



CITY *of* BOSTON

Columbus Avenue Bus Lanes Project Report

July 2023

Today, the Columbus Ave
bus lanes are used by about

4,900
passengers
every weekday.



In a survey of people riding
the Columbus Ave bus lanes,

over 75%
were satisfied

with the new bus lanes.

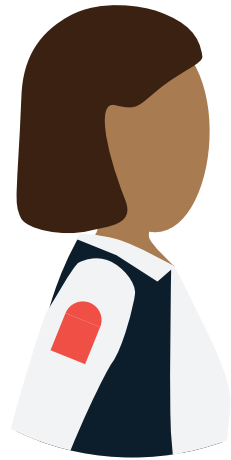


In a survey of people riding
the Columbus Ave bus lanes,

about 25%
ride more often

with the new bus lanes.





I love it! Love that I'm not stuck in that [pointing at traffic]. My only concern is about people crossing in the middle of the bus lanes.

Bus driver of 22 bus

More of it!
Bus lanes
should go all
the way to
Mattapan Sq.



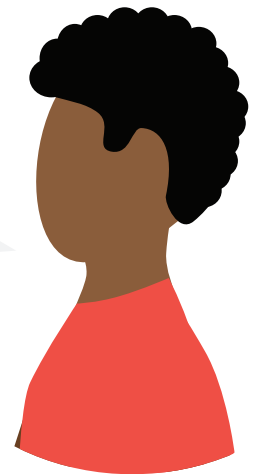
I don't have to be guessing when the bus is coming.



VIP express to the
train station. I love it!



I heard the new bus lanes were coming, so I tried it out and it's much faster. I like it because it's much more economical. I'm headed to the doctor and if I took an Uber it would cost \$20.



During rush hour, the Columbus Ave bus lanes save bus riders about

**3-4 mins
each trip**

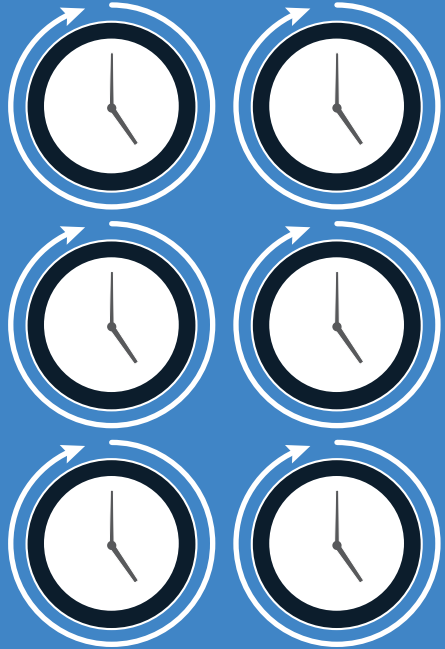
or about 7 mins a day,
which gives you extra
time to grab your morning
coffee.



The Columbus Ave bus lanes save an average of 2 minutes per bus trip, or

**about
6 hours**

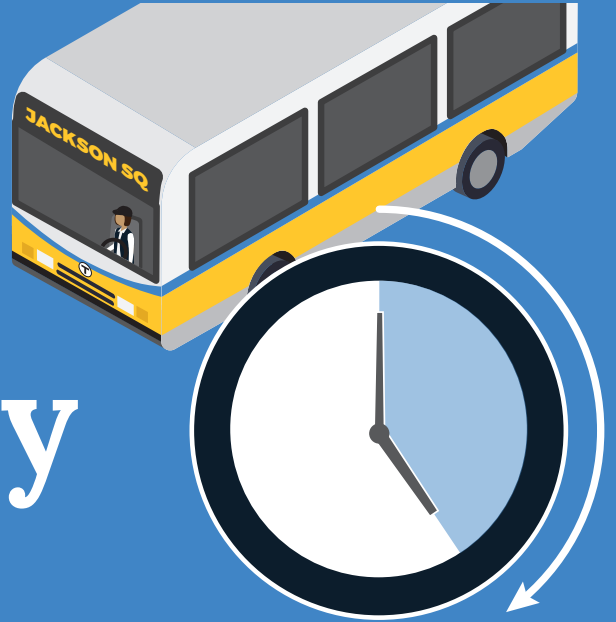
of bus operating time every day.



The time savings from
the Columbus Ave bus
lanes could allow the
T to operate buses

**more
frequently**

with the same number
of operators.



Added up across all
riders, the bus lanes
save the equivalent of

81 hours
each day

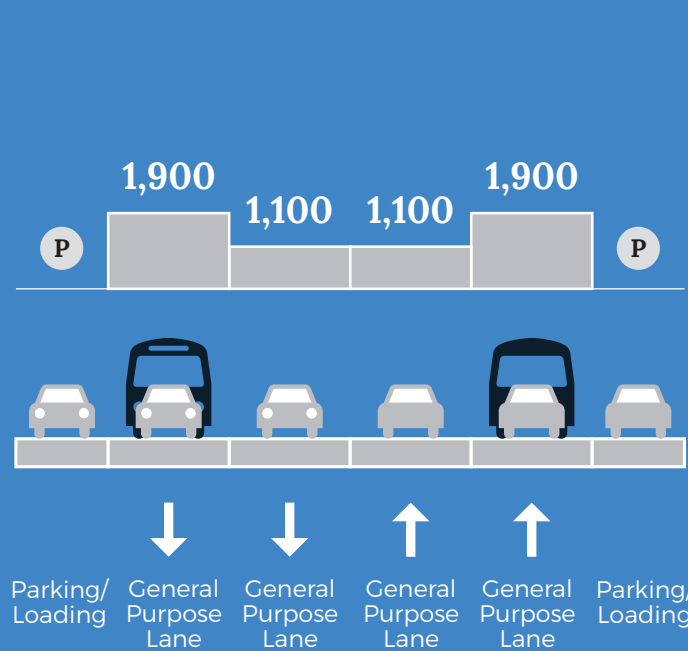
or the amount of time it
takes to drive to Los Angeles
and back again.



BEFORE the Columbus Ave bus lanes, Columbus Ave could move about

6,000 people

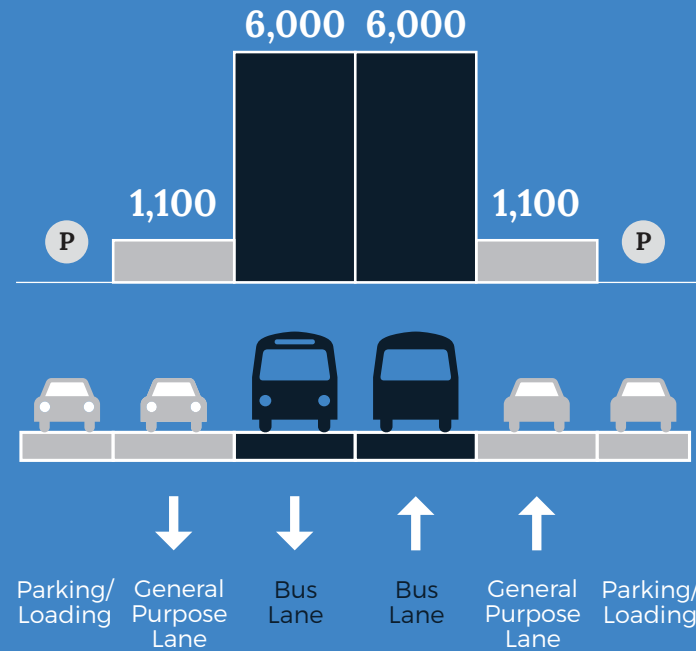
on the roadway every hour.



AFTER the Columbus Ave bus lanes, Columbus Ave can move about

14,200 people

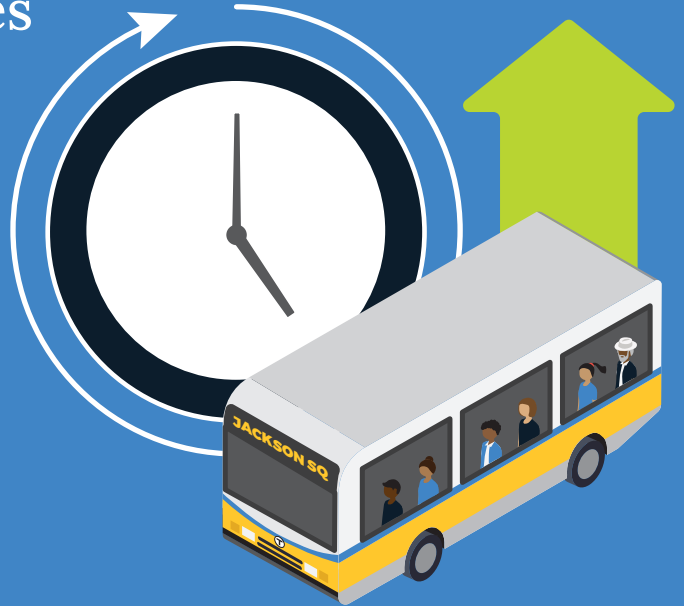
on the roadway every hour.



The Columbus bus lanes
increased the number
of people that could
move on the road by

8,200
per hour

or 34%.

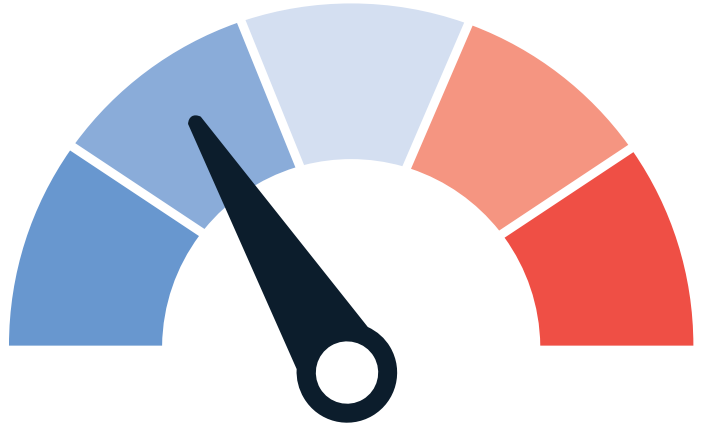


**AFTER the Columbus
Ave bus lanes, about
10% more vehicles are
obeying
the speed
limit**



**AFTER the Columbus
Ave bus lanes,** average
auto speeds have
declined by

1.5 mph



**AFTER the Columbus Ave
bus lanes were built,** it takes
an average of about

**20-40 more
seconds**
for people to drive the corridor

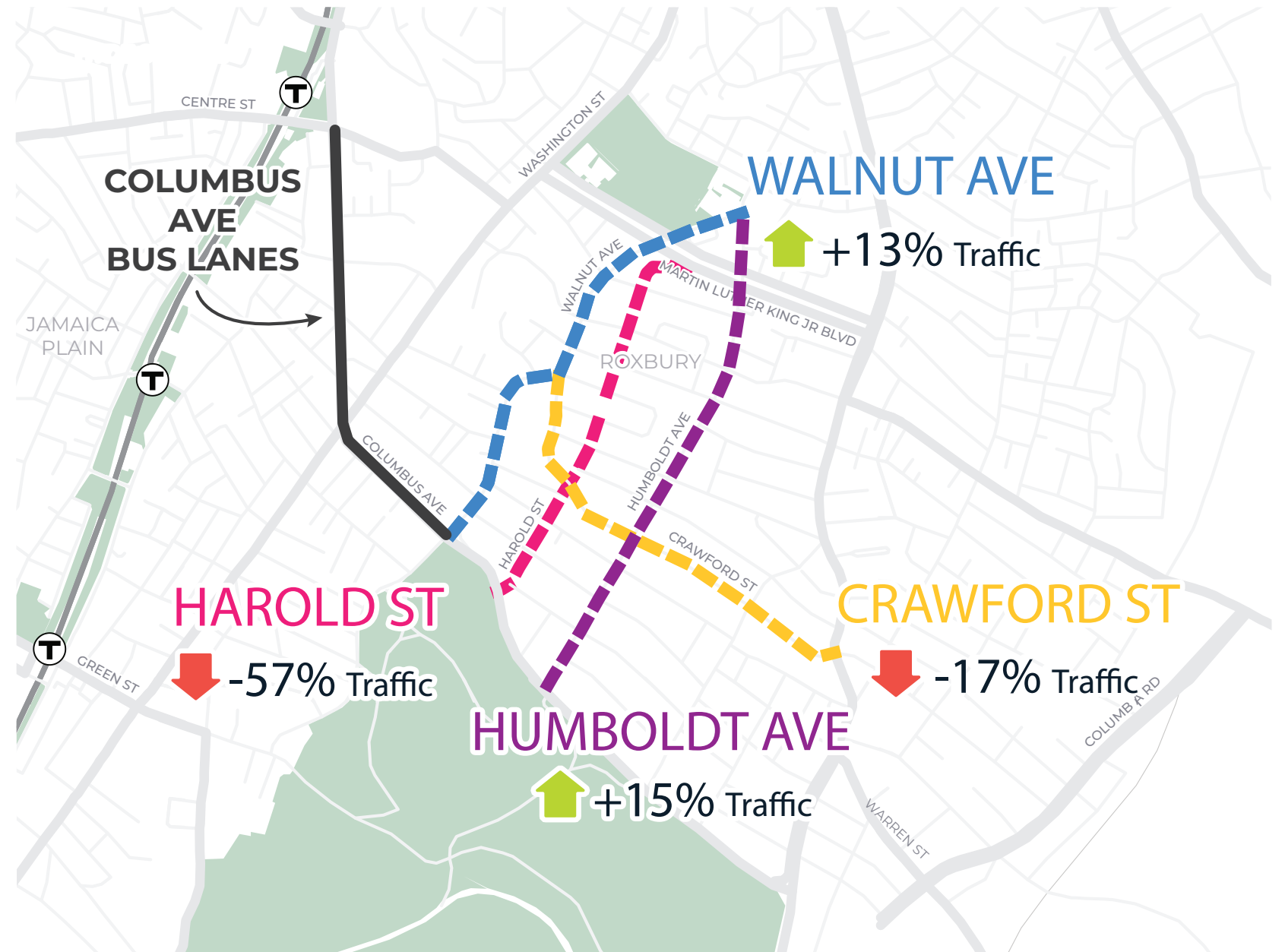
**The 20- to 40-second range shows that added time for people driving is greater during rush hour, and lower during non-rush-hour times.*




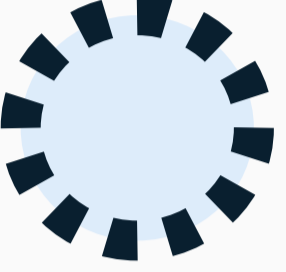


Many through-streets in the neighborhood have returned to pre-pandemic traffic volumes.

The percentages to the right show the change in traffic volumes from a 2016-2019 pre-pandemic average to April 2022.

Data show that although neighborhood traffic across JP and Roxbury has increased substantially since the lows of the COVID-19 pandemic when the Columbus Ave project was being constructed, the increase in volumes on specific neighborhood streets varies widely.



Roxbury Safe Routes to School Project Area

-  Project Boundary
-  Safer Crossing Focus Area (coming soon)
-  Speed Hump Streets Marked in Blue (in progress)
-  Speed Humps



The City is committed to safe streets. Before the Columbus Ave project even began, the Boston Transportation Department was working to make Roxbury's neighborhood streets safer for all users, especially children, through our Safe Routes to School program. We are installing speed humps and safer crossings to reduce speeds and keep people safe.



MEMORANDUM

To: Boston Transportation Department (BTD)
From: Nelson\Nygaard Consulting Associates, Inc.
Date: May 22, 2023
Subject: Columbus Avenue Bus-Lane Analysis Methods

This memorandum documents methods Nelson\Nygaard staff used to perform the Columbus Avenue bus-lane analysis for the BTD Transit Team in March 2023. The memorandum is separated into sections that address statistics used in the infographics created for this project.

Bus Ridership



Bus ridership data were provided by the MBTA and include ridership on routes 22, 29, and 44 in Fall 2022. About 2,400 people per weekday rode onboard buses on the Columbus Avenue bus lanes in the northbound direction, and about 2,500 per weekday in the southbound direction, for a total of about 4,900 riders per day using the Columbus Avenue bus lanes. A technical term for the number of people riding on a bus at a given time is 'onboard load'. The MBTA is able to determine the 'onboard load' for each bus route at each stop.

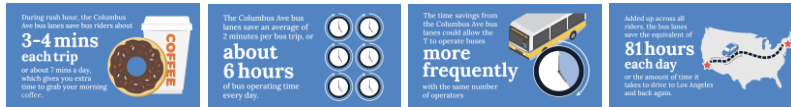
Bus-Lane Survey Data



Data showing rider satisfaction and ridership growth on the Columbus Avenue bus lanes was taken from an in-person survey conducted from December 1 through December 11 in 2021.¹ The [full results of that survey](https://www.boston.gov/sites/default/files/file/2022/03/Columbus%20Ave%20Survey%20Summary%20for%20Publication%20%282%29.pdf) are available publicly on the City of Boston's Columbus Avenue project website.

¹ BTD. Columbus Avenue Summary of Survey Results.
<<https://www.boston.gov/sites/default/files/file/2022/03/Columbus%20Ave%20Survey%20Summary%20for%20Publication%20%282%29.pdf>>

Bus Travel Times



Bus travel-time data was provided by the MBTA. Data from before the Columbus Avenue bus lanes were built are from Fall 2021, and data from after the bus lanes were built are from Winter 2022. The MBTA measures bus travel times as the amount of time the doors are open (dwell time) plus the amount of time it takes the bus to travel between stops (run time). The automatic passenger counter (APC) system on each bus records the exact time at which bus doors open and close at stops. Thus, MBTA can calculate dwell time at each stop on Columbus Ave, as well as run time between each stop on Columbus Avenue to arrive at a total bus travel-time for the corridor.

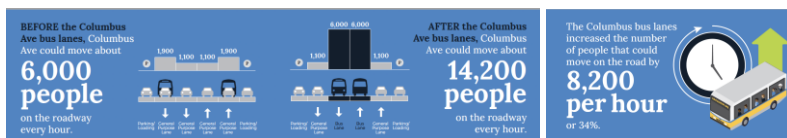
Before the Columbus Avenue bus lanes were built, in Fall 2021, an average weekday bus round trip (northbound + southbound) on the project corridor took about 13 minutes. After the bus lanes were built, in Winter 2022, that same round trip took about 11 minutes.

To identify how much time was saved by buses during the most congested times of day, we looked at weekday 90th percentile travel times, or the times of day when traffic is most congested and the corridor is busiest. For this part of the analysis, we looked at the southbound and northbound directions separately because each direction tends to be most congested at different times of day. These data show that during the most congested times of day, buses were able to travel through the Columbus Avenue bus lanes about 3.5 minutes faster in each direction after the bus lanes were built.

To calculate how much total time this saves the MBTA per day, the trip-time savings of two minutes were multiplied by the number of weekday bus trips operated on the project corridor (178 trips).

To calculate the total amount of time saved by riders, we looked at the number of passenger trips on the corridor each weekday (4,900). Assuming the vast majority of riders are making a roundtrip during the day, we divided 4,900 by 2 to get the number of individual riders likely traveling on the corridor – 2,450 riders. We then multiplied the number of riders by the two-minute average daily travel time savings to arrive at 81 total hours saved by riders each weekday.

Roadway Capacity



The roadway capacity infographics are based on theoretical person-throughput values from the [National Association of City Transportation Officials \(NACTO\)](https://nacto.org/publication/transit-street-design-guide/introduction/why/designing-move-people/), which in turn based its values on national research, such as the *Transit Capacity and Quality of Service Manual*.² These

² NACTO. Transit Street Design Guide. <<https://nacto.org/publication/transit-street-design-guide/introduction/why/designing-move-people/>>

throughput values are based on real-world observations and represent capacity, not actual person throughput. As an example, sidewalks on Columbus Avenue may have a theoretical capacity of 9,000 people per hour, but it is unlikely there is demand on the corridor for foot traffic of that magnitude.

Dedicated bus lanes are assumed to have a capacity of 6,000 people per hour, while mixed-traffic lanes are assumed to have a capacity of 1,100 people per hour. Frequent bus service operating in a mixed-traffic lane is assumed to have a capacity of 1,900 people per hour.

This means that before the bus lanes were implemented, Columbus Avenue could move two lanes of mixed-traffic with frequent bus service ($1,900 \times 2$), plus two lanes of general mixed-traffic ($1,100 \times 2$), which equals 6,000 people per hour. After the bus lanes were implemented, Columbus Avenue still has two lanes of general mixed-traffic ($1,100 \times 2$), but now it also has the dedicated bus lanes ($2 \times 6,000$), which means it can move a total of 14,200 people per hour. The difference between these two totals is 8,200, or an increase of 34%.

Theoretical roadway capacity values are a good way to illustrate how we allocate road space to maximize efficiency, as roadway allocation to personal auto travel is one of the least space- and time-efficient uses of shared public right-of-way.

Auto Speeds on Columbus Ave



Speeds for autos on Columbus Avenue are from StreetLight. The speed data from before the Columbus Avenue bus lanes implementation looks at the averages across April 1-30, 2021 and the speed data from after the implementation looks at the averages from across April 1-30, 2022.

What is StreetLight?

StreetLight is a company that buys and combines data from a variety of sources such as smartphones, commercial GPS devices, and connected vehicles. StreetLight uses these data to estimate things like how much traffic operates on a road, how fast traffic goes, and where it is traveling to and from. StreetLight is an industry-standard data source with pros and cons. The primary pros are that it is a comprehensive data source that collects far more records than manual or camera-based counting could capture. The major cons are that it estimates many values, as data for every single trip made are not available.

These data show that speeds on Columbus Avenue between Walnut Avenue and Centre Street declined from an all-day average of 13 mph before the bus lanes were built to 11 mph after they were constructed. Because this is an average, speeds at certain times of day may differ, and therefore the changes between them pre- and post-implementation may also differ.

We used StreetLight data to identify the percent of vehicles traveling over 25 mph, which is the speed limit on Columbus Avenue. StreetLight is able to identify the percent of vehicles traveling in buckets of 5 mph, i.e. 0-5 mph, 5-10 mph, 10-15 mph, and so on. To determine the number of vehicles traveling within and above the speed limit, we multiplied the total volume of vehicles on the corridor during an average day by the percent of vehicles traveling at speeds at

or under 25 mph and above 25 mph. Before the project in April 2021, approximately 90% of vehicles on average were obeying the speed limit. After the project in April 2022, approximately 100% of vehicles were obeying the speed limit on average, or a difference of 10%.

The change in the percent of vehicles obeying the speed limit may be more pronounced late at night or in the off-peak periods, and less pronounced during the peak periods, when fewer vehicles are exceeding the speed limit due to more traffic.

Why use these dates for comparison?

Beginning with May 2022 data, the StreetLight platform changed its methods to rely on a different combination of data sources than it previously used. For this reason, we chose to look only at data from April 2022 and earlier so that all of our datasets would be calculated from the same sources and with the same methods.

For post-implementation, April 2022 is roughly six months after the Columbus Avenue bus lanes project was completed. This provides time for riders and drivers alike to become accustomed to the new infrastructure and for travel patterns to settle in after the new street design.

For pre-implementation, the team used an average of April 2016, April 2017, April 2018, and April 2019 data. StreetLight data for vehicles only goes back to 2016, and in April 2020, the COVID-19 pandemic sparked massive changes to travel patterns that make this time period challenging for data comparisons.

Auto Travel Times on Columbus Ave



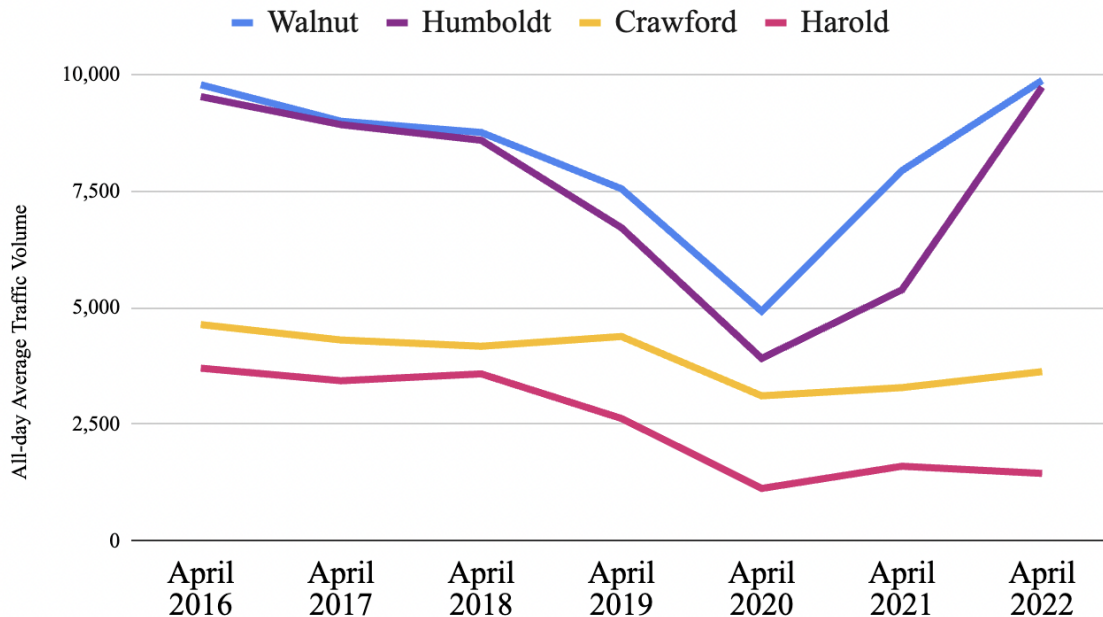
The change in auto travel times is from StreetLight data and shows the average change in the time it takes for an auto to travel the length of the project corridor from Seaver Street at Walnut Avenue to Columbus Avenue at Centre Street (or the opposite direction). Using data from April 1-30, 2021 as the pre-implementation date and data from April 1-30, 2022 as the post-implementation date shows that these travel times increased modestly. Looking at the average daily travel time, there was an increase of 20 seconds per trip. If we narrow the data to southbound travel along Columbus Avenue during the p.m. peak (3:00 - 7:00 p.m.), StreetLight shows that those trips have increased on average by approximately 40 seconds.

Traffic Volumes on Neighborhood Side Streets



StreetLight data were used to look at how much traffic volumes have changed on select roadways near the Columbus Avenue bus lanes: Walnut Avenue, Crawford Street, Harold Street, and Humboldt Avenue. These roadways were selected based on community feedback BTM had received about increases in traffic volumes due to bus-lane construction.

The data used were all-day average traffic volumes (the number of vehicles) and all-day average speed. We looked at these data for the month of April for the years 2016, 2017, 2018, and 2019 for an understanding of pre-pandemic traffic volumes. For post-project implementation, we used data from April 2022. You can see a graph of those numbers, as well as the COVID-19 pandemic-induced drop in traffic volumes during 2020 and 2021, below.



For the percentages displayed on the map, we compared the average of the April 2016, April 2017, April 2018, and April 2019 volumes to the April 2022 volume for each neighborhood street.

Because all-day averages were used, it is possible that these changes do not reflect everyone's experience (e.g., someone may not notice a decline in traffic on Crawford Street if they aren't home during the day, when most of that traffic reduction occurs).

In general, when traffic volumes on roads went up, speeds went down. Likewise, where traffic declined, average speeds went up. This relationship between traffic volumes and traffic speeds is common.

Roxbury Safe Routes to School Project



In 2019, Ellis Elementary in Roxbury was selected for Massachusetts Department of Transportation's Massachusetts Safe Routes to School Infrastructure Project funding program.

The Safe Routes to School grant application was submitted before the Columbus Avenue bus lanes were started. Although Safe Routes to School is a different project, we include information about it here because the project is related to traffic on many neighborhood side streets near the Columbus Avenue bus lanes.

The goal of the Roxbury Safe Routes to School project is to create safer, calmer streets and crossings. The project will focus on:

- Working with Ellis Elementary school to develop programming to encourage walking and biking to school
- Installing speed humps to slow speeds to 20 to 25 mph
- Making crossings safer at:
 - Harold Street, Crawford Street, and Abbotsford Street
 - Walnut Avenue where it meets Crawford Street and Holworthy Street
 - Walnut Avenue at Cobden Street
 - Walnut Avenue at Westminster Avenue
 - Walnut Avenue at Ruthven Street
 - Humboldt Avenue at Munroe Street

You can learn more by visiting the [City's project website](#).³

³ BT. Roxbury Safe Routes To School Project.
<https://www.boston.gov/departments/transportation/roxbury-safe-routes-school-project>