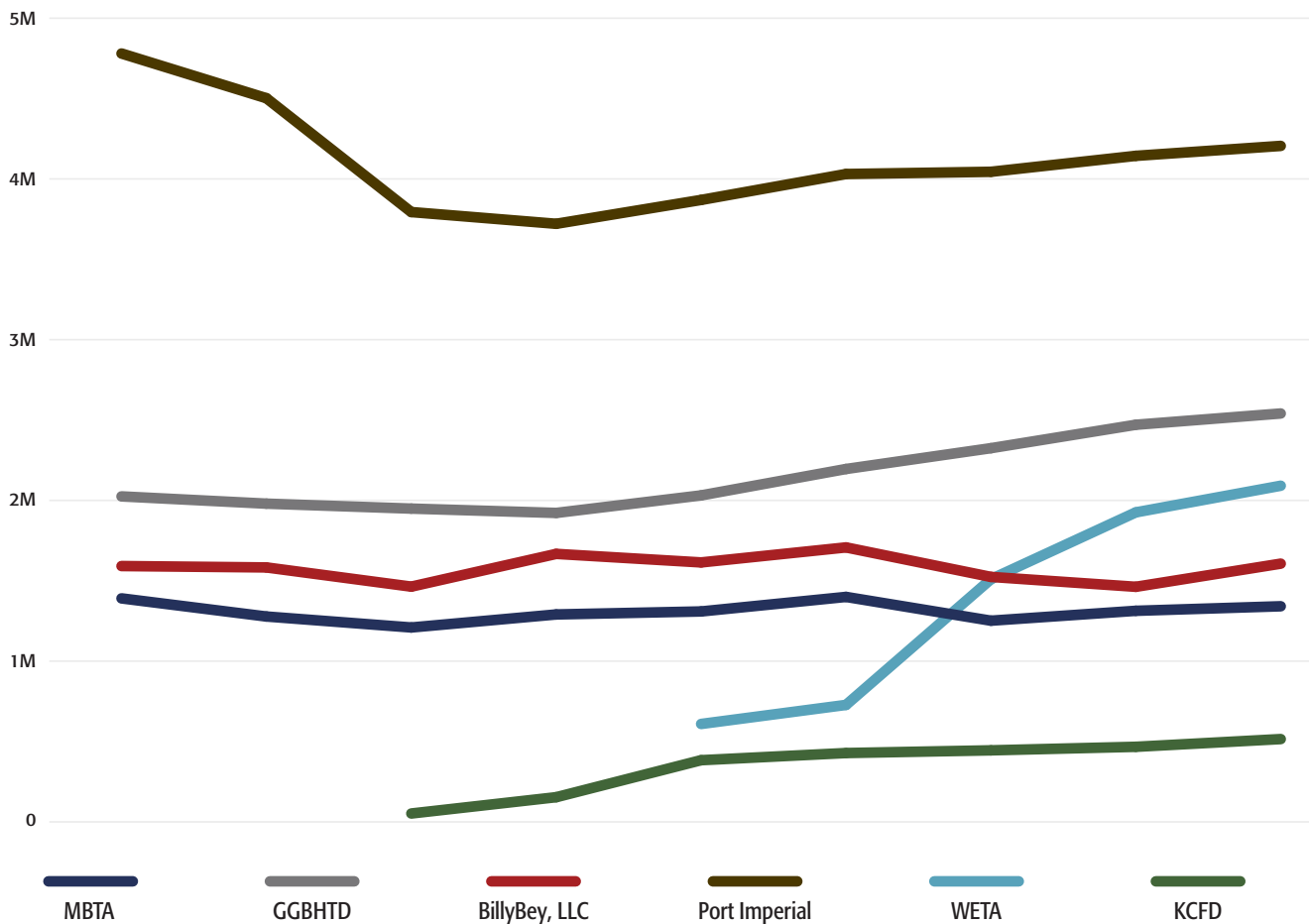
Figure 18 shows the 2015 fare recovery ratios for all full-reporting U.S. ferry operators with data available through the NTD and offers additional context in assessing how the MBTA ferry compares to other operators nationwide. As the visualization shows, in 2015 the MBTA ferry had the fourth highest recovery ratio of the 21 full-reporting operators with available data for this measure.⁷⁷ It is important to note that this is not an exhaustive or complete list of all major U.S. ferry operators, but includes those for which fare recovery data is available via the NTD.

The volume of passenger trips on the MBTA ferry and two of its five peers with data available back to 2007 remained relatively unchanged over the period examined. The Port Imperial

ferry saw ridership decline by almost one million unlinked trips, from 4.78 million to 3.79 million, between 2007 and 2009—a drop of more than 20 percent. From 2010 to 2015, its ridership steadily increased to just over 4.2 million trips annually. WETA had the most significant increase over time out of the group, with ridership rising from 609,253 trips to almost 2.1 million in 2015. KCFD likewise saw ridership increase, from 52,164 to 515,207 trips between 2009 and 2015.

...the MBTA ferry has the fourth highest recovery ratio of the 21 full-reporting operators with available data for this measure.

Figure 19. Ferry ridership, MBTA vs. national peers, 2007 – 2015



Source: National Transit Database

3.3 Service efficiency and effectiveness relative to peers

As described above, by some performance indicators MBTA ferry service is a very efficient and cost-effective service, while it is less so by other measures. Its net subsidy, for instance, is among the lowest at the MBTA. Measuring service by operating expenses per revenue mile and revenue hour, however, the service is less efficient than other modes. When assessed side-by-side with the INTDAS-designated peer group, the results are similar. The 2015 data suggest the service performs well by several measures of efficiency and effectiveness, though not by all.

Starting with the performance measures based on productivity ratios, the table in Figure 21 breaks down the MBTA's cost effectiveness relative to the peer group by operating expenses per revenue mile, revenue hour and unlinked passenger trip for 2015.

In operating expense per vehicle revenue mile, the MBTA ferry had the second lowest cost of service of the six operators that year at \$58.62 per mile, which exceeds only the BillyBey

Ferry Company (\$45.80 per revenue mile). The operator with the next lowest per-mile operating expense is the Port Imperial Ferry, which had a cost of service of \$62.51 per mile according to this measure. The Golden Gate Bridge Ferry had by far the most expensive service according to this metric at \$161.47 per revenue mile in 2015.

Comparing operators on the basis of operating expenses per vehicle revenue hour reveals a similar picture. In 2015, MBTA ferry service had a per-hour cost of \$586.84 by this measure, second lowest among the same group of seven operators and significantly less than the peer group average (\$1,174.65). Of the group assessed, the costs ranged from a low of \$579.38 per revenue hour (BillyBey) to a high of \$2,152.25 per revenue hour (Golden Gate Bridge, Highway and Transportation District, or GGBHTD, in California).

When measured in operating expenses per passenger mile, the MBTA ferry is also cost-effective relative to other groups that operate ferry transportation.⁷⁸ The MBTA cost \$1.22 per passenger mile by this measure in 2014, which is lower than three

operators but higher than Golden Gate (\$1.11) and San Francisco's Water Emergency Transportation Authority (WETA) (\$0.82). The MBTA's costs were less than the average of the group according to this measure—\$1.67—in 2015. The most expensive service by this measure is the BillyBey, with a cost per passenger mile of \$3.08.

When measured in terms of operating expense per unlinked passenger trip, the T was just above the group average in 2015. By this metric, the MBTA ferry costs \$9.88 per trip versus the group average, \$9.69 per trip. The operator with the lowest cost of service by this metric is Port Imperial, which cost \$6.42 per passenger trip, while WETA had the highest cost per trip at \$12.21.

When measured by a different unit of service effectiveness—unlinked passenger trips per vehicle revenue mile—the MBTA has the least efficient service, with 5.9 trips per vehicle revenue mile in 2015. This is 0.6 fewer trips per revenue mile than the next highest, BillyBey (6.5), 2.9 trips less per revenue mile than the average across the group of six operators (8.8), and 7.7 trips less per mile than Golden Gate, which had the highest that year (13.6). In 2015 the MBTA ferry also had the

lowest number of unlinked passenger trips per vehicle revenue hour at 59.4, versus BillyBey's 81.8 per hour (the next highest) and a peer average of 118.7. As with trips per revenue mile, the Golden Gate Ferry also had the most effective service by trips per revenue hour with 180.9.

As the MBTA ferry's performance in these comparative measures illustrates, the T operates a cost-effective and efficient water transportation service relative to peer operators (ranking in the top three out of a group of six) nationwide as measured by four out of six performance indicators.

As the MBTA ferry's performance in these comparative measures illustrates, the T operates a cost-effective and efficient water transportation service relative to peer operators (ranking in the top three out of a group of six) nationwide as measured by four out of six performance indicators. When measured in both trips per revenue hour and trips per revenue mile, the T ferry has the lowest service effectiveness among its peers, ranking last in the group of six.

3.4 Peer rankings

As is the case with the comparison of the MBTA ferry to other T modes using the performance measures referenced above, comparing ferry operators using these measures is meant to offer general insights on their relative performance and cost effectiveness. To provide a more comprehensive picture of how the MBTA ferry compares to the INTDAS-designated peer

Figure 20. Peer group operating expenses by passenger trip, vehicle revenue hour/mile, passenger miles

Operator	Operating expenses per passenger trip	Operating expense per vehicle revenue hour	Operating expense per vehicle revenue mile	Operating expense per passenger mile traveled
Port Imperial	\$6.42	\$967.43	\$62.51	\$1.69
BillyBey Ferry Company	\$7.08	\$579.38	\$45.80	\$3.08
MBTA	\$9.88	\$586.84	\$58.62	\$1.22
KCFD	\$10.63	\$1,095.08	\$107.70	\$2.12
GGBHTD	\$11.90	\$2,152.25	\$161.47	\$1.11
WETA	\$12.21	\$1,666.88	\$82.86	\$0.82

Source: National Transit Database, 2014 – 2015

Figure 21. Peer group ridership per vehicle revenue mile/hour

Operator	Unlinked passenger trips per vehicle revenue mile	Unlinked passenger trips per vehicle revenue hour
MBTA	5.9	59.4
BillyBey Ferry Company	6.5	81.8
WETA	6.8	136.5
Port Imperial	9.7	150.6
KCFD	10.1	103.0
GGBHTD	13.6	180.9

Source: 2015 National Transit Database

group, the following analysis weighs 12 factors, providing an amalgam of measures of capacity by unit of time, cost per passenger and other indicators discussed above, in addition to the six standard productivity ratios. The additional metrics included in this scoring are:

- Passengers per hour
- Fare revenues per unlinked passenger trip;
- Cost per hour
- Cost per passenger
- Fare recovery ratio

Figure 22. Peer rankings by amalgamated scores

Operator	Rank
Port Imperial	1
BillyBey	2
GGBHTD	3
MBTA	4
WETA	5
KCFD	6

Each of the six operators in the peer group was ranked for each individual measure, and the final ranking for each operator is a rounded average of their scores in each category.⁷⁹ The results show that the MBTA ferry ranks fourth according to this scoring method, behind the Golden Gate Ferry, BillyBey and Port Imperial. WETA and KCFD rank fifth and sixth, respectively.

3.5 Institutional characteristics and modal features of peer operators

That the MBTA, the fifth largest transit agency nationwide by ridership⁸⁰, operates the core ferry services for Greater Boston makes administration of the T ferry unique relative to its peer operators. Among the peer group reviewed in this report, the MBTA ferry is the only water transportation commuting service run by an agency that operates more than two service modes.

Of the five peer groups examined, three operators—WETA, King County and BillyBey—run ferry service exclusively. The governance structure for all three reflect the different public policy approaches municipalities and other districts take with regard to ferry service. Nationally, some public bodies employ a policy of outsourcing service to private companies with varying levels of subsidy (such as the MBTA) in districts with ferry operators, while in other districts service is managed by private companies independently of any public oversight role or is directly operated and funded entirely by a public agency itself.

These distinctions are illustrated in the different management structures for WETA, King County Ferry and BillyBey. WETA is a regional public transit agency that deals exclusively with water-based transportation and managing transportation issues related to maritime emergencies, or “coordinating the water transit response to regional emergencies.”⁸¹ Similarly, the King County Ferry District is a special

purpose district established exclusively to operate the county’s water taxi service.⁸² BillyBey is a private operator that runs the East River ferry service in New York, though New York City and its Port Authority have made significant capital investments to improve infrastructure for ferry use, and the Port Authority currently manages operations of the Port Authority Trans-Hudson (PATH) ferry that complements existing commuter rail service.

New York has a very unique history with ferry service. Since the mid-1980s, the driving ethos of state policy on ferry services has been that the most optimal system is a free market in which new operators face few barriers to entry and can experiment with different routes, bringing significant benefit to area residents.⁸³

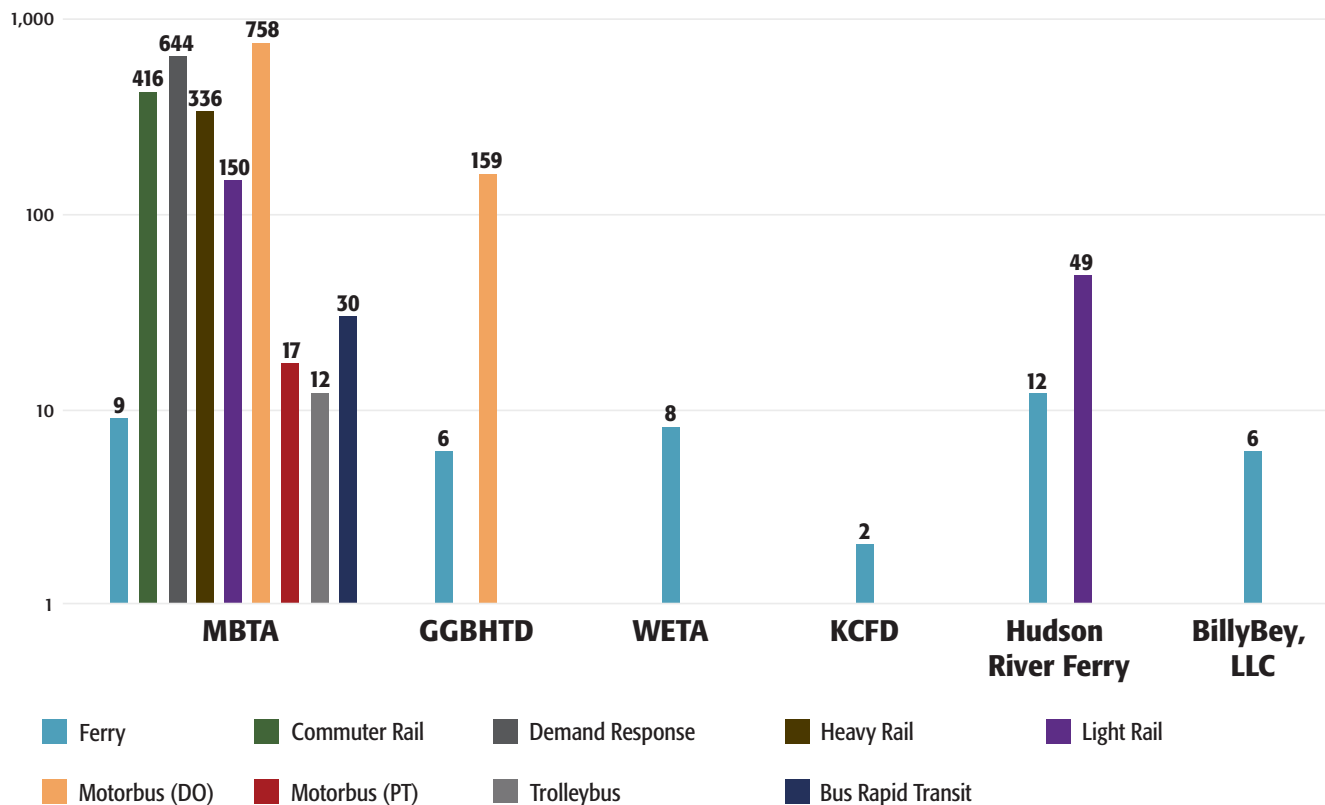
As the Transportation Cooperative Research Program (TCRP) concluded in its 2012 report, there is no such thing as a “typical” ferry service, as each system has unique features.⁸⁴ The examples of the MBTA ferry’s closest peers reflect the variability in governance structure and funding sources, but even more variability can be observed among other service providers nationwide. As the TCRP notes, both North Carolina and Washington, as well as the U.S. Virgin Islands, include their state-operated ferry systems as a feature of their state highway systems in consideration of their “critical linkages [to] the state’s transportation system.”⁸⁵ Some studies have pointed out that public funding of ferry services is more common than not. A TCRP survey of 46 agencies that operate a ferry service, for instance, found that 32 receive some public subsidy, while eight receive no public funding.⁸⁶

3.6 Vehicle fleet differences

The Golden Gate Ferry and the Hudson River Ferry operate both ferry and bus service, with the latter comprising the most significant percentage of both agencies’ vehicle fleets as measured by vehicles operated in maximum service (VOMS), which refers to the number of vehicles in use at peak times. According to 2014 data, ferry service makes up 3.64 percent of the Golden Gate Ferry’s total vehicle fleet, while the rest of their fleet consists of directly operated buses. Just under 20 percent of the Hudson River Ferry’s fleet consists of ferry vehicles, and the remaining vehicles are also directly operated buses. An aberration from the modal norm among its peers, the MBTA operates nine transit

That the MBTA, the fifth largest transit agency nationwide by ridership, operates the core ferry services for Greater Boston makes administration of the T ferry unique relative to its peer operators.

Figure 23. Operations by mode, MBTA ferry peers



Source: 2014 National Transit Database

modes (Fig. 23).⁸⁷ Ferry boats make up 0.38 percent of the T's total vehicle fleet, while commuter rail, demand response, heavy rail, light rail and directly operated motorbus comprise over 97 percent of the agency's total vehicles in service.

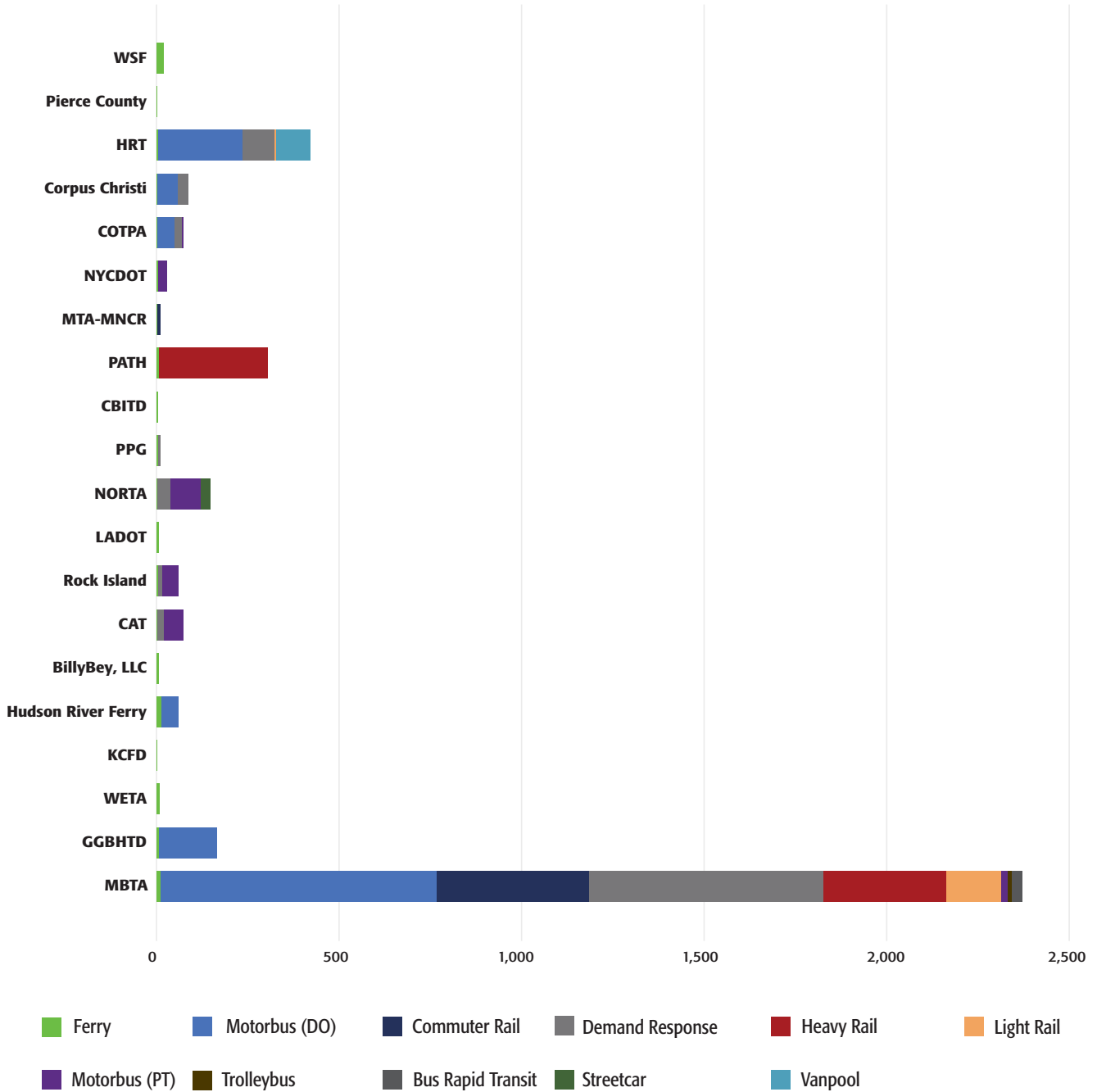
Expanding the group serving as the basis of comparison to include all ferry service operators with data available in the NTD further illustrates how the MBTA is a departure from the norm among ferry operators with regard to number of modes and VOMS size. The agency has the most variable and robust intermodal operations of any operator in this group, based on 2014 data (Fig. 24). With 2,372 vehicles in service, the MBTA has more than twice as many VOMS as the agency with the next highest number, the Metro-North Railroad (MTA-MNCR) of the New York metropolitan area, which has 1,184 vehicles in service. Another important distinction between these two services is that the MTA-MNCR operates just two modes, ferry service and commuter rail—the latter of which makes up the overwhelming majority of all vehicles in service—while the MBTA operates nine. After the MBTA, the agencies with the highest number of transit modes are the New Orleans Regional Transit Authority (NORTA), the Central Oklahoma Transportation and Parking Authority (COTPA), and the Transportation District Commission

of Hampton Roads (HRT), all of which operate four service modes.⁸⁸ As this comparison suggests, the MBTA is unique among agencies that operate ferry service for which NTD data on full-reporting ferry operators is available, at least with regard to modal character and number of vehicles operated.

4. Conclusion

By many measures the MBTA ferry is a cost-effective and reliable mode of transportation. It has the highest fare recovery of any mode at the T, the highest fare revenue per passenger mile and unlinked trip, and the best on-time performance of all forms of transit system-wide. It also has significantly lower capital costs over time relative to the authority's other transit services. The MBTA ferry has one of the smallest net subsidies of all T modes, according to an MBTA analysis. Our own analysis, factoring in average debt service on capital expenses by passenger miles traveled, suggests that system-wide, the ferry has the second lowest net subsidy per passenger mile. By other performance indicators, such as operating expenses per unlinked passenger trip and operating expenses per vehicle revenue mile and hour, the ferry is more expensive to run and less efficient than other MBTA modes.

Figure 24. MBTA vs. ferry operators nationwide by mode and VOMS size



Source: 2014 National Transit Database

When examined side-by-side with similar operators designated as peers by the INTDAS peer selector tool, the MBTA is tied with the New York-based Port Imperial Ferry for the largest active vehicle fleet and has a total average capacity per vehicle that is in the middle range when compared to the five other operators. With regard to fare revenues per trip and cost per passenger, the T ferry also falls in the middle of the group, but it has the lowest number of passengers per hour. The ferry is, by two out of six productivity ratios, the second least

expensive service among the six operators. When measured in terms of operating expense per unlinked passenger trip, the MBTA was just above the group average in 2015. Measured by unlinked trips per revenue mile and revenue hour, the T ferry has the poorest service effectiveness of the five peers selected for comparison.

A comparison of the T ferry to all ferry operators nationwide with data available through the NTD shows that the MBTA

is by far the largest and most modally diverse agency that operates a passenger ferry. The arrangement whereby the MBTA, the nation's fifth largest transit agency, manages ferry service can in this respect be considered a national anomaly. Whether this presents a benefit or issue to the MBTA is an item for discussion regarding future governance of the T ferry and the agency's role in any additional Greater Boston ferry services.

The MBTA ferry is a significant part of the agency's future capital investment plans. The T's FY2015-2019 Capital Investment Program dedicates \$42 million, or 1 percent of all scheduled investment, towards ferry service capital assets over this timeframe. This includes a vehicle engine overhaul and acquisition of new catamarans, among other items. Much of this investment is underway; in February the MBTA opened a new terminal worth \$7 million, and the rollout of two new catamarans, which cost a total of \$11 million, is slated to continue this fall.⁸⁹

The MBTA's investments signal their recognition of the value of water-based transportation options, and this mode could allow the T to expand service at a lower cost than extending heavy, light and/or commuter rail lines. At a time when the MBTA is strapped for cash to invest in capital expansion and fund new operations, ferry routes could be a channel to improve service access without enormous upfront investment. As one transit blogger puts it, "Think of a ferry as a rapid transit line, minus the huge cost of land and rails and power supply, but unable to continue across a land-water boundary."⁹⁰

As mentioned earlier, a number of municipalities have started their own ferry service, while others have expressed interest in launching their own service. The City of Boston has likewise publicly announced goals to develop inner harbor ferry routes to improve mobility between waterfront neighborhoods. Given this demand, in determining the future of Greater Boston passenger ferry options, it is helpful to look at examples of cities that have engineered effective ferry networks. A good example of this is New York City, which has facilitated a robust market for water transit options largely due to the ease with which new routes and services have been able to establish themselves where there is unmet demand. The Washington State Ferries system likewise offers useful insights into the value of creating a coordinated network of ferry options.

New water transportation services have the potential to reduce the number of vehicles on the road that contribute to worsening congestion in the Boston metropolitan area. The collateral impact of higher numbers of ferry riders on congestion and the environmental benefits this would generate are additional considerations that should not be ignored.

For these reasons, as well the appeal of an alternative to the high costs of fixed-route transit projects, investing in more water-based transportation merits serious consideration. Opening up new channels through which to expand water commuting options is a strategy that MBTA leadership should consider in weighing approaches to better address the growing demand for service in the Commonwealth's coastal communities.

Appendix A.

Figures A – B. Peer agency scorecard

Operator	Passengers per Hour	Fare Revenues per Unlinked Passenger Trip	Cost per Hour	Passengers per Hour	Cost per Passenger	Fare Revenues per Total Operating Expense (Recovery Ratio)
Massachusetts Bay Transportation Authority	6	4	2	6	3	3
Golden Gate Bridge, Highway and Transportation District	1	5	6	1	5	4
Port Imperial Ferry Corporation dba NY Waterway	2	6	3	2	1	1
San Francisco Bay Area Water Emergency Transportation Authority	3	2	5	3	6	5
BillyBey Ferry Company, LLC	5	4	1	5	2	2
King County Ferry District	4	1	4	4	4	6

Operator	Operating expenses per passenger trip	Operating expense per vehicle revenue hour	Operating expense per vehicle revenue mile	Operating expense per passenger mile	Unlinked passenger trips per vehicle revenue mile	Unlinked trips per vehicle revenue hours
Massachusetts Bay Transportation Authority	3	2	2	3	6	6
Golden Gate Bridge, Highway and Transportation District	5	6	6	2	1	1
Port Imperial Ferry Corporation dba NY Waterway	1	3	3	4	3	2
San Francisco Bay Area Water Emergency Transportation Authority	6	5	4	1	4	3
BillyBey Ferry Company, LLC	2	1	1	6	5	5
King County Ferry District	4	4	5	5	2	4

Endnotes

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3. Data on operating expenses, fare revenues, passenger miles traveled and other measures for Rapid Bus (RB) is not available prior to 2014 through the NTD.
4. Comparison by mode for all the measures examined in this report does not include Demand Response (DR), which is the MBTA’s paratransit service, ‘The Ride’.
5. “State of the Service: Water Transportation,” 2.
6. Boston Harbor Cruises maintains all vessels that make up the MBTA ferry service’s fleet.
7. This is scheduled service only, and does not include trips on the T’s paratransit service “The Ride”.
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18. Email from Thomas Humphrey, Transit Analysis and Planning Manager at Central Transportation Planning Staff, to author on February 2, 2017 at 11:43 AM.
19. Email from Thomas Humphrey, Transit Analysis and Planning Manager at Central Transportation Planning Staff, to author on February 2, 2017 at 11:43 AM.
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23. T. Grillo, “Ferry will float again this summer,” *The Daily Item* (Lynn, MA, June 9, 2017), <https://www.itemlive.com/2017/06/09/ferry-will-float-again-this-summer/>.
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33. Bus service here is “Directly Operated (DO)” and not “Purchased Transportation (PT)”.
34. This does not include Demand Response (DR) service, which refers to “The Ride”—the MBTA’s paratransit service.
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64. MBTA’s paratransit service, The Ride, is not included in this comparison due to its on-demand nature, lack of service schedule and other anomalous features. By this measure, The Ride is by far the most expensive, with a net cost of \$5.45 per passenger mile.
65. Consider the \$2.3 billion price tag of the green line extension, which will extend the light rail service an additional 4.3 miles, as one illustrative example of the great costs that come with building new rail infrastructure.
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68. CTPS Results of Literature Review of Recent Trends in Passenger Ferry Systems. 2.
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78. Because 2015 data on passenger miles traveled was not available through the NTD for two operators in the group, 2014 data is used for this measure.
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84. TCRP Report 152: Guidelines for Ferry Transportation. 8.
85. TCRP Report 152: Guidelines for Ferry Transportation. 6.
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87. This chart employs a logarithmic scale for more effective visualization of the VOMS sizes of peer groups that have a significantly smaller number of vehicles in use than the MBTA.
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