



CITY OF CAMBRIDGE

TRAFFIC, PARKING, + TRANSPORTATION

Garden Street Safety Improvement Project Local Traffic Analysis

To: Yi-An Huang, City Manager
From: Brooke McKenna, Acting Chief
Date: March 30, 2023
Subject: AR-22-79 – November 14, 2022

This report has been prepared in response to Awaiting Report Item AR-22-79 from the November 14, 2022 City Council Meeting, requesting that the Traffic, Parking, and Transportation Department and Department of Public Works meet with and receive input from residents living on the streets in the impacted area of the Garden Street Safety Improvement Project to discuss strategies to mitigate and reduce overflow and cut-through traffic, including the proposal mentioned in the order, or other traffic calming or traffic diversion methods, and report back to the Council on any short-term recommendations no later than December 19, 2022. The order further requests that a final report be submitted no later than March 27, 2023. This memorandum is intended to respond to the request for the final report.

Executive Summary

In October 2022, the City of Cambridge installed quick-build separated bike lanes on a portion of Garden Street as part of the implementation of the City's Cycling Safety Ordinance. To accommodate separated bike lanes on each side of the street and retain some parking where it was requested by community members, the City changed the operation of Garden Street between Huron Avenue and Concord Avenue from a two-way road to an eastbound one-way for vehicles.

This report, prepared by the City of Cambridge Traffic, Parking, and Transportation Department responds to Awaiting Report Item AR-22-79, which requests a final report on how resident concerns about Garden Street switching to one-way traffic are being addressed.

This report:

- Evaluates the effects of the Garden Street Safety Improvement Project on traffic speeds, traffic volumes, and parking on Garden Street and the surrounding neighborhood.
- Examines the potential outcomes of returning the section of Garden Street from Linnaean Street to Huron Avenue to two-way vehicular traffic.

- Responds to comments from residents about parking on Garden Street, trucks on Walker Street, and traffic at the Garden/Huron intersection.
- Makes recommendations on further measures the City could take to address resident concerns.

Key takeaways include:

- **Speeds:** Count data shows that speeds have increased slightly on all streets that were monitored. Since no changes were made to the geometry or character of the streets surrounding the project, we believe a combination of data collection margin of error and placement of the devices account for much of the changes in vehicular speeds.
- **Traffic volume:** Traffic volume data shows that, while many streets in the neighborhood have increases in vehicle volume, these increases are not out of scale with traffic volumes on similar streets throughout the City.
- **Parking availability:** Parking counts indicate ample parking availability along Garden Street and neighboring streets at midday and overnight. While some streets have high parking utilization, street parking across the study area is underutilized according to parking management standards.
- **Changing traffic patterns on Garden Street:** Restoring the section of Garden Street from Linnaean Street to Huron Avenue to a two-way for vehicles would likely reduce comfort and safety for people biking and walking, and increase queues, gridlock, and congestion near the Garden/Huron/Sherman intersection. While this change may divert some cut-through traffic from Raymond Street, traffic patterns will likely not change to the extent that residents hope for. However, there are measures the City could take to slow or divert traffic on side streets, which are outlined in this report.
- **Trucks on Walker Street:** It is unlikely that the state will approve a truck restriction on Walker Street based on MassDOT's criteria. However, based on the parking utilization on the street, there may be an opportunity to remove spaces at the bend to keep trucks from getting stuck while turning.
- **Moving parking on Garden Street:** We do not plan to move parking on Garden Street: the current design has safety benefits, moving parking to the north side would not add many parking spaces, and we have heard primarily positive feedback from the users of the existing spaces.

Our recommendation is that we leave the design of Garden Street itself as-is and continue to work on solutions for traffic and speed management within the greater project area. This report provides detail on a number of alternatives to achieve the desired results without major modifications to the project. The following ideas are explored in the report and could help reduce cut-through traffic in the neighborhood, but represent fairly significant changes to the operation of the streets. The City would need to consult the residents of the area before implementing any of these measures.

Recommendations and potential changes include:

- **No left turn sign on Walker Street at Linnaean Street for peak hours:** Reduction in cut-through traffic on Raymond Street that originates from Massachusetts Avenue (Shepard Street to Walker Street to Linnaean Street to

Raymond Street). Reduction in cut-through traffic along Walker Street and Graham and Parks School.

- **Parking chicanes on Raymond Street:** Potential for speed reduction.
- **All-way stop at Raymond Street and Huron Avenue intersection:** Further analysis and observations are required, but this could potentially improve safety at this location for all users if this type of control is warranted.
- **Fernald Drive and Robinson Street one-way pair:** Reduced cut-through traffic on Madison Street, Robinson Street, and Raymond Street as well as an opportunity to add more permit parking on a street with high parking utilization.

The remainder of this report examines the data, suggestions from the community, and potential traffic and speed management solutions in more detail. Use the table of contents below to navigate to specific sections:

Contents

Executive Summary.....	1
Project Background	4
Feedback Since Installation	5
December 15 Council Order Response.....	6
Changes Since December Council Order Response.....	6
Speed and Volume Data	7
Key Takeaways.....	7
Data Collection.....	7
Methods and Notes	8
Summary.....	9
Streets with Increases in Volume.....	14
Comparisons to Pre-COVID Volumes.....	21
Comparisons to Citywide Volumes	22
Parking Utilization Data	23
Key Takeaway	23
Parking Background.....	23
Methods	24
Parking Study Results.....	25
Analysis: Returning Garden Street to Two-Way Vehicular Traffic between Linnaean Street and Huron Avenue	33
Key Takeaway	33
Background.....	33
Safety of the bicycle facility	36
Impacts to traffic signals and congestion	37

Other Considerations	44
Summary.....	44
Analysis: Moving Parking on Garden Street.....	45
Key Takeaway	45
Background.....	45
Safety and Sightlines	46
Abutter Requests	46
Analysis: Trucks and Traffic on Walker Street.....	47
Key Takeaway	47
Background.....	47
Trucks and Other Heavy Vehicles	47
Volume.....	49
Non-viable Changes	50
Residents-Only signs	50
Returning Garden Street to a Full Two-Way for Vehicles	50
Recommendations and Potential Changes	52
No Left Turn Sign on Walker Street at Linnaean Street for Peak Hours.....	52
Parking Chicanes on Raymond Street.....	52
All-way Stop at Raymond Street and Huron Avenue Intersection	53
Fernald Drive and Robinson Street One-way Pair.....	53

Project Background

In October 2022, the City of Cambridge made changes to Garden Street to add quick-build separated bike lanes as part of the Garden Street Safety Improvement Project. Major modifications to the street included changing the operation of Garden Street to eastbound one-way for vehicles between Huron Avenue and Concord Avenue and a reduction in parking spaces. Work included new traffic signal indications and phasing, updated metal street signs, road markings, bicycle stencils, and flex posts. This spring, more colored surface treatments will be installed as part of the project.

The Garden Street Safety Improvement Project is part of the implementation of the Cycling Safety Ordinance. The Ordinance, passed in 2019 and amended in 2020, represents a shift from designing our streets primarily around car transportation to also prioritizing cycling, which is resulting in changes to how we allocate space on City streets. The Cycling Safety Ordinance mandates the accelerated development of a full network of separated bike lanes across the City.

Creating this alternative transportation network is a significant step toward building a sustainable, healthy future for Cambridge, but it does not come without other impacts.

In a dense city with limited space on our roadways, making space for separated bike lanes is not easy, and results in reductions in parking and changes to how the roadway network operates. We recognize that it is challenging for many residents, that our roads are becoming more complex, and that we are making difficult trade-offs.

The decision to include the one-way conversion of Garden Street came from the input of the members of the community who took part in the public process in advance of the project's implementation. The conversion to one-way was appealing both to residents who prioritized retaining parking and to residents that bike, who preferred one-way bike lanes on each side of the street. Removing one of the two travel lanes provided enough space to both retain parking in areas most-requested by the community and to add the one-way separated bike lanes on each side.

With the installation of bike lanes and conversion of the road to one-way in late October, we saw an increase in traffic on many nearby streets and heard significant concerns from the wider community about increases in traffic volumes, speeds, and general traffic safety in the neighborhood.

When significant changes are made to traffic patterns, it can take three to six months for drivers to adjust to new routes. Following the initial change to one-way operation, we saw increased congestion on certain streets as users learned and adjusted. We recognize that this was challenging for residents, and we continued to hear from members of the community in the months after the changes were implemented. We hosted two in-person events and one virtual event specifically to hear concerns from the community that we could investigate. Straightforward requests and changes have now been completed, and this report seeks to address concerns that are either larger in magnitude, or that required a complete picture of the fully developed effects of the project.

Feedback Since Installation

To prepare for the December 15 Council order response and this report, the City solicited resident feedback on the Garden Street Safety Improvement Project through three neighborhood listening sessions, one-on-one conversations with residents, an online feedback form, and emails from residents. Neighborhood listening sessions included:

- November 9, 2022: First listening session on impacts of the Garden Street Safety Improvement Project, held at the Graham and Parks School. About 80 people attended this meeting.
- November 29, 2022: Second listening session on impacts of the Garden Street Safety Improvement Project, held at the Graham and Parks School. About 100 people attended this meeting.
- January 4, 2023: Third listening session on impacts of the Garden Street Safety Improvement Project, held on Zoom. About 120 people attended this meeting.

December 15 Council Order Response

On December 15, 2022, the Traffic, Parking, and Transportation Department submitted [a memorandum](#) in response to Awaiting Report Item AR-22-79's request for short-term recommendations.

This memo, included in the appendices of this report, included:

- A summary of outreach conducted prior to project installation and after installation.
- An initial data analysis, comparing vehicle volume and speed data from October 12 and the first week of December.
- An overview of changes made in response to community concerns. These included making signal timing adjustments at the Concord/Huron and Garden/Huron/Sherman intersections, adding "Wrong Way" biking signs, and encouraging drivers to take alternate routes via VMS message boards.

Changes Since December Council Order Response

In the December Council order response, the City outlined what changes were made in response to resident concerns. Since then, the City has made several additional changes:

Garden/Huron/Sherman Traffic Signal Timing Changes

Residents told us that it was hard to turn left onto Sherman Street from eastbound Huron Avenue due to opposing westbound Huron Avenue traffic, and that this caused congestion on Huron Avenue between Concord Avenue and Garden Street.

In response, we added a 10 second leading protected left turn phase for eastbound Huron Avenue traffic to provide an opportunity for left turns without waiting for a suitable gap. This helped the signal process more left turns and clear the block more efficiently.

This change was made on Friday, February 10. Observations performed the following Monday, Tuesday, and Wednesday showed that, while Huron Avenue was occasionally backed up, there were also phases where the blocks from Concord Avenue to Garden Street emptied completely.

Warning Sign for Large Trucks Using Walker Street

Residents observed that more large trucks are using Walker Street between Garden Street and Shepard Street and are getting stuck at the bend in the road. In response, we installed a warning sign for large trucks at the corner of Walker Street and Garden Street. The sign warns of the sharp turn on the block of Walker Street between Garden Street and Shepard Street.

We present more analysis on this concern later in this report.



Speed and Volume Data

Key Takeaways

Speeds: Count data shows that speeds have increased on all streets that were monitored in the project's vicinity. Since no changes were made to the geometry or character of the streets surrounding the project that we obtained counts from, we believe a combination of data collection margin of error and placement of the devices account for much of the changes in vehicular speeds.

Traffic volume: Traffic volume data shows that, while many streets in the neighborhood have increases in vehicle volume, these increases do not put them out of scale with traffic volumes on similar streets throughout the City. The most noticeable traffic increases were on Concord Avenue, Madison Street, Huron Avenue, and Raymond Street.

- Traffic increases on **Concord Avenue** were accommodated by existing infrastructure, including changes made to signal timings following the project's implementation.
- Current traffic volumes on **Huron Avenue** are within the range of traffic counts taken in May 2018.
- Current traffic volumes on **Madison Street** remain in line with what we would expect to see for a side street.
- Traffic on **Raymond Street** increased in the westbound (away from Harvard Square) direction, although total traffic volumes are comparable to pre-COVID levels from May 2018.

Learn more about potential steps the City can take to reduce traffic volumes in the last section of this report.

Data Collection

We collected volume, speed, and vehicle classification data in and around the project area on October 12, 2022 (before we installed changes to Garden Street), and then monthly from December 2022 through March 2023. These counts helped us to monitor the impacts of the project and the effects of any interim changes that were implemented to address concerns during the break-in period. Data was collected from 14 count locations (unless otherwise noted) using in-road tube counters or video detection. The March counts taken on March 8 and 9, 2023 serve as the “after” data for the purposes of this report. The 14 count locations were as follows:

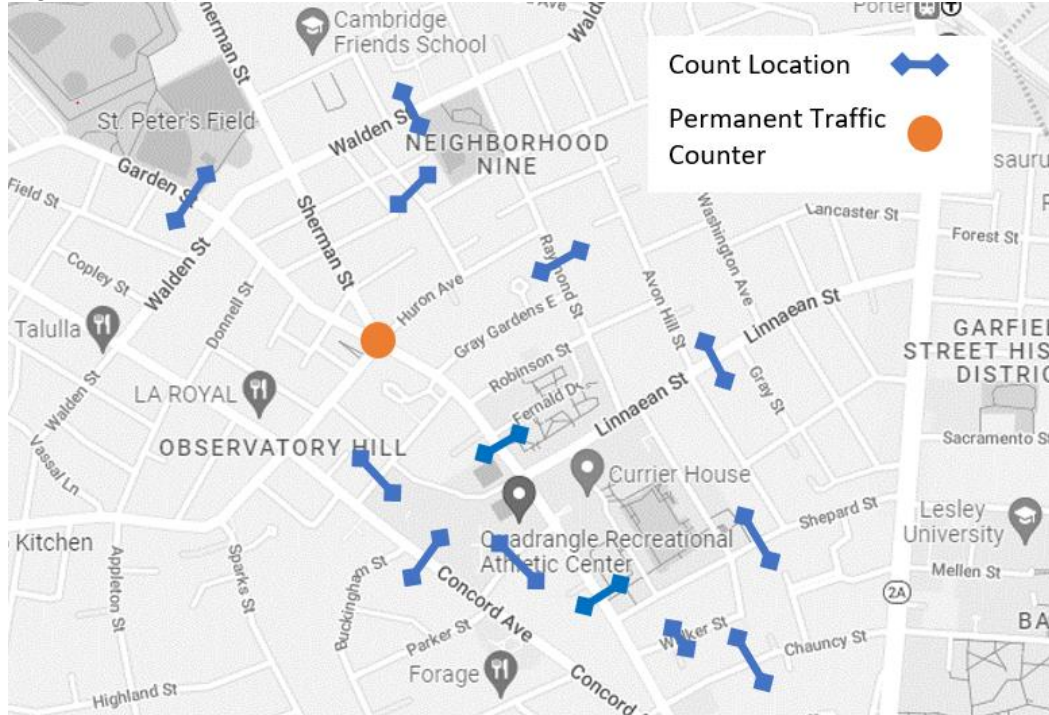
- | | |
|--|--|
| 1. Bond Street (at #20) | 10. Newell Street, north of Upland Road |
| 2. Chauncy Street (at #23) | 11. Raymond Street, north of Gray Gardens East |
| 3. Concord Avenue, west of Buckingham Street | 12. Shepard Street, east of Walker Street |
| 4. Garden Street, east of Ivy Street | 13. Walden Street, east of Wood Street |
| 5. Garden Street, west of Robinson Street | 14. Walker Street (at #33) |
| 6. Garden Street, west of Shepard Street | |
| 7. Huron Avenue, north of Garden Street | |
| 8. Linnaean Street west of Gray Street | |
| 9. Madison Street, south of Holly Avenue | |



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Figure 1: Map of Data Collection Locations



Methods and Notes

- The City uses an independent traffic data collection firm to collect speed and volume data. Equipment is placed on the street in the same locations each time to allow for comparisons over time. Weather can impact our ability to collect data, as the equipment can malfunction due to snow, but efforts were made to take advantage of good weather days to demonstrate trends over time.
- Volume data for Huron Avenue was collected using the traffic signal controller's native traffic counting and detection mechanism (Miovision). This data is available for all days for the intersection of Garden Street, Huron Avenue, and Sherman Street.
- Except for the October counts, two days of data was collected each month. We then averaged the two days to compare to the single day of data collection done prior to the project implementation. Counts were collected on October 12 and December 7 and 8, 2022, and January 11 and 12, February 15 and 16, and March 8 and 9, 2023.
- Data collection equipment varied slightly over the course of the counts. Initial counts were obtained using in-road tube counters, while "after" counts were collected using radar and/or video detection. Care was taken to locate each data collection device in the same location for each count, however, their locations varied slightly due to the way in which they are affixed. In-road counters need to

be at locations where there is no parking, like at a fire hydrant, while the radar/video counters need to be affixed to a tall structure like a light pole or utility pole.

- For some locations, we have historical data from years past that can help contextualize the volumes, speeds, or vehicle classifications that we experience today. This data was included in our analysis when available.

Summary

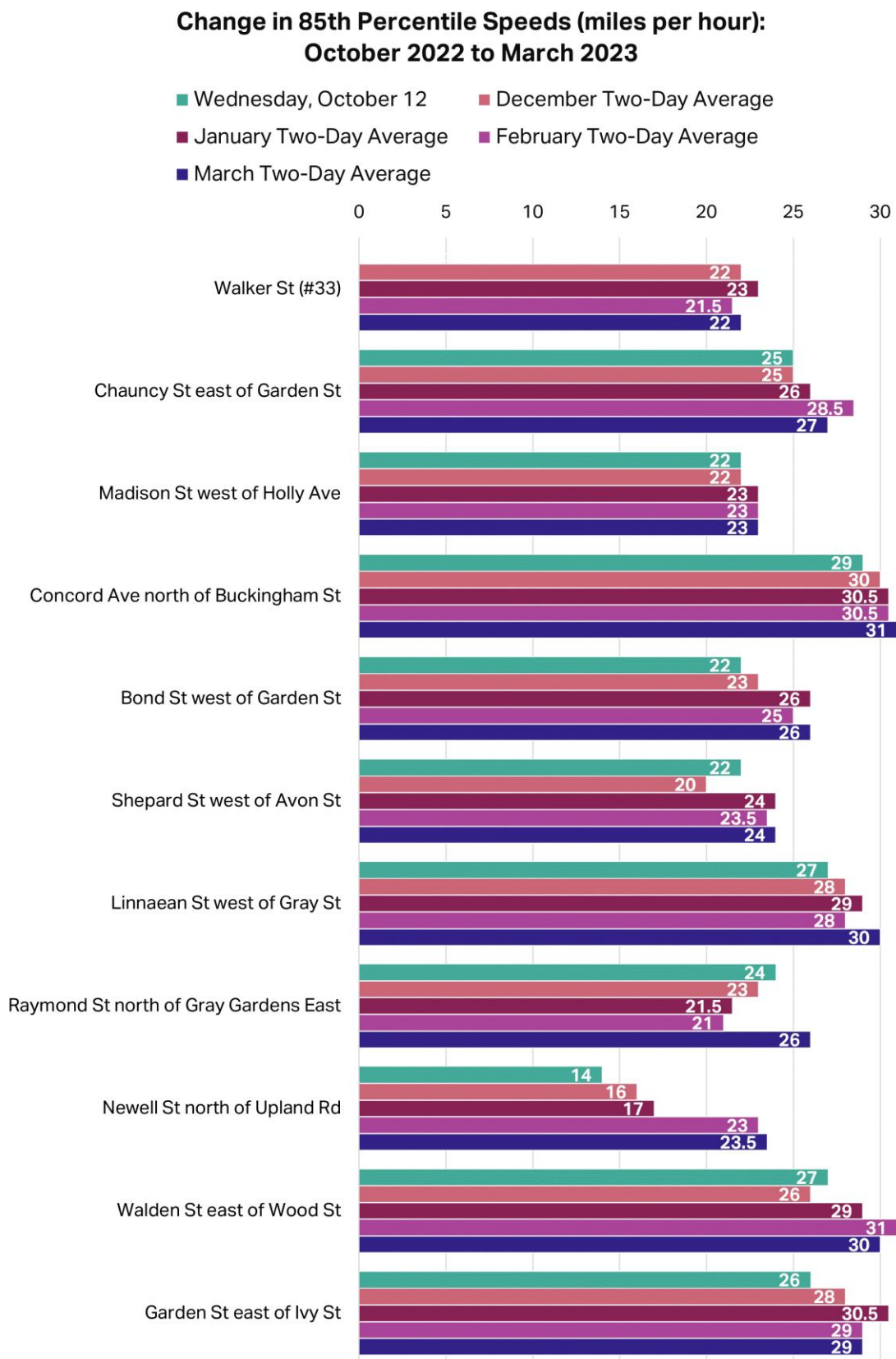
Speed

Like many places in Cambridge, speed continues to be a concern in the project area as it was prior to the project, and we continue to look for ways to decrease speeds across the neighborhood and throughout the City.

Variations of 1 mile per hour (mph) to 2 mph are within the margin of error for the data collection equipment. Care was taken to locate each data collection device in the same location for each count, however, their locations varied slightly due to the way in which they are affixed. In-road counters need to be at locations where there is no parking, like at a fire hydrant, while the radar/video counters need to be affixed to a tall structure like a light pole or utility pole.

Since no changes were made to the geometry or character of the streets that we obtained counts from, we believe a combination of data collection margin of error and placement of the devices account for much of the changes in vehicular speeds.

Figure 2:



We track the 85th percentile speed, which is consistent with industry best practice. This is the speed at or below which 85 percent of the drivers travel on a road segment. Most motorists (typically 75 percent according to research) drive within 5 mph of the 85th percentile speed, making it more representative of the speeds experienced on the roadway when compared to average speeds.

- **Overall speed impacts are relatively small, typically between 2 mph and 3 mph.** For example, on Shepard Street, the 85th percentile speed increased from 22 mph to 24 mph. On Chauncy Street, the 85th percentile speed increased from 25 mph to 27 mph.
- **In several locations, the 85th percentile speed is above the speed limit**, similar to prior to the project implementation. For example:
 - Linnaean Street (speed limit 20 mph) saw an increase from 27 mph to 30 mph.
 - Bond Street (speed limit 20 mph) saw an increase from 22 mph to 26 mph.
 - Concord Avenue (speed limit 25 mph) saw an increase from 29 mph to 31 mph.

To reduce speeds on streets in the Garden Street project area (and other areas in Cambridge), there are options other than signage and enforcement. Between 2016 and 2019, many speed limits in Cambridge were reduced to 25 mph (unless otherwise posted) and to 20 mph (on most side streets) as part of our commitment to Vision Zero. By lowering speed limits, we made it possible to employ traffic calming techniques that will self-enforce lower speed limits through design. As streets are reconstructed or modified with traffic-calming measures appropriate for lower-speed streets, we will see many of these speeds reduced.

Volume

Volume counts include all modes of wheeled travel, including personal vehicles, trucks, buses, people on bikes, etc. Counts took place over 48-hour periods that represented normal traffic days (Tuesdays, Wednesdays, and/or Thursdays) with the exception of the initial Wednesday, October 12, 2022 count, which was for a single 24-hour day on a holiday week. Unfortunately, delays in scheduling the counts before the project's installation required this less-than-ideal count day selection. To ensure the validity of the data, we used our Miovision counters to compare October 12 to other dates that would have had more typical volumes and found them to be similar. Regardless, it is still possible that this initial count day may have skewed comparative data to some extent.

By monitoring traffic volumes on 14 streets throughout the project area between October and March, City staff sought to identify and address any unintended consequences of changing Garden Street to a one-way between Huron Avenue and Concord Avenue. The following figure presents 12 of the count locations (omitting the two Garden Street counts along the project), to provide context for the selected count locations.

Figure 3:

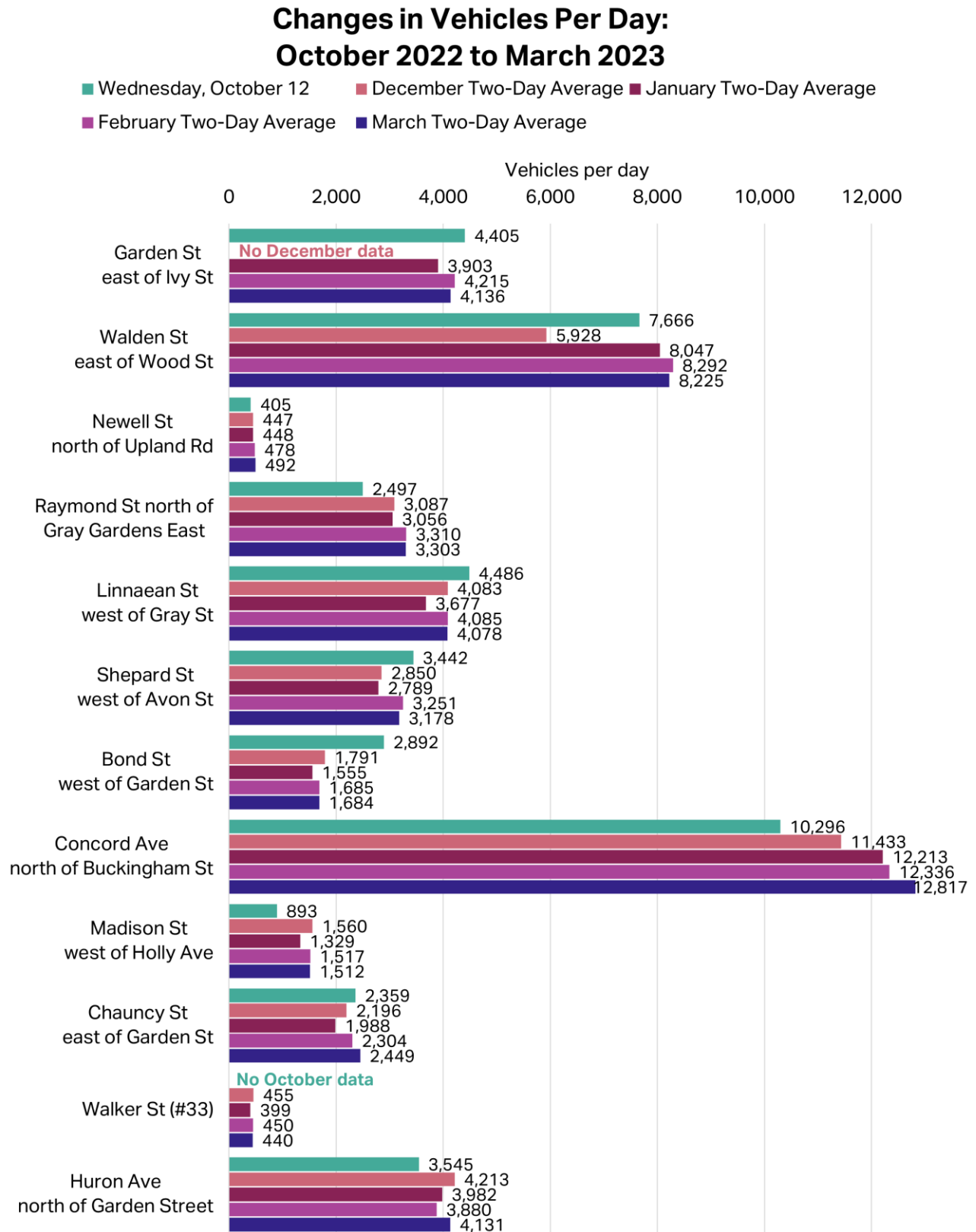
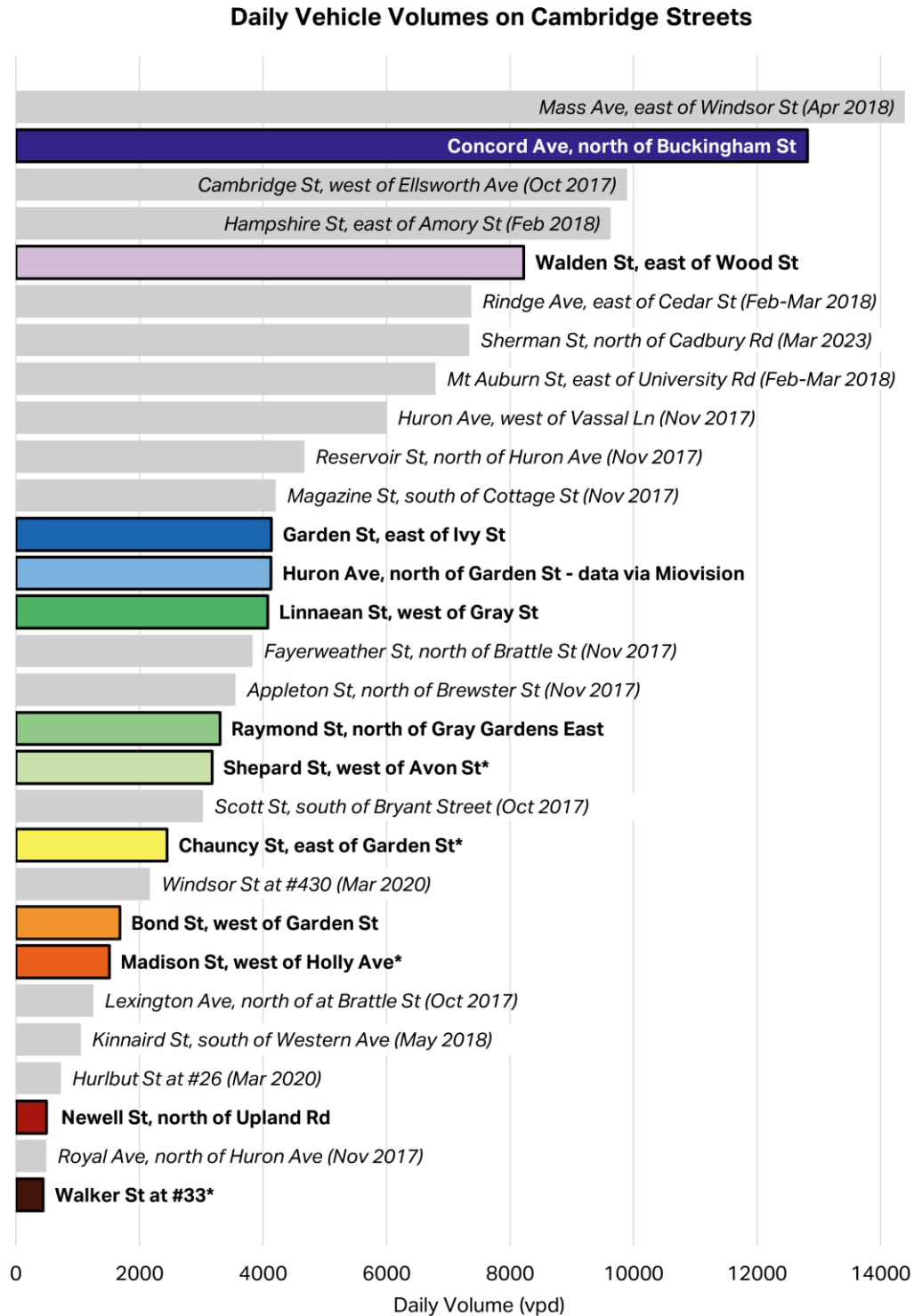


Figure 4: Traffic counts on Cambridge streets, in vehicles per day. March 2023 counts from the project area are in color with a bold outline. Comparison streets are in grey.

* Streets marked with an asterisk are one-way



Streets with Increases in Volume

This next section we will discuss notable increases in volume on specific streets throughout the analysis area.

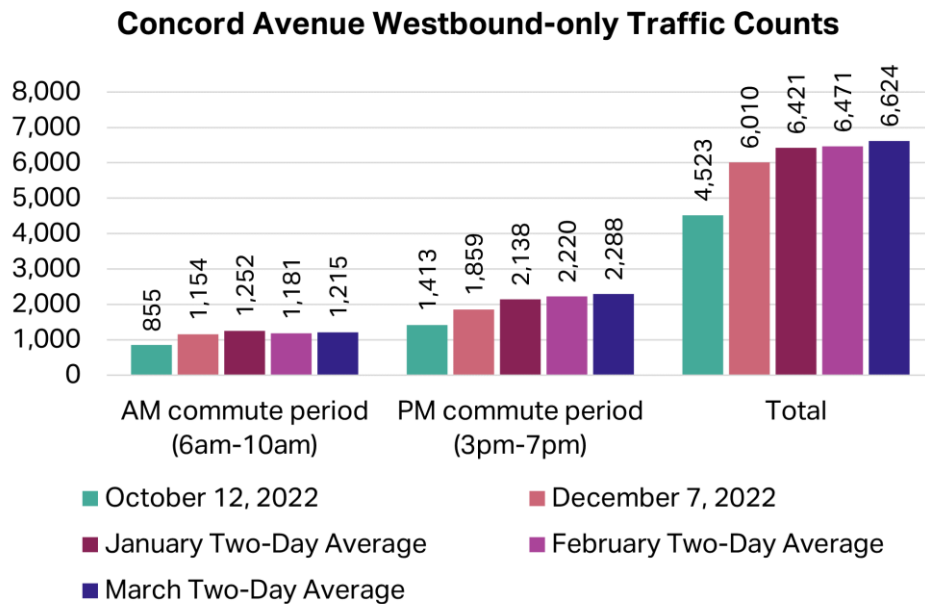
Concord Avenue

Concord Avenue experienced the greatest increase in the number of vehicles using the roadway, going from 10,296 in October 2022, to 12,817 in March 2023. Most of this increase was in the westbound direction, away from Harvard Square.

The increased traffic volumes on Concord Avenue were accommodated by existing infrastructure, including changes made to signal timings at the Concord Avenue and Huron Avenue intersection late last year.

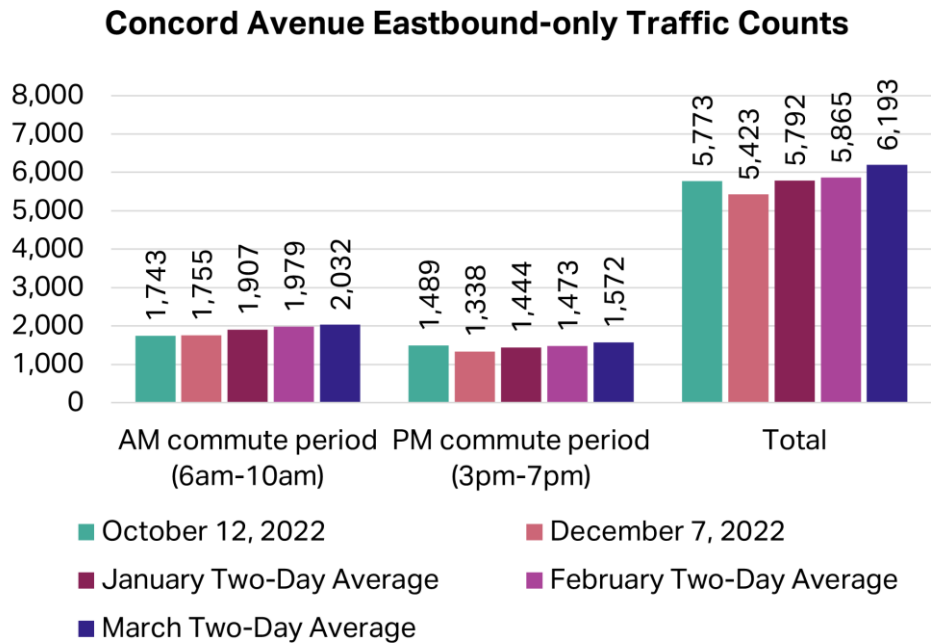
Concord Avenue was one of the anticipated alternative routes for rerouted westbound trips to use in place of Garden Street. Westbound volumes increased because of the addition of some rerouted Garden Street trips during the morning commute period (6 a.m. to 10 a.m.), the evening commute period (3 p.m. to 7 p.m.), and for the day overall. Each commute period consists of the total vehicles during the 4-hour window. For example, in March 2023, the AM commute period experienced 1,215 westbound vehicles over 4 hours, averaging 304 vehicles in that direction per hour.

Figure 5: Concord Avenue Westbound-Only Traffic Counts



Those traveling eastbound (towards Harvard Square) did not experience a change to the routes available to them in that direction due to the project. As a result, eastbound volumes remained largely steady with only slight increases during the two commute periods and for the day overall.

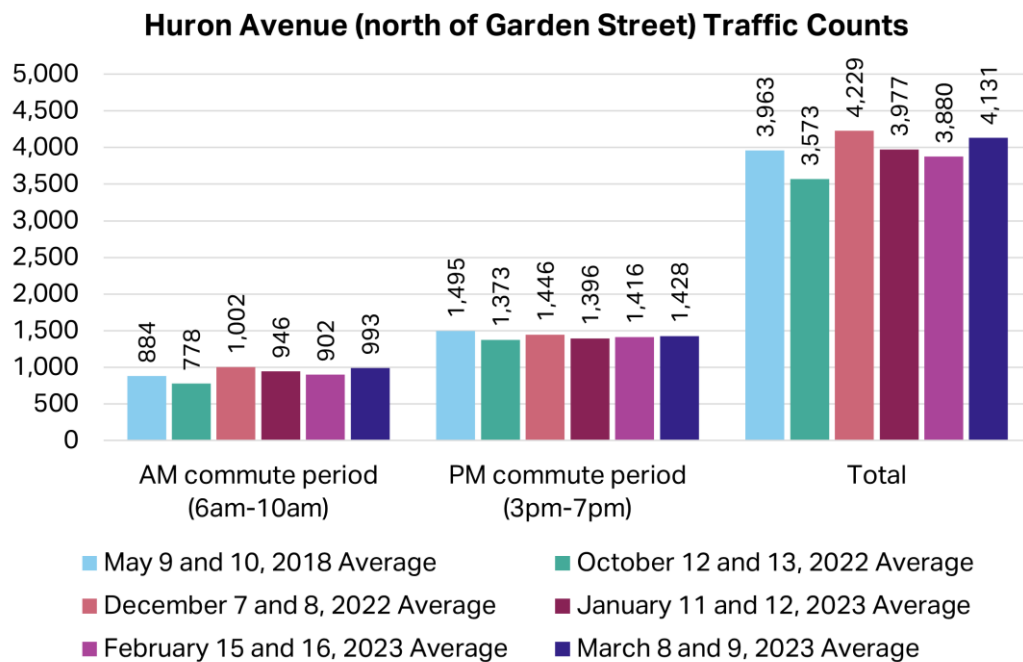
Figure 6: Concord Avenue Eastbound-Only Traffic Counts



Huron Avenue

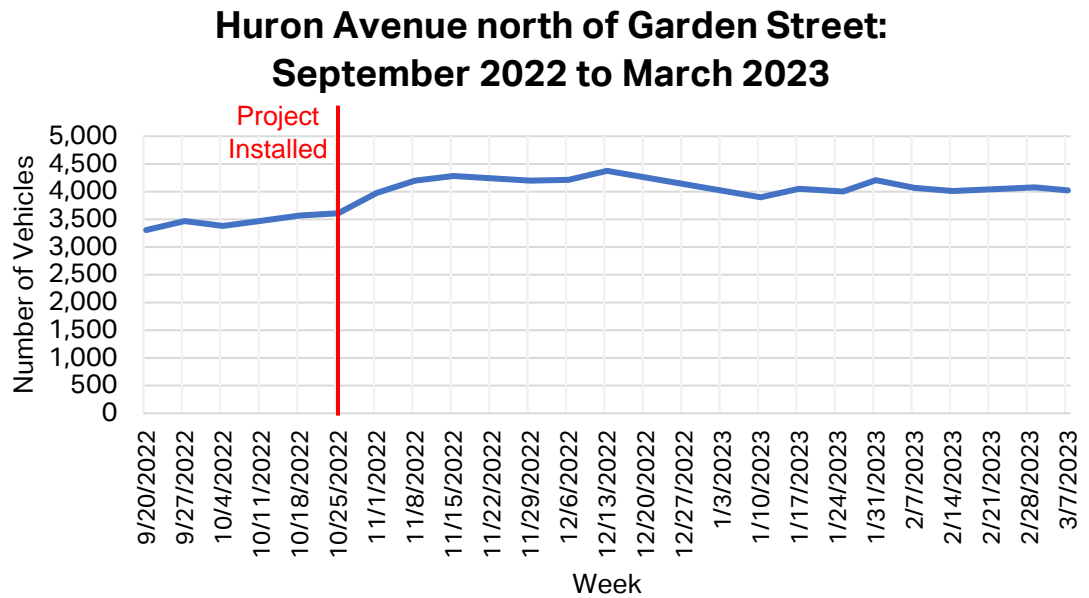
Huron Avenue, to the north of Garden Street, experienced a large increase in volumes following installation of the project when compared to the October count (3,545 before versus 4,131 now). To help contextualize this increase, we reviewed counts taken from the same location in May 2018. The “before” counts in October 2022 were the lowest volumes for the morning commute period (6 a.m. to 10 a.m.), evening commute period (3 p.m. to 7 p.m.), and for the day overall; however, all four post-project implementation counts were within the range of the May 2018 counts. Each commute period consists of the total vehicles during the 4-hour window. For example, in March 2023, the AM commute period experienced 993 vehicles over 4 hours, averaging 248 vehicles per hour.

Figure 7: Huron Avenue (north of Garden Street) Traffic Counts



The presence of the Miovision traffic signal controller at the nearby Garden Street, Huron Avenue, and Sherman Street intersection also allows us to view trends since it continuously counts vehicles. The chart below compares the weekly average number of vehicles using Huron Avenue north of Garden Street between September 2022 and March 2023, omitting non-representative days (school vacations, snowstorms, etc.). After initial increases, Huron Avenue volumes appear to have reduced since November—shortly after the project was implemented—and have been steady from January through early March 2023.

Figure 8: Huron Avenue, north of Garden Street: September to March 2023

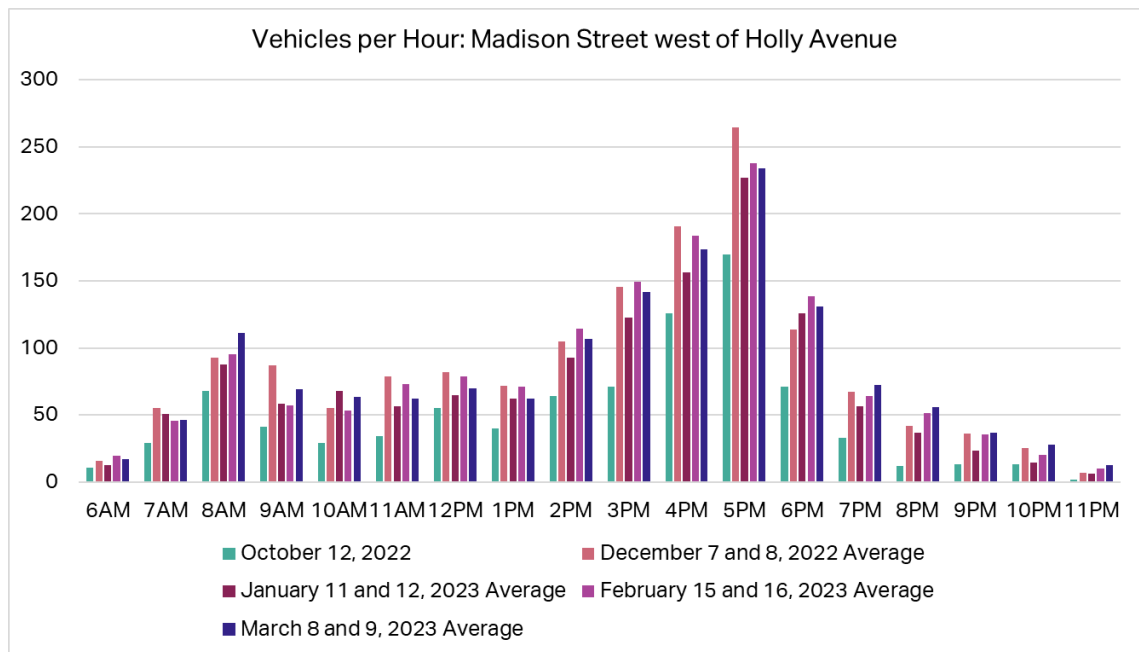


Madison Street

In our December report, we noted that volumes on Madison Street increased quite substantially on a percentage basis (approx. 43%), going from roughly 893 vehicles per day to 1,559 vehicles per day in early December. When Huron Avenue between Concord Avenue and Garden Street is congested, we noted that some drivers use Madison Street to Holly Avenue to try to get further ahead in the Huron Avenue queue. This was most evident during the evening commute time, specifically 4 p.m. through 6 p.m., which is also the busiest time for Madison Street in general according to our data.

With the changes we made to the traffic signals at Concord Avenue and Huron Avenue and at Garden Street at Huron Avenue and Sherman Street, we expect this cut-through pattern to be less enticing moving forward. Counts from January through March 2023 have already started to reflect fewer vehicles using this route during the evening commute hours of 4 p.m. to 6 p.m. Overall, these volume numbers remain in line with what we would expect to see for a side street. Refer back to Figure 4 for the comparison with other streets in Cambridge.

Figure 9: Vehicles per Hour: Madison Street, west of Holly Avenue

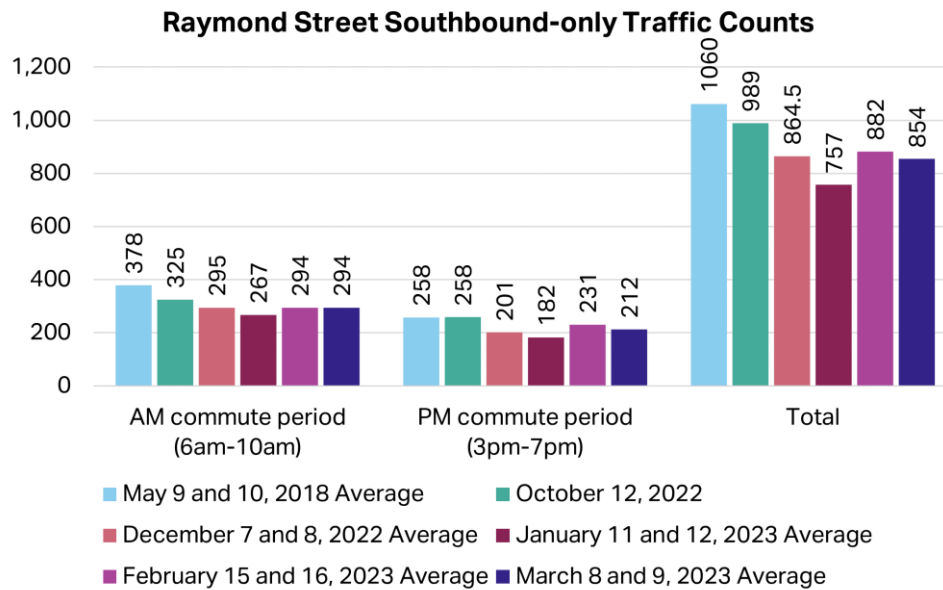


Raymond Street

Overall traffic volumes also increased on Raymond Street between October 12, 2022 and March 2023. To help contextualize this increase, we reviewed counts taken in the same location in May 2018 as part of the traffic calming improvements made at the intersection of Raymond Street and Huron Avenue (the raised intersection and crosswalks).

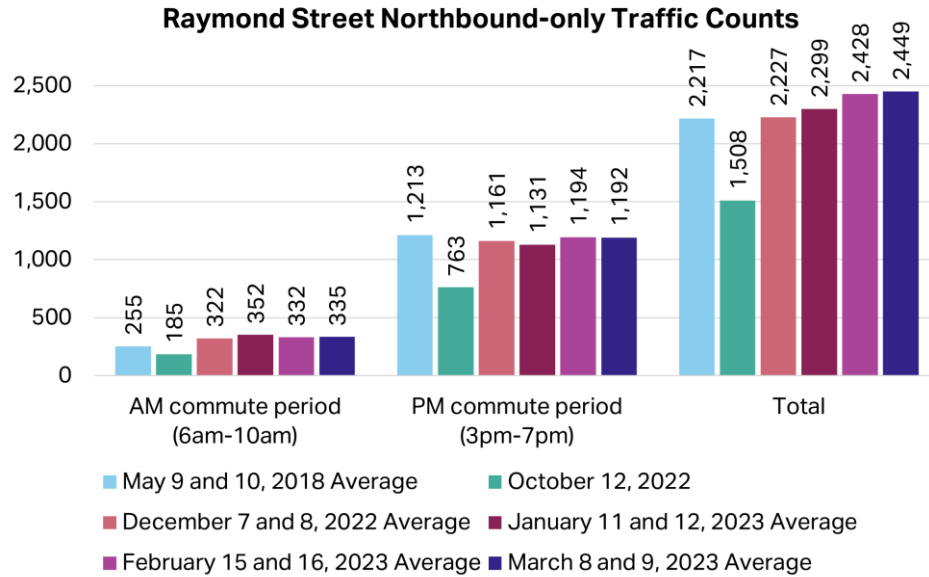
Looking at the southbound Raymond Street volumes for drivers traveling from Huron Avenue towards Linnaean Street (in the direction of Harvard Square), we found that there are lower volumes today compared to both the May 2018 and October 2022 counts during the morning commute (6 a.m. to 10 a.m.), evening commute (3 p.m. to 7 p.m.), and for the day overall. Southbound trips are unaffected by the Garden Street project, and the decline in trips in this direction can likely be attributed to changes in regional commuting patterns, work from home, etc. Each commute period consists of the total vehicles during the four-hour window. For example, in March 2023, the AM commute period experienced 294 southbound vehicles over four hours, averaging 74 vehicles in that direction per hour.

Figure 10: Raymond Street Southbound-only Traffic Counts



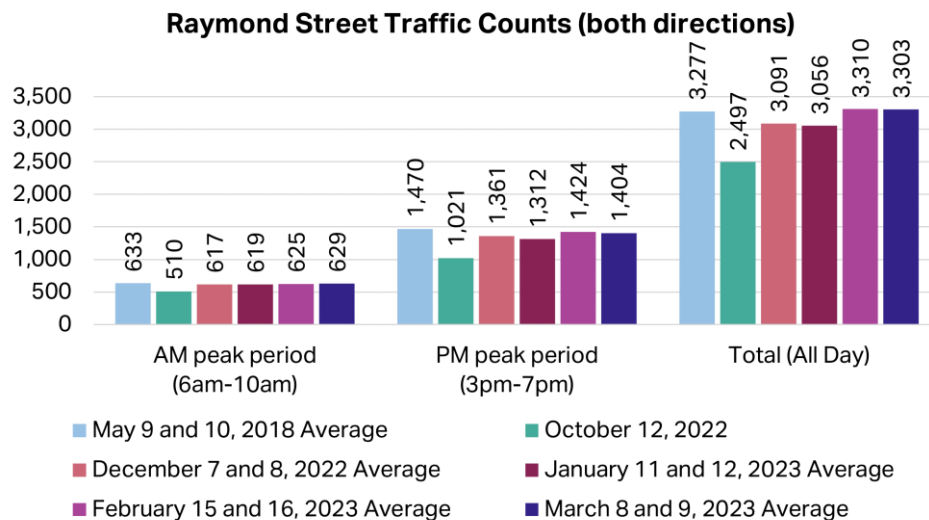
In the northbound direction (away from Harvard Square), volumes have increased significantly since October 2022 and are now comparable to the May 2018 counts for both commute periods and for the day overall. Northbound trips include rerouted Garden Street trips from Linnaean Street.

Figure 11: Raymond Street Northbound-only Traffic Counts



Total volumes in both directions combined are much higher than they were just prior to the project's implementation, but are now near even with the counts from May 2018.

Figure 12: Raymond Street Traffic Counts, both directions

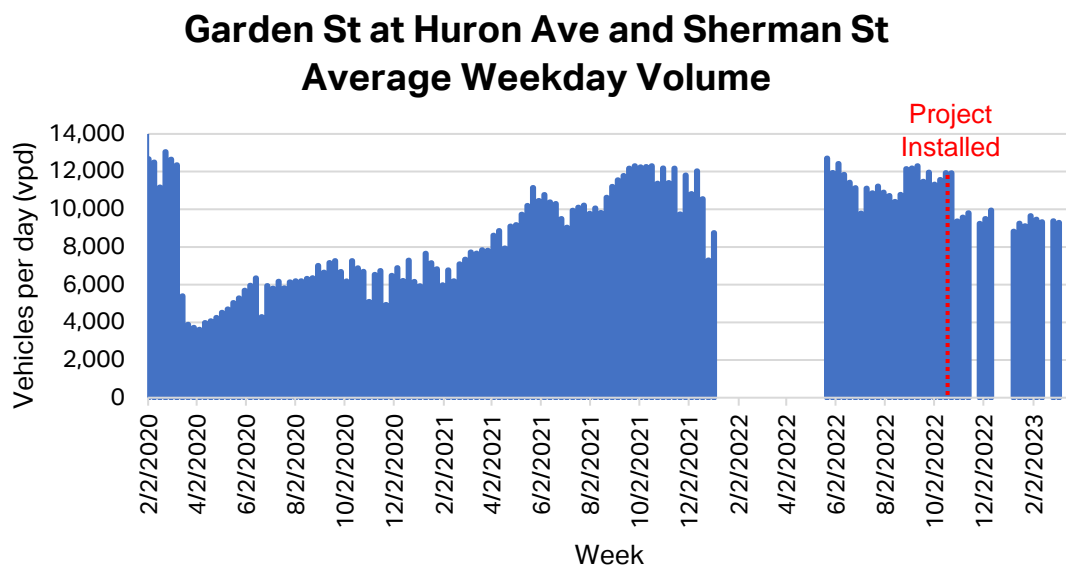


We understand that the community is interested in reducing the number of vehicles using Raymond Street. At this point, total traffic volumes seem comparable to past volumes. However, we will continue to explore options for volume and speed reduction, including some recommendations outlined later in this report.

Comparisons to Pre-COVID Volumes

The Miovision traffic controller is located at the intersection of Garden Street, Huron Avenue, and Sherman Street and it continuously counts roadway volumes. We have data at this intersection from early February 2020 through the present. Prior to travel reductions in March 2020, this intersection was processing around 12,000 vehicles per day (vpd). These volumes returned by September 2021 and had remained relatively stable through late October 2023, the point at which the Garden Street project was installed. The project removed the westbound Garden Street approach from the signal, and total volumes were reduced to approximately 9,000 vpd on average.

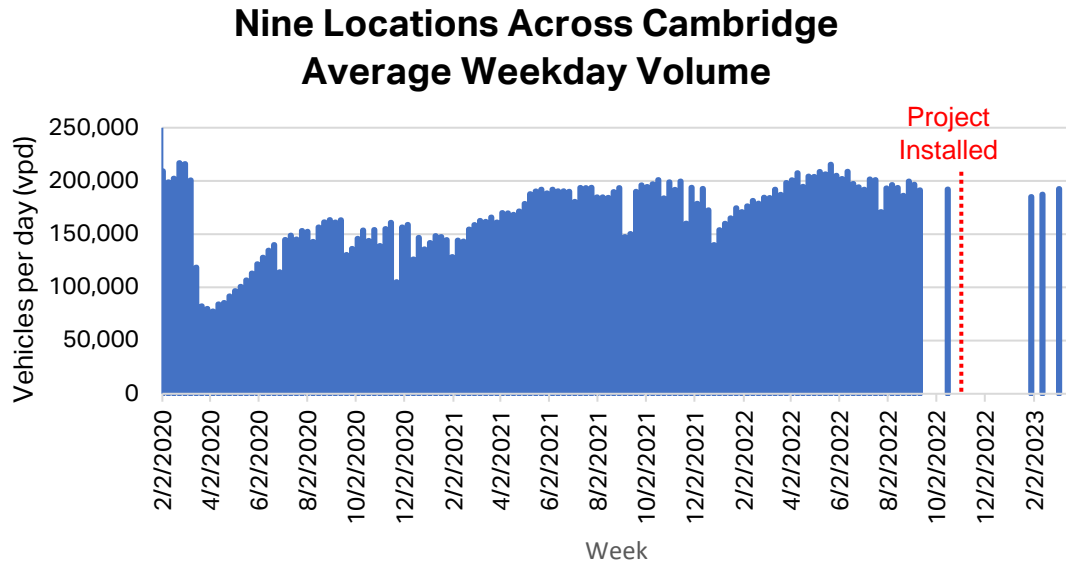
Figure 13: Garden Street at Huron Avenue and Sherman Street, Average Weekday Volume



Comparisons to Citywide Volumes

We have 17 Miovision traffic controllers at 17 signalized intersections across the City. Nine of these 17 controllers have been continuously recording count data since at least early February 2020. These can help us understand whether overall traffic volumes in Cambridge are returning to pre-COVID levels. As shown in Figure 14, volumes have already largely returned to where they were pre-COVID and haven't changed much on average since mid-2021.

Figure 14: Nine Locations Across Cambridge, Average Weekday Volume



Monitored intersections:

- Broadway and Third Street
- Concord Avenue and Blanchard Road
- Third Street and Binney Street
- Third Street and Cambridge Street
- Binney Street and Fulkerson Street
- Garden Street and Massachusetts Avenue
- Massachusetts Avenue and Fresh Pond Parkway
- Massachusetts Avenue and Vassar Street
- Prospect Street and Massachusetts Avenue

Parking Utilization Data

Key Takeaway

Both midday (10 a.m.) and overnight (10 p.m.) parking occupancy rates averaged between 72% and 74%, respectively, for the study area. Best practices for parking management set the optimal target for parking utilization at 85%. Occupancy rates below 85% indicate that someone searching for a parking space is likely to find one nearby their destination.

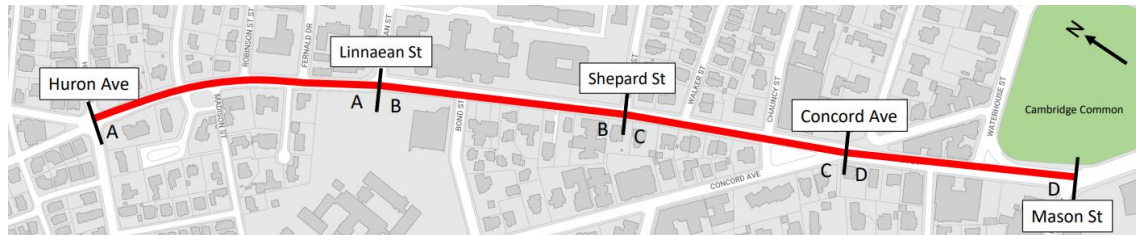
- Higher utilization is found in the eastern end of the project area during both the midday (80%) and overnight (83%) time periods, but with opportunities to find spaces nearby on side streets or abutting street segments.
- There remains excess parking capacity in the western end of the project, an area that experienced the largest removal of permit parking as part of the project.

Parking Background

The changes to Garden Street removed a little over 50 of the approximately 110 parking spaces on Garden Street between Huron Avenue and Mason Street. Most of the parking removal occurred in the western end of the project, between Shepard Street and Huron Avenue, with the Linnaean Street to Huron Avenue blocks having all of their parking removed. A majority of the total spaces removed were designated as permit parking, with loading zones, accessible/disability parking, and time-limited parking (i.e. 1-hour parking) retained or relocated nearby.

Table 1: Permit Parking Before and After Garden Street Safety Improvement Project

Huron to Linnaean		Linnaean to Shepard		Shepard to Concord		Concord to Mason		Overall	
Before	After	Before	After	Before	After	Before	After	Before	After
26	0	49	27	18	19	19	13	112	59



During the project's design phase, community members asked us to increase the parking supply on specific side streets in the western end of the project, closer to Huron Avenue, to mitigate the loss of parking on Garden Street in that area. They also asked us to identify where people who used to park along Garden Street could park instead.

We conducted a parking utilization study in March 2023 to understand where there may be high demand for on-street parking and where there may be excess capacity for parking within the Garden Street project area. The data collected and analysis that follows will be used to inform the City on what areas may be suitable to add parking and to help residents identify where they may be able to find parking within the existing signed areas.

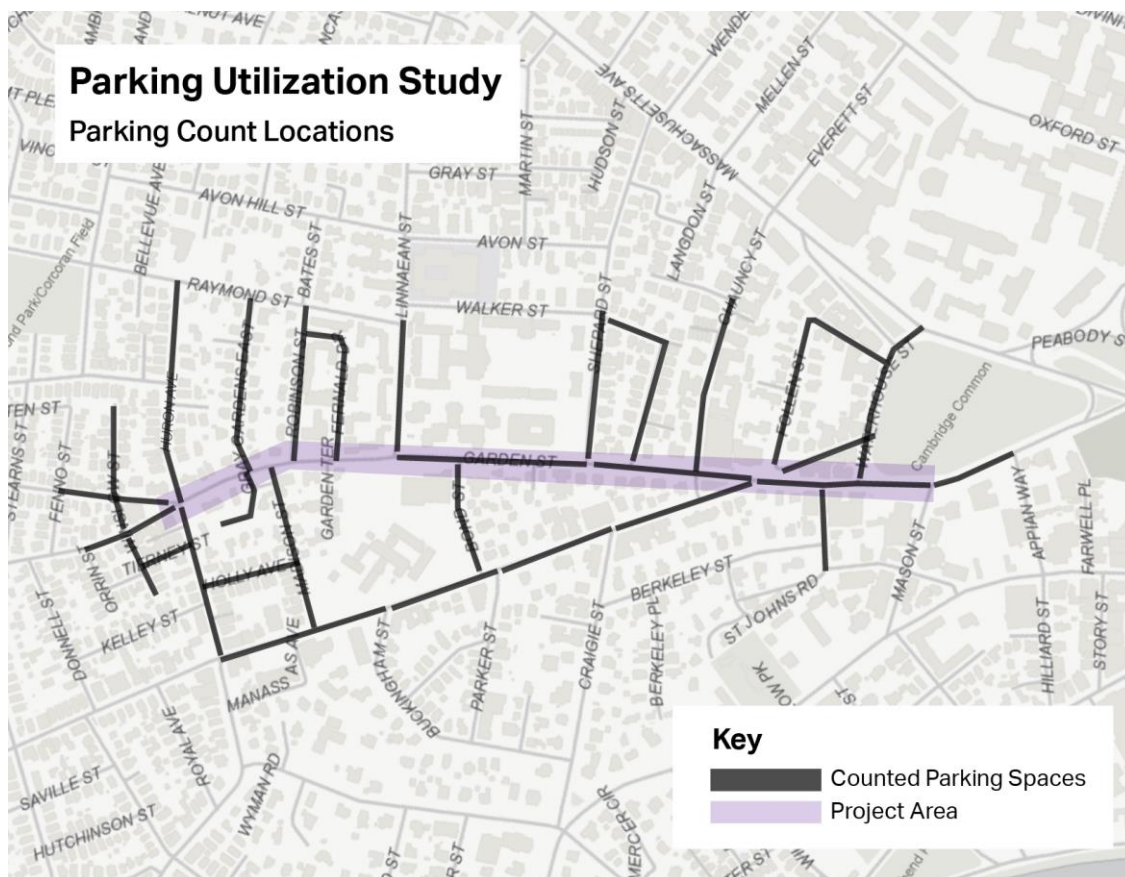
Methods

- Parking utilization was monitored on three separate days and averaged to obtain a representative figure. Care was taken to ensure that observations were conducted on “typical” days, meaning weekdays with fair weather, schools in session, no snow present, and no street cleaning scheduled. Observations were performed on Thursday, March 8; Tuesday, March 21; and Thursday, March 23, 2023.
- On each day, we conducted observations around 10 a.m. and around 10 p.m. Morning observations capture midday occupancy when many residents might be at work, and evening observations help us understand utilization overnight.
- The study included approximately 717 parking spaces within the project area and focused on permit and metered parking. Some streets within the area have loading zones and accessible/disability spaces available for use by residents, but these were not monitored as part of this study.

Study area:

- Berkeley Street (Phillips Place to Garden Street)
- Bond Street (Concord Avenue to Garden Street)
- Chauncy Street (Garden Street to Langdon Street)
- Concord Avenue (Huron Avenue to Garden Street)
- (Little) Concord Avenue
- Fernald Drive
- Follen Street
- Garden Street (Orrin Street to Appian Way)
- Gray Gardens East
- Gray Gardens West
- Holly Avenue
- Huron Ave (Concord Avenue to Raymond Street)
- Linnaean Street (Garden Street to Raymond Street)
- Madison Street
- Robinson Street
- Shepard Street (Garden Street to Walker Street)
- Sherman Street (Fenno Street to Huron Avenue)
- Tierney Street
- Walker Street (Garden Street to Shepard Street)
- Waterhouse Street
- Winslow Street

Figure 15: Parking Count Locations



Parking Study Results

The results of the parking study indicate ample parking availability along Garden Street and within the larger study area. Best practices for parking management set the optimal target for parking utilization at 85%. Occupancy rates below 85% indicate that someone searching for a parking space is likely to find one nearby their destination. The parking study showed that midday parking occupancy in the study area averaged 72% and overnight parking occupancy averaged 74%.

Parking Near Harvard Square/Cambridge Common

The Garden Street project prioritized keeping parking in the eastern end of the project area, closest to Harvard Square and Cambridge Common, where most residents do not have driveways. There was an increase of one permit parking space on Garden Street between Shepard Street and Chauncy Street (18 to 19) and a decrease of five permit spaces between Concord Avenue and Waterhouse Street (19 to 14, but this will eventually go down to 13 when the bike lane separation is added there).

The results of the study show high utilization in this immediate area during both midday (80% at 10 a.m.) and overnight (83% at 10 p.m.). However, these are under the 85% target utilization rate, and there are opportunities to find spaces nearby on side streets or abutting street segments.

Parking Near Huron Avenue/Shepard Street

In the western end of the project, between Shepard Street and Huron Avenue, experienced the most concentrated parking removal from Garden Street. We found excess capacity on all side streets at all times, with the exception of Fernald Drive.

More specific information, including street-by-street data, can be obtained through the following figures and tables:

Figure 16: Weekday Mid-Morning Parking Utilization

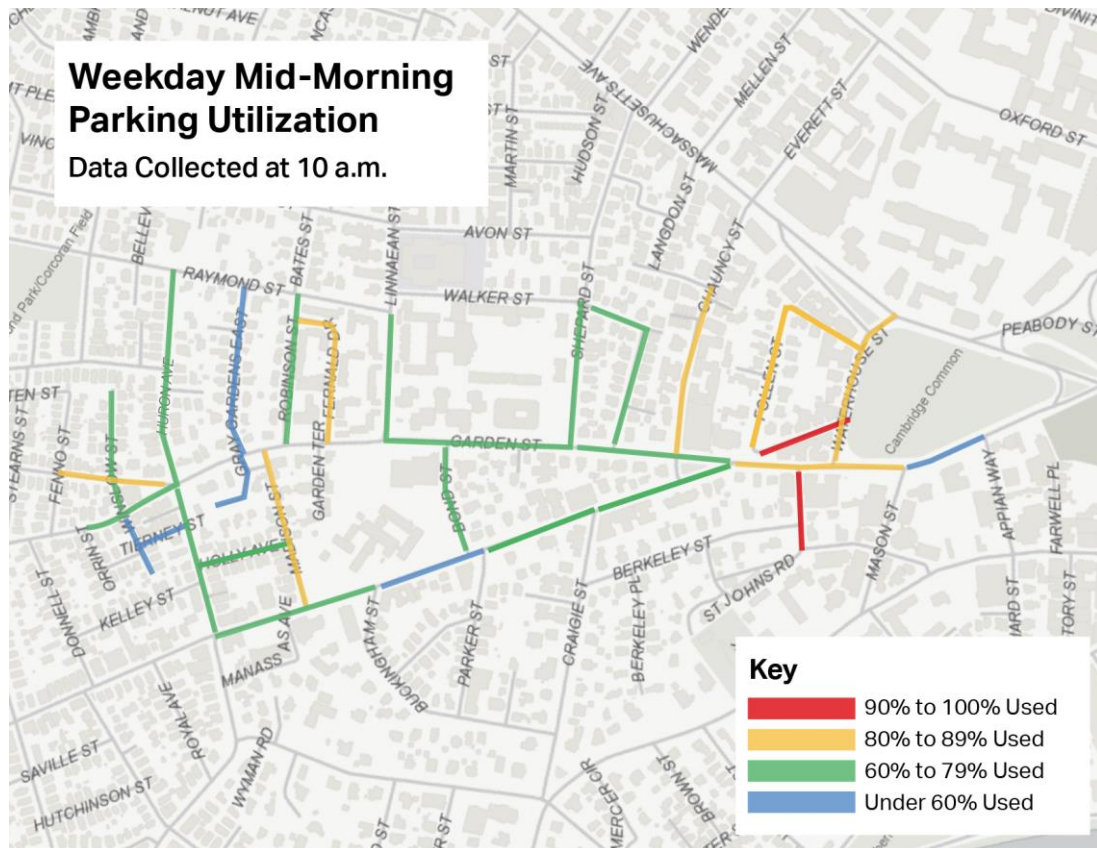


Figure 17: Weekday Evening Parking Utilization

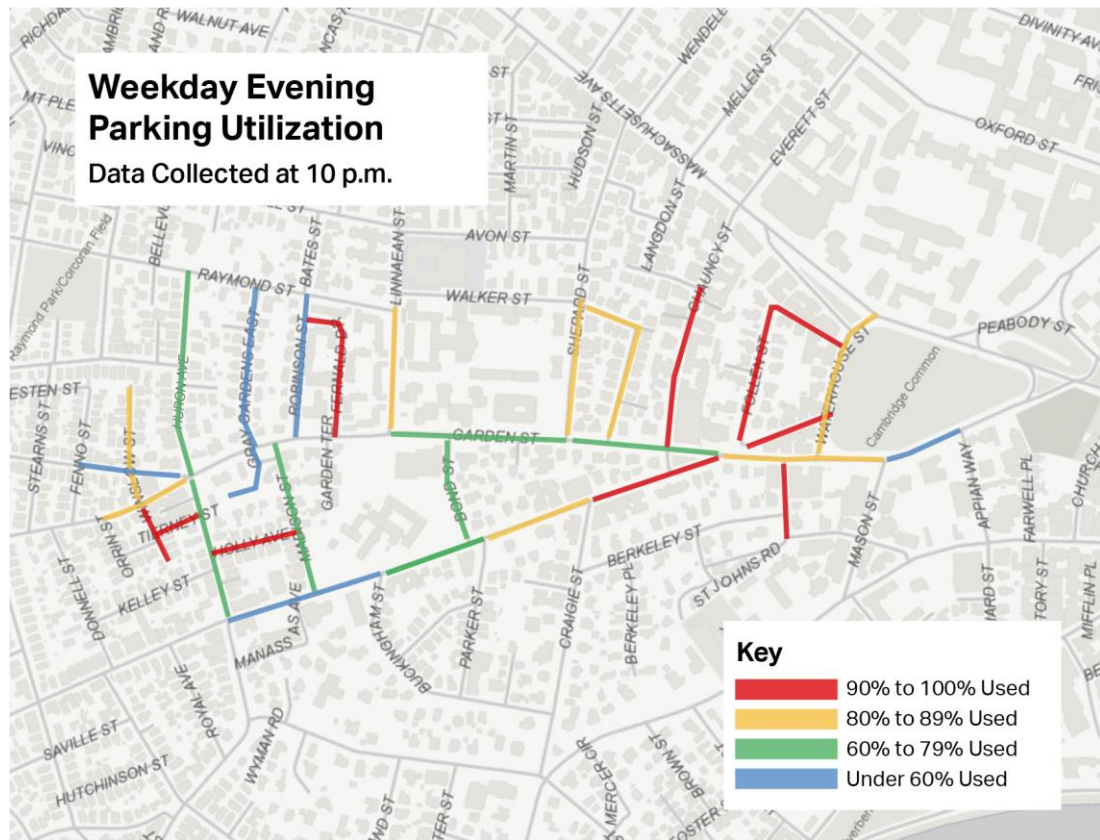


Table 2: Parking Occupancy Rates by Roadway Segment

	Segment	Time of Day	Spaces	Average Occupancy	Average Available	% Occupied
Garden Street	Orrin St to Huron Ave	10:00 AM	15	10.0	5.0	67%
		10:00 PM	15	12.7	2.3	84%
	Linnaean St to Shepard St	10:00 AM	24	17.3	6.7	72%
		10:00 PM	24	17.7	6.3	74%
	Shepard St to Concord Ave	10:00 AM	22	16.0	6.0	73%
		10:00 PM	22	15.0	7.0	73%
	Concord Ave to Mason St	10:00 AM	14	12.0	2.0	86%
		10:00 PM	14	12.3	1.7	88%
	Mason St to Appian Way (daytime meters)	10:00 AM	25	13.0	12.0	52%
		10:00 PM	25	5.3	19.7	21%
North of Garden Street	Sherman St (Fenno St to Huron Ave)	10:00 AM	11	9.0	2.0	82%
		10:00 PM	11	6.0	5.0	55%
	Winslow St	10:00 AM	16	11.0	5.0	69%
		10:00 PM	16	13.0	3.0	81%
	Huron Ave (Garden St to Raymond St)	10:00 AM	29	17.7	11.3	61%
		10:00 PM	29	19.3	9.7	67%
	Gray Gardens E (Garden St to Raymond St)	10:00 AM	24	3.0	21.0	13%
		10:00 PM	24	3.0	21.0	13%
	Robinson St	10:00 AM	39	24.7	14.3	63%
		10:00 PM	39	18.3	20.7	47%
	Fernald Dr	10:00 AM	31	25.0	6.0	81%
		10:00 PM	31	28.7	2.3	92%
	Linnaean St (Garden St to Raymond St)	10:00 AM	24	17.7	6.3	74%
		10:00 PM	24	19.7	4.3	82%
	Shepard St (Garden St to Walker St)	10:00 AM	22	16.3	5.7	74%
		10:00 PM	22	18.7	3.3	88%
	Walker St (Garden St to Shepard St)	10:00 AM	55	37.7	17.3	68%
		10:00 PM	55	45.7	9.3	83%
	Chauncy St (Garden St to Langdon St)	10:00 AM	48	42.3	5.7	88%
		10:00 PM	48	45.0	3.0	94%
	Follen St	10:00 AM	59	52.3	6.7	89%
		10:00 PM	59	54.0	5.0	92%
	Little Concord Ave	10:00 AM	31	28.3	2.7	91%
		10:00 PM	31	30.3	0.7	98%
	Waterhouse St	10:00 AM	37	32.7	4.3	88%
		10:00 PM	37	32.3	4.7	87%

Garden Street Safety Improvement Project Local Traffic Analysis — Parking Utilization Data

	Segment	Time of Day	Spaces	Average Occupancy	Average Available	% Occupied
South of Garden Street	Winslow St	10:00 AM	9	5.0	4.0	56%
		10:00 PM	9	8.7	0.3	96%
	Tierney St	10:00 AM	9	5.3	3.7	59%
		10:00 PM	9	8.7	0.3	93%
	Huron Ave (Concord Ave to Garden St)	10:00 AM	19	14.0	5.0	74%
		10:00 PM	19	12.3	6.7	65%
	Holly Ave	10:00 AM	12	7.3	4.7	61%
		10:00 PM	12	11.3	0.7	94%
	Gray Gardens W	10:00 AM	22	12.0	10.0	55%
		10:00 PM	22	6.3	15.7	29%
	Madison St (Concord Ave to Garden St)	10:00 AM	23	19.7	3.3	86%
		10:00 PM	23	16.0	7.0	70%
	Concord Ave (Huron Ave to Buckingham St) – (daytime meters)	10:00 AM	9	6.3	2.7	70%
		10:00 PM	9	2.3	6.7	26%
	Concord Ave (Buckingham St to Parker St)	10:00 AM	18	10.7	7.3	59%
		10:00 PM	18	12.7	5.3	70%
	Concord Ave (Parker St to Craigie St)	10:00 AM	14	10.3	3.7	74%
		10:00 PM	14	12.3	1.7	88%
	Concord Ave (Craigie St to Garden St)	10:00 AM	20	15.7	4.3	78%
		10:00 PM	20	18.7	1.3	93%
	Bond St (Concord Ave to Garden St)	10:00 AM	34	23.7	10.3	70%
		10:00 PM	34	20.7	13.3	61%
	Berkeley St (Phillips Pl to Garden St)	10:00 AM	2	2.0	0.0	100%
		10:00 PM	2	2.0	0.0	100%
	Project area totals	10:00 AM	717	518.0	199.0	72%
		10:00 PM	717	528.7	188.3	74%

Figure 18: Entire Study Area

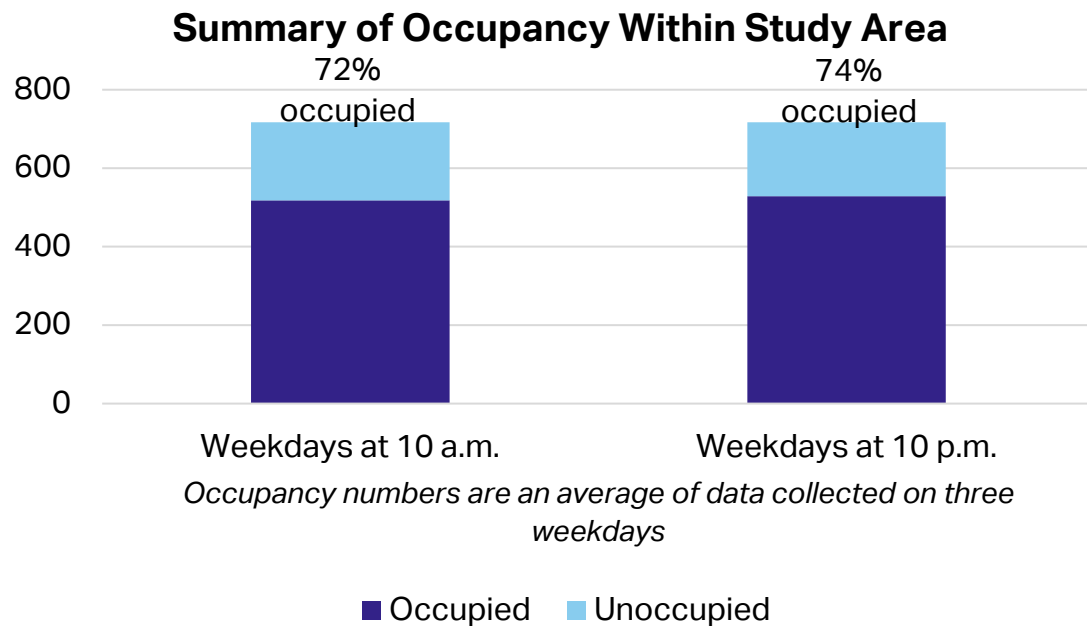


Figure 19: Along Garden Street Only

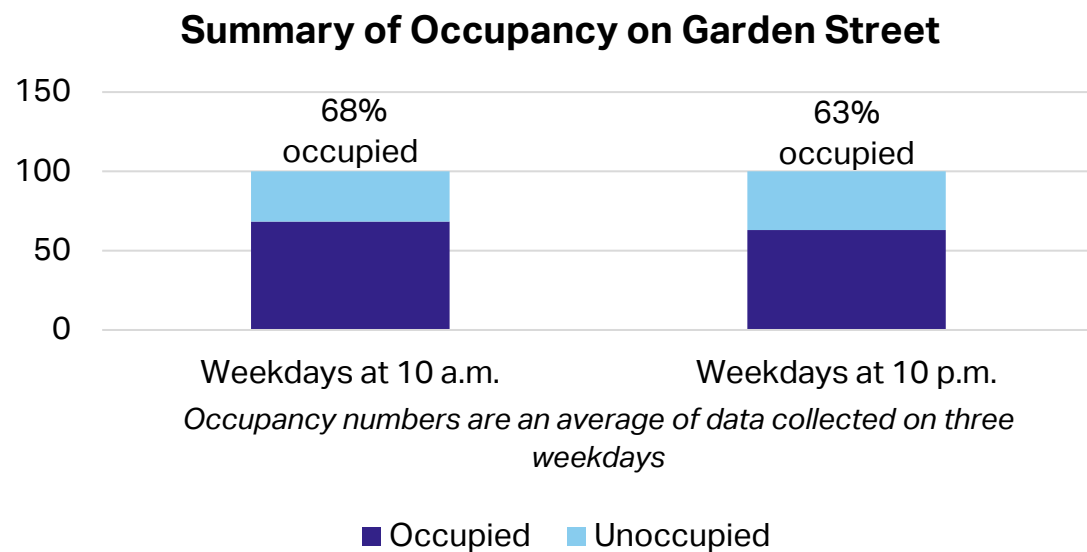


Figure 20: Streets North of Garden Street

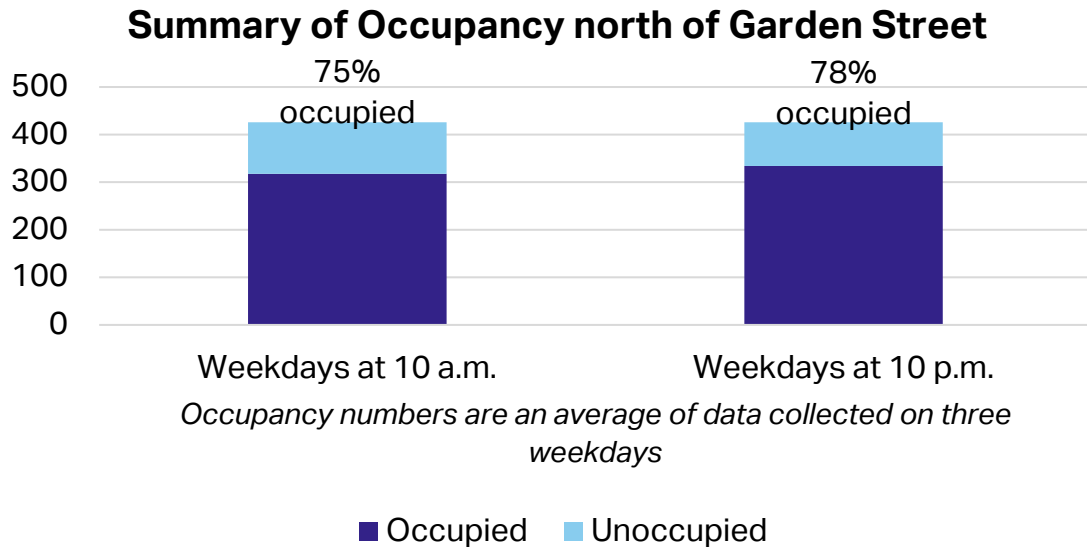


Figure 21: Streets South of Garden Street

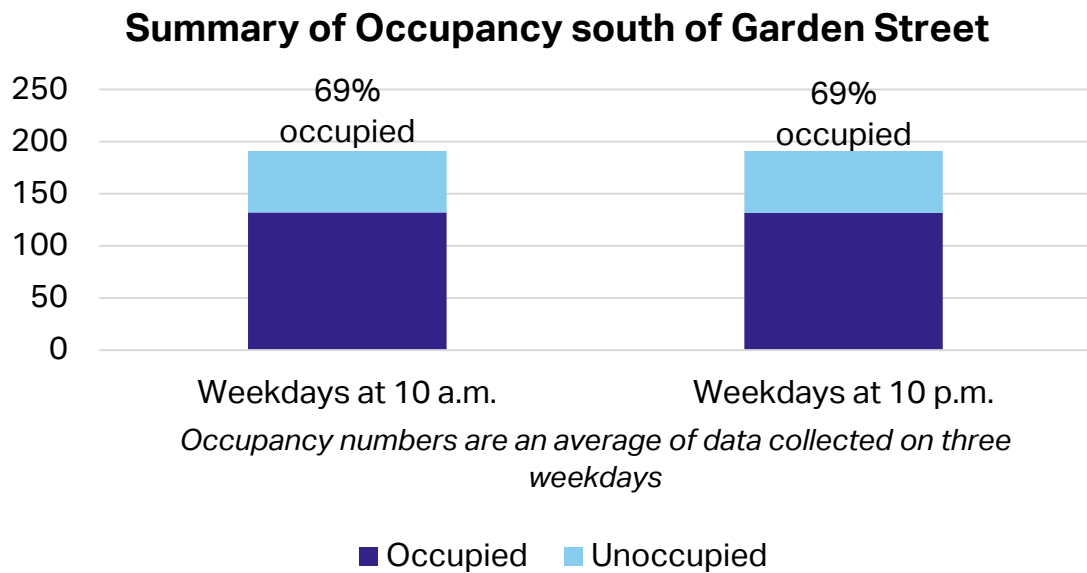
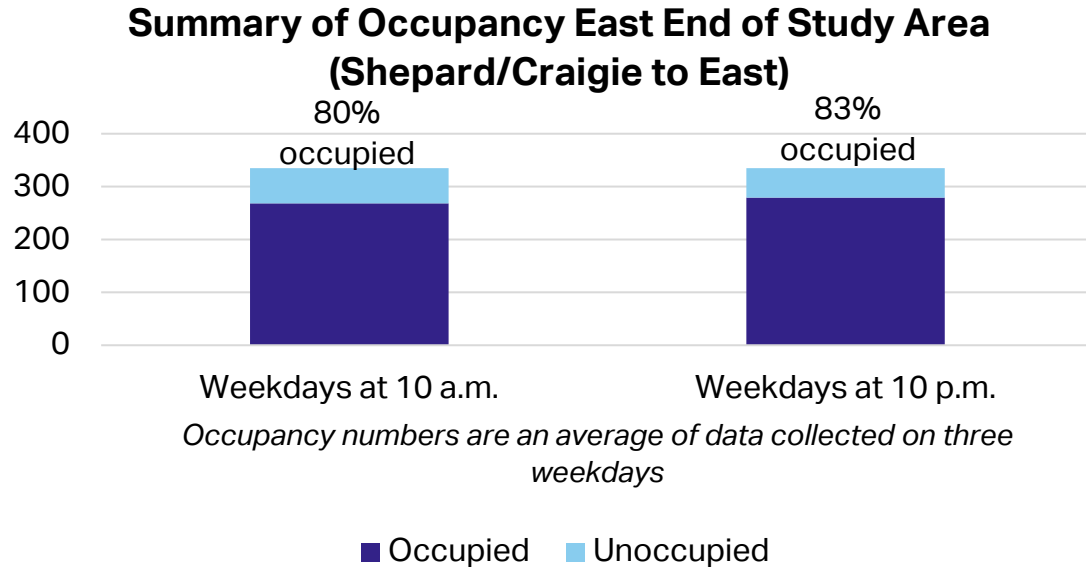


Figure 22: Streets in the East End of the Study Area

We looked at these streets as a group to understand utilization in the eastern end of the project, where many residents do not have driveways and have a higher reliance on street parking.



Note: Above "East End" segments are Garden Street from Shepard Street to Concord Avenue, Concord Avenue to Mason Street, and Mason Street to Appian Way, Shepard Street from Walker Street to Garden Street, Walker Street from Garden Street to Shepard Street, Chauncy Street from Garden Street to Langdon Street, Follen Street, Little Concord Avenue, Waterhouse Street, Berkeley Street, and Concord Avenue from Craigie Street to Garden Street.

Analysis: Returning Garden Street to Two-Way Vehicular Traffic between Linnaean Street and Huron Avenue

Key Takeaway

Restoring the section of Garden Street from Linnaean Street to Huron Avenue to a two-way for vehicles would likely reduce comfort and safety for people biking and walking, and increase queues, gridlock, and congestion near the Garden/Huron/Sherman intersection. While this change may divert some cut-through traffic from Raymond Street, traffic patterns will likely not change to the extent that residents hope for. However, there are measures the City could take to slow or divert traffic on side streets.

Background

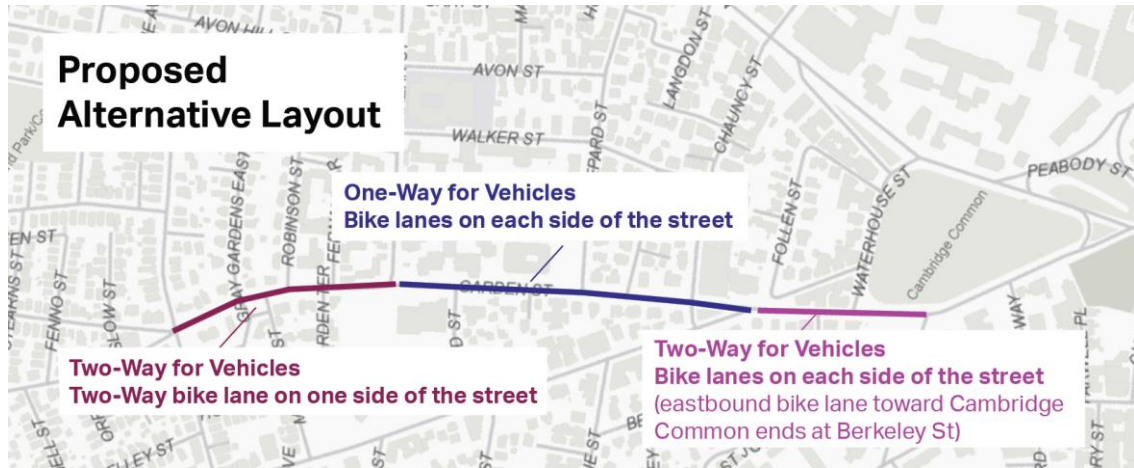
There have been significant calls to return two-way vehicular travel to Garden Street, with most requesting the change be made to the section being between Huron Avenue and Linnaean Street. To do this and have separated bike lanes, as required by the Cycling Safety Ordinance, we would also have to change to a single two-way bike lane on one side of the road.

Some early comments suggested that we look at the section from Bond Street to Huron Avenue for a return to two-way traffic; however, we did not explore that option in detail. It was clear from our knowledge of the street network that drivers would make their way back to Garden Street via Bond Street, rather than using main roads like Concord Avenue or Massachusetts Avenue to get through or out of the neighborhood. We also do not believe that such a quick detour would reroute regional trips out of the area completely. This option did not appear to be feasible for exploration, and therefore we studied the impacts for two-way traffic between Linnaean Street and Huron Avenue only.

Figure 23: Current Layout on Garden Street



Figure 24: Proposed Alternative Layout



There are significant considerations and potential negative impacts to returning to two-way travel for vehicles on any section of Garden Street. Making the change between Linnaean Street and Huron Avenue would in no clear way be a cure-all for some of the impacts of the project that some residents are experiencing.

In the following analysis, we are looking at the section of Garden Street from Huron Avenue to Linnaean Street.

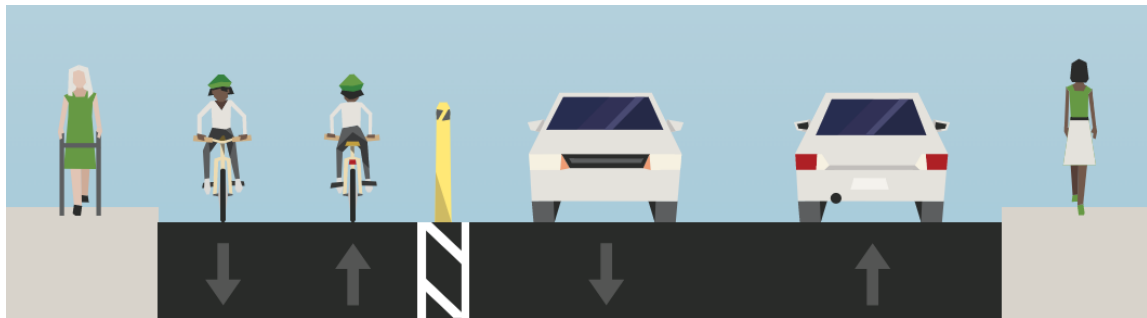
Existing: One-way for vehicles and separated bike lanes on each side of the street: Right now, the section of Garden Street from Huron Avenue to Linnaean Street has a single vehicular travel lane and bike lanes on each side of the street:

Figure 25: Example of a One-Way Vehicular Travel Lane and Separated Bike Lanes on Each Side of the Street



Proposal: Two-way for vehicles and a two-way separated bike lane on one side of the street: The proposed layout for the section of Garden Street between Huron Avenue and Linnean Street has two travel lanes for vehicles and a two-way bike lane on one side of the street:

Figure 26: Example of a Two-Way Vehicular Travel Lane and a Two-Way Bike Lane on One Side of the Street



To analyze this potential change, we looked at two major factors: the safety of the resulting bicycle facility and impacts to the signalized intersection of Garden Street, Huron Avenue, and Sherman Street. We also explored additional considerations that the change would bring, as well as potential mitigation strategies if the street were to remain one-way.

Safety of the bicycle facility

Background

At the first community meeting for the project on May 24, 2022, we discussed the trade-offs between two design options for bike lanes: separated bike lanes on each side of the street, and or two-way separated bike lane on one side of the street.

For this initial discussion, it was assumed that the roadway would remain two-way for vehicles. Separated bike lanes on each side of the street provide access to destinations on both sides of the roadway, keep bikes moving in the same direction as vehicles, and create predictable interactions with people driving. A two-way separated bike lane on one side of the street uses less roadway width, provides more space to pass slower riders, and has the potential for fewer conflict points with driveways or cross streets.

During the question and feedback period of the meeting and through subsequent correspondence and outreach, we heard from community members representing many viewpoints (residents, people who ride bikes, people who don't or can't ride bikes, etc.) that there was a strong preference for separated bike lanes on each side of the street due to their familiarity, ease of use, and the resulting increase in safety for users.

Alongside the discussion of the type of separated bike lane, we heard that parking was very important for residents in the eastern (Harvard Square) end of the project where there are fewer driveways. Turning Garden Street into a one-way for vehicles either maintained or provided additional parking opportunities in that end of the project area. These discussions with community members involved in the public process inspired the final design: a one-way road for vehicles and a one-way separated bike lane on both sides of the street. This option maximized parking to the greatest extent while also ensuring a consistent biking experience.

Analysis

The suggested new layout for the section of Garden Street between Huron Avenue and Linnaean Street has two travel lanes for vehicles and a two-way bike lane on one side of the street. (Refer to Figure 26)

The number of driveways and side streets and the frequency of their use are factors when considering a two-way separated bike lane on one side of the street. This can be considered in tandem with popular destinations and access points for people biking along Garden Street.

- **North side:** Linnaean Street, Chauncy Street, and Shepard Street are north side streets that experience high volumes of vehicles turning on and/or off Garden Street. Many people biking are also looking for access to north-side destinations and routes, including Radcliffe Quad or connections to Little Concord Avenue and Cambridge Common; bicycle accommodations on this side would provide this access to these popular destinations. However, adding a two-way separated bike facility to this side is not recommended because of the number of high-volume conflict points between people driving and people biking.
- **South side:** There are few high-volume side streets on the south side of Garden Street, but there are also fewer destinations for people biking served by this side. A two-way separated bike lane on the south side of Garden Street would require

users seeking north-side destinations to have to cross the street, potentially more than once (to arrive at their destination and to depart). It would however provide an easier eastbound connection for people biking towards Berkeley Street and Harvard Square. A two-way separated bike lane on this side is not recommended as it does not provide safe all ages and abilities biking access to destinations.

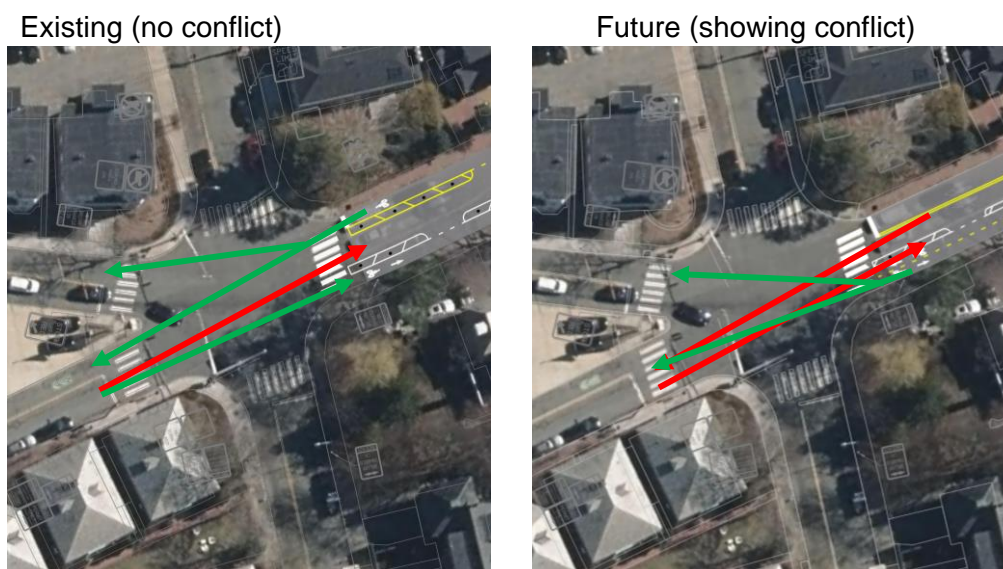
The implemented design consisting of a one-way separated bike lanes on each side of the street simplifies the interactions of people driving and biking through higher-volume intersections. It also does not establish a preference for specific routes, allowing better access by bike to all uses and destinations on both sides of the street.

Impacts to traffic signals and congestion

The intersection of Huron Avenue, Garden Street, and Sherman Street has heavy traffic movements in each direction. The conversion of Garden Street to one-way for vehicles simplified the intersection to some extent and allowed us to allocate extra time in the signal cycle to specific approaches to help mitigate congestion. This congestion was one of the main concerns immediately after project implementation, when we heard many reports of gridlock on Huron Avenue, extending back and onto Concord Avenue. We made changes and installed new equipment to address the concerns to the greatest extent possible. Converting Garden Street back to two-way for vehicles on the eastern leg of this intersection would introduce additional delay with limited ability for it to be mitigated.

There are two significant changes to the intersection that would need to occur to accommodate the reintroduction of westbound Garden Street traffic. We would need to modify the traffic signal timing to accommodate the return of westbound Garden Street traffic and add a mechanism to facilitate the movement of bicycles into and out of the two-way separated bike lane. At present, the lack of a westbound Garden Street approach allows the westbound bicycle lane to proceed on green at the same time as the eastbound Garden Street (vehicle/bicycle shared lane) approach. The recent changes to the signal to accommodate the Garden Street project were largely a reallocation of green signal times to reflect changes in traffic volumes. To re-introduce two-way vehicle travel on Garden Street alongside a two-way bicycle lane, a new bike-only phase would need to be added to address an otherwise conflicting new through movement. Figure 27 illustrates this conflict.

Figure 27: Garden Street Through Movements (Existing and Future)



The traffic signal operates at a current maximum cycle length of about 125 seconds. This means that at peak times, each approach will receive a green light (or walk signal) about every 2 minutes. We have Miovision signal equipment at this intersection that adaptively controls each phase's green time; if there are no vehicles or bicycles present, the light turns red early. Off-peak, this greatly reduces the amount of time that road users need to wait for green (or walk). During the peak commuting hours, however, the volume of vehicles using this intersection typically requires the full maximum green time and therefore the full 125 second cycle length. For context, typical signal cycle lengths in Cambridge are between 90 and 100 seconds, and sometimes as low as 75 seconds. Keeping cycle lengths low reduces wait times for people walking, increases signal compliance for people walking, biking, and not turning on red, and increases the frequency of each approach getting a green light.

Analysis

We conducted an analysis of how traffic would change at the Huron/Sherman/Garden intersection if we change the signal timing to accommodate a two-way bicycle lane and westbound Garden Street traffic.

We would want to keep the maximum cycle length at 125 seconds to avoid increasing wait times for people walking and to align with Cambridge's preference for lower cycle lengths. This intersection has an exclusive pedestrian phase, allowing everyone at a crosswalk to walk at once while all vehicles have red lights. Keeping cycle lengths low at these types of intersections limits the amount of time that people need to wait for a walk signal to cross the street and decreases the likelihood that someone will cross "against the light" when they do not have a walk signal.

For the purposes of this analysis, we assume the longest-possible green times for drivers and the minimum green time for people biking. As such, this analysis reflects the minimum negative impacts to vehicular traffic. Even with signal timing maximized for

drivers' benefit, we found that queue lengths could gridlock the Concord Avenue at Huron Avenue intersection.

Ideally, the length of the bike-only phase would be longer to better match the volume of people biking on the facility. The selected bicycle phase for the analysis was 9 seconds of green, followed by 2 seconds of yellow, and a 5 second all-red clearance phase. A person biking has approximately a 7% chance of arriving at the signal during a green light (9 seconds/125 seconds). A rate this low will likely lead to low compliance for the bicycle signal phase. Realistically, we would need to increase the length of the bike-only phase, which would increase vehicular delay and queuing.

The tables below show the capacity analysis for the intersection:

- Before the one-way change (“2022 Previous”),
- Currently (“2023 Current”), and
- With a future change to two travel lanes for vehicles and a two-way bike lane on one side of the street (“2023 Future”)

Level of Service (LOS) for an intersection is a qualitative measure (represented by a letter grade between A and F) to analyze roadways and intersections based on speed, travel times, maneuverability, delay, and safety. In urban settings, a LOS D is typically considered acceptable, since the analysis only pertains to the busiest one-hour periods of the morning and evening commute times.

Table 3: Capacity Analysis Summary: Weekday Morning Peak Hour

		2022 Previous (2-way)			2023 Current (1-way)			2023 Future (2-way)		
Movement		LOS¹	Delay²	V/C³	LOS	Delay	V/C	LOS	Delay	V/C
EB	LTR	D	42.0	0.54	F	93.3	0.92	F	80.3	0.86
WB	LT/LTR	E	60.4	0.78	n/a	n/a	n/a	F	173.1	1.06
	R	B	11.5	0.30	n/a	n/a	n/a	n/a	n/a	n/a
NB	LTR	E	57.1	0.76	E	57.8	0.85	E	63.7	0.87
SB	LTR	D	44.3	0.54	E	57.2	0.75	E	58.6	0.70
SEB	LTR	E	58.3	0.77	E	79.6	0.92	F	232.0	1.37
<i>Overall</i>		<i>D</i>	<i>48.6</i>	<i>0.76</i>	<i>E</i>	<i>71.2</i>	<i>0.74</i>	<i>F</i>	<i>122.4</i>	<i>0.81</i>

1 Level-of-Service

2 Average vehicle delay in seconds

3 Volume to capacity ratio

Table 4: Capacity Analysis Summary: Weekday Evening Peak Hour

		2022 Previous (2-way)			2023 Current (1-way)			2023 Future (2-way)		
Movement		LOS¹	Delay²	V/C³	LOS	Delay	V/C	LOS	Delay	V/C
EB	LTR	D	39.7	0.36	E	58.8	0.58	E	55.3	0.51
WB	LT/LTR	D	52.1	0.67	n/a	n/a	n/a	F	85.8	0.85
	R	C	34.0	0.68	n/a	n/a	n/a	n/a	n/a	n/a
NB	LTR	D	48.3	0.74	F	102.5	1.09	F	214.4	1.37
SB	LTR	D	35.7	0.42	D	43.6	0.61	D	54.4	0.66
SEB	LTR	E	57.3	0.67	E	58.4	0.67	E	72.8	0.77
<i>Overall</i>		<i>D</i>	<i>44.1</i>	<i>0.74</i>	<i>E</i>	<i>72.6</i>	<i>0.72</i>	<i>F</i>	<i>123.6</i>	<i>0.79</i>

1 Level-of-Service

2 Average vehicle delay in seconds

3 Volume to capacity ratio

The analysis shows that prior to the project, the intersection operated with an “acceptable” LOS D, while it now operates with a LOS E. The current LOS E is why we continue to see some queues not cleared during the busiest times of the day. For both the morning and evening commute periods under a future scenario with a return to two-way vehicular traffic alongside a two-way bike lane, we would experience a LOS F, leading to a degraded experience for people walking, driving, and biking through the intersection and the larger area.

The tables and figures that follow seek to take the LOS analysis and present it in a more tangible way by showing how long queue lengths could be.

- The 50th percentile queue is the queue length experienced about half the time during the analysis hour.
- The 95th percentile queue is the queue length exceeded 5% of the time. Over the course of the peak hour, that may be during one cycle.
- Queue lengths are presented in feet of queued vehicles. One vehicle queuing for a signal occupies approximately 25 feet.

Table 5: Queue Summary: Weekday Morning Peak Hour

Movement		2022 Previous (2-way)		2023 Current (1-way)		2023 Future (2-way)	
		50 th Queue ¹	95 th Queue ²	50 th Queue	95 th Queue	50 th Queue	95 th Queue
EB	LTR	116	181	172	280	175	270
WB	LT/LTR	124	228	n/a	n/a	78	185
	R	9	58	n/a	n/a	n/a	n/a
NB	LTR	123	229	161	282	179	347
SB	LTR	110	197	203	292	166	248
SEB	LTR	154	361	250	439	356	541

1 50th Percentile Queue Length, in feet

2 95th Percentile Queue Length, in feet

Table 6: Queue Summary: Weekday Evening Peak Hour

Movement		2022 Previous (2-way)		2023 Current (1-way)		2023 Future (2-way)	
		50 th Queue ¹	95 th Queue ²	50 th Queue	95 th Queue	50 th Queue	95 th Queue
EB	LTR	67	108	85	137	92	139
WB	LT/LTR	128	213	n/a	n/a	136	283
	R	102	197	n/a	n/a	n/a	n/a
NB	LTR	187	395	327	654	508	718
SB	LTR	134	211	205	286	182	239
SEB	LTR	113	204	125	204	140	257

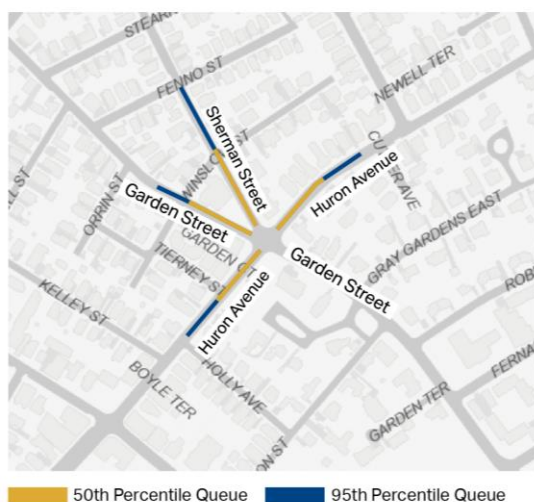
1 50th Percentile Queue Length, in feet

2 95th Percentile Queue Length, in feet

Garden Street Safety Improvement Project Local Traffic Analysis — Analysis: Returning Garden Street to Two-Way Vehicular Traffic between Linnaean Street and Huron Avenue

Figure 28: Queue Length Diagrams

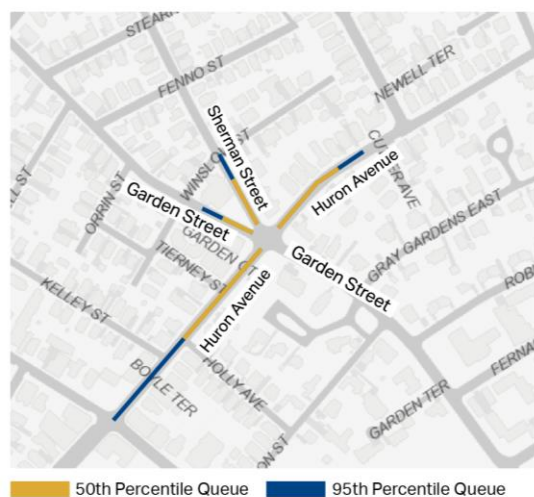
Current Weekday AM Queues



Weekday AM Queues if Garden Street Returns to 2-Way with a 2-Way Bike Lane



Current Weekday PM Queues



Weekday PM Queues if Garden Street Returns to 2-Way with a 2-Way Bike Lane



Raymond Street Traffic

One of the stated reasons to return to two-way vehicular traffic on Garden Street between Linnaean Street and Huron Avenue is to provide an alternative for drivers who are now traveling north on Raymond Street from Linnaean Street. The analysis shows that queue lengths on the southbound Huron Avenue approach (those coming from Raymond Street) will remain relatively the same, varying by approximately two to three vehicles.

This is explained by two factors: volume vs. green time and equilibrium.

- The green time for the Huron Avenue approach is shortened so that the bicycle phase can be added. There are fewer vehicles, but they also have less time to get through the intersection.
- The new Garden Street westbound queue will be near equal to the Huron Avenue southbound queue because drivers will continue to take Raymond Street rather than Garden Street if it saves time. This is likely to manifest over time as people choose their preferred routes (and as wayfinding software dictates). Additionally, some trips, namely to Sherman Street and the northwest, would benefit by continuing to use Raymond Street.

Concord/Huron Intersection Traffic

The northbound Huron Avenue approach currently exhibits occasional cascading congestion issues into the intersection at Concord Avenue and Huron Avenue, and gridlock would likely increase if Garden Street returned to two-way vehicular traffic between Huron Avenue and Linnaean Street.

As shown in the current queue length figures for the PM period (Figure 28), the 95% queue extends back (and into) the Concord/Huron intersection. If vehicles cannot turn onto Huron Avenue, they stop and block the lane while waiting. This has the potential to gridlock the intersection, blocking Concord Avenue through traffic, including buses, in both directions.

The leading left turn phase that the City added in February at the Garden Street, Huron Avenue, and Sherman Street intersection has greatly reduced the frequency of this occurrence; however, the timing changes required for a return to two-way traffic on Garden Street have the potential to negate this improvement. The 50% queue on Huron Avenue for the future PM peak stops just short of the intersection, and the 95% queue goes through the intersection (Figure 28). This means that there is a high likelihood that the Concord Avenue/Huron Avenue intersection would be gridlocked frequently during the evening peak hour.

Other Considerations

Linnaean Street and Graham and Parks School

Making Garden Street a one-way for vehicles reduced volumes on Linnaean Street, with volumes decreasing by more than 9% from 4,486 in October 2022 to 4,078 in March 2023. During the design process, we heard support for increasing the accessibility of Graham and Parks School for people who are not driving. Linnaean Street is identified in the Cambridge Bicycle Network Vision as a future low-volume and low-speed street, comfortable for people of all ages and abilities to use the roadway while biking without the need for dedicated infrastructure. Reducing volumes to the extent this project has is a small but important step toward aligning with this vision. Fewer vehicles during drop off and pick up times creates a safer atmosphere for walking and biking.

Garden Street in the Cambridge Bicycle Plan

The City does not plan to add separated bike lanes to Garden Street west of Huron Avenue. To the west of Huron Avenue, Garden Street is designated as a low-volume and low-speed street in the Bicycle Network Vision, similar to Linnaean Street. During the design process, we spoke about how by removing westbound traffic from Garden Street, we are de-emphasizing the street as an attractive alternative for cut-through traffic wishing to bypass Concord Avenue. This project has thus far reduced volumes on Garden Street near Ivy Street from 4,405 to 4,136 vehicles, or just over 6%, helping us align with the vision for lower volumes.

For both Linnaean Street and the western end of Garden Street, more substantial traffic calming to reduce vehicle speeds and further discourage through trips would be required to fully realize these roadways as low volume and low speed, however, progress can and should be made to attain these goals when opportunities arise.

Summary

In summary, returning Garden Street to a two-way for vehicles between Huron Avenue and Linnaean Street has merit as a potential relief valve for some northbound (former Garden Street) trips on Raymond Street, but we do not believe it has the potential to change travel patterns to the extent that is hoped for. The reduced safety of the biking and walking experience along Garden Street and the increased delay and added congestion stemming on all sides of the Garden Street/Huron Ave/Sherman Street would introduce new complications and impacts that we would not be able to mitigate. In the final section of this report, we have outlined other alternatives that could reduce cut-through traffic.

Analysis: Moving Parking on Garden Street

Key Takeaway

Several community members asked us to move all parking on Garden Street to the north (Harvard) side of the street, reasoning that it would increase the number of parking spaces and make it so drivers don't need to exit their vehicles into the travel lane.

At this time, we do not plan to make this change because:

- The current design has safety benefits.
- Moving parking to the north side would not add many parking spaces.
- We have heard positive feedback from the users of the spaces.

Background

While we were designing this project, we had the option of keeping all the parking on the north side of Garden Street between Linnaean Street and Chauncy Street. We ultimately decided to locate most parking on the north side of the street, but keep a handful of spaces on the south side between Garden Lane and Shepard Street. This decision was made for a few reasons: a desire to engineer a safer street and a compelling argument by the direct abutters and the future users of the parking.

Figure 29: Planview/Aerial of Existing Parking on Garden Street near Shepard Street



Safety and Sightlines

By having the parking switch sides, we have created a traffic calming technique called a chicane, where drivers are forced by design to slow down to maneuver through the area instead of continuing straight at speed. In this location, we heard many concerns about the safety of the crosswalk across Garden Street at Shepard Street. This implemented design slows drivers down, preparing them for the potential to yield to pedestrians, and also better aligns their vision with both ramps of the crosswalk to see anyone waiting to cross.

This condition also improves safety and sightlines from a driver's perspective, as those waiting to pull out of Shepard Street are provided with commanding views of oncoming traffic in order to judge for a gap. If the parking were instead on the north side, we would likely need a large clear zone for visibility, making any potential increase in the number of parking spaces negligible.

Abutter Requests

Despite the safety benefits outlined above, parking on the north side could have been designed safely. It was ultimately the decision of the users of these spaces, who determined which alternative worked best for them. We heard that people prefer parking on the right side of the road (as that is typical for parallel parking), that they did not want to have to cross the street to access their vehicles, and the speed mitigation of the chicanes negated much of the concern of opening their doors.

We continue to hear positive remarks by the users of these spaces regarding their experience with them. The opposition to parking on the right side of the road was very limited.

Analysis: Trucks and Traffic on Walker Street

Key Takeaway

We heard from residents that there was increased traffic on Walker Street between Garden Street and Shepard Street, including large vehicles that have difficulty maneuvering through the bend in the road.

Our analysis shows that the number of vehicles on Walker Street seems to be in-line with what we would expect to see on a side street, and heavy vehicle percentages were low. Many of the heavy vehicles on Walker Street were single-unit trucks typically used for local deliveries or services.

To reduce the chance of large vehicles getting stuck at the bend in the road, one option is to remove some parking near the intersection. Parking occupancy data showed Walker Street routinely had free parking spaces during the average midday and overnight period. We can further explore the option if there is support from the immediate neighborhood.

Background

We heard from residents that there are more trucks and increased traffic on the section of Walker Street that connects Garden Street to Shepard Street. This is a different section of the street than the Shepard Street to Linnaean Street segment that is used as a route to Raymond Street.

We did not collect before data for this section of Walker Street, however, the monthly counts since the project's installation and a comparison with other streets that are similar in nature can help provide context for the concerns of Walker Street residents.

Trucks and Other Heavy Vehicles

Our review did not find a concerning number of heavy vehicles to be using Walker Street.

The table below highlights the number and percentage of heavy vehicles that we found to be using Walker Street over the eight days that we collected data with our monthly counts. Vehicles are classified as bus, single unit (delivery truck), or multi-unit (tractor trailer) largely based on their wheelbase and quantity of wheels.

There are many single-unit vehicles using Walker Street, however, these are likely for local trips, such as parcel and package delivery, landscaping or construction, and trash pickup or other city-service vehicles. It is possible that regional truck trips or multi-unit tractor trailers occasionally used Walker Street, but that they did not show up in our counts over these eight days and these larger vehicles do not appear to use Walker Street to an extent that requires intervention.

We also saw the percentage of trucks going down over time, with the highest outlier number occurring on December 8, when 8.78% of vehicles using the street were classified as heavy vehicles.

Table 7: Heavy Vehicle Volumes on Walker Street

Count Date	Heavy Vehicles			Total Heavy Vehicles	Total Day Volume (all vehicles)	% Heavy Vehicles
	Bus	Single Unit	Multi-Unit			
Dec. 7, 2022	1	18	0	19	426	4.46%
Dec. 8, 2022	2	41	0	43	490	8.78%
Jan. 11, 2023	0	20	0	20	406	4.93%
Jan 12, 2023	0	14	0	14	391	3.58%
Feb. 15, 2023	1	20	0	21	448	4.69%
Feb. 16, 2023	1	18	0	19	451	4.21%
Mar. 8, 2023	1	16	0	17	442	3.85%
Mar. 9, 2023	3	8	0	11	438	2.51%
Average	1.1	19.4	0.0	20.5	436.5	4.63%

Truck restrictions on local roadways must be approved by the Massachusetts Department of Transportation (MassDOT), based on a specific set of criteria. To qualify for a truck restriction, typically trucks must make up between 5% and 8% of traffic on the roadway, the weight of the trucks must be causing damage to the pavement, or the trucks must be causing congestion.

On Walker Street, the heavy vehicle percentage is below 5% on average, the presence of trucks does not cause congestion, and no multi-unit trucks were identified that would introduce heavy loads on the pavement. It is unlikely that a heavy vehicle exclusion would be granted for Walker Street based on these criteria. A night restriction may be possible; however, it is unlikely to reduce the number of trucks using Walker Street as it would only be at night, while nearly all heavy vehicles use Walker Street during the daytime for local access.

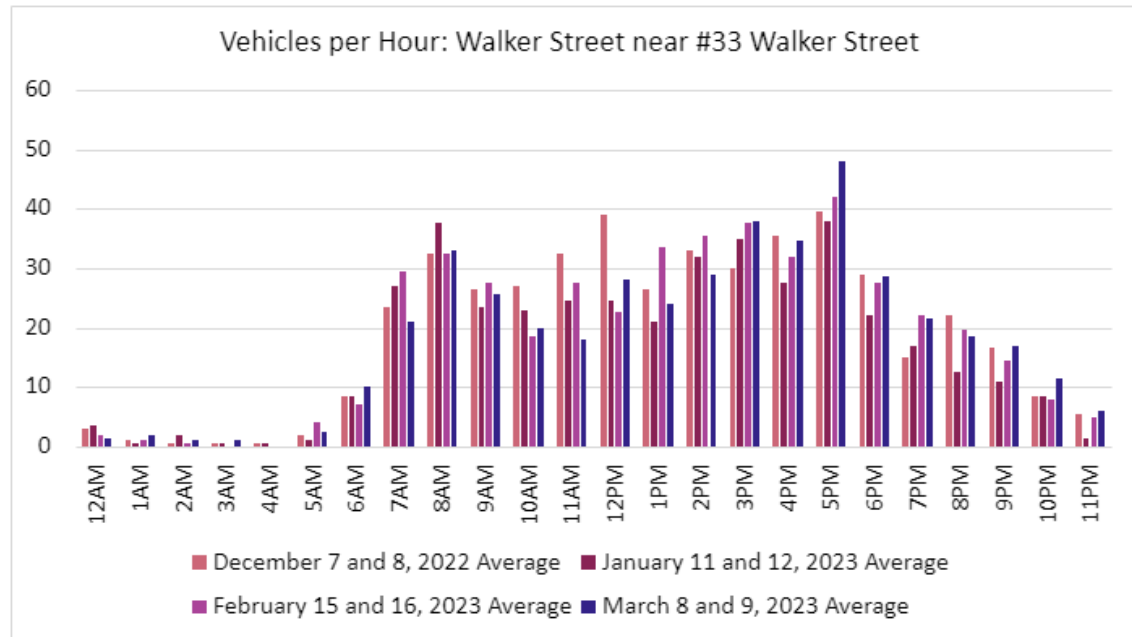
Regardless of the vehicle count data, we have received reports of at least two large vehicles having difficulty maneuvering the bend in Walker Street. As stated in the Feedback and Changes Since December Report section, we have installed a warning sign at the Shepard Street intersection indicating that large vehicles may not be able to navigate the bend and they should seek alternative routes.

Another solution might be to restrict parking at the bend in the road to provide more space for larger vehicles to turn. Our parking utilization study indicated that Walker Street has 32% of parking spaces empty during the day and 17% of parking spaces empty overnight, respectively, meaning that the removal of one to two spaces would likely have a minimal impact on parking availability on the average day. As the count data does not indicate a continuing issue with this reported concern, we would recommend against new parking restrictions, although we can further explore this if there is support from the immediate neighborhood.

Volume

The graph below shows volumes on Walker Street during each monthly count. During the busiest hour, fewer than 50 vehicles used Walker Street, which is less than one vehicle per minute.

Figure 30: Vehicles per Hour: Walker Street near #33 Walker Street



We classify Walker Street as a “local street.” In the roadway classification hierarchy, “local streets” have the lowest speeds and lowest traffic volumes, typically less than 1,500 vehicles per day (vpd) depending on jurisdiction. Over the course of the study period, and as shown in Table 7, volumes on Walker Street ranged from 391 vpd to 490 vpd, with an average of 436.5 vpd. This is well below the upper threshold for a local street. Newell Street and Royal Avenue are two similar streets that have comparable traffic volumes: two-way Newell Street has volumes of 491.5 vpd and one-way Royal Avenue has volumes of 491 vpd.

The one-way network of streets in the vicinity highly discourages through trips by regional traffic. Drivers that use Walker Street today are likely residents circulating to get to and from their houses nearby. We understand that the volumes experienced today might be greater than they were before the Garden Street project, however, they remain very low.

Non-viable Changes

We heard the following ideas from community members. However, they are not viable options for the reasons outlined below.

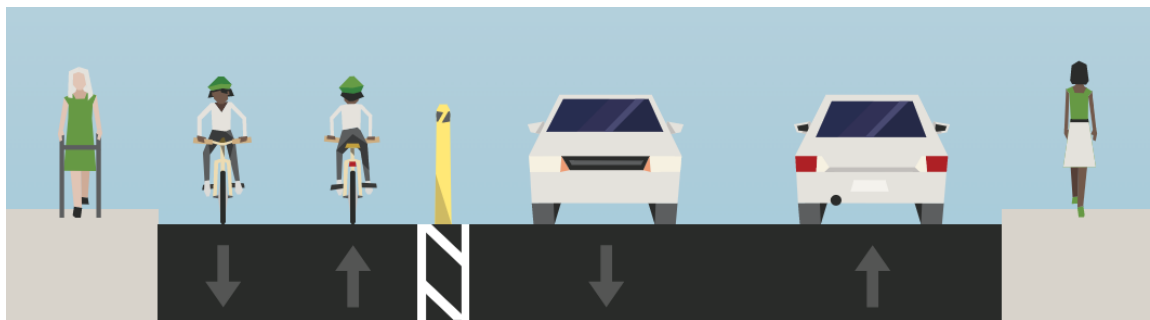
Residents-Only signs

Community members have proposed that an easy solution might be to post a “residents only” sign at the Linnaean Street end of Raymond Street for the morning and evening peak periods to keep cut-through traffic off the roadway. This is a frequent request that we have received from residents of other streets across the City, but a residents-only sign has never been implemented. According to the City’s law department, “while the City would not be expressly prohibited from restricting access to public ways, this type of regulation may be vulnerable to legal challenge” (Response to Policy Order/Awaiting Report 18-87). Significant police resources would be needed to attempt to enforce such a restriction and it would be difficult to identify non-resident drivers. Additionally, wayfinding applications may not be able to remove links for resident-only streets for only specific hours, and resident-only signs would restrict necessary non-resident access such as taxis, ride share, deliveries, visitors, and contractors performing work on nearby residences. Implementing such a regulation here would set a precedent that could have wide-ranging impacts for City-wide traffic circulation and mobility.

Returning Garden Street to a Full Two-Way for Vehicles

Some community members have asked us to explore returning all of Garden Street to a two-way street for vehicles. This design would not have enough space to maintain both the bike lane separation required in the Cycling Safety Ordinance and parking/loading for cars. The street would only be able to fit separated bike lanes and vehicle travel lanes.

Figure 31: Example of a Two-Way Vehicular Travel Lane and a Two-Way Bike Lane on One Side of the Street



When we designed this project, community members and direct abutters expressed a strong desire to maintain as much parking as possible in the eastern end of the project where fewer homes have driveways. The final design maintained approximately 49 parking spaces along Garden Street between Linnaean Street and Concord Avenue.

In addition to the ability to park, we heard that short-term needs such as pick-up and drop-off, loading and unloading of groceries, deliveries, ride share, and contractor access for work on nearby residences should be accommodated in some way. A two-

way Garden Street for vehicles without any space for a vehicle to stop for the full length of the project area does not accommodate these requested activities.

We explained earlier in this report that a two-way Garden Street and separated bike lanes also presented challenges at traffic signals (notably at the intersection of Garden Street, Huron Avenue, and Sherman Street). A Garden Street that is two-way for vehicles for the full length would also have implications at the Linnaean Street signal and the Concord Avenue signal. Under this alternative, it would take longer to cycle through traffic signal phases, causing additional delays and likely back-ups for all travelers at these intersections.

We did not further pursue analysis of this full two-way alternative after hearing strong feedback during the design process against its consideration as an option.

Recommendations and Potential Changes

Given our analysis, we recommend that we keep the design of the Garden Street Safety Improvement Project the same as it is today and continue to make changes on surrounding streets to discourage cut-through traffic and encourage lower speeds.

We believe that there are other options to help reduce the number of vehicles using neighborhood streets without returning two-way vehicular traffic to Garden Street.

The following ideas could help reduce cut-through traffic in the neighborhood, but represent fairly significant changes to the operation of the streets. The City will continue to consult with the residents of the area before implementing any of these measures.

No Left Turn Sign on Walker Street at Linnaean Street for Peak Hours

Rather than taking Concord Avenue or Massachusetts Avenue, some drivers who would have used Garden Street seem to be traveling up Massachusetts Avenue and turning on Shepard Street to reach Walker Street and Raymond Street.

Our observations of the intersection of Linnaean Street and Raymond Street indicate that there is a significant volume of vehicles turning left onto Linnaean Street from Walker Street, and then turning right on Raymond Street.

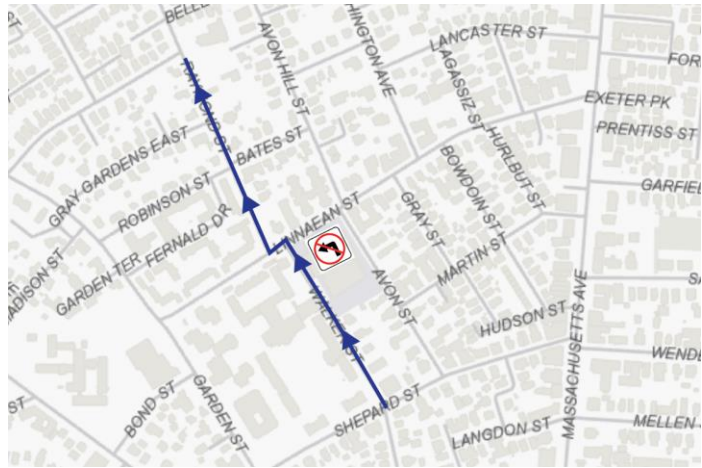


Figure 32: Adding a peak-hour “no left turn” sign at the intersection of Walker Street and Linnaean Street could reduce cut-through traffic using Raymond Street.

A “No Left Turn” sign could be placed at the end of Walker Street for peak hours, addressing the source of the cut-through traffic without placing undue restrictions on local circulation. Such a restriction would likely reduce traffic on Raymond Street, Walker Street, and Shepard Street during peak times.

Parking Chicanes on Raymond Street

Parking chicanes are a traffic calming technique where parking spaces switch from one side of the street to the other side periodically to make an otherwise straight road feel less like a straightaway. People drive more slowly when they need to be more alert to navigate through bends and turns. We’ve determined that there may be an opportunity to introduce this feature to Raymond Street. Specifically, the parking could switch from the east side to the west side between Linnaean Street and Robinson Street/Bates Street with potentially no impact to the number of parking spaces. This alternative would likely not reduce vehicular volumes, but it would make the street slower, increase driver awareness, and increase yielding to people walking at crosswalks.

All-way Stop at Raymond Street and Huron Avenue Intersection

In our December report, we wrote that we would install an all-way stop at the intersection of Raymond Street and Huron Avenue. As we've collected more data and performed more observations, we've found that this location does not currently meet the criteria for an all-way stop as outlined in the Manual on Uniform Traffic Control Devices (MUTCD). We are pausing our plans to install the all-way stop while we further monitor the location.

Our review of crash data since project implementation found one crash in November 2022 shortly after the project was installed, and no reported crashes since then. Typically, five or more crashes within a 12-month period are reviewed to identify if an all-way stop sign is an appropriate preventative measure.

Volumes for the approaching streets are also well below the criteria. Minimum volumes on both major approaches combined should average at least 300 vehicles per hour for at least 8 hours according to the MUTCD, while approaching volumes on the minor (side street) approach should be at least 200 vehicles per hour for the same eight hours. We saw only about 1,600 northbound vehicles approaching the intersection on Huron Avenue for the full day, far short of the minimum volumes (approx. 1,600 over eight hours) for an all-way stop.

Aside from the MUTCD's prescribed warrants, we do also have leeway for engineering judgement based on the particulars of the intersection. In the past several years, the City has installed a raised intersection and fence lines on both corners have changed, increasing the visibility for drivers on Huron Avenue. We plan to continue to monitor this location and will investigate the feasibility of an all-way stop through our normal traffic control reviews outside of the Garden Street project.

Fernald Drive and Robinson Street One-way Pair

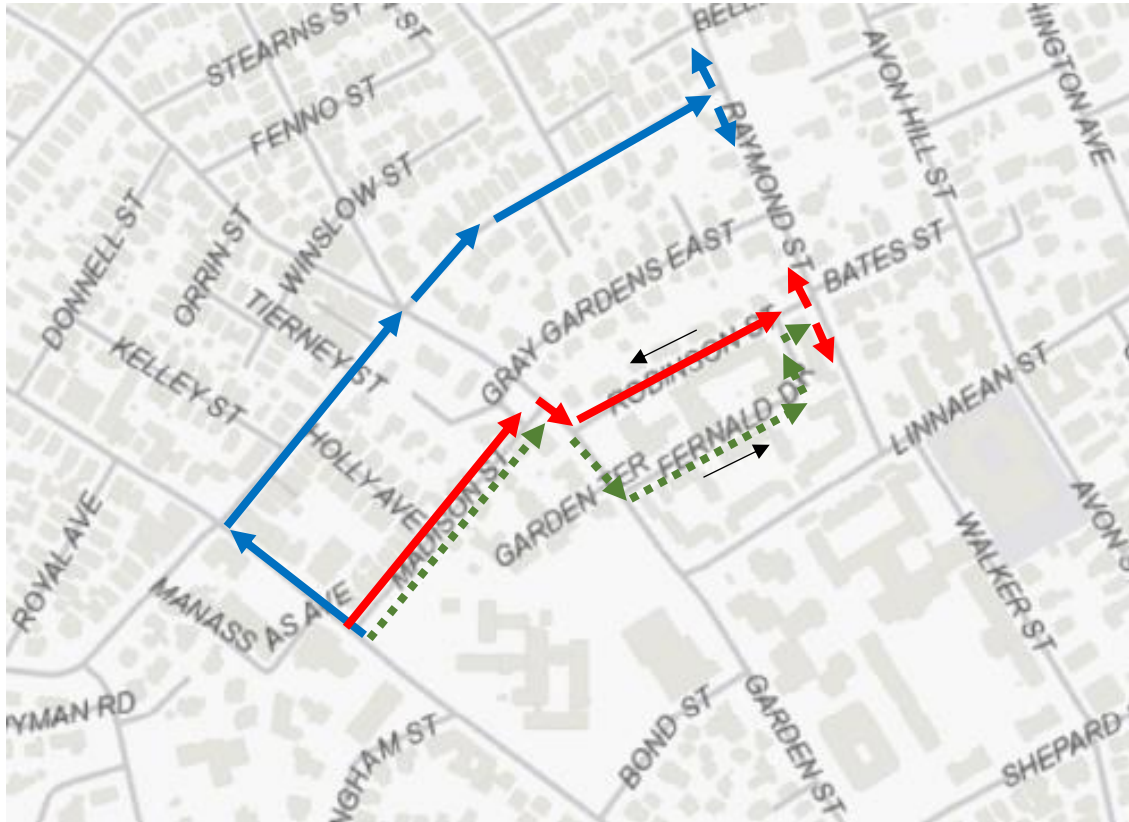
Making Fernald Drive and Robinson Street one-ways in opposite directions could increase parking availability on Fernald Drive and reduce cut-through traffic on Madison Street, Raymond Street, and Robinson Street.

Our parking utilization study outlined earlier in the report identified Fernald Drive as having a higher parking utilization when compared to nearby streets. It experienced an 83% occupancy rate midday (10 a.m.) and 92% occupancy rate overnight (10 p.m.). Of the approximately 31 spaces, an average of six were available midday and two overnight during the three nights of observations. This contrasted with parallel road Robinson Street, which experienced a 63% occupancy rate midday and 47% occupancy rate overnight. Robinson Street routinely had an average of about 14 and 21 spaces open for use midday and overnight, respectively. Converting Robinson Street and Fernald Drive to one-way pairs could open the other (non-parking) side of Fernald Drive to approximately 25 additional parking spaces, which could lower overall occupancy rates and increase the likelihood that a resident could find a parking space on Fernald Drive. The small section of Robinson Street between Raymond Street and Fernald Drive could continue to be two-way to maintain neighborhood circulation and access.

Parking could also be added to the other side of Fernald Drive without converting the street to a one-way. This would create another yield street like Robinson Street (one lane for two-way traffic). The one-way pair alternative, however, would have the added

benefit of discouraging cut-through trips through the neighborhood. This would specifically impact the Huron Avenue bypass route that brings drivers down Madison Street to Garden Street to Robinson Street and ultimately to Raymond Street.

Figure 33: Map Showing Huron Avenue and Alternative Routes



In the figure above, the blue lines indicate a desired route for drivers; the red lines show a potential cut-through route when Huron Avenue is congested.

We have made changes at the traffic signals to reduce the likelihood that Huron Avenue is congested, but some drivers, and especially those using wayfinding software, may still opt to use the cut-through route. If Robinson Street were a one-way westbound and Fernald Drive a one-way eastbound, drivers seeking to cut through the neighborhood would have to travel further out of their way and make additional turns (dashed green lines). This would make the cut-through route much less attractive, while also maintaining local access. We could also make these directional changes without any changes to existing parking regulations.



CITY OF CAMBRIDGE

TRAFFIC, PARKING, + TRANSPORTATION

MEMORANDUM

To: Yi-An Huang, City Manager
From: Brooke McKenna, Acting Chief
Date: December 15, 2022
Subject: AR-22-79 – November 14, 2022

This memorandum has been prepared in response Awaiting Report Item AR-22-79 from the November 14, 2022 City Council Meeting requesting that the Traffic, Parking, and Transportation Department and Department of Public Works meet with and receive input from residents living on the streets in the impacted area to discuss strategies to mitigate and reduce overflow and cut through traffic, including the proposal mentioned in the order, or other traffic calming or traffic diversion methods, and report back to the Council on any short-term recommendations no later than December 19, 2022. The order further requests that a final report be submitted no later than March 27, 2023. This memo is intended to respond to the request for short-term recommendations.

In October 2022, the City of Cambridge made changes to Garden Street to add a quick-build separated bike lane as part of the Garden Street Safety Improvement Project. Major changes to the street included changing the operation of Garden Street to eastbound one-way for vehicles between Huron Avenue and Concord Avenue and a reduction in parking spaces. Work included new traffic signals, updated metal street signs, road markings, bicycle stencils, flex posts, and colored surface treatments.

This project is part of the implementation of the Cycling Safety Ordinance. The Cycling Safety Ordinance, passed in 2019 and amended in 2020, represents a shift from designing our streets primarily around car transportation to also prioritizing cycling, which is resulting in changes in how we allocate space on City streets. The Cycling Safety Ordinance mandates the accelerated development of a full network of separated bike lanes across the City.

The creation of this alternative transportation network is a significant step forward towards creating a sustainable, healthy future for Cambridge, but it does not come without other impacts. In a dense city with limited space on our roadways, making space for separated bike lanes is not easy, and results in reductions in parking and changes to how the roadway network operates. We recognize that it is challenging for many residents, that our roads are becoming more complex, and that we are making difficult trade-off's.

The decision to include the one-way conversion of Garden Street came from the input of the members of the community who took part in the public process in advance of the project implementation. The conversion to one-way was appealing both to local

residents who prioritized retaining parking as well as local cyclists who preferred one-way bike lanes on each side of the street, as safety is better provided for with a consistent bike lane alignment along the longer corridor.

Removal of one of the two travel lanes provided enough space to both retain parking in areas most-requested by the community and to add the one-way bike lanes on each side. We recognize that community engagement could have been improved across the broader community that is now affected by the conversion to one-way and we hear the many voices that feel like they were not involved in planning conversations. This is an area we are committed to continuing to improve.

Data

We collected data in and around the project area on October 12 (before we installed changes to Garden Street), and again during the first week of December. These counts help us to monitor the impacts of the project and we plan to continue interim data collection and analysis in the coming months and share this publicly. Final data collection that reflects the longer-lasting impacts of the project will follow in early Spring 2023.

Traffic impacts from the project were most significant in the days immediately following implementation. Our observations have shown that some of the additional traffic has abated and that the immediate impact on side streets has started to come down as traffic patterns have adjusted (See Appendix A). While there is still some increased traffic on certain side streets, the total volume is within the range across side streets from October before implementation.

When significant changes are made to traffic patterns, it can take three to six months for drivers to adjust to new routes. We are currently six weeks post implementation, and we are still seeing road users learning and making adjustments. This is mostly from people outside of the neighborhood who came to the area infrequently or that are newly returning to the area after COVID-19 office re-openings. People unfamiliar with the area tend to make peculiar choices in response to road changes, and we are still in the settle-in period, without a full picture of what the fully developed effects will be. We recognize that this is also challenging for residents and we will continue to hear from the community, make adjustments, and collect data and observations.

Methods

- The City uses an independent traffic data collection firm to collect speed and volume data. Equipment is placed on the street in the same locations each time to allow for comparisons over time. Weather can impact our ability to collect data, as the equipment can malfunction due to snow, but we will make all efforts to take advantage of good weather days between now and March/April to demonstrate trends over time.
- In the most recent data collection, and moving forward, we will be collecting two days of data each month. We then average the two days to compare to the single day of data collection done prior to the project implementation.
- With speed data, we track the 85th percentile speed which is consistent with industry best practice. This is the speed at or below which 85 percent of the drivers

travel on a road segment. Most motorists (typically 75 percent according to research) drive within 5mph of the 85th percentile speed, making it more representative of the speeds experienced on the roadway when compared to average speeds.

Summary

Graphs showing the comparison between the pre- and post- project speeds and volumes are included in Appendix A, and we've summarized some key points here:

- Overall speed impacts are relatively small and include both increases and decreases. For example, the 85th percentile speed on Shepard Street decreased from 22 mph to 20 mph. On Newell Street, the 85th percentile speed increased from 14 mph to 16 mph. In a number of locations, the 85th percentile speed is slightly above the speed limit, similar to where the numbers were prior to the project implementation. For example, Linnaean Street saw an increase from 27 mph to 28 mph, Bond Street saw an increase from 22 mph to 23 mph, and Concord Avenue saw an increase from 29 mph to 30 mph. Several streets saw small reductions in speed, including Raymond Street moving from 24 mph to 23 mph and Shepard Street dropping from 22 mph to 20 mph. Variations of 1-2 mph are within the margin of error for the data collection equipment, and we will closely monitor trends in these values over the next few months. Like many places in Cambridge, speed continues to be a concern in the project area as it was prior to the project, and we continue to look for ways to decrease speeds across the neighborhood.
- Similar to the speed findings, volumes both increased and decreased across the neighborhood. Madison Street saw a significant increase, going from 893 vehicles per day to 1560 vehicles. While this is a significant change, the numbers are still within typical volumes on a one-way side street. Bond Street saw a drop from 2892 vehicles to 1791 vehicles per day. Huron Avenue west of Garden Street went from 3545 vehicles to 4213 vehicles per day. Raymond Street, where there has been significant concerns about volume increases, went from 2497 vehicles to 3087 vehicles per day. This is a material increase but also continues to be below pre-implementation volumes on Linnaean, Huron, and Shepard and we hope that there will be decreases in volume as traffic patterns adjust.
- The data collected this month will act as the post-installation baseline as we collect additional data in coming months. We will provide regular updates as this data is collected.

Outreach

We began installing the changes on Friday, October 28, 2022. In advance of installation, the community process included:

- May 24: Community Meeting 1 - Broad outline of project, gathered initial community feedback
- July 12: Community Meeting 2 - Presented two draft layouts of Garden Street
- August 9: Community Meeting 3 - Presented a new third draft layout based on community feedback from the previous meeting, alongside the original two draft layouts
- September 20: Community Meeting 4 - Presented details on final layout selection based on community feedback

*Garden Street Safety Improvement Project Local Traffic Analysis Appendix:
December 15 Council Order Response*

- September 22: Community Open House on Garden Street - Chance to meet with City staff and ask questions

Our outreach to the neighborhood about the project and these meetings included:

- Postcards: Postcards announcing the start of the project sent to 3,500 addresses in May 2022 and postcards announcing the one-way change and final meetings sent to 4,700 addresses in September 2022
- Physical signage on Garden Street and side streets ahead of each meeting and installation
- Flyers distributed to doors in May 2022 and August 2022
- Conversations with local stakeholders, businesses, and institutions
- Regular emails to a project email list and in the City's daily email update

For more details and examples of outreach, see the "Outreach" section of the project webpage: www.cambridgema.gov/GardenStHuronMason. This project page also contains audio/video recordings of the community meetings and PDF versions of the slides from each presentation.

When it became clear that this project would have wider impacts than just the area immediately adjacent to Garden Street, we widened the outreach area in advance of the final meeting, trying to ensure that a wider area of the neighborhood was aware of the upcoming project and could provide their feedback on the selected alternative prior to installation. While this emailing and flyering of the neighborhood took place in advance of the last community meeting and open-house, we recognize based on feedback from the community that many felt that the outreach effort fell short. We are continuously trying to improve our outreach methods and will continue to do so in the future.

With the installation and conversion to one-way in late October, we saw an increase in traffic on many nearby streets and have heard significant concerns from the wider community about increases in traffic volumes, speeds, and general traffic safety in the neighborhood.

Since late October, we have been listening to the concerns of the neighborhood and making adjustments to the design as well as looking for opportunities for mitigation.

Thus far we have hosted two neighborhood listening sessions, have had many one-on-one conversations with residents, and received feedback via email and an online survey. These feedback opportunities include:

- November 9: First listening session on impacts of the Garden Street Safety Improvement Project, held at the Graham and Parks School. About 80 people attended this meeting.
- November 29: Second listening session on impacts of the Garden Street Safety Improvement Project, held at the Graham and Parks School. About 100 people attended this meeting.

A third listening session will be held on Zoom on January 4, 2023.

Response

In response to the concerns we have been hearing from the community, as well as observations we have been making, we have made or plan to make the following changes:

1. Feedback: Severe traffic congestion on Concord Avenue during the PM commute time
 - a. **What we did:** We made signal timing adjustments at the Concord Avenue at Huron Avenue traffic signal to give Concord Avenue more green time. This adjustment was made midday on Monday, November 7. As a result, fewer cars were stuck behind the red light and traffic flowed more efficiently. Before the project, peak-hour traffic queues usually went as far back as Madison Street or Buckingham Street. Peak-hour observations on November 7, 8, and 9 showed queues returning to this pre-project extent.
2. Feedback: Huron Ave is backed up eastbound from Concord Ave to Garden St during the PM commute time.
 - a. **What we did:** As part of our original project plan, we made signal timing adjustments at the Garden Street/Huron Avenue/Sherman Street traffic signal to give Huron Avenue more green time. This time was taken from the Garden Street phase, since westbound flows were eliminated with the change to one-way. Appropriate green time was retained for Garden Street to accommodate eastbound traffic as well as bi-directional bicycle traffic. This change was made midday Tuesday, November 8. We made green time adjustments at Walden Street and Sherman Street at the same time to help address a related issue.
3. Feedback: It is hard to turn left onto Sherman Street from eastbound Huron Avenue, because of opposing westbound Huron Avenue traffic.
 - a. **Our plan:** We will add a leading protected left turn phase for eastbound Huron Avenue traffic to provide an opportunity for left turns without waiting for a suitable gap. This will help the signal process more left turns and clear the block more efficiently.
4. Feedback: There is a steady flow of left turns from Garden Street onto Walker Street.
 - a. **What we did:** We determined that these turns were a result of wayfinding apps trying to loop drivers back around to Linnaean Street. Apps told drivers to take a (now illegal) right onto Garden Street at Linnaean Street and when they couldn't do that, the apps directed them down Walker Street to go back to Linnaean Street to try again. We have confirmed that our changes to wayfinding apps have been accepted and this movement no longer occurs (as of Saturday, November 5). We still see some added traffic compared to before the one-way change, but the high initial volume of turns has subsided.
 - b. **What we did:** We have reached out to Harvard transportation staff to request that their drivers not use Walker Street when approaching or departing the loading docks on Garden Street.
 - c. **Our Plan:** We will be installing a warning sign for large trucks at the corner of Walker Street and Garden Street warning of the sharp turn on the block of Walker Street between Garden Street and Shepard Street.

5. Feedback: Drivers on Garden Street find themselves stopped behind parked cars at the Concord Avenue traffic signal, thinking they are queued.
 - a. **What we're doing:** Tan-colored markings within the buffer zone areas at the crosswalk are planned to be installed to better define the walking, parking, and driving spaces. Once installed (when weather permits), we will evaluate whether these changes fix the issue. Observations indicate that this issue has subsided as drivers adjust to the new configuration of the street.
6. Feedback: People biking and scooting are going the wrong way in the new Garden Street bike lane between Shepard Street and Concord Avenue.
 - a. **What we are doing:** The previous condition did not have a bike lane in the eastbound direction, so we are already seeing some eastbound cyclists and scooter riders use the new bike lane instead of traveling the wrong way or using the sidewalk. For those who are still traveling the wrong way within the one-way bike lane, we installed "wrong way" biking signs. These signs were installed at decision points to discourage this practice. We will educate users on-location and coordinate with Harvard about potential outreach strategies to students.
7. Feedback: Through traffic that should be using Concord Avenue, Massachusetts Avenue, and/or Rindge Avenue is using local residential streets.
 - a. **Our plan:** We have placed variable message signs at two key decision points on Massachusetts Avenue to direct drivers departing Harvard Square to preferred through routes.
8. Feedback: There are many safety concerns regarding the intersection of Raymond Street and Huron Avenue.
 - a. **Our plan:** We will install an all-way stop at the intersection of Raymond Street and Huron Avenue. The Department is also planning to purchase permanent speed feedback signs for locations around the neighborhood. In the meantime, we are working with the Police Department to place the speed feedback trailer on Raymond Street.

Next Steps

We have received requests from community members to reverse all or part of the one-way Garden Street configuration. There are significant considerations and potential negative impacts to going back to a two-way configuration for any segment of the corridor. Resuming two-way traffic between Linnaean Street and Huron Avenue would introduce new cut through patterns that will need to be further examined and would potentially require additional mitigation on side streets such as new turn restrictions or reversals of travel directions on side streets. The intersection of Garden Street, Huron Avenue, and Sherman Street would also require an additional traffic signal phase resulting in added delay at this key intersection. This phase would be required to move people on bikes into and out of the two-way facility on Garden Street.

We have also heard strong support for the project from residents of the neighborhood as well as users of the Garden Street bike lanes. We ultimately believe that it is too early in the process to know if the one-way configuration can be successful in the long run. We recognize that these are difficult changes to make and that all options are complex and require trade-offs. A significant reversal would create different negative impacts. However, we are committed to continuing to engage with the entire community, listen,

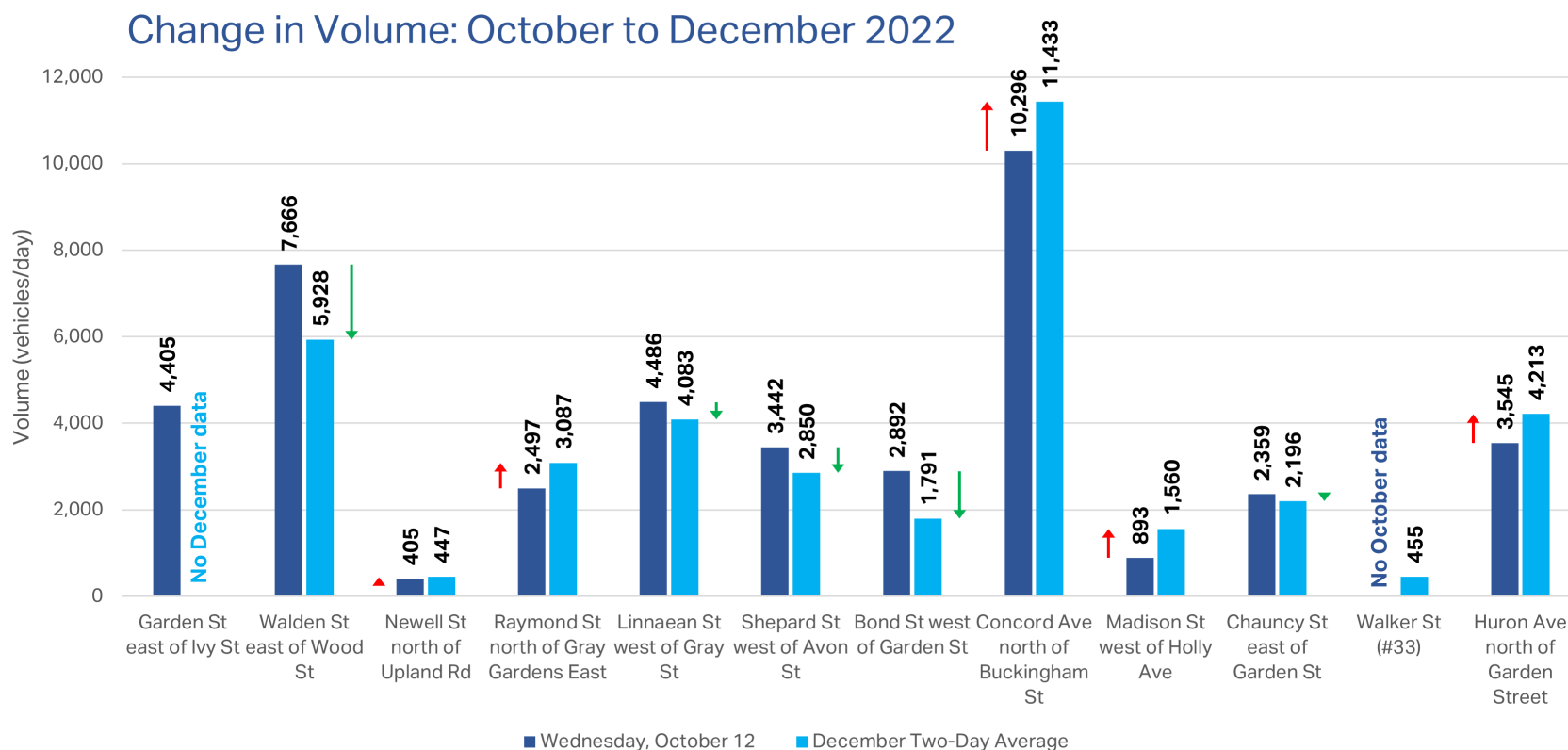
collect data, and execute mitigation strategies through the Winter before making a final determination in the early Spring.



CITY OF CAMBRIDGE

TRAFFIC, PARKING, + TRANSPORTATION

Appendix A: Change in Volumes



Appendix B: Change in 85th Percentile Speeds

Change in 85th Percentile Speeds: October to December 2022

