

Route 47 Routing

MBTA presentation to Cambridge Transit Advisory Committee

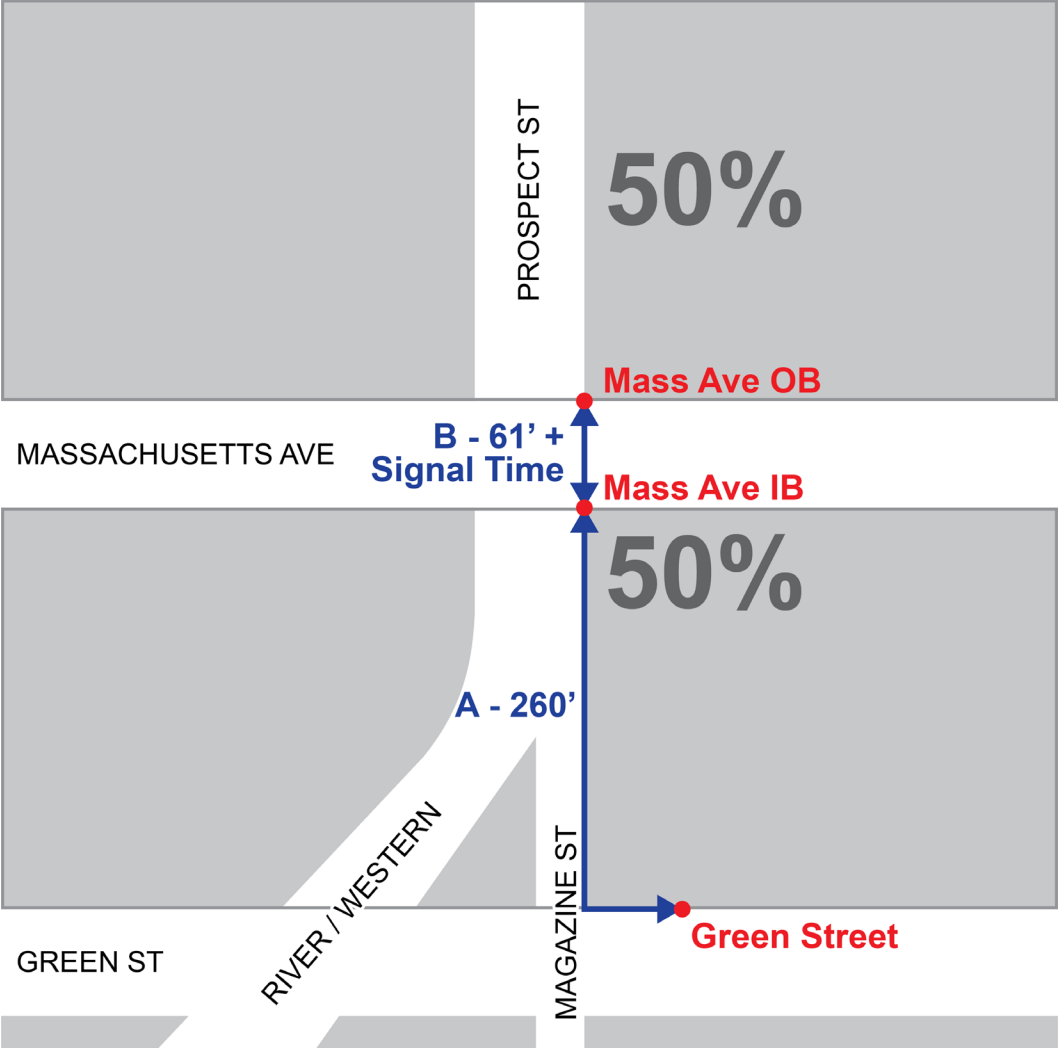
November 3, 2021



Routing options



Calculating Walking Distances to Central Square (not transit)



Customers overall benefit using the Green St alternative (July 2021)

		Walking Time	Travel Time	Additional Waiting Time	Total
	Passengers	1,205	2,020	5,565	
Time per Passenger	Mass Ave	0:00:57	0:03:30 (+0:00:16)	0:00:26 (+0:00:26)	
	Green St	0:02:14 (+0:01:17)	0:03:14	0	
Time Total	Mass Ave	19:03:36	117:49:32 (+9:14:10)	40:12:23 (+40:12:23)	177:05:31 (+23:32:03)
	Green St	44:58:06 (+25:54:30)	108:35:21	0	153:33:28
Time per Passenger (weighted)	Mass Ave	0:01:54	0:03:30 (+0:00:16)	0:00:52 (+0:00:52)	
	Green St	0:04:29 (+0:02:35)	0:03:14	0	
Time Total (weighted)	Mass Ave	38:07:12	117:49:32 (+9:14:10)	80:24:46 (+80:24:46)	236:21:30 (+37:49:56)
	Green St	89:56:13 (+51:49:00)	108:35:21	0	198:31:34



Customers overall benefit using the Green St alternative (September 2021)

		Walking Time	Travel Time	Additional Waiting Time	Total
	Passengers	2,020	2,020	5,565	
Time per Passenger	Mass Ave	0:00:45	0:03:30 (+0:00:16)	0:00:26 (+0:00:26)	
	Green St	0:02:05 (+0:01:20)	0:03:14	0	
Time Total	Mass Ave	25:30:02	117:49:32 (+9:14:10)	40:12:23 (+40:12:23)	183:31:57 (+4:49:22)
	Green St	70:07:14 (+44:37:12)	108:35:21	0	178:42:36
Time per Passenger (weighted)	Mass Ave	0:01:31	0:03:30 (+0:00:16)	0:00:52 (+0:00:52)	
	Green St	0:04:10 (+0:02:39)	0:03:14	0	
Time Total (weighted)	Mass Ave	51:00:05	117:49:32 (+9:14:10)	80:24:46 (+80:24:46)	249:14:23 (+0:24:33)
	Green St	140:14:28 (+89:14:24)	108:35:21	0	248:49:50



Model built to favor Mass Ave alternative

Subtitle

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- In bus travel time calculation, used conservative travel time which did not include turning times (notably did not include additional turn time at unsignalized lefts from Mass Ave to Pleasant; Franklin to River, as well as crossing Western)
- Used slowest NACTO slower walking speed – 59 ft/min instead of “between 59 ft/min and 98 ft/min”
- Assumed everyone alighting at Central Square stops are going to Mass Ave or points north (everyone going southwest of the final stop would use this stop as well, not that that would be many people).

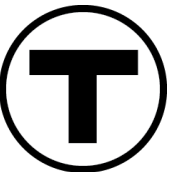


Summary

Subtitle

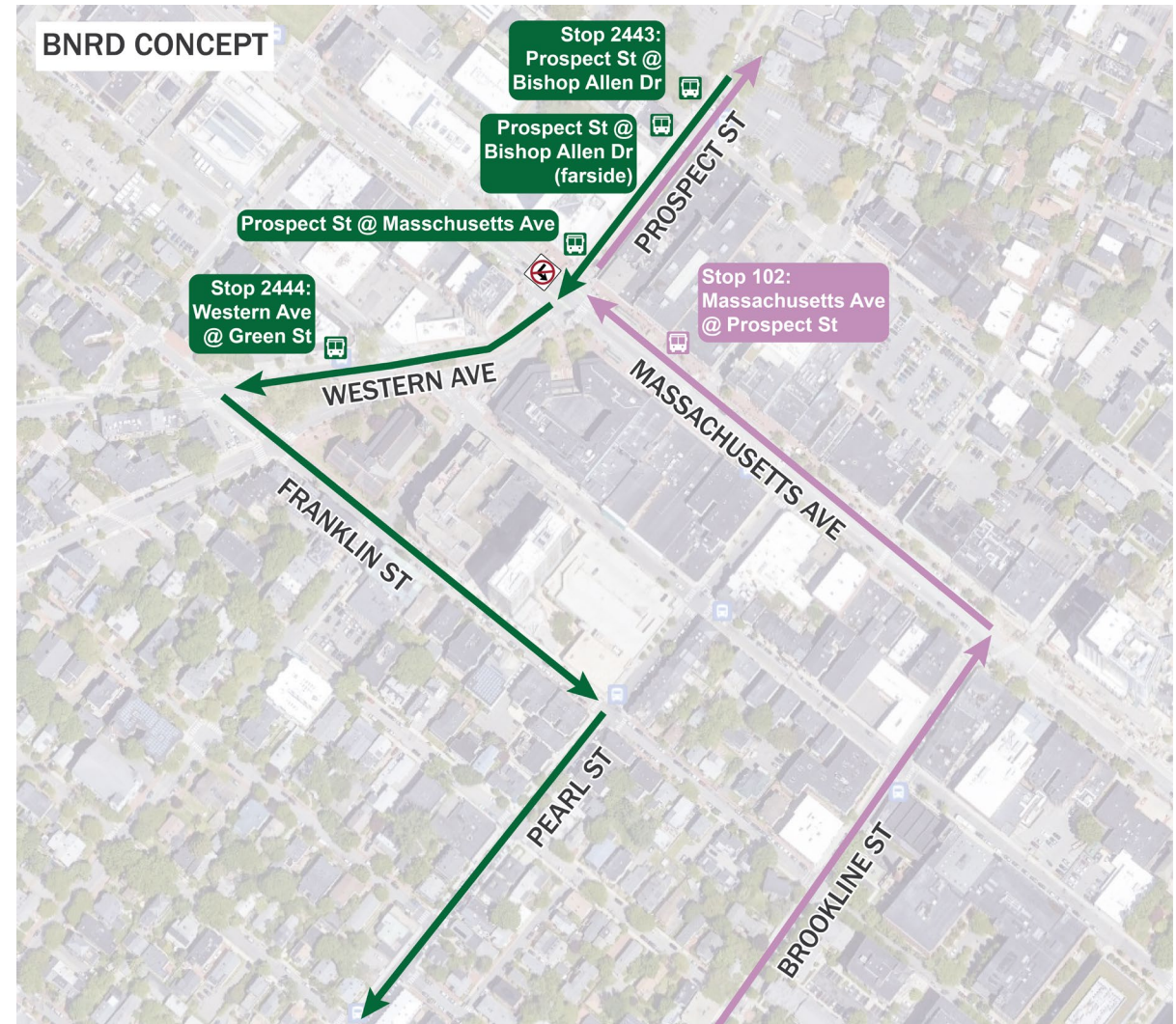
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- We compared the total time impact of the Mass Ave and Green St alternatives.
 - The Mass Ave alternative created time savings only for those alighting/boarding at Central Square.
 - The Green Street alternative created larger time savings when all riders are considered, including the majority of route 47 riders who do not go to Central Square.
 - These conclusions are true if a 2x weight is added to walking and waiting time.
 - Therefore, the MBTA Service Planning recommendation is to pursue the Green Street alternative.



BNRD Concept

- Early concepts
- No Left Turn from Prospect to Massachusetts
- Possible solutions
 - Allowing left from Prospect to Mass Ave
 - Prospect Ave @ Bishop Allen Dr
 - Prospect Ave @ Massachusetts Ave
 - Western Ave @ Green St



BNRD Concept

Streetview.



Stop 2443: Prospect St @ Bishop Allen Dr



Prospect St @ Bishop Allen Dr (Farside)



Prospect St @ Massachusetts Ave



Stop 2444: Western Ave @ Green St

July 7, 2021 Presentation

Routing options



Customer experience measures

Subtitle

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- **Walking time**
 - Changes affect those who transfer between the 47 and other transit at Central Square.
 - Estimated at 1,205 people on a typical 2019 weekday.
- **Travel time**
 - Changes affect those who travel to or from Central Square.
 - Estimated at 2,020 people on a typical 2019 weekday.
- **Waiting time**
 - Changes affect those who ride the 47.
 - Estimated at 5,565 people on a typical 2019 weekday.



Customers who are travelling to and transferring at Central Square benefit using the Mass Ave alternative

		Walking Time	Travel Time	Additional Waiting Time	Total
59 feet per minute	Mass Ave	0:02:21	0:03:30 (+0:00:16)	0:00:26 (+0:00:26)	0:06:17
	Green St	0:06:06 (+0:03:45)	0:03:14	0	0:09:20 (+0:03:03)
264 feet per minute	Mass Ave	0:00:46	0:03:30 (+0:00:16)	0:00:26 (+0:00:26)	0:04:42
	Green St	0:01:44 (+0:00:58)	0:03:14	0	0:04:58 (+0:00:16)

- NACTO: “people who walk with assistance—in form of canes, walkers, or other devices — are limited to speeds of 0.3 m/s–0.5 m/s”* or 59 feet per minute to 98 feet per minute.
- Five-minute quarter mile: 264 feet per minute.



Customers overall benefit using the Green St alternative

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Time per Passenger	Mass Ave	0:00:57	0:03:30 (+0:00:16)	0:00:26 (+0:00:26)	
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Customer experience measures: weighting

Subtitle

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- Walking and waiting for a bus is perceived as taking more time than riding a bus.
- As part of the Bus Network Redesign, our colleagues at OTP are using a multiplier of 2 for this, so we did as well.
- This is referred to below as “weighted delay”.



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Summary

Subtitle

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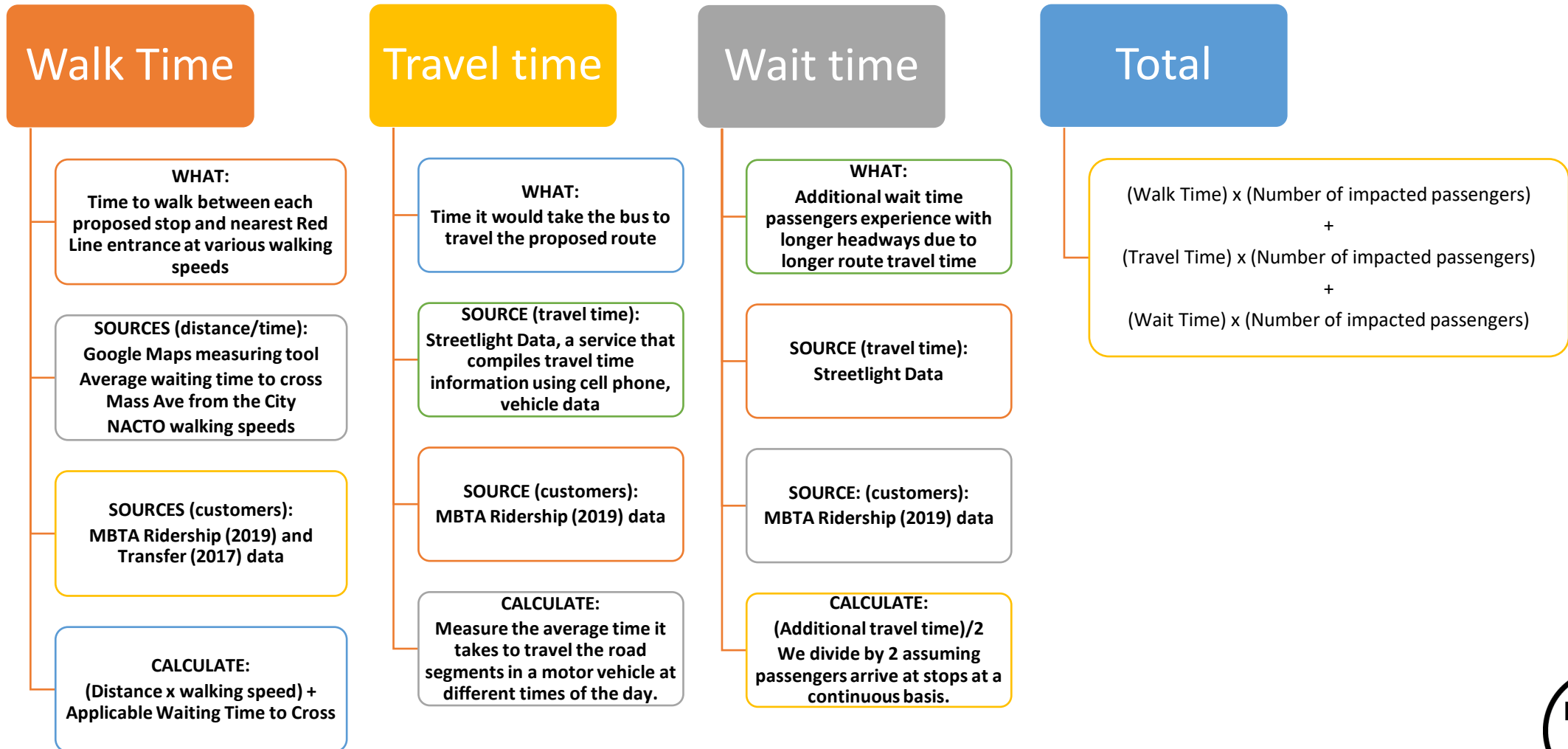
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 - These conclusions are true if a 2x weight is added to walking and waiting time.
 - Therefore, the MBTA Service Planning recommendation is to pursue the Green Street alternative.



Developing Data

Developing data: Overview

For each alternate routing (Massachusetts Avenue and Green Street) we calculated:

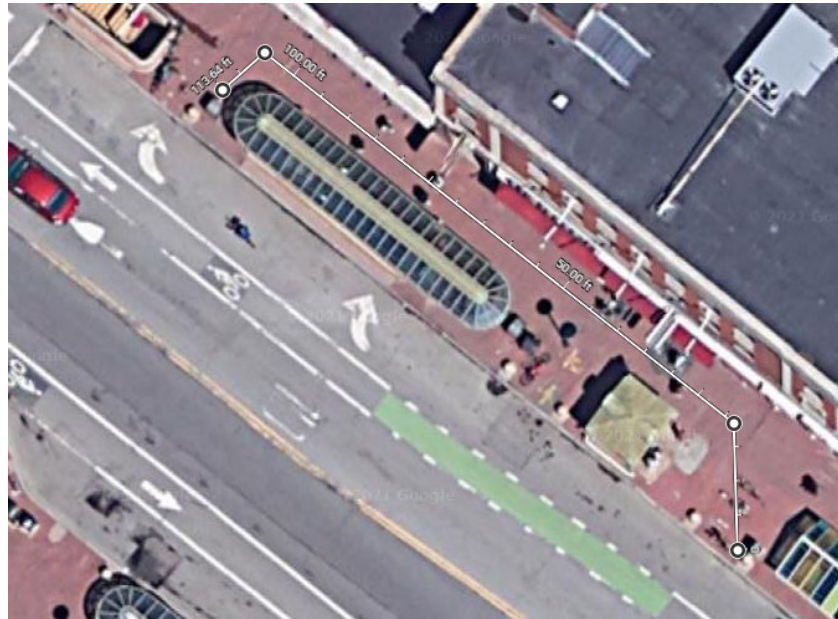


Developing data: Walking Time

Distance, speed, and time

Walk Time

Walk distance to nearest Red Line entrance



+

Average waiting time to cross Mass Ave



Speed

It is important to look at range of experiences

- Five-minute quarter mile: 264 ft/min
- NACTO: *"People who walk with assistance—in form of canes, walkers, or other devices—are limited to speeds of 0.3 m/s–0.5 m/s"** or 59 ft/min to 98 ft/min.



Developing data: Walking Time

Distance, speed, and time

Walk Time

Crossing Mass Ave adds on average 37.5 seconds.

About 77% of transfers were 47 Outbound to Redline Outbound or Redline Inbound to 47 Inbound, which favors the Mass Ave proposal.

	Transfer	Cross Mass Ave?	Transfer	Cross Mass Ave?
Mass Ave	47 OB to RL OB	N	RL IB to 47 IB	N
Mass Ave	47 OB to RL IB	Y	RL OB to 47 IB	Y
Green St	47 OB to RL OB	Y	RL IB to 47 IB	N
Green St	47 OB to RL IB	N	RL OB to 47 IB	Y



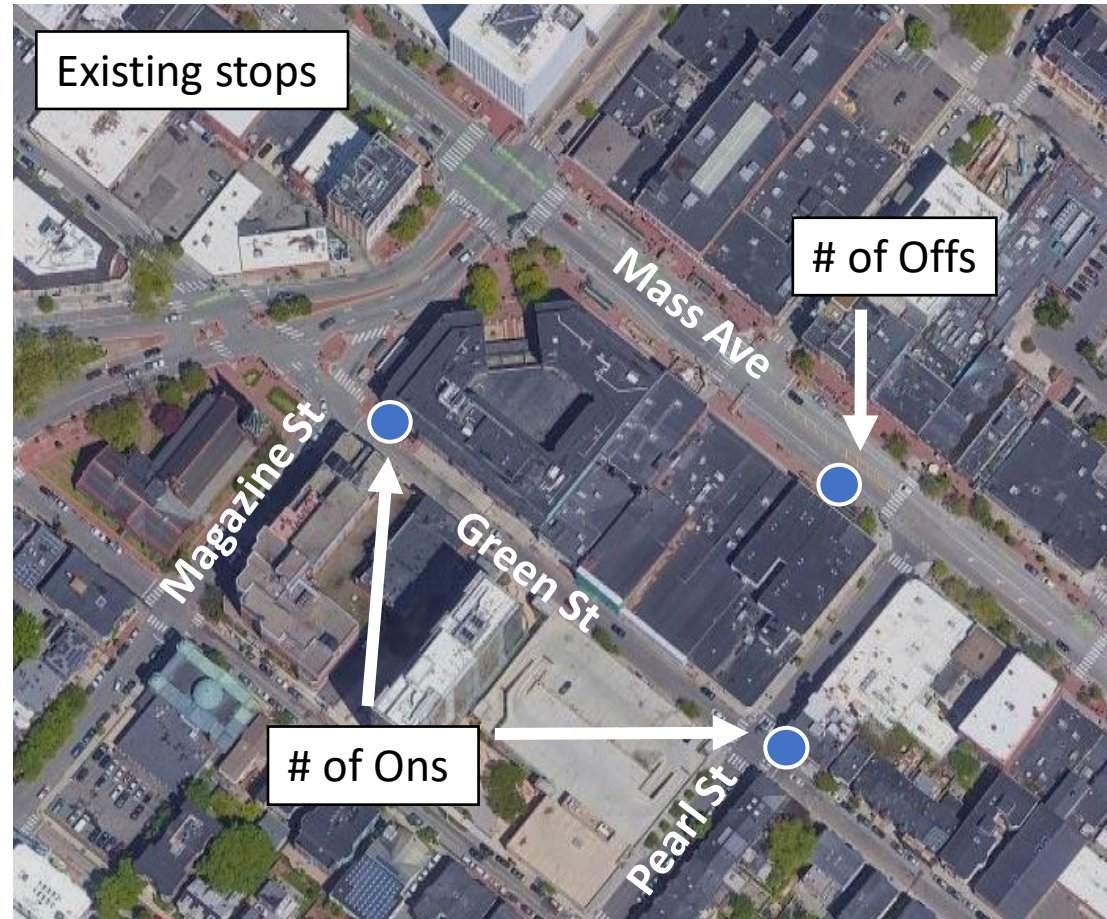
Developing data: Walking Time

Passengers Affected

Walk Time

2,020 Route 47 passengers impacted at the three existing stops on the map →

Data source: MBTA Ridership by Stop data from Fall 2019



Developing data: Walking Time

Passengers Affected

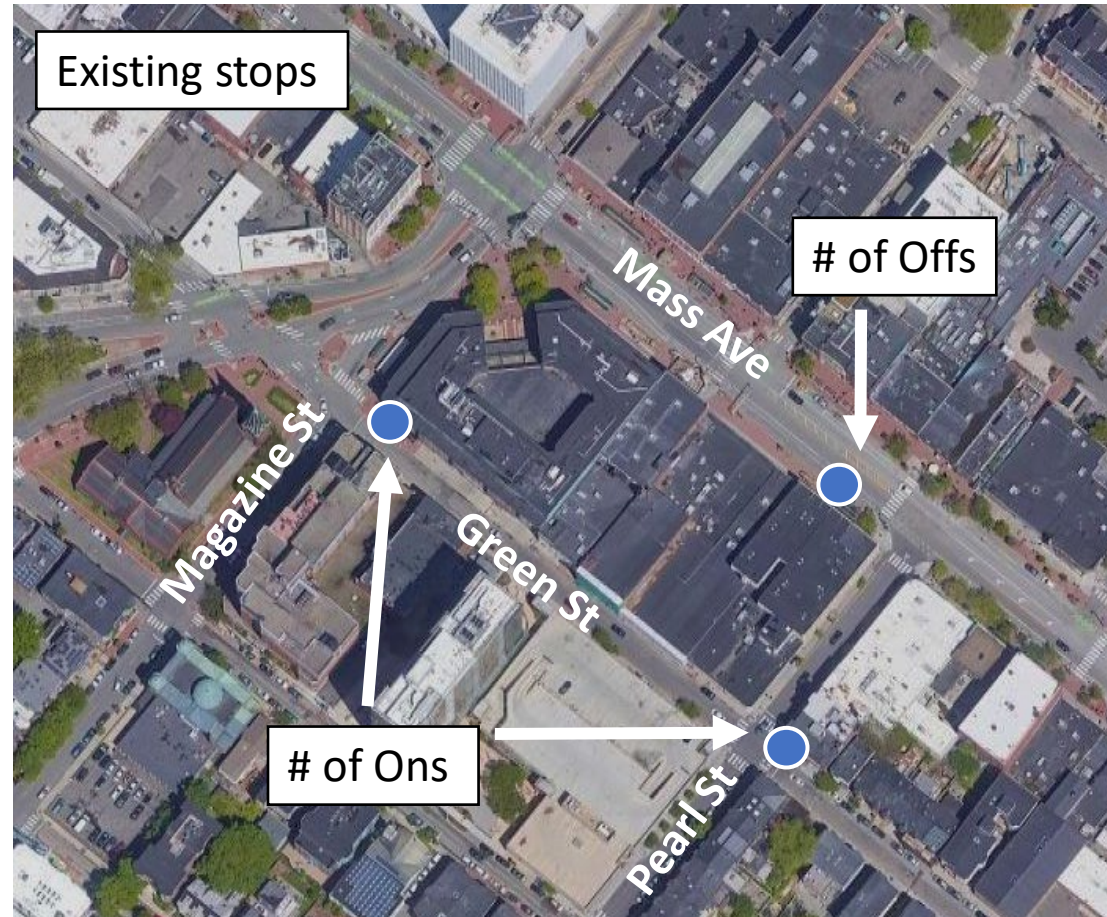
Walk Time

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60% transfer to transit (78% of those transfer to/from the Red Line)

Data source: MBTA Origin-Destination-Transfer model (ODX) data from 2017 (latest)



Developing data: Walking Time

Passengers Affected

Walk Time

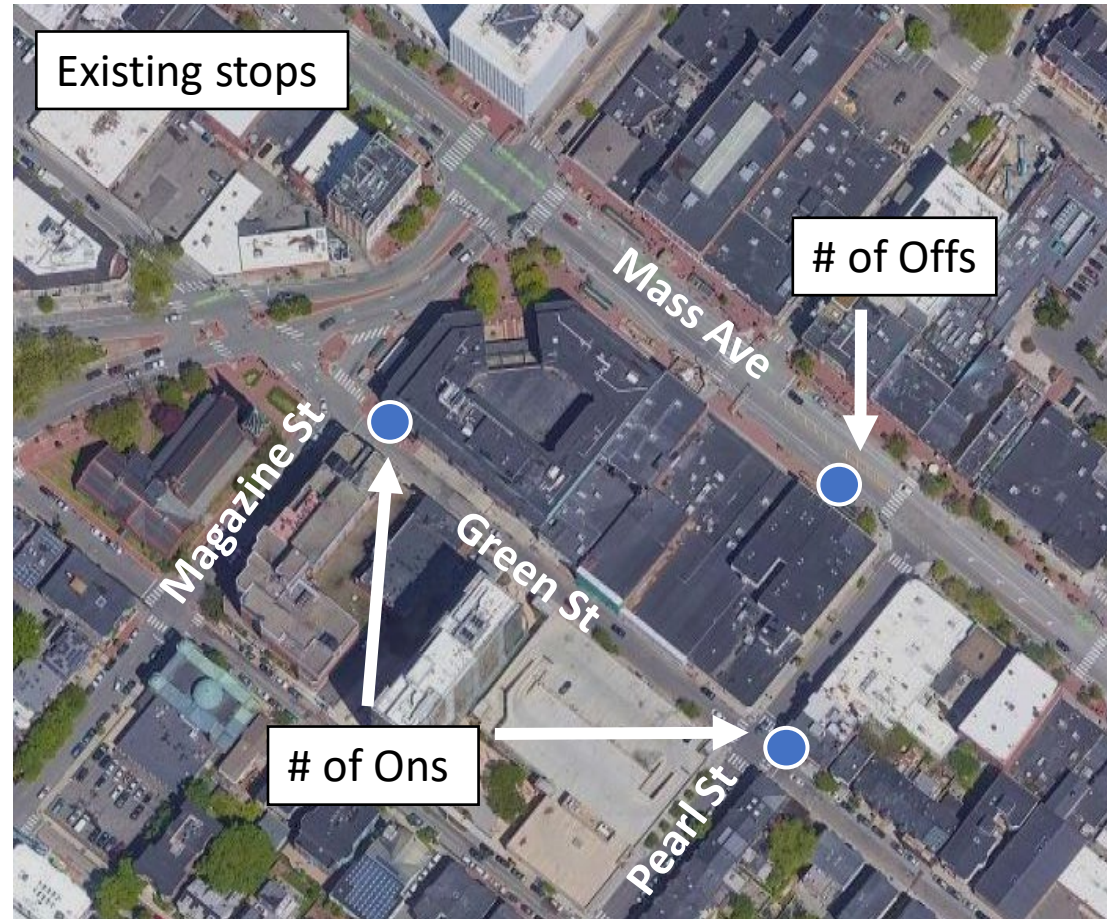
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Therefore, 1,205 Route 47 passengers are affected by Walking Time.



Developing data: Walking Time

Passengers Affected

Walk Time

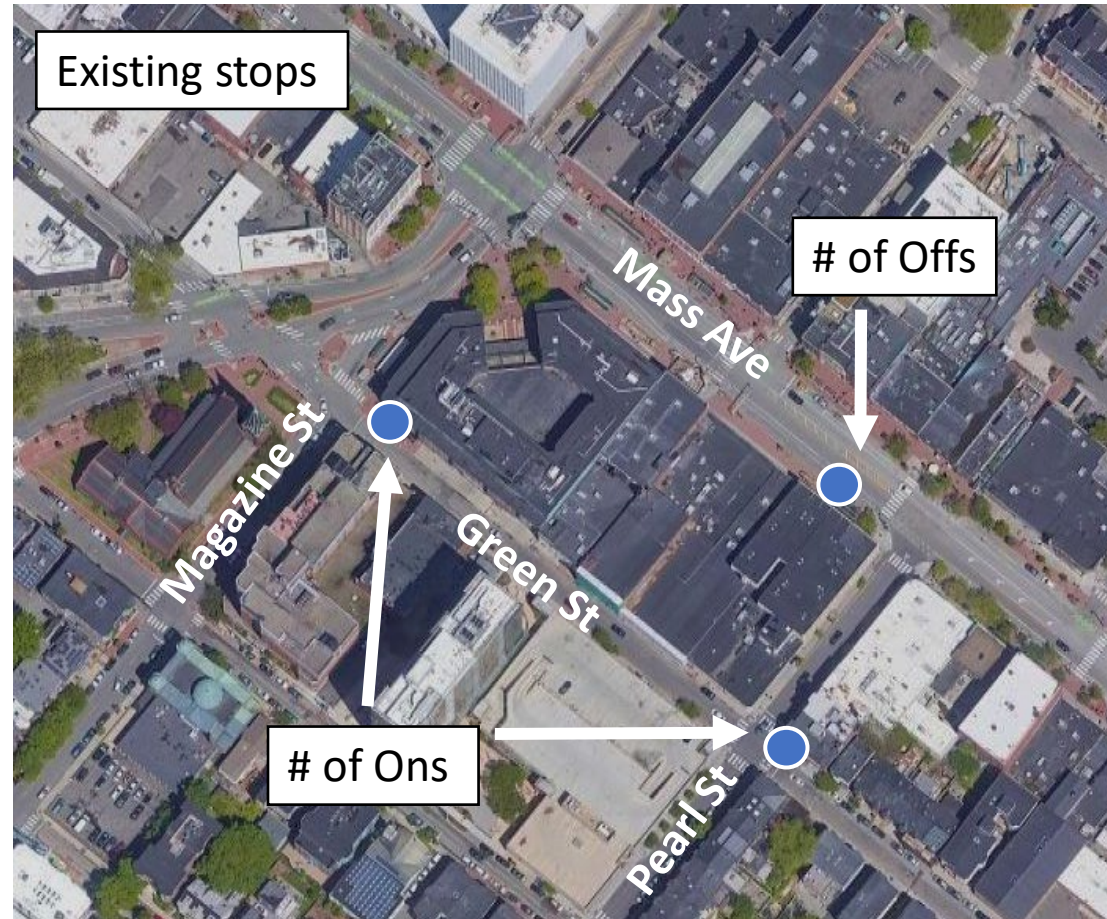
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Therefore, 1,205 Route 47 passengers are affected by Walking Time.



Total Walking Time = (Walk time per passenger) x (# of affected passengers)



Developing data: Travel Time

Sources and Methodology

Travel time



Developing data: Travel Time

Sources and Methodology

Travel time



The interface includes several control panels:

- Time Controls:** Day Types (All Days (M-Su)), Day Parts (All Day (12am-12am)).
- Zone Selection:** Segments (36 Zones).
- Metric Controls:** Property to Visualize (Average Speed (Mph)).
- Data trimming (percent):** A slider from 0 to 100.
- Map Layers:** Legend, Labels, Segments, Unselected Zones, Base.
- Advanced Visualization Controls:** A legend for Segments with a color scale from 8-9 to 20.

The map shows a street grid with highlighted travel routes in yellow. The routes correspond to the alternatives shown in the left panels. The interface also includes a navigation map on the right side.

This does not account for buses running slower than cars, and does not account for the time to turn, therefore minimizing the impact of travel time, favoring Mass Ave proposal.

Developing data: Travel Time

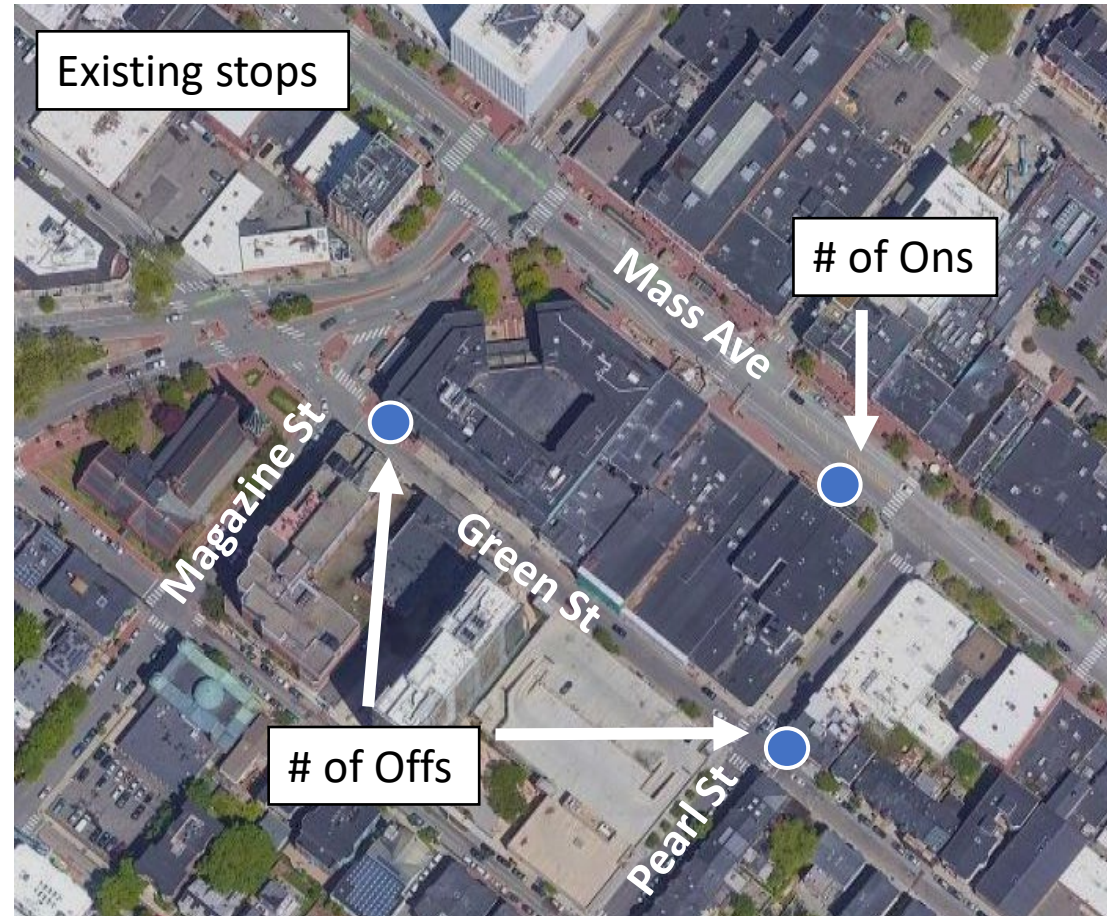
Passengers Affected

Travel time

2,020 Route 47 passengers impacted at the three stops on the map →

Data source: MBTA Ridership by Stop data from Fall 2019, broken down by time of day.

Therefore, 2,200 Route 47 passengers are affected by Travel Time



$$\text{Total Travel Time} = (\text{Additional Travel Time per passenger}) \times (\# \text{ of affected passengers})$$

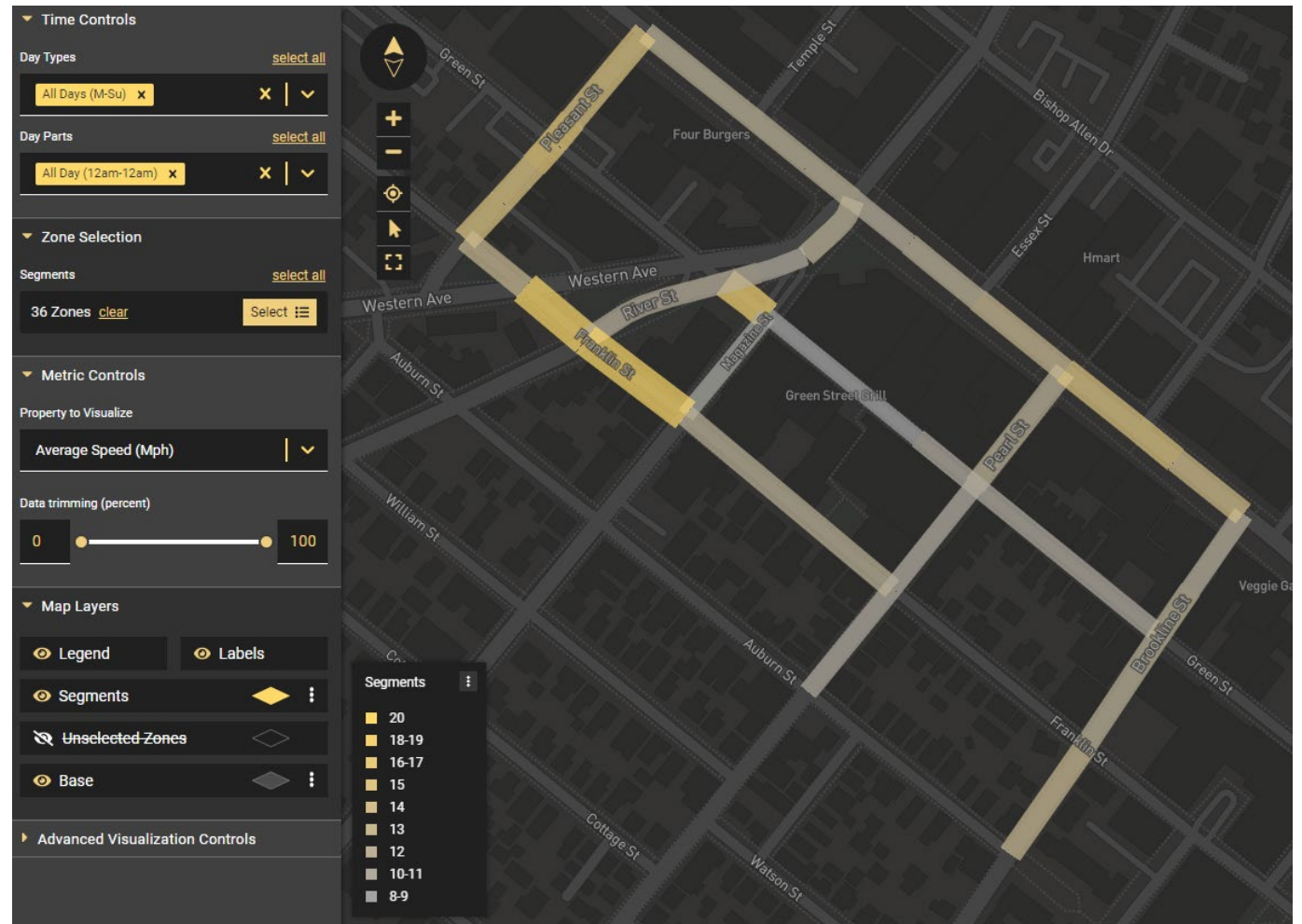


Developing data: Waiting Time

Sources and Methodology

Wait time

- If you have the same number of buses, and it takes longer to run the route, the buses come less frequently.
- Streetlight data was used to understand the full run time, including deadhead, for each proposal at different times of day.
- Customers arrive at stop at different times, so we do not assign entire waiting period to each. Rather averaged to half the waiting time per passenger.



Developing data: Waiting Time

Passengers Affected

Wait time

On average, 5,565 passengers ride the Route 47 daily

Data source: MBTA Ridership by Stop data from Fall 2019, broken down by time of day.

Assumes 100% of Route 47 passengers are impacted by longer travel times.

Therefore, 5,565 Route 47 passengers are affected by Travel Time

Massachusetts Bay Transportation Authority								
Route 47								
Weekday - Inbound								
Fall 2019								
(Urban Transportation Associates)								
	06:45 (47.8)(B287) [62] {FA19}			07:00 (47.8)(B288) [63] {FA19}			07:15 (47.8)(B289) [64] {FA19}	
Seq - StopID - Stop Name	On	Off	Load	On	Off	Load	On	Off
1 - 72 - MASSACHUSETTS AVE @ PEARL ST	25	0	25.2	27.3	0	27.7	33.7	0
2 - 1817 - PEARL ST @ FRANKLIN ST	0.6	0.1	25.7	0.6	0.2	28.1	1.1	0
3 - 1764 - PEARL ST @ COTTAGE ST	2.3	0	27.9	2.5	0	40.6	2.4	0.1
4 - 1766 - PEARL ST @ ERIE ST	1.9	0.7	29	2.6	0.4	42.8	2.5	0.7
5 - 11767 - PEARL ST @ PUTNAM AVE	2.6	0.2	31.5	3.1	0.2	45.7	3.6	0.3
6 - 1771 - GRANITE ST @ PEARL ST	1.5	0.4	32.5	1.1	0.4	46.4	1.9	0.4
7 - 1772 - GRANITE ST @ BROOKLINE ST	0.4	0.8	32.1	0.3	0.7	46	1.2	0.4
8 - 1773 - MOUNTFORT ST @ LENOX ST	0.2	0.7	31.6	0.4	1	45.4	0.6	2.4
9 - 1775 - PARK DR @ BEACON ST	0.3	0.5	31.4	0.6	1.1	45	1.9	0.8
10 - 9434 - PARK DR @ FENWAY STA	0.2	1.5	30.1	0.7	3.1	42.6	1.1	3.7
11 - 1777 - BROOKLINE AVE @ PILGRIM RD	0.1	0.2	30	0.1	0.7	42	0.5	1.4
12 - 1778 - BROOKLINE AVE @ SHORT ST	0.3	6.4	23.9	0.8	5.8	37.1	1	6.5
13 - 1779 - LONGWOOD AVE @ BROOKLINE AVE	0.6	14.5	10.1	2.2	19.3	19.9	2.3	14.9
14 - 1780 - LONGWOOD AVE @ BLACKFAN ST	0.5	2.8	7.8	0.9	6.4	14.4	2.2	8.5
15 - 11780 - AVE LOUIS PASTEUR @ LONGWOOD	0.1	2.3	5.7	0.4	3.2	11.6	0.3	1.7
16 - 11781 - AVE LOUIS PASTEUR @ THE FENWA	0.2	0.4	5.5	0.7	1.2	11.1	0.3	1.4

Total Waiting Time = (Wait time per passenger) x (# of affected passengers)



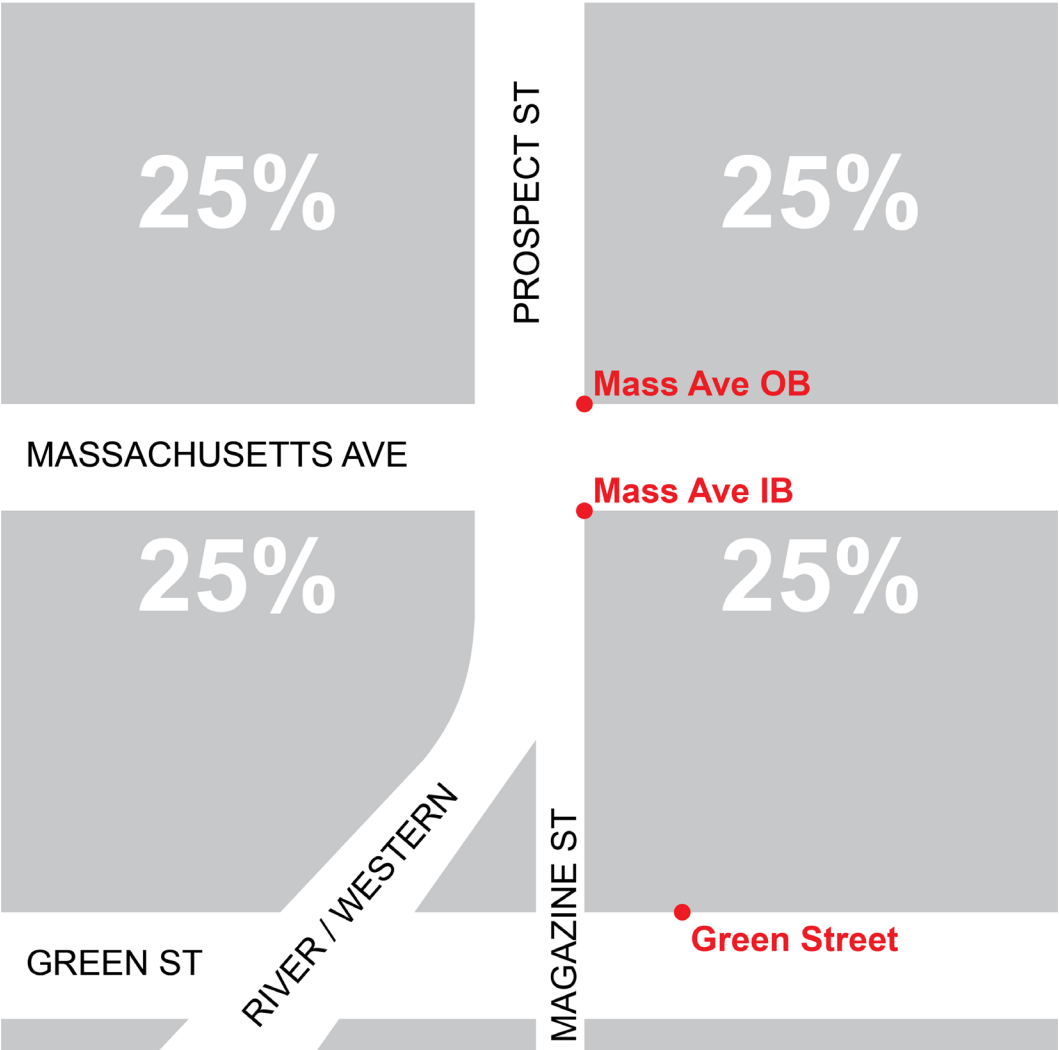
Thank you



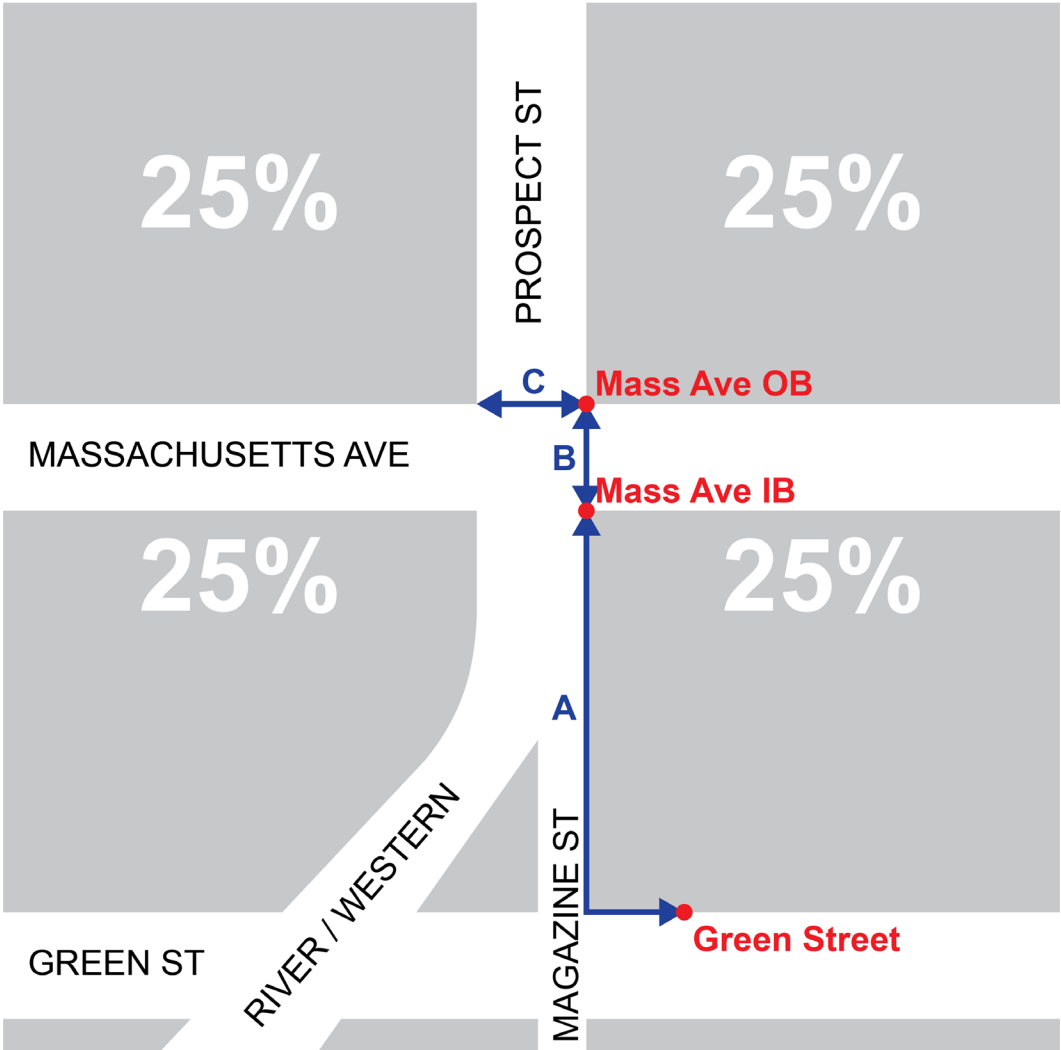
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