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MEMORANDUM

November 17, 2022

To: Cambridge Traffic, Parking, and Transportation Department
From: Michelle Danila, PE, PTOE; Chris Puglisi, PE, RSP1; Kristen Braley, EIT
Project: Engineering Services for Separated Bike Lane Project, Massachusetts Avenue (Dudley Street to Alewife Brook Parkway

Re: Post-Implementation Travel Time Analysis of Massachusetts Avenue

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The northern section of Massachusetts Avenue consisted of two general purpose travel lanes, conventional bike lanes, and curbside parking/loading lanes travelling northbound and southbound. As spurred by Cambridge's Cycling Safety Ordinance, the street was reconfigured to consist of one general purpose travel lane, a bus-only/parking/loading lane, and separated bike lanes in both directions in late-November/early-December 2021. The post-implementation study summarized in this technical memorandum is intended to provide insight to vehicle and transit travel times and ridership trends along the corridor before and after installation of the new cross section.

Study Area

Massachusetts Avenue, typically called "Mass Ave," between Dudley Street and Alewife Brook Parkway is an urban principal arterial roadway owned and maintained by the City of Cambridge. This 0.4-mile segment intersects key pedestrian and bicycle network paths including the Alewife Linear Park and Somerville Community Path at Cedar Street and the Alewife Greenway Bike Path at Alewife Brook Parkway (Figure 1).

Figure 1. Massachusetts Avenue Study Area

Corridor Modifications

Before the street reconfiguration, the corridor consisted of two general purpose travel lanes, conventional bike lanes, and curbside parking/loading lanes in each direction (Figure 2).

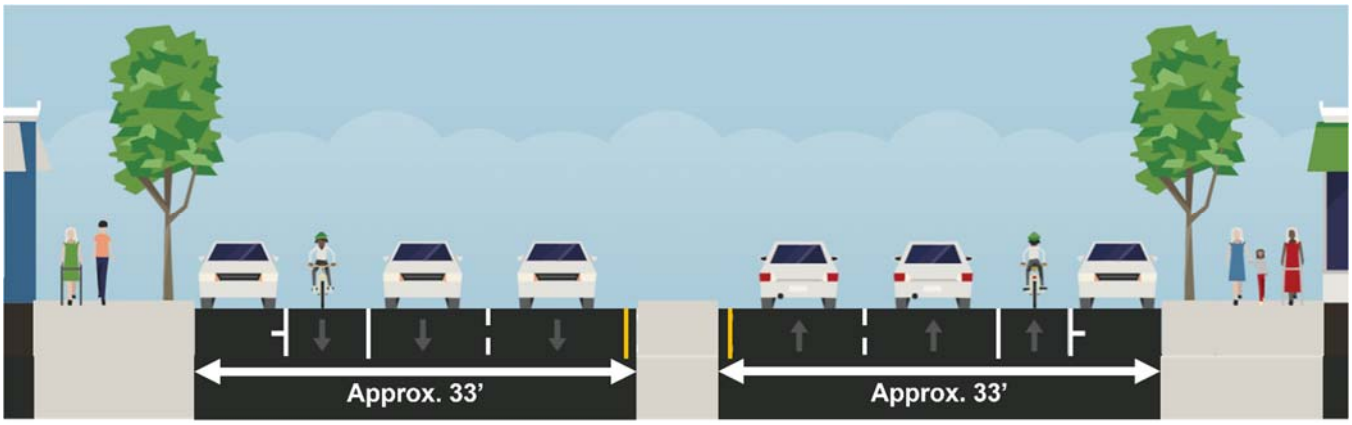


Figure 2. Before Cross Section

Cambridge’s Cycling Safety Ordinance requires that separated bike lanes be installed along the entirety of Massachusetts Avenue in Cambridge by Spring 2026. While the cross section did provide dedicated space for bicyclists, the conventional bike lanes were not comfortable for all users and were often blocked by double parked vehicles.

The Massachusetts Bay Transportation Authority (MBTA) Bus Route 77 travelling from Arlington Heights to Harvard Station runs along Massachusetts Avenue for the duration of the study area, including a connection to the Porter Square Red Line Station. Route 77 is a Key Bus route as noted in the MBTA’s State of the Bus System report released in 2018. A Key Bus route is one that “serve(s) high passenger demand in high-density travel corridors, providing higher frequency services for longer spans.”[1] Though this route is a Key Bus route, it often saw delay along Massachusetts Avenue with run times “regularly exceeding their scheduled running times” by three to ten minutes depending on the time of day and direction (Figure 3, Figure 4).[2]

[1] State of the Bus System, Massachusetts Bay Transportation Authority, 2018 (https://cdn.mbta.com/sites/default/files/projects/betterbus/documents/mbta-better-bus-project-state-of-the-bus-system-2018-v2.pdf)

[2] Route 77 Better Bus Project Profile, Massachusetts Bay Transportation Authority, 2018 (https://cdn.mbta.com/sites/default/files/projects/betterbus/route-profiles/77.pdf)

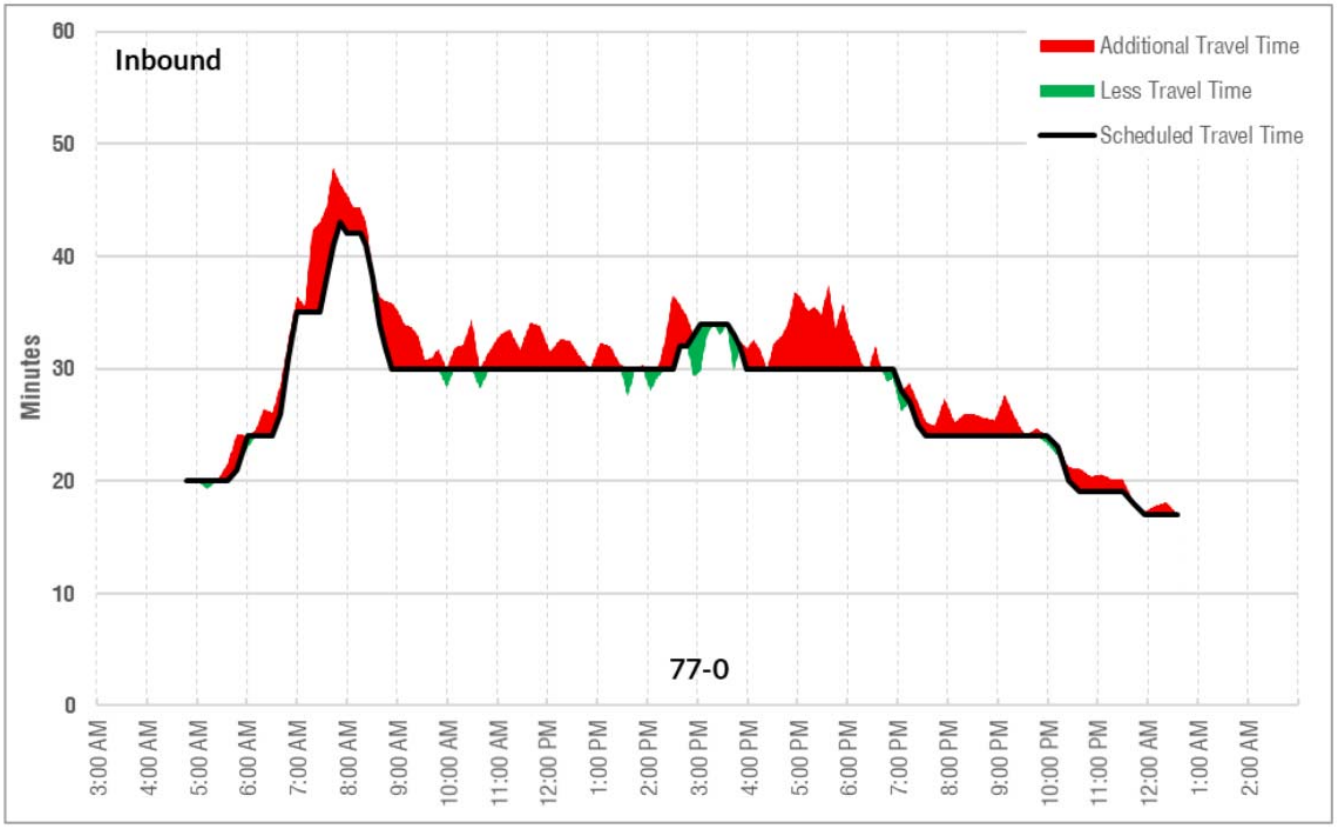


Figure 3. Scheduled and Median Travel Times for Inbound Trips (Arlington Heights to Harvard Square) (Source: Route 77 Better Bus Project Profile)

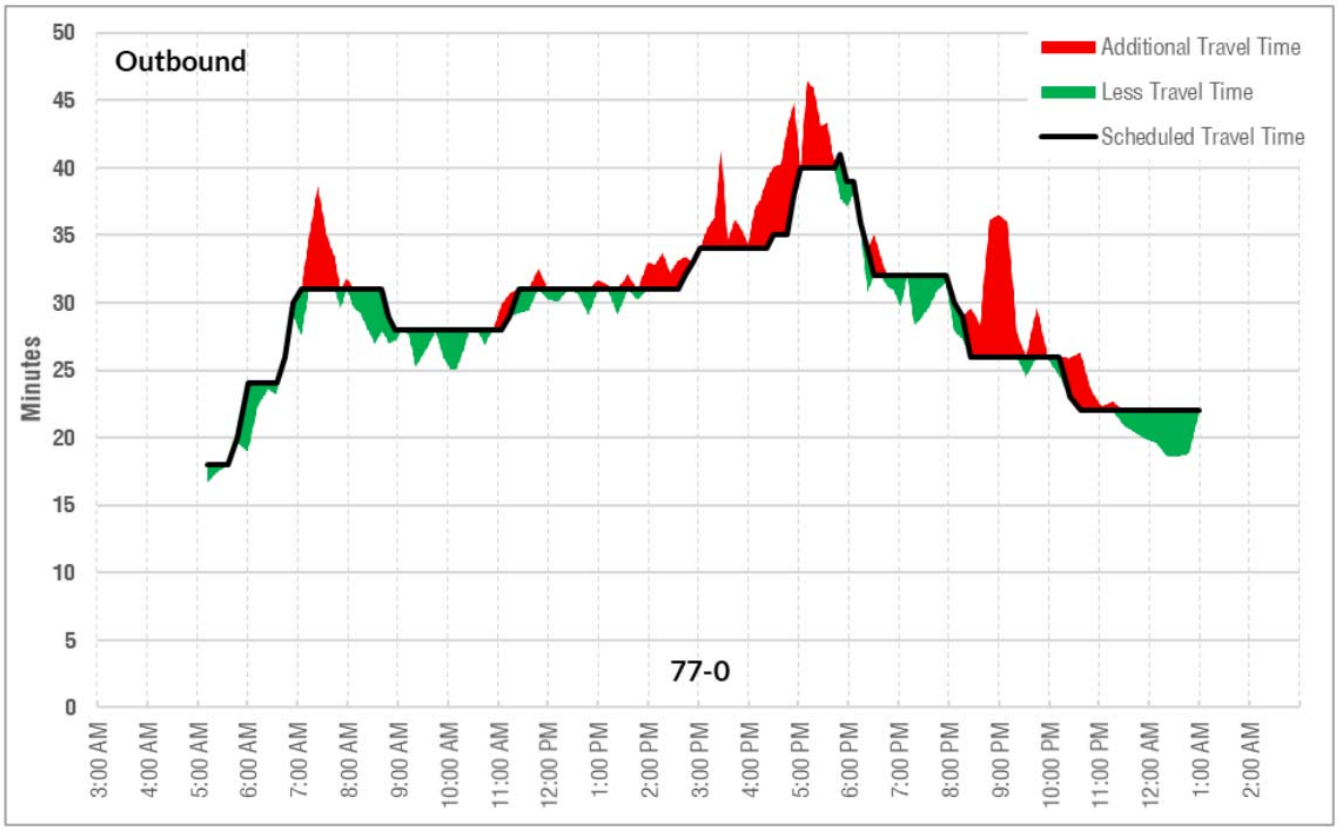


Figure 4. Scheduled and Median Travel Times for Outbound Trips (Harvard Square to Arlington Heights) (Source: Route 77 Better Bus Project Profile)

To address the Cycling Safety Ordinance's call for separated bike facilities and the high-delay experienced by Route 77 riders, in late-November/early-December 2021, the cross section was reconfigured to consist of one general purpose travel lane, a dedicated bus lane that in some sections can be used for loading/parking in off-peak hours, and separated bike lanes within the existing curb-to-curb width (Figure 5). The northbound dedicated bus lane operates as a bus-only lane at all times; however, the southbound dedicated bus lane operates as a bus-only lane during peak hours and loading/parking between 9:00 am and 10:00 pm.

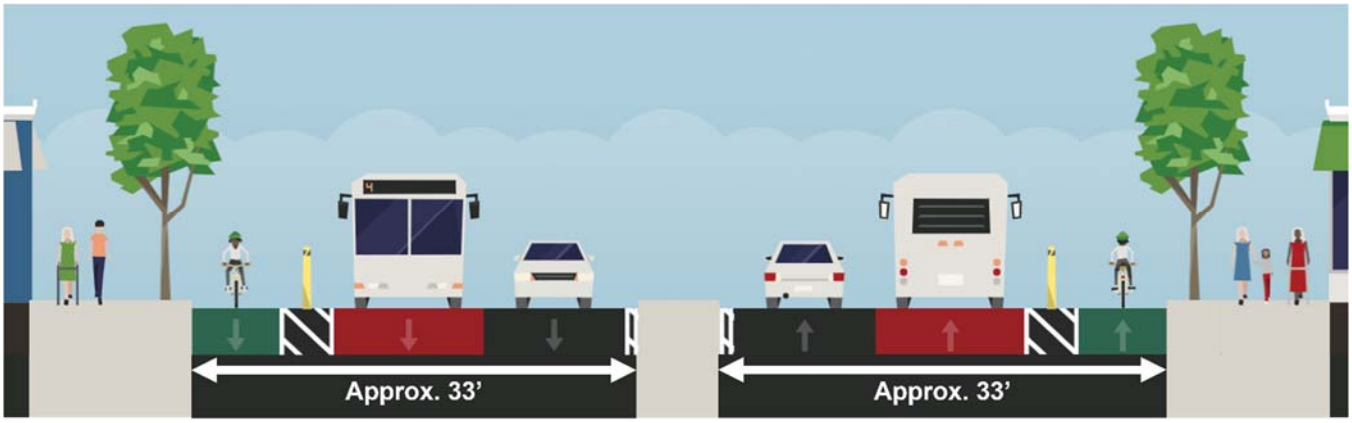


Figure 5. After Cross Section

To understand the implications of the installed cross section to motor vehicles and transit vehicles, data was collected and provided by the Regional Integrated Transportation Information System (RITIS) and the MBTA to

evaluate general motor vehicle travel times, transit vehicle travel times, and transit ridership before and after the reconfiguration. Within context, pre- and post-implementation data will provide an understanding of how travel times along the corridor and ridership has changed.

RITIS Travel Time Data

Data Collection

RITIS is a crowd-sourced “Big Data” aggregate that provides up-to-date and historical transportation-related information, such as travel time and speed. It has been used to observe the impacts of the reconfigured cross section along Massachusetts Avenue during periods immediately preceding the installation of the project and immediately following, on weekdays (Tuesday, Wednesday, Thursday), and weekends (Saturday). Additional periods were collected before the COVID-19 Pandemic and approximately six months after implementation to understand changes on travel patterns and travel times. The time periods collected are outlined in Table 1. Dates were selected to avoid peak COVID-19 outbreaks, influences of holidays/holiday weekends (Christmas, Memorial Day, Veterans Day), and April school vacation week.

Table 1. Travel Time Evaluation Periods

	Days	Immediately Surrounding Implementation		Pre-Pandemic and 6-mo After Implementation	
		Before	After	Before	After
Weekday	**Tuesday, Wednesday, Thursday**	Nov 2-4, 2021	Dec 14-16, 2021	April 30-May 9, 2019	May 3-12, 2022
Weekend	**Saturday**	Nov 6, 2021	Dec 18, 2021	May 4-11, 2019	May 7-14, 2022

RITIS collects data by segment. For Massachusetts Avenue the segment used extends from Somerville Avenue to the south and Alewife Brook Parkway to the north (Figure 6). To account for outside impacts during these time periods (pandemic-related fluctuations in traffic, events throughout Cambridge, etc.), Broadway (a generally east-west corridor travelling through Cambridge) was selected as a “control corridor”, with data available between Quincy Street and Prospect Street (Figure 6). Broadway was selected as the control corridor as opposed to other roadways in Cambridge as it:

- Does not run parallel to Massachusetts Avenue and is therefore not a viable alternate route that may be impacted by the project,
- Has similar traffic volume and geometric characteristics to Massachusetts Avenue, and
- Supports MBTA bus routes.

Figure 6. Travel Time Analysis Limits on Massachusetts Avenue and Broadway

Motor Vehicle Travel Time Analysis

Immediately Before and After Installation: November 2021 versus December 2021

Generally, travel times on Massachusetts Avenue increased between 2-12% immediately following installation (Table 2, Table 3). The exceptions include the northbound weekday morning peak hour (decreased 6%) and the northbound full weekend average (decreased 1%). Compared to Broadway where travel times generally remained similar to or decreased pre- and post-installation, the increases along Massachusetts Avenue suggest that the project caused some additional delay for drivers following installation.

Table 2. Nov/Dec 2021 Weekday Travel Times on Massachusetts Avenue in minutes

	Northbound				Southbound			
	Nov 2021	Dec 2021	Difference	% Difference	Nov 2021	Dec 2021	Difference	% Difference
Full Day Average	5.1	5.2	+0.1	+2%	4.6	4.7	+0.2	+4%
AM Peak Period (7-9AM)	5.6	5.3	-0.3	-6%	6.0	6.2	+0.3	+5%
PM Peak Period (4-6PM)	7.3	7.9	+0.6	+8%	5.1	5.6	+0.5	+9%
Off-peak Period (9AM-4PM)	5.4	5.9	+0.5	+10%	4.9	5.3	+0.4	+7%

Table 3. Nov/Dec 2021 Weekend Travel Times on Massachusetts Avenue in minutes

	Northbound				Southbound			
	Nov 2021	Dec 2021	Difference	% Difference	Nov 2021	Dec 2021	Difference	% Difference
Full Day Average	4.5	4.4	-0.1	-1%	4.4	4.5	0.1	+2%
Saturday Midday (10AM-2PM)	5.1	5.7	0.6	+12%	5.0	5.4	0.4	+9%

Table 4. Nov/Dec 2021 Weekday Travel Times on Broadway in minutes

	Eastbound				Westbound			
	Nov 2021	Dec 2021	Difference	% Difference	Nov 2021	Dec 2021	Difference	% Difference
Full Day Average	3.2	3.2	0.0	-1%	3.2	3.0	-0.2	-5%
AM Peak Period (7-9AM)	4.4	4.3	0.0	0%	3.5	3.5	0.0	-2%
PM Peak Period (4-6PM)	3.9	3.8	-0.1	-3%	3.8	3.8	0.0	+1%
Off-peak Period (9AM-4PM)	3.7	3.8	0.1	3%	3.6	3.4	-0.2	-5%

Table 5. Nov/Dec 2021 Weekend Travel Times on Broadway in minutes

	Eastbound				Westbound			
	Nov 2021	Dec 2021	Difference	% Difference	Nov 2021	Dec 2021	Difference	% Difference
Full Day Average	2.9	2.7	-0.2	-7%	2.7	2.6	-0.1	-2%
Saturday Midday (10AM-2PM)	3.5	3.0	-0.5	-15%	2.9	2.8	-0.1	-3%

Pre-Pandemic versus 6-months After Installation: May 2019 versus May 2022

Travel times on Massachusetts Avenue in 2022 generally remained similar to or were shorter than travel times in 2019 in both directions. Travel times increased by 1-4% in the weekday evening peak and weekday off peak periods, but otherwise decreased by 3-24% (Table 6). On weekends, average travel times decreased by approximately 30 seconds travelling northbound and 6 seconds travelling southbound (Table 7). On Broadway, eastbound travel times generally increased during all time periods except for weekday mornings and westbound travel times generally decreased except for the weekday evening peak hour (Table 8, Table 9).

Table 6. 2019/2022 Weekday Travel Times on Massachusetts Avenue in minutes

	Northbound				Southbound			
	2019	2022	Difference	% Difference	2019	2022	Difference	% Difference
Full Day Average	5.7	5.0	-0.7	-12%	4.9	4.7	-0.2	-4%
AM Peak Period (7-9AM)	6.9	5.2	-1.7	-24%	6.6	6.4	-0.2	-3%
PM Peak Period (4-6PM)	8.0	8.2	+0.1	+2%	5.2	5.4	+0.2	+4%
Off-peak Period (9AM-4PM)	5.9	5.5	-0.4	-7%	5.0	5.1	+0.1	+1%

Table 7. 2019/2022 Weekend Travel Times on Massachusetts Avenue in minutes

	Northbound				Southbound			
	2019	2022	Difference	% Difference	2019	2022	Difference	% Difference
Full Day Average	5.0	4.5	-0.5	-10%	4.5	4.4	-0.1	-2%
Saturday Midday (10AM-2PM)	5.7	5.4	-0.3	-5%	4.9	5.3	+0.5	+9%

Table 8. 2019/2022 Weekday Travel Times on Broadway in minutes

	Eastbound				Westbound			
	2019	2022	Difference	% Difference	2019	2022	Difference	% Difference
Full Day Average	3.1	3.2	0.0	1%	3.3	3.1	-0.2	-7%
AM Peak Period (7-9AM)	4.5	4.1	-0.4	-8%	3.7	3.4	-0.3	-8%
PM Peak Period (4-6PM)	3.5	3.9	0.4	11%	3.8	3.9	0.1	+2%
Off-peak Period (9AM-4PM)	3.6	3.7	0.1	4%	3.6	3.4	-0.2	-7%

Table 9. 2019/2022 Weekend Travel Times on Broadway in minutes

	Eastbound				Westbound			
	2019	2022	Difference	% Difference	2019	2022	Difference	% Difference
Full Day Average	2.8	2.9	+0.1	+4%	3.0	2.7	-0.3	-9%
Saturday Midday (10AM-2PM)	3.0	3.4	+0.4	+12%	3.3	3.1	-0.2	-5%

While Massachusetts Avenue saw greater variability in travel times immediately before and after implementation compared to Broadway, the similar overall trends between 2019 and 2022 on the two roadways suggest that the installation affected travel times on Massachusetts Avenue for a short period of time but have since stabilized.

MBTA Bus Travel Times and Ridership

The MBTA provided 2019 and 2022 bus ridership and travel time data for Route 77 between its stops through the project area including those listed below and shown in Figure 7:

- Inbound service (Arlington Heights to Harvard Square)
  - » Magoun Street to Cottage Park Avenue
  - » Cottage Park Avenue to Cedar Street
  - » Cedar Street to Norris Street
- Outbound service (Harvard Square to Arlington Heights)
  - » Shea Road to Cameron Avenue (2022 only)
  - » Dover Street to Cameron Avenue (2019 only)
  - » Cameron Avenue to Churchill Avenue
  - » Churchill Avenue to Gladstone Street
  - » Gladstone Street to Route 16

Ridership and travel time data are an average of all days in May 2019 and in May 2022, allowing for pre- and post-installation comparison of bus operations along Massachusetts Avenue. The Shea Road bus stop was introduced through this project and, since the distance between Dover Street and Cameron Avenue is greater than the distance between Shea Road and Cameron Avenue, the travel times before and after implementation between these stops was not compared. All ridership and travel time data are included as an Attachment.

Figure 7. Inbound and Outbound Bus Segments with Available Travel Time Data in 2019 and 2022. Travel time data from Shea Road to Cameron Avenue is only available in 2022 and data from Dover Street to Cameron Avenue is only available in 2019 and were therefore not compared in this study

Ridership

Following the initial onset of the COVID-19 Pandemic in March 2020, the entire MBTA system saw a drastic decrease in ridership on all buses, subway lines, and the commuter rail system. As of October 2022, bus ridership has been between 70-73% of pre-Pandemic ridership.[3] As is prevalent throughout the entire system, bus ridership on Route 77 decreased in May 2022 compared to May 2019 by between 8-16% (Table 10). Though ridership is less than that of pre-installation conditions, ridership along Route 77 is recovering to pre-pandemic levels faster than the average route in the MBTA system. While this does not explicitly indicate an increase in ridership following installation of the dedicated bus lanes along Massachusetts Avenue, it does highlight the prevalence of Route 77 as a high-use, Key Bus route that transit users rely on.

[3] Cawley, Gayla. "MBTA ridership levels nearing pandemic-era highs after fall boost." October 15, 2022. (https://www.bostonherald.com/2022/10/15/mbta-ridership-levels-nearing-pandemic-era-highs-after-fall-boost/)

Table 10. 2019/2022 Average Hourly Ridership on Route 77

	May 2019 Average	May 2022 Average	Difference	% Difference
Inbound Service				
Magoun St to Cottage Park Dr	68	62	-5	-8%
Cottage Park Dr to Cedar St	71	65	-6	-9%
Cedar St to Norris St	75	66	-9	-12%
Outbound Service				
Shea Rd/Dover St to Cameron Ave	78	65	-13	-16%
Cameron Ave to Churchill Ave	75	65	-10	-14%
Churchill Ave to Gladstone St	72	62	-10	-13%
Gladstone St to Route 16	71	62	-10	-13%

Travel Times

MBTA Bus Route 77 runs along the duration of the study area from Arlington Heights to Harvard Station. The Key Bus route was often subject to delays resulting in long travel times while operating in mixed-traffic conditions. Following the installation of the dedicated bus lanes, Route 77's median daily run times decreased between all bus stops by approximately 23% travelling inbound and 40% outbound (Table 11). Travel times between stops in both directions are consistently lower post installation than when the bus was operating in mixed traffic and see less variability in those travel times throughout the day (Figure 8, Figure 9). For example, an outbound bus in May 2019 would typically take between 111 seconds (nearly 2 minutes) to travel between Cameron Avenue and Churchill Avenue and that time could range between approximately 44 seconds and 303 seconds (approximately 5 minutes) (Table 12, Table 13). In May 2022, that same trip took an average of 35 seconds and could range between 23 seconds and 45 seconds. With the installation of the dedicated bus lane along Massachusetts Avenue, Route 77 riders are experiencing shorter travel times and more consistent service.

Table 11. 2019/2022 Changes in Median Travel Times between Bus Stops

	Inbound Bus Stop				Outbound Bus Stop			
From	Magoun St	Cottage Park Ave	Cedar St	Average	Cameron Ave	Churchill Ave	Gladstone St	Average
To	Cottage Park Ave	Cedar St	Norris St		Churchill Ave	Gladstone St	Route 16	
Full Day Average	-23%	-28%	-21%	-23%	-68%	-41%	-30%	-40%
7-9 AM	-26%	-42%	-27%	-31%	-76%	-44%	-12%	-40%
4-6 PM	-11%	-29%	-14%	-17%	-83%	-44%	-24%	-50%

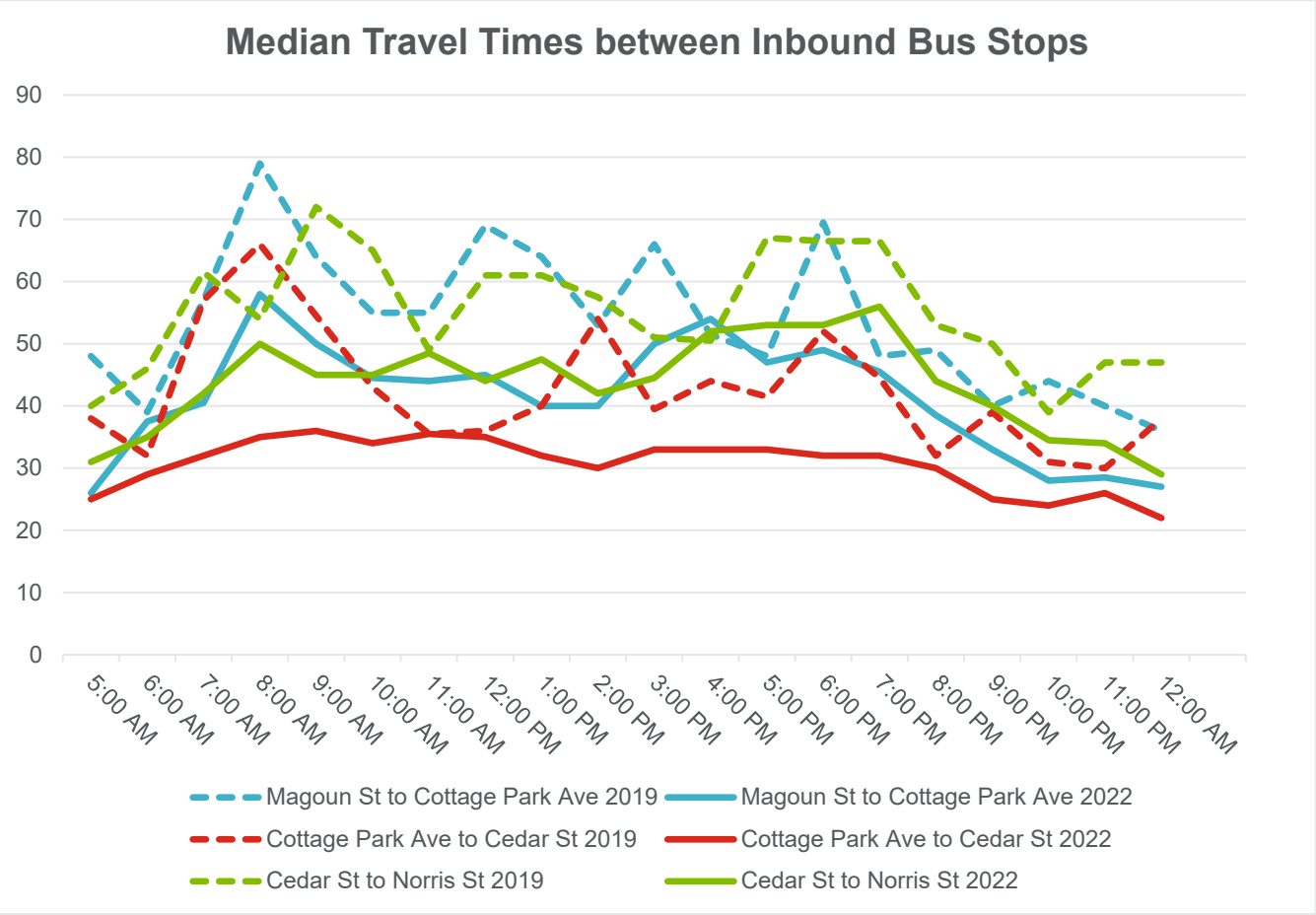


Figure 8. 2019/2022 Median Travel Times between Inbound Bus Stops

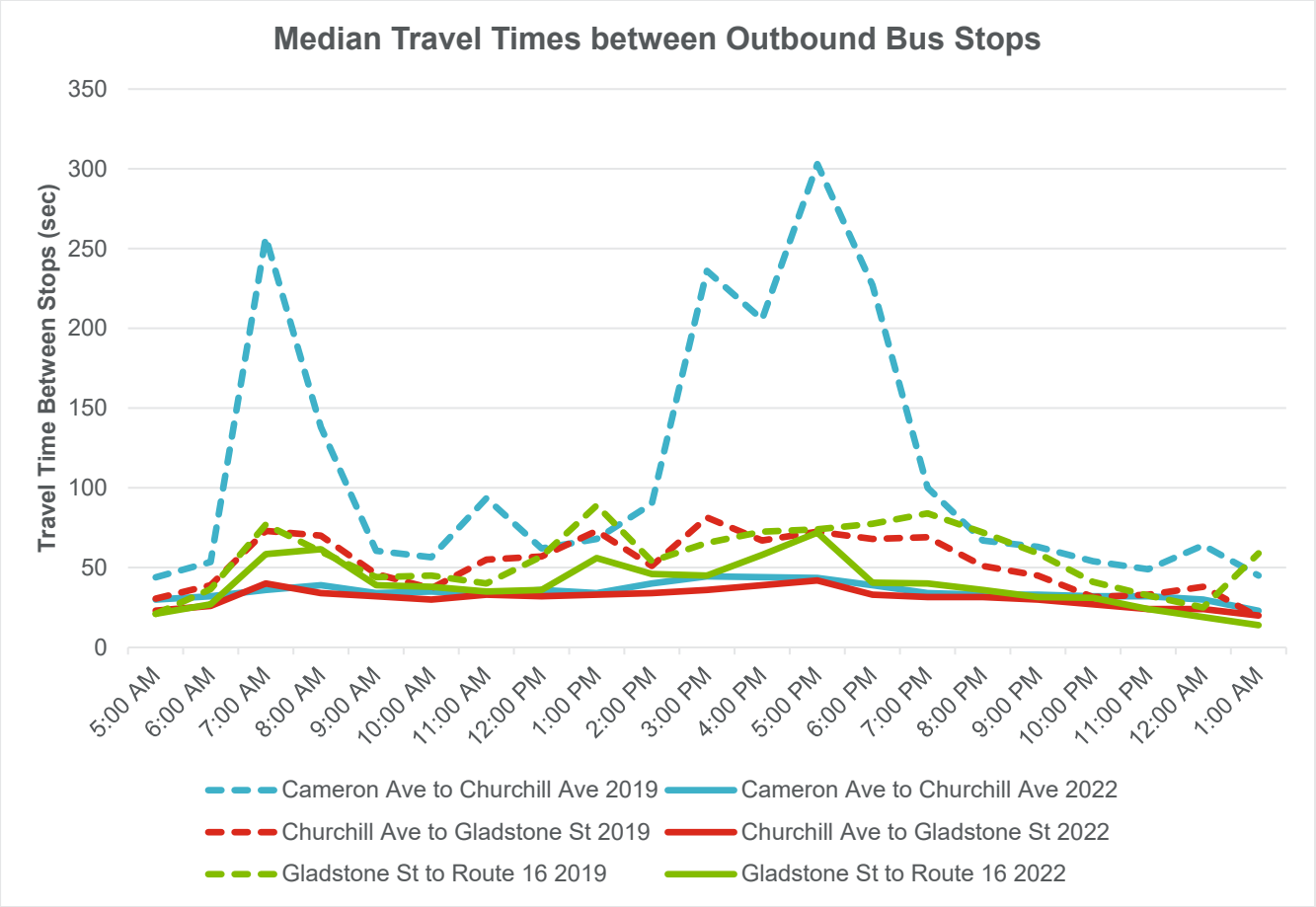


Figure 9. Median Travel Times between Outbound Bus Stops in May 2019 and May 2022

Table 12. 2019/2022 Average, Minimum, and Maximum Travel Times between Inbound Bus Stops (in seconds)

	May 2019				May 2022			
Inbound Stops	Average	Min	Max	Difference	Average	Min	Max	Difference
Magoun St to Cottage Park Ave	54	36	79	43	41	26	58	32
Cottage Park Ave to Cedar St	42	30	66	36	31	22	36	14
Cedar St to Norris St	55	39	72	33	44	29	56	27

Table 13. 2019/2022 Average, Minimum, and Maximum Travel Times between Outbound Bus Stops (in seconds)

Outbound Stops	May 2019				May 2022			
	Average	Min	Max	Difference	Average	Min	Max	Difference
Cameron Ave to Churchill Ave	111	44	303	259	35	23	45	22
Churchill Ave to Gladstone St	53	19	82	63	31	20	42	22
Gladstone St to Route 16	56	21	89	68	39	14	72	58

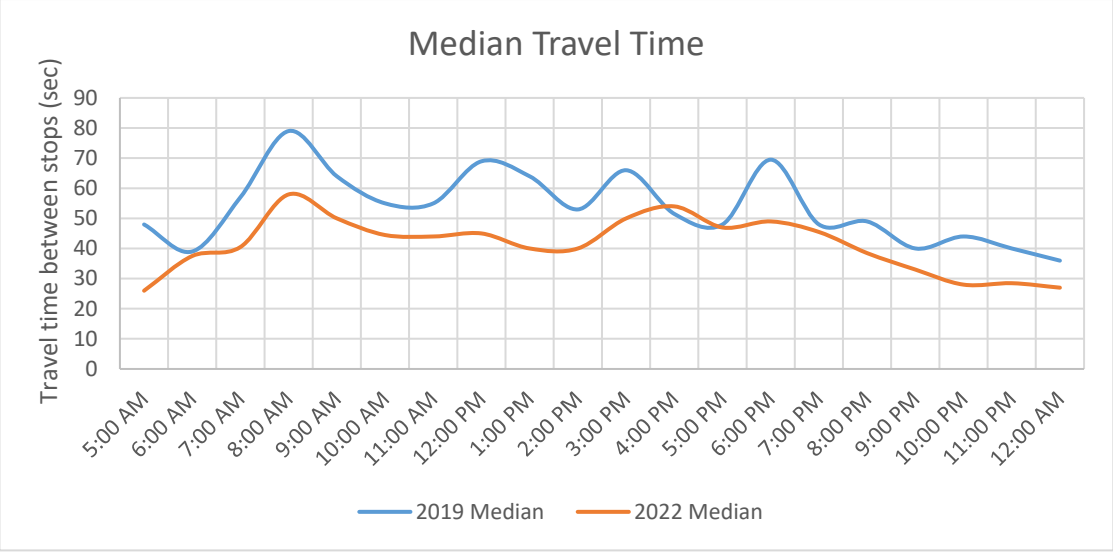
Conclusion

The reconfiguration of the northern Massachusetts Avenue segment between Dudley Street and Alewife Brook Parkway reallocated vehicle space to provide people biking fully separated bike lanes and the Bus Route 77 a dedicated bus-only lane during peak hours. While travel times along the corridor for all motor vehicles increased immediately following implementation, they have since stabilized and travel time trends are similar to those on the control corridor, Broadway. Bus-specific travel times through the study area have decreased drastically while operating in the bus-only lanes and travel times vary less than pre-pandemic, mixed-traffic conditions. Furthermore, though Route 77 ridership has not reached pre-pandemic levels, ridership has recovered at a higher rate than other buses throughout the MBTA system. The project has provided bicyclists more comfortable, connected facilities and transit users shorter and more consistent operations without sacrificing private vehicle operations along Massachusetts Avenue.

Attachments

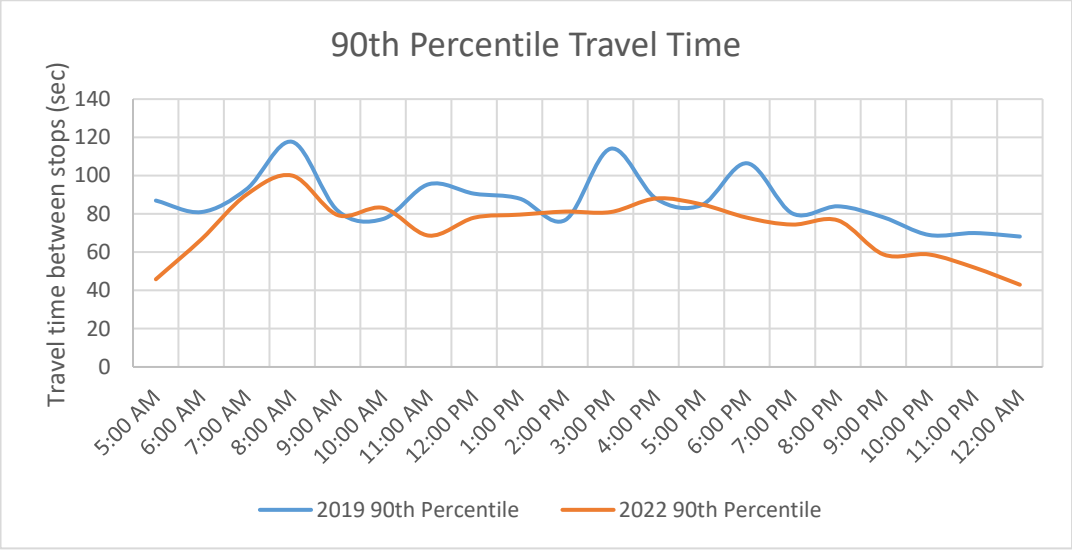
Magoun Street to Cottage Park Avenue

Travel Time	2019 Median	2022 Median	Difference	% Difference
5:00 AM	48	26	-22	-46%
6:00 AM	39	37.5	-1.5	-4%
7:00 AM	57	40.5	-16.5	-29%
8:00 AM	79	58	-21	-27%
9:00 AM	64	50	-14	-22%
10:00 AM	55	44.5	-10.5	-19%
11:00 AM	55	44	-11	-20%
12:00 PM	69	45	-24	-35%
1:00 PM	64	40	-24	-38%
2:00 PM	53	40	-13	-25%
3:00 PM	66	50	-16	-24%
4:00 PM	51.5	54	2.5	5%
5:00 PM	48	47	-1	-2%
6:00 PM	69.5	49	-20.5	-29%
7:00 PM	48	45.5	-2.5	-5%
8:00 PM	49	38.5	-10.5	-21%
9:00 PM	40	33	-7	-18%
10:00 PM	44	28	-16	-36%
11:00 PM	40	28.5	-11.5	-29%
12:00 AM	36	27	-9	-25%
Full Day Average	**53.8**	**41.3**	**-12.5**	**-23%**
7-9am Average	66.7	49.5	**-17.2**	**-26%**
4-6pm average	56.3	50.0	**-6.3**	**-11%**



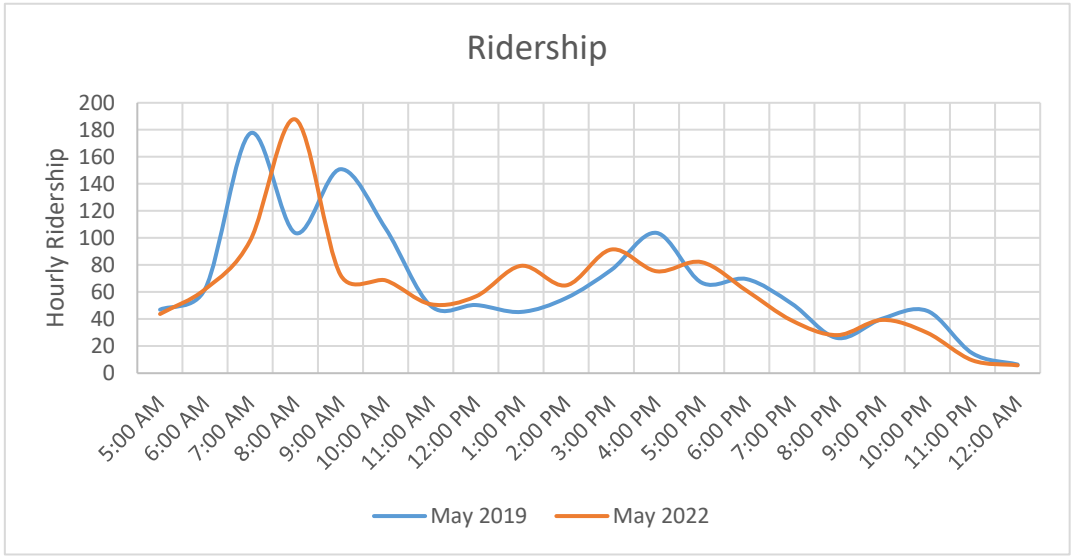
Magoun Street to Cottage Park Avenue

Travel Time	2019 90th Percentile	2022 90th Percentile	Difference	% Difference
5:00 AM	87	45.8	-41.2	-47%
6:00 AM	81	66.7	-14.3	-18%
7:00 AM	93	90.2	-2.8	-3%
8:00 AM	117.7	100	-17.7	-15%
9:00 AM	81.6	79.4	-2.2	-3%
10:00 AM	77.4	83.1	5.7	7%
11:00 AM	95.5	68.7	-26.8	-28%
12:00 PM	90.6	78	-12.6	-14%
1:00 PM	88	79.6	-8.4	-10%
2:00 PM	76.8	81.2	4.4	6%
3:00 PM	114.1	81	-33.1	-29%
4:00 PM	88	88.1	0.1	0%
5:00 PM	84.6	85	0.4	0%
6:00 PM	106.5	78	-28.5	-27%
7:00 PM	80.2	74.4	-5.8	-7%
8:00 PM	84	76.6	-7.4	-9%
9:00 PM	78.2	58.8	-19.4	-25%
10:00 PM	69	58.8	-10.2	-15%
11:00 PM	70	51.9	-18.1	-26%
12:00 AM	68.2	43	-25.2	-37%
Full Day Average	**86.6**	**73.4**	**-13.2**	**-15%**
7-9am Average	97.4	89.9	**-7.6**	**-8%**
4-6pm average	93.0	83.7	**-9.3**	**-10%**



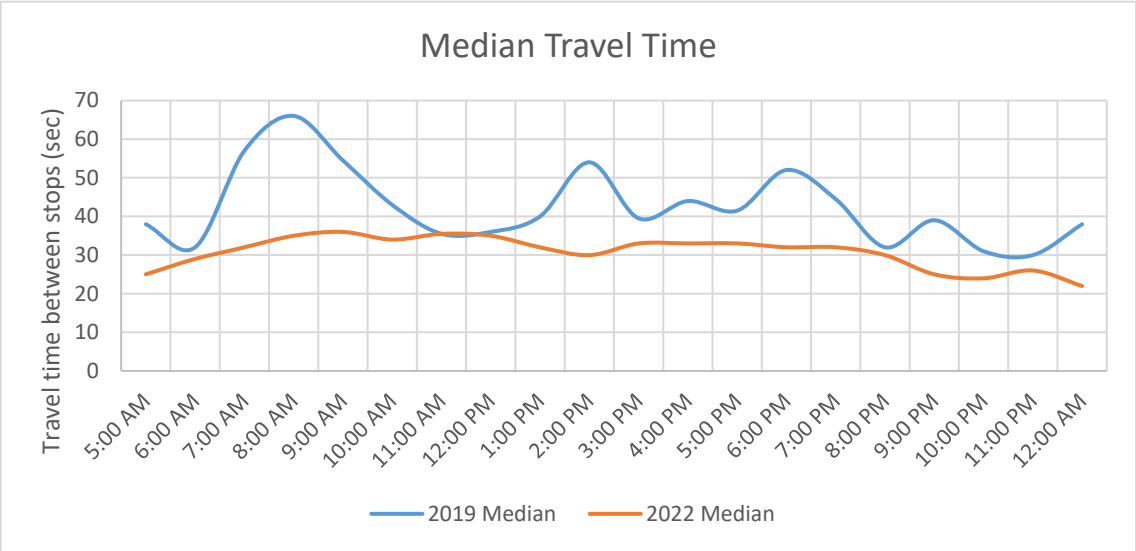
Magoun Street to Cottage Park Avenue

Ridership	May 2019	May 2022	Difference	% Difference
5:00 AM	47	44	-3.1	-7%
6:00 AM	62	62	-0.2	0%
7:00 AM	177	98	-79.2	-45%
8:00 AM	104	188	83.9	81%
9:00 AM	151	73	-78.3	-52%
10:00 AM	107	69	-38.3	-36%
11:00 AM	50	51	1.2	2%
12:00 PM	50	57	6.4	13%
1:00 PM	45	79	34.2	76%
2:00 PM	56	65	9.3	17%
3:00 PM	76	91	15.0	20%
4:00 PM	104	75	-28.3	-27%
5:00 PM	67	82	15.2	23%
6:00 PM	70	61	-8.6	-12%
7:00 PM	51	39	-12.5	-24%
8:00 PM	26	28	2.1	8%
9:00 PM	40	39	-0.9	-2%
10:00 PM	46	30	-16.3	-35%
11:00 PM	15	9	-5.1	-35%
12:00 AM	6	6	-0.5	-8%
Full Day Average	**67.5**	**62.3**	**-5.2**	**-8%**
7-9am Average	144.0	119.5	**-24.5**	**-17%**
4-6pm average	80.1	72.8	**-7.2**	**-9%**



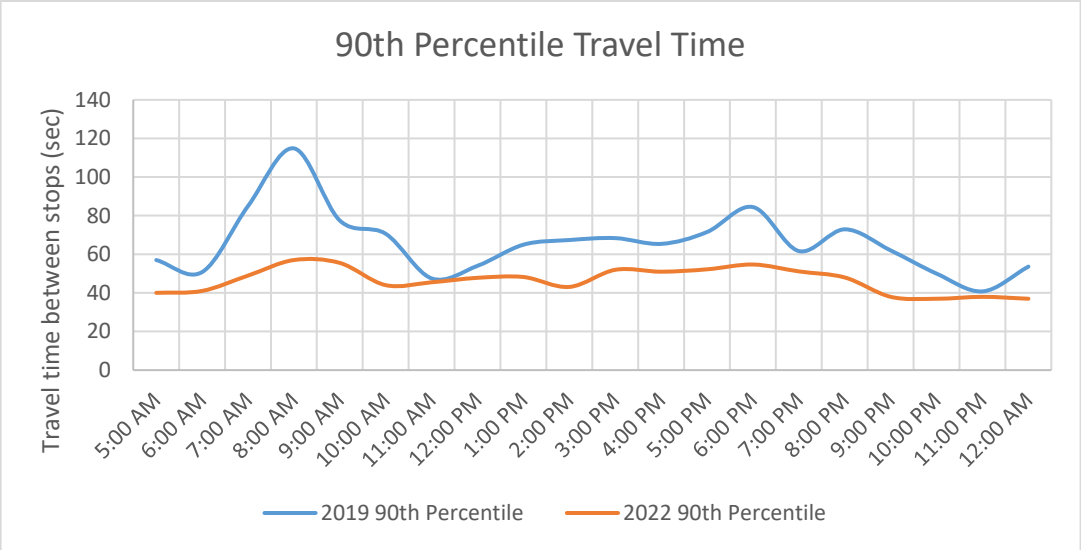
Cottage Park Avenue to Cedar Street

Travel Time	2019 Median	2022 Median	Difference	% Difference
5:00 AM	38	25	-13	-34%
6:00 AM	32	29	-3	-9%
7:00 AM	57	32	-25	-44%
8:00 AM	66	35	-31	-47%
9:00 AM	54.5	36	-18.5	-34%
10:00 AM	43	34	-9	-21%
11:00 AM	35.5	35.5	0	0%
12:00 PM	36	35	-1	-3%
1:00 PM	40	32	-8	-20%
2:00 PM	54	30	-24	-44%
3:00 PM	39.5	33	-6.5	-16%
4:00 PM	44	33	-11	-25%
5:00 PM	41.5	33	-8.5	-20%
6:00 PM	52	32	-20	-38%
7:00 PM	44.5	32	-12.5	-28%
8:00 PM	32	30	-2	-6%
9:00 PM	39	25	-14	-36%
10:00 PM	31	24	-7	-23%
11:00 PM	30	26	-4	-13%
12:00 AM	38	22	-16	-42%
Full Day Average	**42.4**	**30.7**	**-11.7**	**-28%**
7-9am Average	59.2	34.3	**-24.8**	**-42%**
4-6pm average	45.8	32.7	**-13.2**	**-29%**



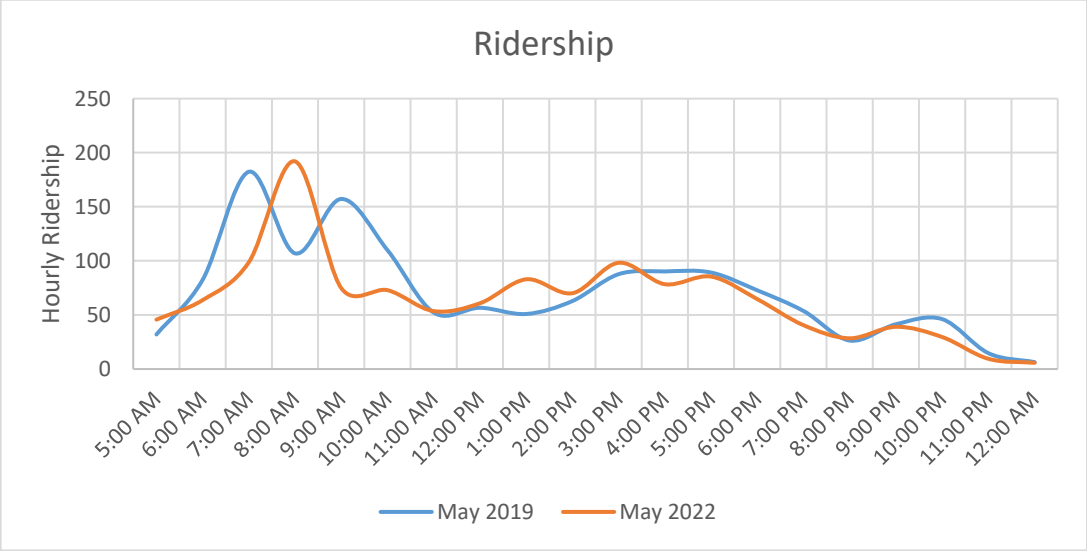
Cottage Park Avenue to Cedar Street

Travel Time	2019 90th Percentile	2022 90th Percentile	Difference	% Difference
5:00 AM	57	40	-17	-30%
6:00 AM	50.8	41	-9.8	-19%
7:00 AM	85	49	-36	-42%
8:00 AM	114.9	57	-57.9	-50%
9:00 AM	77.5	55.5	-22	-28%
10:00 AM	70.6	44	-26.6	-38%
11:00 AM	47.5	45.5	-2	-4%
12:00 PM	54	47.8	-6.2	-11%
1:00 PM	65	48.2	-16.8	-26%
2:00 PM	67.4	43.1	-24.3	-36%
3:00 PM	68.4	52	-16.4	-24%
4:00 PM	65.4	51	-14.4	-22%
5:00 PM	71.5	52.2	-19.3	-27%
6:00 PM	84.5	54.7	-29.8	-35%
7:00 PM	61.7	51.1	-10.6	-17%
8:00 PM	72.9	48	-24.9	-34%
9:00 PM	62	38	-24	-39%
10:00 PM	50	37	-13	-26%
11:00 PM	40.8	38	-2.8	-7%
12:00 AM	53.6	37	-16.6	-31%
Full Day Average	**66.0**	**46.5**	**-19.5**	**-30%**
7-9am Average	92.5	53.8	**-38.6**	**-42%**
4-6pm average	73.8	52.6	**-21.2**	**-29%**



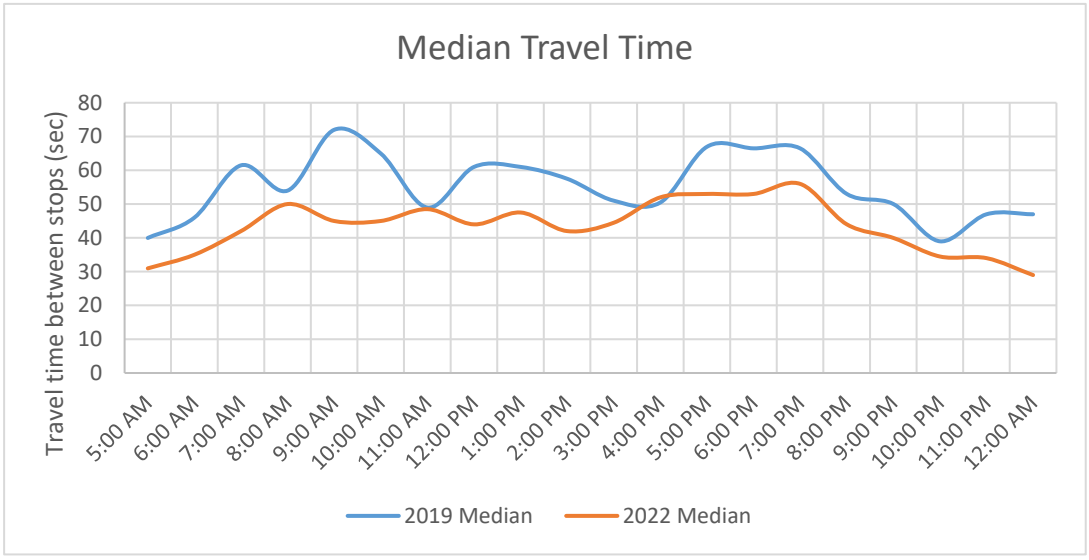
Cottage Park Avenue to Cedar Street

Ridership	May 2019	May 2022	Difference	% Difference
5:00 AM	32	46	13.8	43%
6:00 AM	83	64	-18.9	-23%
7:00 AM	182	99	-83.5	-46%
8:00 AM	107	192	85.0	80%
9:00 AM	157	75	-82.5	-52%
10:00 AM	110	73	-37.0	-34%
11:00 AM	52	54	1.3	2%
12:00 PM	57	61	4.1	7%
1:00 PM	51	83	32.1	63%
2:00 PM	63	70	7.2	11%
3:00 PM	88	98	10.5	12%
4:00 PM	90	78	-11.9	-13%
5:00 PM	89	85	-3.7	-4%
6:00 PM	73	65	-8.1	-11%
7:00 PM	54	40	-13.2	-25%
8:00 PM	26	28	2.0	8%
9:00 PM	41	39	-2.3	-6%
10:00 PM	46	30	-16.5	-36%
11:00 PM	15	9	-5.3	-36%
12:00 AM	6	6	-0.6	-9%
Full Day Average	**71.1**	**64.7**	**-6.4**	**-9%**
7-9am Average	148.9	121.9	**-27.0**	**-18%**
4-6pm average	84.1	76.2	**-7.9**	**-9%**



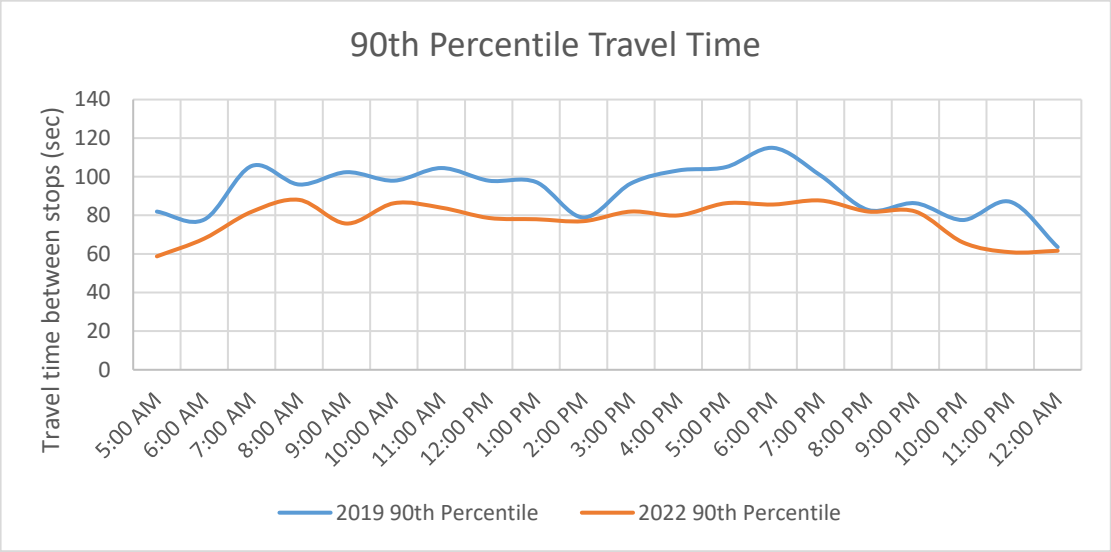
Cedar Street to Norris Street

Travel Time	2019 Median	2022 Median	Difference	% Difference
5:00 AM	40	31	-9	-23%
6:00 AM	46	35	-11	-24%
7:00 AM	61.5	42	-19.5	-32%
8:00 AM	54	50	-4	-7%
9:00 AM	72	45	-27	-38%
10:00 AM	65	45	-20	-31%
11:00 AM	49	48.5	-0.5	-1%
12:00 PM	61	44	-17	-28%
1:00 PM	61	47.5	-13.5	-22%
2:00 PM	57.5	42	-15.5	-27%
3:00 PM	51	44.5	-6.5	-13%
4:00 PM	50.5	52	1.5	3%
5:00 PM	67	53	-14	-21%
6:00 PM	66.5	53	-13.5	-20%
7:00 PM	66.5	56	-10.5	-16%
8:00 PM	53	44	-9	-17%
9:00 PM	50	40	-10	-20%
10:00 PM	39	34.5	-4.5	-12%
11:00 PM	47	34	-13	-28%
12:00 AM	47	29	-18	-38%
Full Day Average	**55.2**	**43.5**	**-11.7**	**-21%**
7-9am Average	62.5	45.7	**-16.8**	**-27%**
4-6pm Average	61.3	52.7	**-8.7**	**-14%**



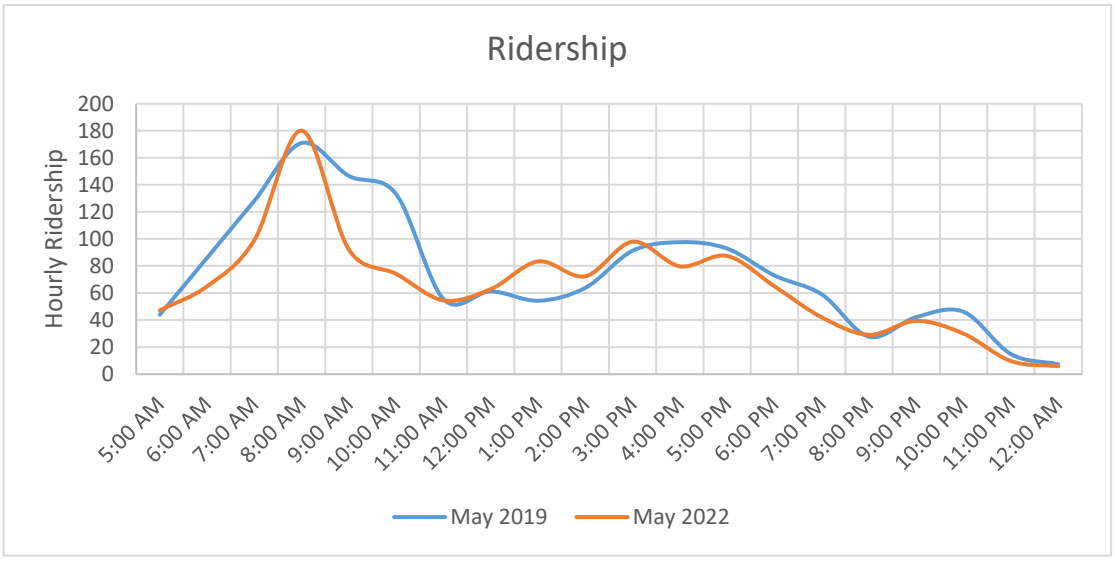
Cedar Street to Norris Street

Travel Time	2019 90th Percentile	2022 90th Percentile	Difference	% Difference
5:00 AM	82	58.8	-23.2	-28%
6:00 AM	77.8	68	-9.8	-13%
7:00 AM	105.6	81.9	-23.7	-22%
8:00 AM	96	88	-8	-8%
9:00 AM	102.4	75.8	-26.6	-26%
10:00 AM	98	86.3	-11.7	-12%
11:00 AM	104.5	84	-20.5	-20%
12:00 PM	98	78.7	-19.3	-20%
1:00 PM	97.2	78	-19.2	-20%
2:00 PM	78.9	77	-1.9	-2%
3:00 PM	96.6	82	-14.6	-15%
4:00 PM	103.3	80	-23.3	-23%
5:00 PM	105	86.3	-18.7	-18%
6:00 PM	115	85.6	-29.4	-26%
7:00 PM	100.6	87.7	-12.9	-13%
8:00 PM	82.8	82	-0.8	-1%
9:00 PM	86.3	82	-4.3	-5%
10:00 PM	77.6	66	-11.6	-15%
11:00 PM	87	60.9	-26.1	-30%
12:00 AM	63.6	61.7	-1.9	-3%
Full Day Average	**92.9**	**77.5**	**-15.4**	**-17%**
7-9am Average	101.3	81.9	**-19.4**	**-19%**
4-6pm Average	107.8	84.0	**-23.8**	**-22%**



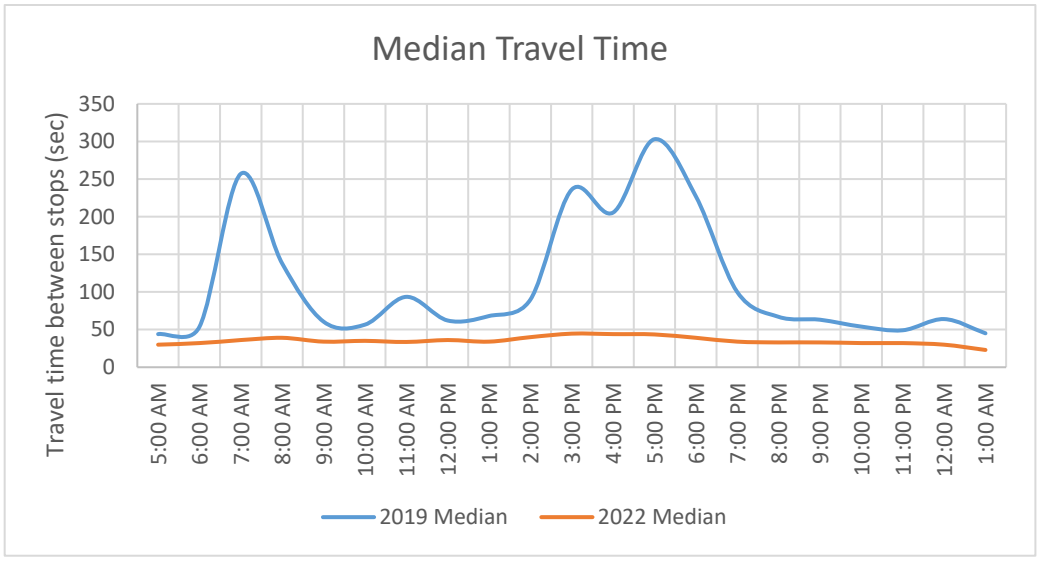
Cedar Street to Norris Street

Ridership	May 2019	May 2022	Difference	% Difference
5:00 AM	44	47	3.1	7%
6:00 AM	86	65	-21.0	-24%
7:00 AM	128	99	-29.2	-23%
8:00 AM	171	180	9.2	5%
9:00 AM	147	92	-54.5	-37%
10:00 AM	133	74	-59.0	-44%
11:00 AM	55	55	-0.9	-2%
12:00 PM	61	63	1.7	3%
1:00 PM	54	83	29.1	53%
2:00 PM	64	72	8.6	13%
3:00 PM	91	98	6.6	7%
4:00 PM	98	80	-17.8	-18%
5:00 PM	93	87	-5.4	-6%
6:00 PM	73	65	-8.0	-11%
7:00 PM	59	42	-17.0	-29%
8:00 PM	28	29	1.4	5%
9:00 PM	42	39	-2.8	-7%
10:00 PM	46	30	-16.2	-35%
11:00 PM	15	10	-5.2	-35%
12:00 AM	7	6	-1.5	-20%
Full Day Average	**74.8**	**65.9**	**-8.9**	**-12%**
7-9am Average	148.6	123.8	**-24.8**	**-17%**
4-6pm Average	87.8	77.4	**-10.4**	**-12%**



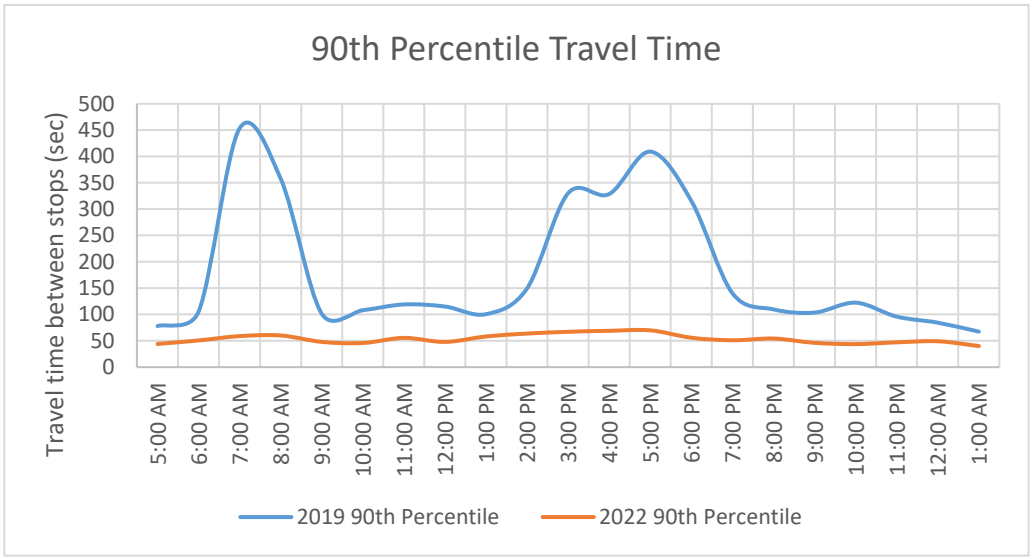
Cameron Avenue to Churchill Avenue

Travel Time	2019 Median	2022 Median	Difference	% Difference
5:00 AM	44	30	-14	-32%
6:00 AM	54	32	-22	-40%
7:00 AM	257	36	-221	-86%
8:00 AM	138	39	-99	-72%
9:00 AM	61	34	-27	-44%
10:00 AM	57	35	-22	-38%
11:00 AM	94	34	-60	-64%
12:00 PM	62	36	-26	-42%
1:00 PM	68	34	-34	-50%
2:00 PM	90	40	-50	-56%
3:00 PM	236	45	-192	-81%
4:00 PM	206	44	-162	-79%
5:00 PM	303	44	-260	-86%
6:00 PM	227	39	-188	-83%
7:00 PM	100	34	-66	-66%
8:00 PM	67	33	-34	-51%
9:00 PM	63	33	-30	-48%
10:00 PM	54	32	-22	-41%
11:00 PM	49	32	-17	-35%
12:00 AM	64	30	-34	-53%
1:00 AM	45	23	-22	-49%
Full Day Average	**111**	**35**	**-76**	**-68%**
7-9am Average	152	36	**-116**	**-76%**
4-6pm average	245	42	**-203**	**-83%**



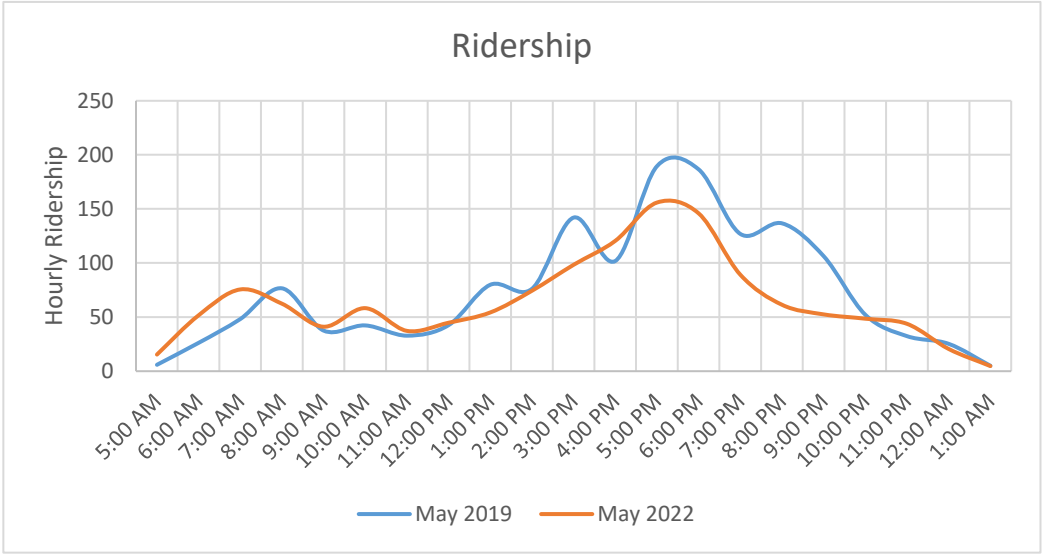
Cameron Avenue to Churchill Avenue

Travel Time	2019 90th Percentile	2022 90th Percentile	Difference	% Difference
5:00 AM	78	44	-34	-44%
6:00 AM	105	51	-54	-52%
7:00 AM	453	59	-395	-87%
8:00 AM	358	60	-298	-83%
9:00 AM	102	48	-54	-53%
10:00 AM	108	46	-62	-58%
11:00 AM	119	56	-63	-53%
12:00 PM	115	48	-67	-58%
1:00 PM	100	58	-42	-42%
2:00 PM	150	64	-86	-57%
3:00 PM	330	67	-263	-80%
4:00 PM	329	69	-260	-79%
5:00 PM	409	70	-339	-83%
6:00 PM	316	56	-260	-82%
7:00 PM	140	51	-89	-64%
8:00 PM	110	54	-55	-51%
9:00 PM	103	46	-57	-55%
10:00 PM	122	44	-79	-64%
11:00 PM	96	47	-49	-51%
12:00 AM	84	49	-35	-42%
1:00 AM	67	40	-27	-41%
Full Day Average	**181**	**54**	**-127**	**-70%**
7-9am Average	304	56	**-249**	**-82%**
4-6pm average	351	65	**-286**	**-82%**



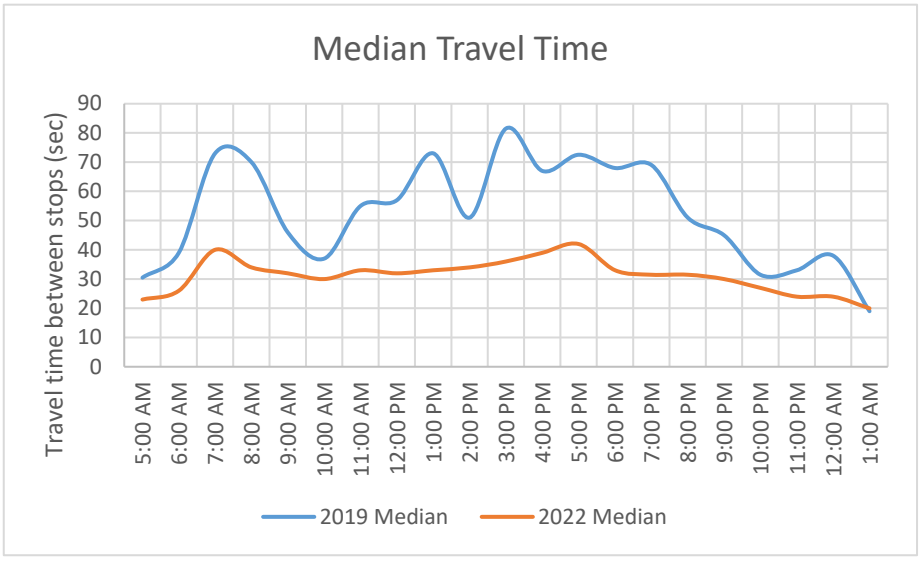
Cameron Avenue to Churchill Avenue

Ridership	May 2019	May 2022	Difference	% Difference
5:00 AM	6	15	9	158%
6:00 AM	26	52	25	97%
7:00 AM	48	76	27	57%
8:00 AM	77	62	-14	-19%
9:00 AM	38	41	3	9%
10:00 AM	42	58	16	37%
11:00 AM	33	37	4	13%
12:00 PM	43	45	2	5%
1:00 PM	80	54	-26	-32%
2:00 PM	76	74	-2	-2%
3:00 PM	142	98	-44	-31%
4:00 PM	102	121	19	18%
5:00 PM	190	156	-34	-18%
6:00 PM	187	146	-41	-22%
7:00 PM	127	89	-38	-30%
8:00 PM	137	61	-75	-55%
9:00 PM	106	53	-54	-51%
10:00 PM	52	49	-4	-7%
11:00 PM	32	44	11	35%
12:00 AM	25	21	-5	-19%
1:00 AM	5	5	0	-5%
Full Day Average	**75**	**65**	**-10**	**-14%**
7-9am Average	54	60	**6**	**10%**
4-6pm average	159	141	**-19**	**-12%**



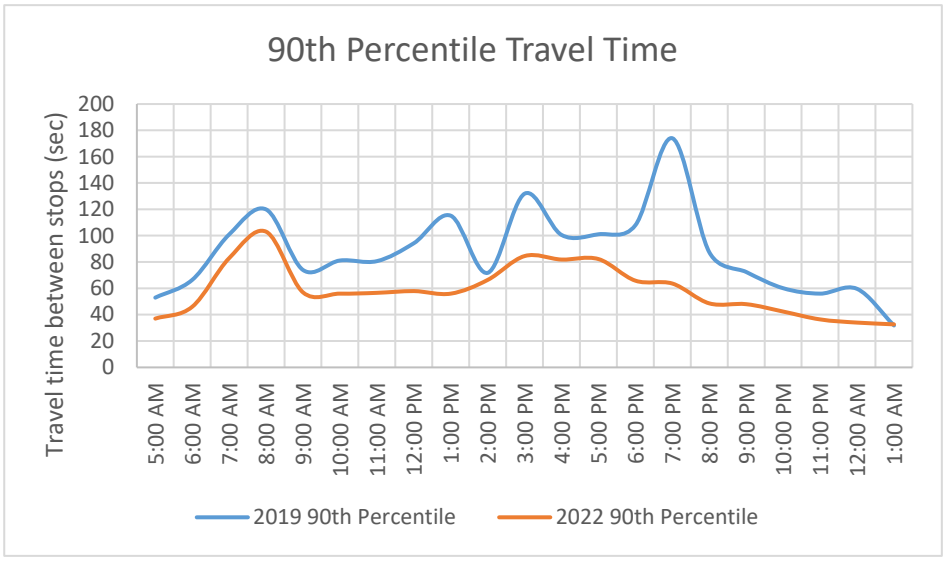
Churchill Avenue to Gladstone Street

Travel Time	2019 Median	2022 Median	Difference	% Difference
5:00 AM	31	23	-8	-25%
6:00 AM	39	26	-13	-33%
7:00 AM	73	40	-33	-45%
8:00 AM	70	34	-36	-51%
9:00 AM	46	32	-14	-30%
10:00 AM	37	30	-7	-19%
11:00 AM	55	33	-22	-40%
12:00 PM	57	32	-25	-44%
1:00 PM	73	33	-40	-55%
2:00 PM	51	34	-17	-33%
3:00 PM	82	36	-46	-56%
4:00 PM	67	39	-28	-42%
5:00 PM	73	42	-31	-42%
6:00 PM	68	33	-35	-51%
7:00 PM	69	32	-38	-54%
8:00 PM	51	32	-20	-38%
9:00 PM	45	30	-15	-33%
10:00 PM	32	27	-5	-14%
11:00 PM	33	24	-9	-27%
12:00 AM	38	24	-14	-37%
1:00 AM	19	20	1	5%
Full Day Average	**53**	**31**	**-22**	**-41%**
7-9am Average	63	35	**-28**	**-44%**
4-6pm average	69	38	**-31**	**-45%**



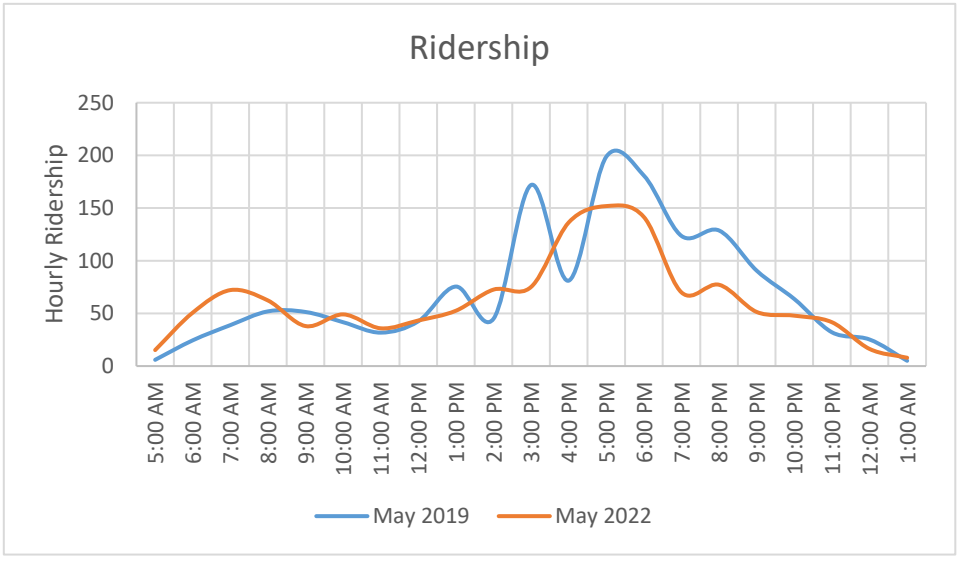
Churchill Avenue to Gladstone Street

Travel Time	2019 90th Percentile	2022 90th Percentile	Difference	% Difference
5:00 AM	53	37	-16	-30%
6:00 AM	67	46	-21	-31%
7:00 AM	101	83	-18	-18%
8:00 AM	120	103	-17	-14%
9:00 AM	74	57	-17	-23%
10:00 AM	81	56	-25	-31%
11:00 AM	81	57	-24	-30%
12:00 PM	94	58	-36	-39%
1:00 PM	115	56	-59	-51%
2:00 PM	72	66	-5	-8%
3:00 PM	132	85	-47	-36%
4:00 PM	101	82	-19	-19%
5:00 PM	101	82	-19	-19%
6:00 PM	108	66	-42	-39%
7:00 PM	174	64	-110	-63%
8:00 PM	87	49	-39	-44%
9:00 PM	72	48	-24	-34%
10:00 PM	60	42	-18	-29%
11:00 PM	56	36	-20	-35%
12:00 AM	60	34	-26	-43%
1:00 AM	32	33	1	3%
Full Day Average	**88**	**59**	**-29**	**-33%**
7-9am Average	98	81	**-17**	**-18%**
4-6pm average	103	77	**-27**	**-26%**



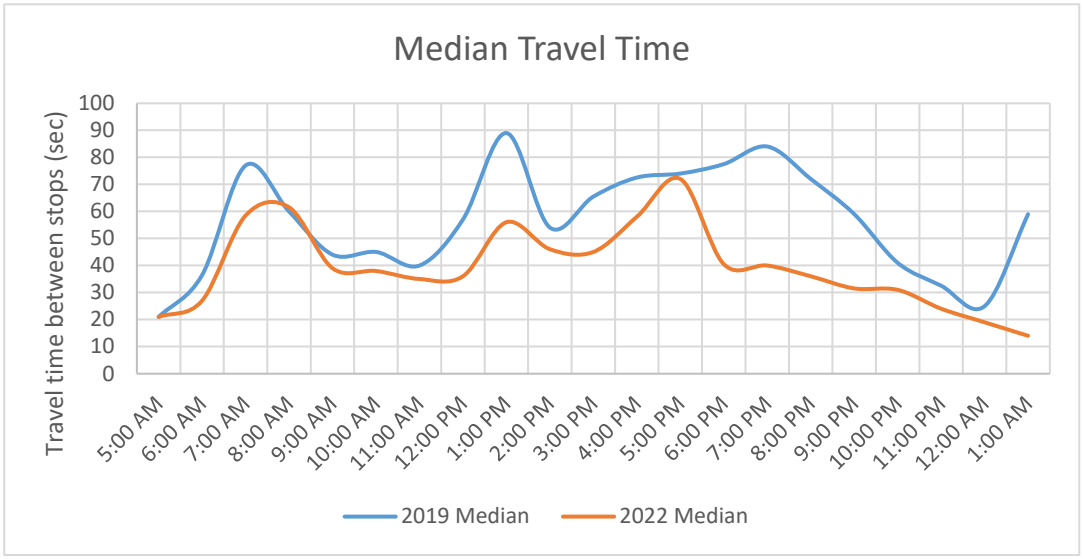
Churchill Avenue to Gladstone Street

Ridership	May 2019	May 2022	Difference	% Difference
5:00 AM	6	15	9	155%
6:00 AM	25	51	26	107%
7:00 AM	39	72	33	85%
8:00 AM	52	62	10	20%
9:00 AM	51	38	-14	-26%
10:00 AM	42	49	7	18%
11:00 AM	32	36	4	13%
12:00 PM	43	43	1	2%
1:00 PM	76	53	-23	-30%
2:00 PM	45	73	28	62%
3:00 PM	172	75	-97	-56%
4:00 PM	81	136	55	68%
5:00 PM	199	152	-47	-24%
6:00 PM	181	141	-39	-22%
7:00 PM	124	70	-54	-43%
8:00 PM	129	77	-51	-40%
9:00 PM	91	51	-39	-43%
10:00 PM	64	48	-16	-25%
11:00 PM	32	42	9	29%
12:00 AM	25	16	-9	-36%
1:00 AM	5	8	3	59%
Full Day Average	**72**	**62**	**-10**	**-13%**
7-9am Average	47	57	**10**	**21%**
4-6pm average	154	143	**-10**	**-7%**



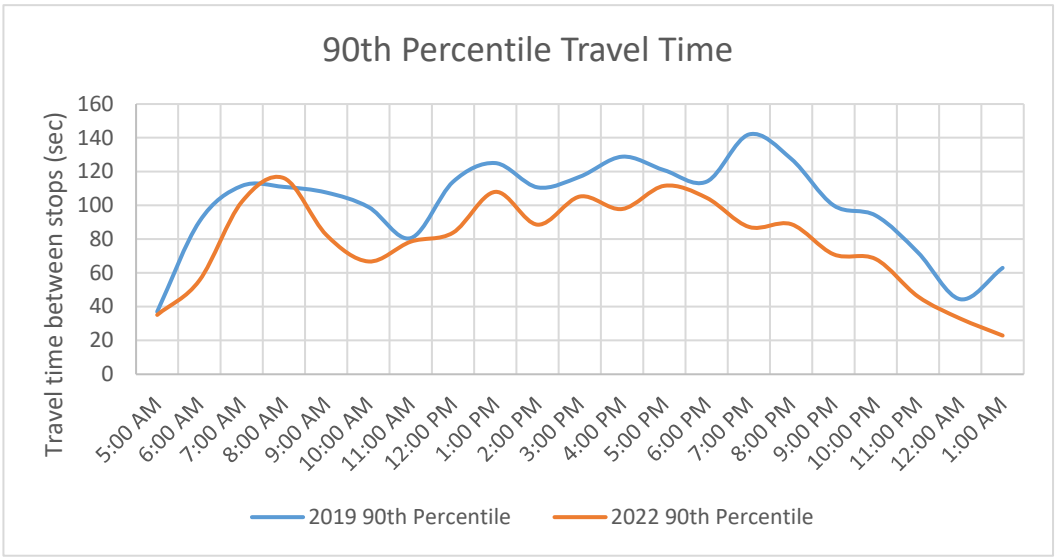
Gladstone Street to Route 16

Travel Time	2019 Median	2022 Median	Difference	% Difference
5:00 AM	21	21	0	0%
6:00 AM	37	27	-10	-26%
7:00 AM	77	59	-19	-24%
8:00 AM	60	62	2	3%
9:00 AM	44	39	-5	-11%
10:00 AM	45	38	-7	-16%
11:00 AM	40	35	-5	-13%
12:00 PM	57	36	-21	-37%
1:00 PM	89	56	-33	-37%
2:00 PM	54	46	-8	-15%
3:00 PM	66	45	-21	-31%
4:00 PM	73	58	-15	-20%
5:00 PM	74	72	-2	-3%
6:00 PM	78	41	-37	-48%
7:00 PM	84	40	-44	-52%
8:00 PM	72	36	-36	-50%
9:00 PM	59	32	-28	-47%
10:00 PM	41	31	-10	-24%
11:00 PM	33	24	-9	-26%
12:00 AM	25	19	-6	-24%
1:00 AM	59	14	-45	-76%
Full Day Average	**56**	**39**	**-17**	**-30%**
7-9am Average	60	53	**-7**	**-12%**
4-6pm average	75	57	**-18**	**-24%**



Gladstone Street to Route 16

Travel Time	2019 90th Percentile	2022 90th Percentile	Difference	% Difference
5:00 AM	37	35	-2	-5%
6:00 AM	91	56	-35	-39%
7:00 AM	112	102	-10	-9%
8:00 AM	111	116	5	5%
9:00 AM	108	83	-25	-23%
10:00 AM	99	67	-32	-33%
11:00 AM	81	79	-2	-3%
12:00 PM	114	84	-30	-26%
1:00 PM	125	108	-17	-14%
2:00 PM	111	89	-22	-20%
3:00 PM	117	105	-12	-10%
4:00 PM	129	98	-31	-24%
5:00 PM	121	112	-9	-8%
6:00 PM	114	105	-10	-8%
7:00 PM	142	87	-55	-39%
8:00 PM	128	89	-39	-30%
9:00 PM	100	71	-29	-29%
10:00 PM	94	68	-26	-27%
11:00 PM	72	46	-26	-36%
12:00 AM	44	33	-11	-26%
1:00 AM	63	23	-40	-64%
Full Day Average	**100**	**79**	**-22**	**-22%**
7-9am Average	110	100	**-10**	**-9%**
4-6pm average	121	105	**-17**	**-14%**



Gladstone Street to Route 16

Ridership	May 2019	May 2022	Difference	% Difference
5:00 AM	6	23	17	279%
6:00 AM	24	51	27	109%
7:00 AM	31	72	41	133%
8:00 AM	60	54	-6	-10%
9:00 AM	52	38	-15	-28%
10:00 AM	41	49	8	19%
11:00 AM	31	36	4	14%
12:00 PM	42	43	1	3%
1:00 PM	75	51	-23	-31%
2:00 PM	45	72	27	61%
3:00 PM	171	75	-96	-56%
4:00 PM	80	135	55	69%
5:00 PM	179	149	-30	-17%
6:00 PM	197	140	-57	-29%
7:00 PM	122	68	-54	-44%
8:00 PM	128	77	-51	-40%
9:00 PM	88	51	-37	-42%
10:00 PM	63	47	-16	-25%
11:00 PM	32	41	9	28%
12:00 AM	25	16	-9	-35%
1:00 AM	5	8	3	59%
Full Day Average	**71**	**62**	**-10**	**-13%**
7-9am Average	48	55	**7**	**14%**
4-6pm average	152	141	**-11**	**-7%**