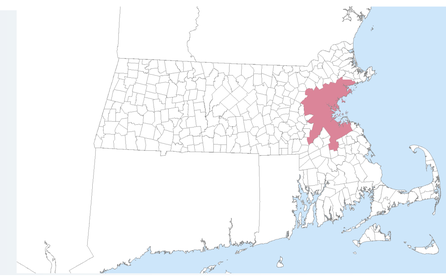
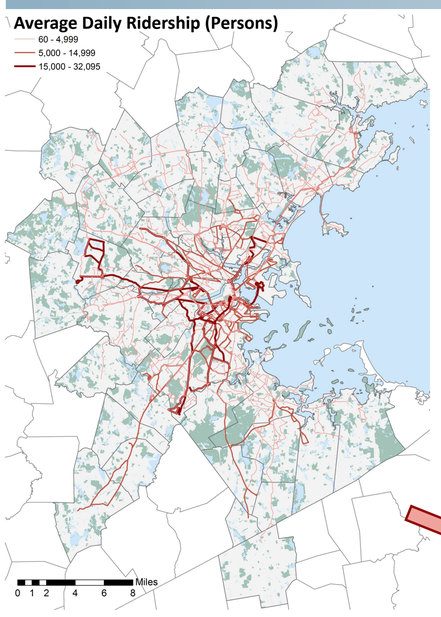
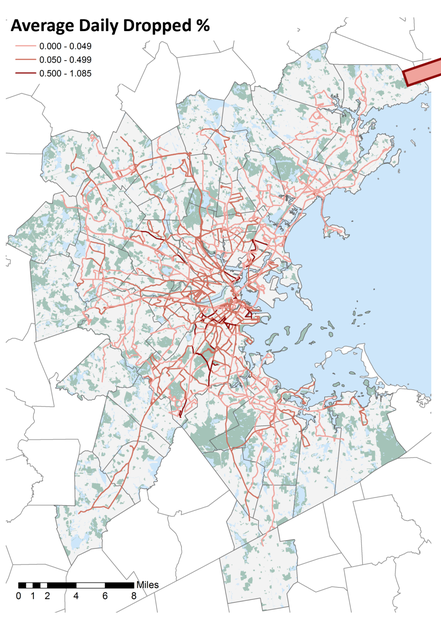
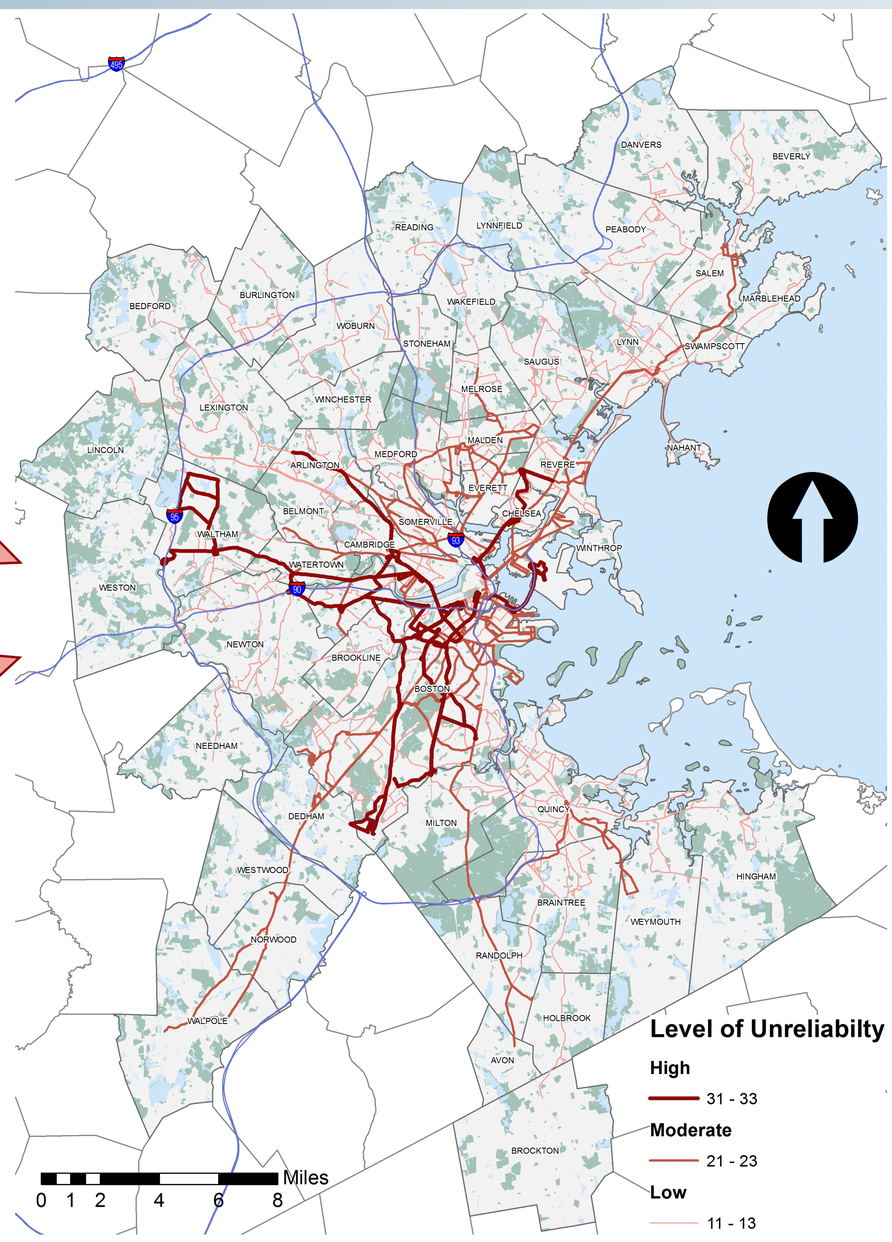
Dropping Bus Service

An analysis of transit reliability in the Boston metro area









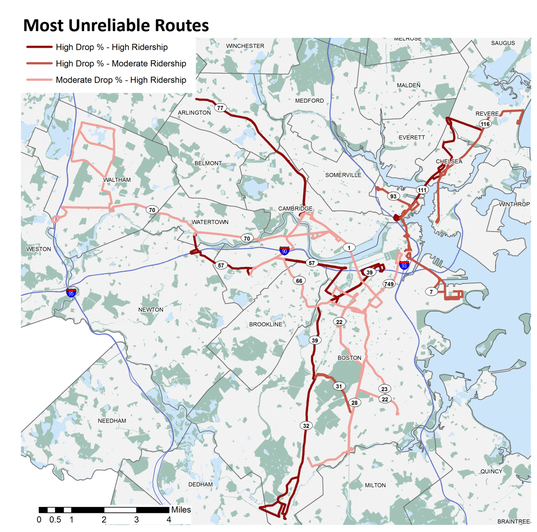
BACKGROUND

Reliability is considered an important element of public transportation service, by both transit agencies and the customers they serve. Transit agencies have traditionally gauged level of reliability by measuring route length, frequency and headways, and have monitored the benefits of controlled holdings, dedicated bus lanes and more efficient boarding and fare collection techniques to improve service. Very few, if any, have used dropped trips data to measure reliability, but the impact of a dropped trip can be just as significant.

What is a Dropped Trip?

A dropped trip is any trip that was not completed according to the published schedule of service.

The Massachusetts Bay Transportation Authority (MBTA) has found that, on average, 93% of all dropped trips occur on bus. Little has been done beyond this to monitor dropped service. The goal of this project is to provide the MBTA with a preliminary analysis of bus operations in the Boston area by breaking down data at the specific route level, tracking which neighborhoods within the service area are being most affected by poor reliability and discussing the context of those neighborhoods using a set of criteria typically used to rationalize the operation of mass transit.



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	Ridership	Ride Class	Dropped %	Drop Class	Reliability Score
High	≥ 15,000	30	0.50 - 1.09	3	33
Med	5,000 - 14,999	20	0.05 - 0.49	2	22
Low	< 5,000	10	0.00 - 0.04	1	11

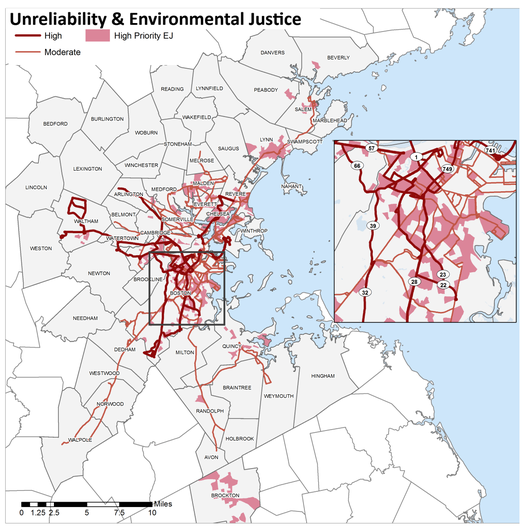
		Ridership		
		High	**Med**	**Low**
Dropped Service	**High**	HH (33)	HM (23)	HL (13)
	Med	MH (32)	MM (22)	ML (12)
	Low	LH (31)	LM (21)	LL (11)

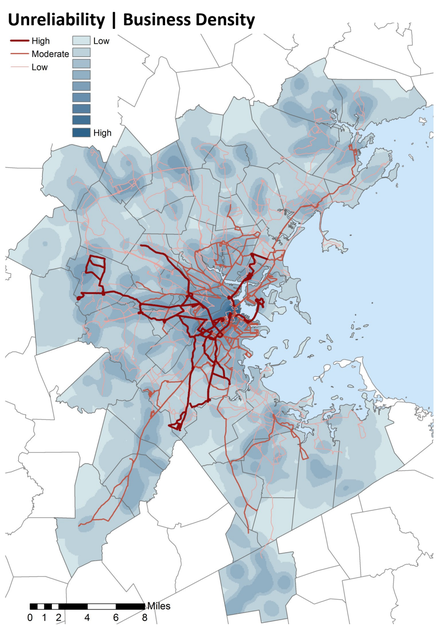
	Route	Daily Drop %	Daily Ridership	Reliability Score
1	77	0.98 (H)	17,917 (H)	33 (HH)
2	111	0.95 (H)	25,468 (H)	33 (HH)
3	32	0.78 (H)	19,065 (H)	33 (HH)
4	39	0.57 (H)	28,549 (H)	33 (HH)
5	57	0.50 (H)	25,541 (H)	33 (HH)
6	31	0.92 (H)	12,384 (M)	23 (HM)
7	93	0.57 (H)	8,164 (M)	23 (HM)
8	7	0.55 (H)	5,141 (M)	23 (HM)
9	116	0.54 (H)	12,007 (M)	23 (HM)
10	28	0.47 (M)	32,095 (H)	32 (MH)

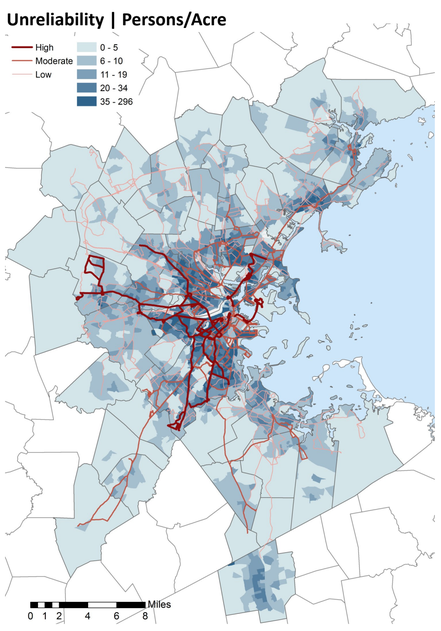
METHODOLOGY

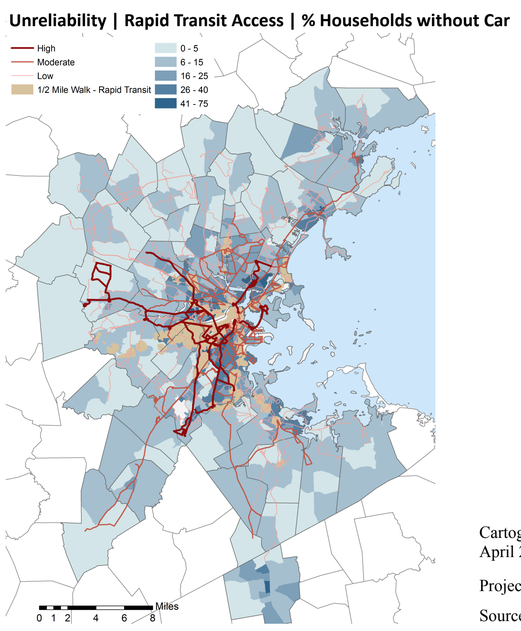
The most important piece of this analysis was the collection and synthesis of the MBTA's dropped trip data for all available bus routes throughout the system. Several bus routes were left out of this analysis due to the fact that the MassGIS data layer is several years old and doesn't account for recent service changes. Taking a full year of recent data (November 1, 2012 – October 31, 2013), I used Microsoft Access to calculate an annual count of dropped trips. In a similar way, I collected average daily ridership and daily scheduled trips. Due to the fact that each bus route runs at a different frequency, scheduled trips were needed to produce a percentage of daily dropped trips. Daily ridership values were used to show the demand each route carries. Ridership and dropped trip frequency values were then used to create a matrix to determine a reliability ranking across the system, between High-Ridership—High-Dropped % (HH) and Low-Ridership—Low-Dropped % (LL).

After displaying bus routes based on the above criteria, I created several additional maps to provide context when observing where in the Boston metro area the lowest reliable bus service falls. Since density is a key determinant in transit service planning, I created a population density map using 2010 census block data from MassGIS. Interested in knowing further where there is a need for public transit, I used the American Community Survey (2011 5-year estimate) to show the percent of households without a vehicle at the tract level. I also decided to pull business data from Reference USA to show which places in the service area there is a lot of activity. Due to limited time I only pulled businesses with 100+ employees. There is a significant amount of data missing here, but there was enough information to show a pattern. After displaying the XY coordinates, I used the Kernel Density tool to more clearly display this information. Finally, I wanted to know whether or not Environmental Justice (EJ) communities were subject to the least reliable bus service. MassGIS has three categories for EJ communities (whether or not they meet 1, 2 or 3 criteria). In order to show the area of the region that are in most need of services based on this criteria, I focused only on areas meeting 2 or 3 criteria.









FINDINGS

The results of this analysis show that the most unreliable bus routes are concentrated in the heart of the metropolitan area, and for the most part, in and around the downtown Boston area. This shouldn't be terribly surprising as the MBTA states that traffic is one of the most common causes for dropped trips. Similarly, highest unreliable service coincides with those routes that run with the greatest frequency. Referencing the Most Unreliable Routes map, many of these busses are on the MBTA's "Key Bus Routes" list, or those busses that have high ridership and high frequency. Bus 749 (Silver Line) is considered rapid transit, but this particular Bus Rapid Transit (BRT) route proves to be less reliable than the MBTA's rapid rail lines.

The Census data shows, generally, that bus transit follows population density throughout the service area. The highest concentration of people reside around Boston, Cambridge, Somerville and Chelsea. These are the same communities that have the highest percentage of households without cars. However, while unreliable bus service has a fairly wide coverage throughout Boston proper, affecting a diverse mix of residents, it is the communities without rapid transit options, or personal vehicles, who are most dependent, and thus, most affected by poor bus reliability. Looking at this data in comparison to Environmental Justice communities, the people of South Boston, Roxbury, Dorchester, Mattapan, Chelsea, Revere, East Somerville and Lynn are feeling the brunt of unreliable service. It is evident from this analysis that these places within the MBTA's service area are in greatest need of improved service. With the Green Line Extension into Somerville and the announcement of expanded Silver Line BRT service to Chelsea in the next several years, investments in better transit to underserved communities are being made. With that, however, are more opportunities for service to be unreliable. Continued service quality analyses will be needed ever more.

Cartographer: Christopher Timmel
April 2014

Projection: NAD 1983 Massachusetts Mainland State Plane

Sources: Mass GIS; Reference USA; U.S. Census (2010, 2011); MassDOT

Tufts UNIVERSITY