Columbia Street Mobility Project Complete Street Monitoring Corridor Report

CITY OF Vancouver WASHINGTON

Long Range Planning | Community Development Department

March 17, 2025

COLUMBIA STREET MOBILITY PROJECT COMPLETE STREET MONITORING CORRIDOR REPORT

This report provides an evaluation of the Columbia Street Mobility Project along Columbia Street between Columbia Way and 45th Street. It uses the City of Vancouver's Complete Streets Monitoring Framework, which was developed to inform this and future complete street projects and improvements. The evaluation compares conditions based on data collected pre-project, one-month post-project, and 12-months post-project. The data is used to identify trends and refine recommendations where needed. Additionally, the report includes data from stationary automated counters piloted on the corridor, providing approximately 20 months of pedestrian and cyclists counts. This evaluation also includes a summary of two post-project surveys: one oriented toward users of the newly added mobility lanes and one oriented toward area residents and business owners.

Executive Summary

The Columbia Street Safety and Mobility Project was designed to create a safe, protected and buffered north-south bicycle and small mobility route west of I-5 for all ages and abilities connecting neighborhoods between the Burnt Bridge Creek Trail and the Vancouver Waterfront. This project came out of the City's Complete Streets ordinance that was adopted in 2017, developed to create a well-connected, safe and accessible street system that benefits all users, ages and abilities, regardless of how they choose to travel. This is done by calming traffic speeds to reflect posted speeds, reducing crashes and near-misses, reduce level of traffic stress for pedestrians and small mobility users, and encouraging mode shift out of single-occupancy vehicles.

Findings from post-project evaluations of the Columbia Street Mobility Project indicate that bicycle and small mobility (BSM) usage has remained constant and increased along the corridor, and level of traffic stress for those users has dropped significantly. Safety along the corridor is also trending down after installation of the project, with crashes between vehicles and vulnerable road users dropping. The project has also improved multi-modal connectivity and completeness as it connects to several east-west BSM routes in the City, including future Complete Streets Corridors such as 29th Street, 33rd Street and Mill Plain Blvd. Automated counters were also installed at key locations on the corridor as a pilot project, and the twenty months of data show broad usage of both pedestrians and bicycle and small mobility facilities. Additional evaluation of measures identified in the draft Complete Streets Evaluation Framework provide supplemental information and are detailed in Appendix A.

Top Level Findings:

- Northbound/southbound cameras measured cyclist volumes on Columbia Street and found increased users after project installation.
- Peak-hour cyclist volumes measured at intersections also showed an upward trend post project installation.
- Automated 'eco-counters' demonstrate that bicycles and small mobility users are more likely to use the Columbia Street facilities in summer versus winter, while pedestrian counts see some fluctuations but are less influenced by weather. At the intersection of Columbia Street and Mill Plain, for example, the average number of cyclists during a summer month was 3,853 compared to 1,362 users during a winter month.
- Motor vehicle speeds on Columbia Street increased slightly on the southern end of the corridor and decreased slightly on the northern end after project installation. The corridor-wide average 85th percentile (bidirectional) speed decreased from 25.8 mph pre-project to 24.8 mph 12 months post-project.
- Motor vehicle volumes increased from 2021 to 2022 and 2023.
- The addition of low-stress mobility facilities is expected to reduce or slow the increase in vehicle-miles traveled (VMT) and air pollution over time by providing safe facilities that encourage cycling and other non-motorized transportation modes.
- Parking surveys demonstrated that overall, ample parking is available on weekdays and weekends on and near Columbia Street, though parking is more widely utilized at peak hours on certain blocks Downtown.

Summary of Community Feedback

- Service providers such as fire, waste services, etc. gave either neutral or positive feedback on the Project's implementation.
- The Corridor User and Neighbor Surveys expressed dissatisfaction about parking removal near businesses and homes.
- Survey responses also revealed appreciation for the safety improvements on the corridor.
- Some survey respondents expressed concerns about poor driver behavior, the visibility of lane separators, and keeping the mobility lanes clear.

Road Surface Maintenance

In 2021, Vancouver Public Works completed several pavement maintenance treatments on Columbia Street in conjunction with the Project. The pavement work was installed in advance of the protected mobility lanes and safety improvements. The pavement work included:

- Resurfacing (milling and grinding followed by asphalt paving) between W Mill Plain Boulevard and W 45th Street.
- Pavement preservation (microsurfacing) treatment between W Columbia Way and W Mill Plain Boulevard. Upgrading sidewalk ramps to Americans with Disabilities Act standards at approximately 43 locations on the corridor.

Project Recommendations

Based on these findings, the following items are recommended to improve safety and comfort for all users on the Columbia Street corridor.

Immediate

- Install additional infrastructure to harden the separation of people cycling in mobility lanes from motor vehicles. Concrete curbs are preferable because they provide the most robust separation, but vertical delineators (wands) may be acceptable where it is not practical to install concrete curbs. Vertical delineators could be combined with the existing Ziclas to maintain the physical barrier that Ziclas provide.
    - Locations with higher motor vehicle volumes (i.e., between 6th Street and Fourth Plain Boulevard) would benefit the most from concrete curbs.
- Add painted bike boxes and leading bicycle intervals (LBIs) where possible with leading pedestrian intervals, or signs that bicycles should follow pedestrian signals[1]. The 8th Street, McLoughlin Boulevard, Fourth Plain Boulevard, and Evergreen Boulevard intersections are high-priority locations for this treatment given the high motor vehicle-bicycle conflicting volumes observed there. Additional intersections may also benefit from bike boxes and LBIs.
    - Restrict right turns on red lights in conjunction with LBIs and bike boxes to further prevent conflicts between motor vehicles and people using sidewalks and mobility lanes. This restriction would be beneficial at all intersections on Columbia Street, regardless of whether they have bike boxes or LBIs.
- Convert the northbound segment of Columbia Street between W 13th Street and Mill Plain Boulevard from shared-lane markings with on street parking to a buffered mobility lane when property is re-tenanted.
- Conduct lighting analysis on the impact of lighting added near the new marked crosswalks.

Ongoing

- Continue to monitor bicycle volumes to gain more insight on usage outside of seasonal variability and as traffic patterns further normalize post-pandemic.
- Continue to monitor motor vehicle speeds and add additional traffic calming as needed.
- Continue to assess the appropriate traffic control signal needs at the Columbia Street/W 39th Street intersection.

[1] Sign R9-5 in Regulatory Signs and Plaques for Bicycle Facilities, 2009 Edition of Manual on Uniform Traffic Control Devices

Project Investments on Columbia Street

The Columbia Street Mobility Project provided upgrades to bicycle and mobility facilities on W Columbia Street between W Columbia Way and W 45th Street. These improvements are listed below in four segments:

Segment 1: W Columbia Way to W 8th Street

- Bicycle and pedestrian wayfinding symbols were added on the west side of Columbia Street.
- Signage was added to indicate that the shared use path is a pedestrian priority zone and that other users should move slowly.
- No changes were made to the existing on-street north/south bike lanes and on-street parking.
- A HAWK signal/enhanced crossing was added between 6th and 8th streets.

Segment 2: W 8th Street to W 13th Street

- A northbound parking-protected and a southbound buffered mobility lane were added.
- Parking was removed on the west side of Columbia Street between W 8th Street and W 11th Street to add a buffered mobility lane.
- On-street parking was relocated from the west to the east side of Columbia Street between W 11th Street and W 12th Street.
- Between W 12th and W 13th Street, protected northbound and southbound bike lanes were added (on-street parking did not and does not exist here).

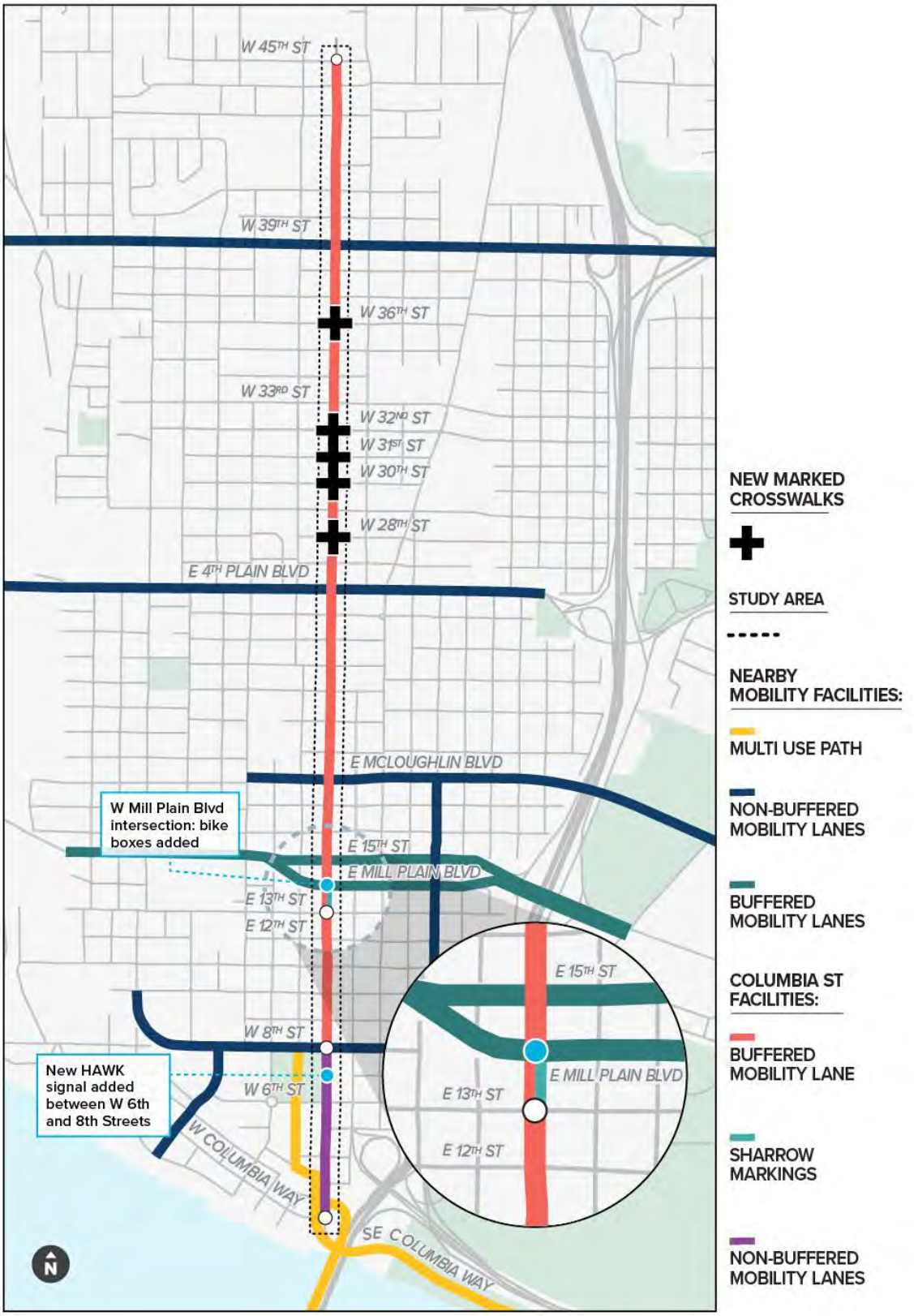
Segment 3: W 13th Street to Mill Plain Boulevard

- A southbound buffered mobility lane was added.
- Maintained on-street parking on eastside adjacent to the Veteran's Assistance Center with a dedicated drop-off zone to serve this tenant.
- Northbound bikes and small mobility users share the travel lane with motorists, with sharrows marking the shared roadway environment.
- Bike boxes were added in both directions at the Columbia Street/Mill Plain Boulevard intersection.

Segment 4: Mill Plain Boulevard to NW 45th Street

- Protected mobility lanes were added for northbound and southbound travel.
- On-street parking was removed from both sides of Columbia Street.
- Marked crosswalks were added at the 28th Street, 30th Street, 31st Street, 32nd Street, and 36th Street intersections.

Additional improvements include pavement resurfacing and the planting of forty-six (46) trees (including twelve (12) on private property) along the corridor. **Error! Reference source n ot found.** below summarizes these improvements and nearby mobility facilities.


W 45TH ST
W 39TH ST
W 36TH ST
W 33RD ST
W 32ND ST
W 31ST ST
W 30TH ST
W 28TH ST
E 4TH PLAIN BLVD
E MCLOUGHLIN BLVD
W Mill Plain Blvd intersection: bike boxes added
E 15TH ST
E MILL PLAIN BLVD
E 13TH ST
E 12TH ST
W 8TH ST
New HAWK signal added between W 6th and 8th Streets
W 6TH ST
W COLUMBIA WAY
SE COLUMBIA WAY
N
NEW MARKED CROSSWALKS
STUDY AREA
NEARBY MOBILITY FACILITIES:
MULTI USE PATH
NON-BUFFERED MOBILITY LANES
BUFFERED MOBILITY LANES
COLUMBIA ST FACILITIES:
BUFFERED MOBILITY LANE
SHARROW MARKINGS
NON-BUFFERED MOBILITY LANES

Columbia Street Corridor Assessment Outcomes

The performance assessment results are summarized in the following sections. Data includes traffic volumes, traffic speeds, ridership data, crashes, and on-street parking utilization to provide the basis for before- and after-project conditions. **Pre-project** data was collected along the corridor in 2018 (and February 2021 for turning-movement counts due to varying availability of data) to establish a baseline. **Post-project** corridor crash data, vehicle, pedestrian, and cyclist counts and transit ridership data, and speed data were collected in September 2022 and September-October 2023 at the same locations to provide the basis for one-month and 12-month post-project conditions. The data was used to establish trends, compare to the baseline data, and identify if additional changes should be recommended along the corridor. While pre- and post- project data offer a glimpse into how project investments impact travel behavior, the COVID pandemic, shifts to work-from-home and hybrid schedules have also had significant impacts to travel behaviors particularly in central business districts.

Mode Share

Description: Mode share measures the number of people and overall percentage of travelers on a corridor utilizing a particular mode of transportation such as taking transit, walking or driving.

Measure(s): Walking, bicycling, and transit usage.

Target: Increase the number of people who walk, bike, or take transit along the corridor after project implementation.

Data Sources: Corridor counts collected by cameras at fixed locations on fixed dates approximating pr-project locations; C-Tran ridership data collected from boardings. Eco-Counters[2] were also installed along Columbia Street between March and June 2023 to collect ongoing counts of pedestrian, bicycle and small mobility users. This represents a different data set in that there is no pre-project equivalent of this tool or data set of daily users. While this makes it difficult to user the information for pre- and post-project comparison, it does provide a broader data of user that pulls from nearly two years of automated counts.

Mode Share Findings

Bicycle and pedestrian counts by cameras were taken in the summer of 2018, September 2022 and October 2023 in both northbound and southbound directions on discrete dates. Eco-

[2] There are six (6) CITIX AI counters placed along Columbia St. at three intersections: Mill Plain Blvd, 28th St. and 36th St. Each intersection has two counters placed along the eastern and western sides of the street to gather northbound or southbound bicycle and small mobility traffic, as well as pedestrian activity on each side of Columbia St. The CITIX AI counters utilize artificial intelligence to count and differentiate between all roadway users including pedestrians, bicyclists, motorized two-wheelers, cars, trucks, and buses. The sensor is utilized for long-term or permanent counts, and is mounted high on existing infrastructure, such as a street light or power pole.

counters were installed at three locations between March and June of 2023 and offer continuous automated counters. The data presented here includes monthly sums between the data of installation and January 2025.

Average transit ridership counts for C-TRAN buses along and near Columbia Street were also taken during the same timeframe as the camera counts. Pre-project turning movement counts for bikes and small mobility devices were conducted later in February 2021.

Bike and Small Mobility Trips by Camera Counts

- Trips increased at both W 39th Street and Mill Plain Blvd between 2018 and 2022 (shown in Table 2).
- 2023 volume was higher at 39th Street compared to 2018, but lower near Mill Plain Blvd.
- Data collection at Mill Plain Blvd was the only project location where mobility users share the northbound travel lane with vehicles via sharrows, which some mobility users may avoid.
- Cameras depicted some bicyclists using the sidewalk at this location.
- Collection date, weather, remote work, or school schedules may have contributed to lower ridership as well.

Table 1: 2018, 2022, and 2023 Bicycle Camera Counts on Columbia Street (Combined Northbound and Southbound Volumes)

LOCATION	PRE-PROJECT (SUMMER 2018)	ONE-MONTH POST-PROJECT (SEPTEMBER 2022)	12-MONTHS POST-PROJECT (OCTOBER 2023)	2022-2018 CHANGE	2023-2018 CHANGE
W 39TH STREET	69	116	81	+47	+12
MILL PLAIN BOULEVARD*	157	177	125	+21	-32
8TH STREET	No Data	180	135	N/A	N/A

- Turning movement counts were conducted to measure the change in number of mobility users on the corridor as they enter Columbia to travel north/south (Table 3).
- Northbound and southbound volumes were higher in 2022 and 2023.
- Seasonality likely played a role, with fewer people willing to bicycle in February's pre-project count window.
- Overall, post-project bicycle counts have either remained close to, or increased from pre-project conditions.

- Longer-term, regular monitoring of bicycle volumes is recommended to better understand changes in ridership on the corridor.

Table 2: Pre- (2021) and One Month Post-Project (2022) and 12-month Post-Project Entering Bicycle Volumes

INTERSECTION	PRE-PROJECT (FEBRUARY 2021)		ONE MONTH POST-PROJECT (SEPTEMBER 2022)		12 MONTHS POST-PROJECT (OCTOBER 2023)		2023-2021 CHANGE
	NB	SB	NB	SB	NB	SB	
A.M. PEAK HOUR							
8TH STREET	0	1	8	0	5	4	+8
MILL PLAIN BOULEVARD	0	0	7	0	4	7	+11
FOURTH PLAIN BOULEVARD	0	0	2	8	3	7	+10
33RD STREET	0	0	1	4	2	3	+5
TOTAL	**0**	**1**	**18**	**12**	**14**	**21**	**+34**
P.M. PEAK HOUR							
8TH STREET	1	1	13	4	12	6	+16
MILL PLAIN BOULEVARD	1	0	14	1	10	4	+13
FOURTH PLAIN BOULEVARD	0	0	17	12	14	10	+24
33RD STREET	0	0	4	1	3	7	+10
TOTAL	**2**	**1**	**48**	**18**	**39**	**27**	**+63**

Walking Trips

- Between 2018 and 2022, there was an increase in pedestrian volume at W 39th St. & decrease at W Mill Plain Blvd (seen in Table 4 below).

- However, between 2018 and 2023, the opposite was true with volumes decreasing at W 39th St. and increasing at W Mill Plain.
- A large increase was seen between 2022 and 2023 at 8th St, but it's unclear if this is a sustained trend or due to land use changes in the area (New Seasons Market opened in Fall 2023).
- Pedestrian Level of Travel Stress (LTS) dropped in this area due to the added buffer between the sidewalk and vehicle travel lane (seed in Appendix B).
- The addition of five new crossings and associated ADA curb ramps likely increased accessibility on the corridor for people walking, using strollers, wheelchairs or other assistive devices.

Table 3: 2018, 2022, and 2023 Weekday Pedestrian counts (Combined Northbound and Southbound Volumes) taken between 6 a.m. and 8 p.m. in 2018 and 2022, and between 7 a.m. and 7 p.m. in 2023.

LOCATION	SUMMER 2018	SEPTEMBER 2022 (ONE-MONTH POST-PROJECT)	OCTOBER 2023 (12-MONTH POST-PROJECT)	2022-2018 CHANGE	2023-2018 CHANGE	2023-2022 CHANGE
39TH STREET	71	136	90	+65	-19	-46
MILL PLAIN BOULEVARD*	262	238	286	-24	+24	+48
8TH STREET	N/A	372	680	N/A	N/A	+308

Note: 2018 and 2022 volumes are for 6:00 a.m. to 8:00 p.m.; 2023 volumes are for 7:00 a.m. to 7:00 p.m.
*Recorded north of 16th St in 2022 and between 13th St and Mill Plain Boulevard in 2023

Bike, Small Mobility and Pedestrian Trip Data from Eco-Counters

- Counts for bicyclist and small mobility users fluctuate more across winter and summer months versus pedestrians that are less influenced by changing seasons and weather patterns.
- At the intersection of Columbia St. and Mill Plain Blvd (Figure 3), the average of bi-directional bicyclists per month in the summer (June – September) is 3,853 versus 1,362 in colder months (November – February).

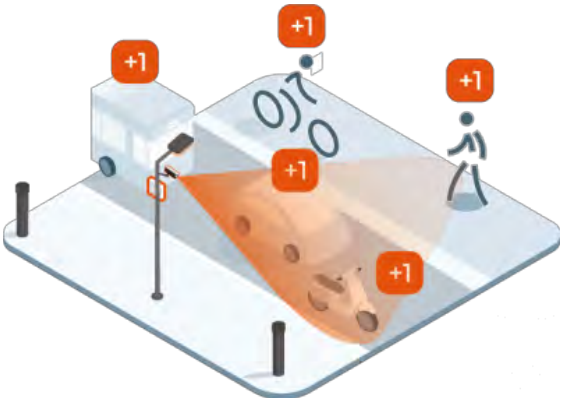


Figure 1 CITIX AI Eco-Counter

- The intersection of Columbia St. and 36th St. (Figure 5) shows that pedestrian counts tend to increase in the warmer months, but remain relatively consistent across seasons.

- The data across the twenty months demonstrate occasional inconsistencies with the counters that the City is working with Eco-Counter to address. For example, the City has noted a significant difference in northbound cyclists counts at West 28th Street compared to the counters located both north and south on the corridor, and are exploring whether this irregularity is a function of the counter operation. These irregularities are important to note, but the counts still offer a larger overview of bicycle and pedestrian usage along Columbia St.

Figure 2 Monthly bi-directional pedestrian and single-direction cyclist counts at Columbia Street and Mill Plain Blvd

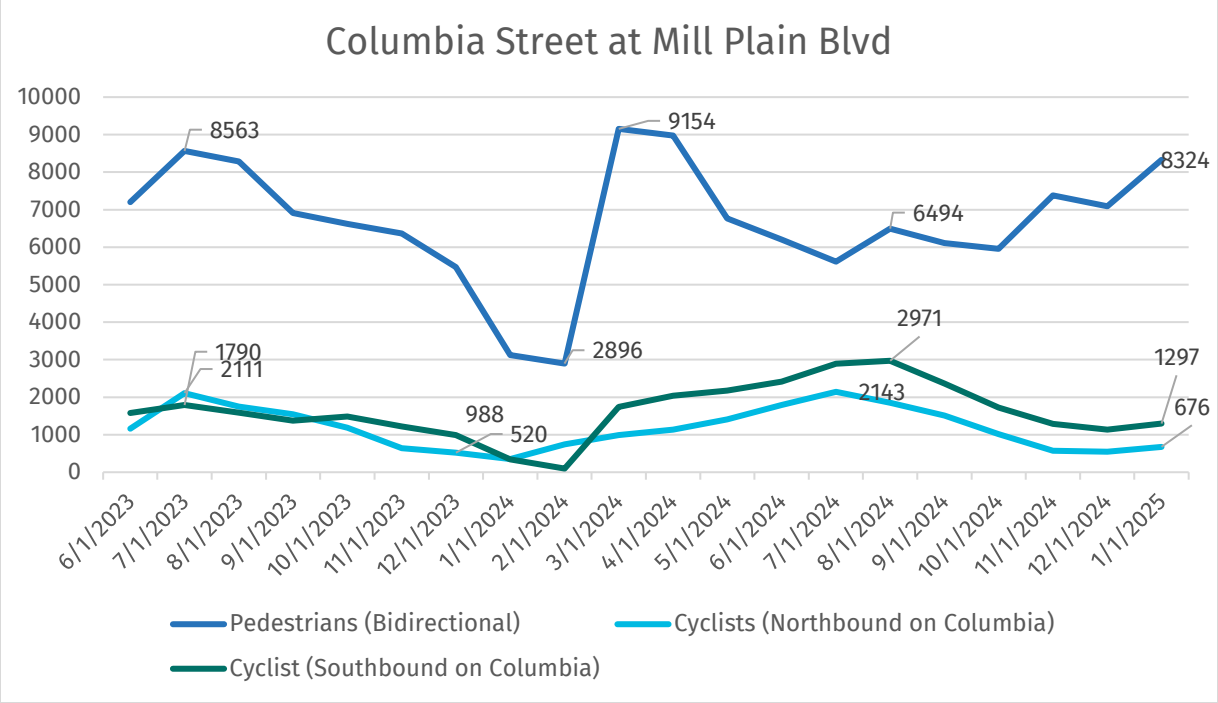


Figure 3 Monthly bi-directional pedestrian and single-direction cyclist counts at Columbia and W 28th Street

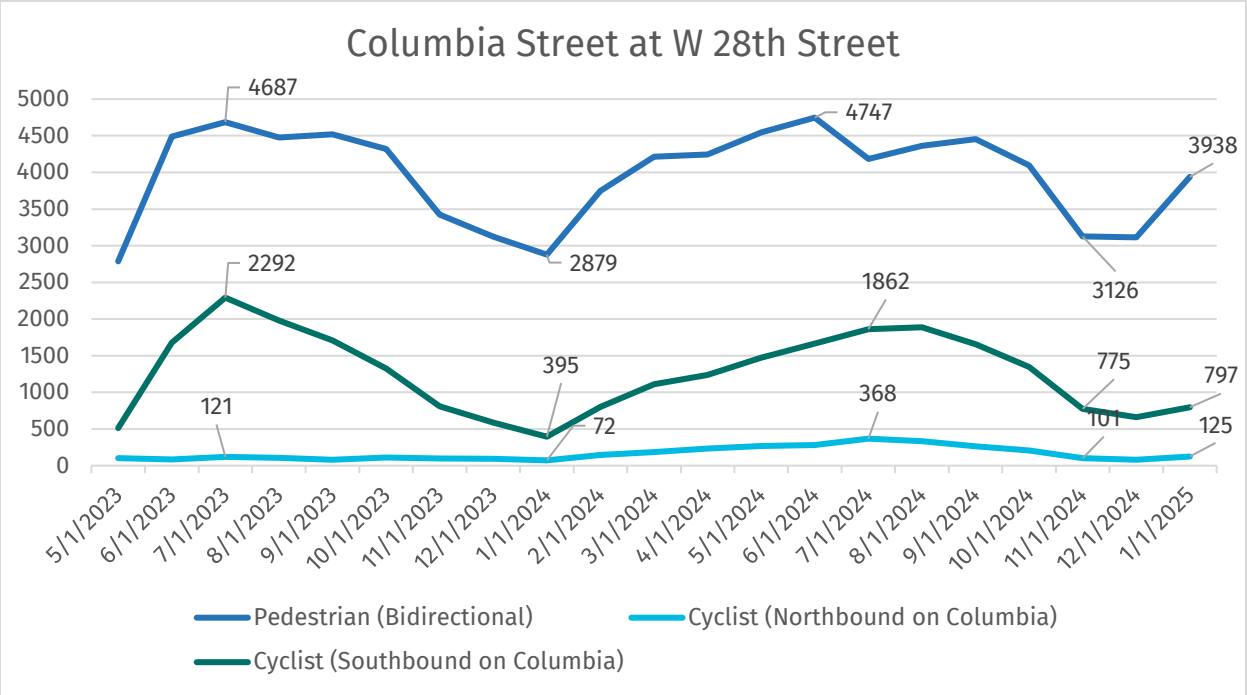
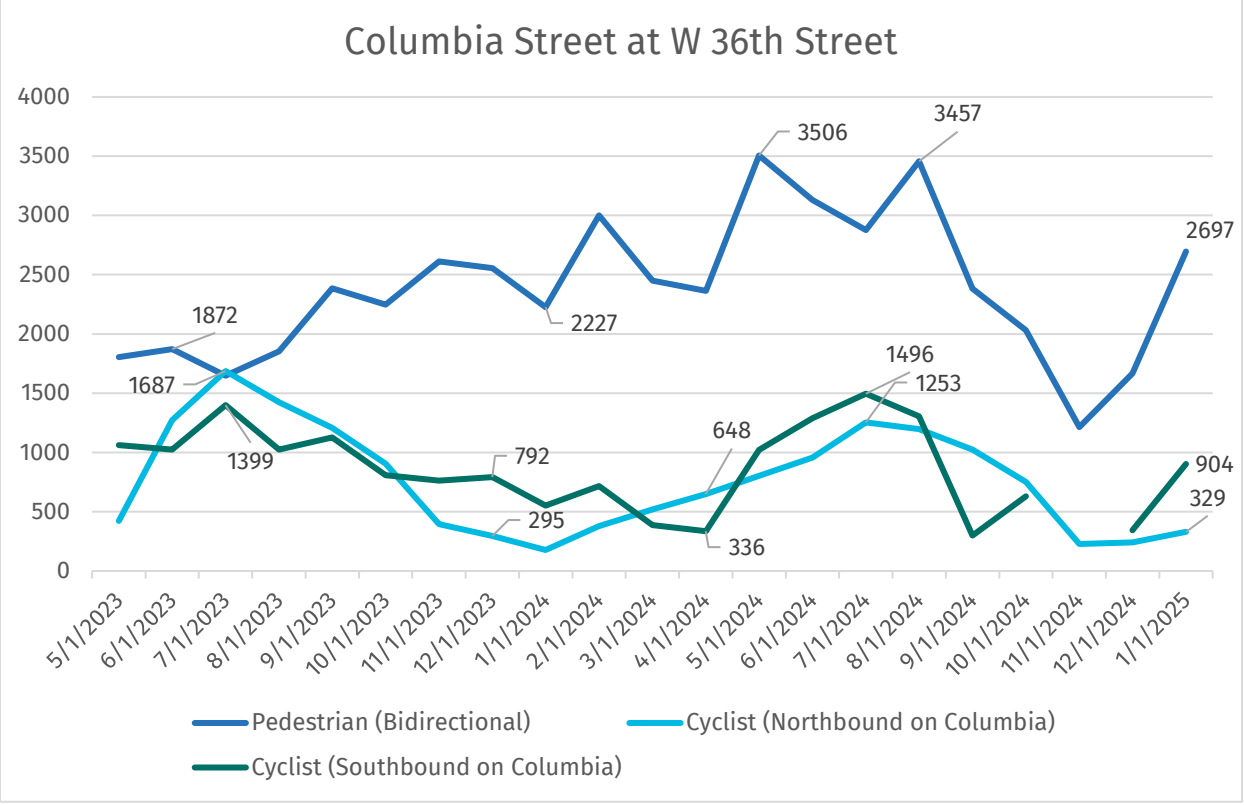


Figure 4 Monthly bi-directional pedestrian and single-direction bicycle counts on Columbia Street at 36th Street



Transit Trips

- Ridership increased on and near the project corridor, between 2019 and 2023 (seen in Table 5).
- Ridership in 2022 was generally lower than both 2019 and 2023, reflecting widespread trends of slower rebounds in transit ridership post-COVID pandemic.
- Some ridership changes may be attributed to C-Tran's bus rapid transit (the VINE) opening a block away from Project corridor, and related local bus service changes.

Table 4 summarizes daily average weekday transit ridership (boardings plus alightings) on C-TRAN buses on and near the Columbia Street Project corridor for 2019, 2022, and 2023. The data indicates that ridership increased some between 2019 and 2023, with 2022 generally having lower ridership than both 2019 and 2023. The overall trend suggests a rebound in transit ridership in 2023 after stagnant ridership in 2022 relative to 2019. These reflect widespread trends of slower rebounds in transit ridership post-COVID pandemic. Some of the ridership changes could also be attributed to the opening of the VINE Green Line, C-TRAN's bus rapid transit a block away from the Project corridor, and associated changes to the local bus service.

Table 4: Pre-Project (2019) and Post Project (2022 and 2023) C-TRAN Average Daily Ridership

STOP #	LOCATION	2019 (PRE-PROJECT) TOTAL	2022 (ONE-MONTH POST PROJECT) TOTAL	2023 (TWELVE-MONTH POST PROJECT) TOTAL	2023-2019 DIFFERENCE
6152	MCLOUGHLIN BOULEVARD & WASHINGTON STREET	246	176	186	-60
579	WASHINGTON ST & 13TH STREET	652	709	1236	+584
6153	WASHINGTON ST & 12TH STREET	595	442	812	+217
6067	EVERGREEN STREET & DANIELS STREET WB	5	13	33	+28
6070	EVERGREEN STREET & COLUMBIA STREET	4	3	4	+1
6053	WASHINGTON STREET & 9TH STREET	47	42	48	+1
638	8TH STREET & MAIN STREET	19	23	24	+5
1384	6TH STREET & WASHINGTON STREET	39	41	44	+5
TOTAL		**1,606**	**1,449**	**2,387**	**+781**

Safety

Description: This measure monitors the safety of travel along the study corridor to provide trends related to total vehicle, pedestrian, and bicyclist collisions, fatal and severe injury collisions, total fatalities and severe injuries, vehicle travel speeds and volumes and vehicle-bicycle conflicts.

Measure(s): Vehicle, pedestrian, and bicyclist fatal and serious injury crashes; Crashes involving a pedestrian, or bicyclist**;** Vehicle travel speeds and volumes; Vehicle-bicycle conflicts.

Target: Reduce transportation related collisions, fatalities, and serious injuries for all users after project implementation.

Data Sources: City's Collision Dashboard (Washington Department of Transportation data); Collected count and speed data.

Safety Findings

Fatal and Serious Injury Crashes Involving People Walking and Biking

The pre-project analysis period was September 1, 2019-August 31, 2020, while the post-project analysis period was June 1, 2022-May 31, 2023. Twenty-one (21) crashes occurred during the pre-project period. Seventeen (17) of these were motor-vehicle-only, two involved people bicycling, and two involved people walking.

No fatal crashes occurred during the pre-project period, but five of the crashes caused severe injuries in that period. Two of the severe-injury crashes only involved motor vehicles, one involved a person walking, and two others involved a person bicycling. Both motor vehicle injury crashes occurred at the Columbia Street and W Mill Plain Boulevard intersection. One of the cyclist-involved injury crashes occurred at the intersection of Columbia Street and W 36th St, while the other occurred at the intersection of Columbia Street and W 39th Street. The pedestrian-involved injury crash happened at the intersection of Columbia Street and W 16th Street. Figure 5 below summarizes these findings.

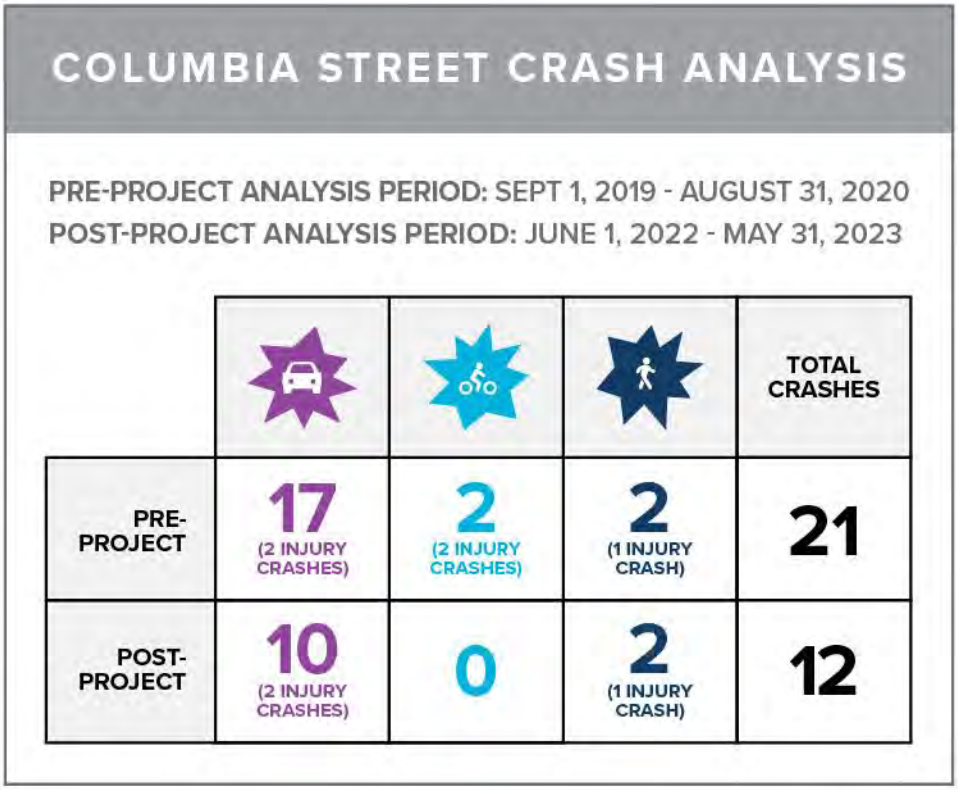
The number of pre-project crashes that caused injuries (five of 21 total crashes) suggests that during the pre-project period, Columbia Street corridor presented safety challenges for all road users, especially at major intersections, such as at W 39th St and W Mill Plain Boulevard. Future monitoring of the corridor will provide data on the effect of the Project facilities on fatal and severe injury and total crash rates.

As shown in Figure 5, there were 12 total crashes during the post-project period on the corridor, with no bicycle-involved crashes and two crashes involving people walking. One of the crashes involving a pedestrian occurred when a driver failed to yield the right of way in daylight conditions, with no injury. The other pedestrian-involved crash is attributed to the

vehicle driver turning left and failing to yield to a person walking at the Evergreen Street intersection; the crash resulted in a minor injury.

The lower number of crashes in the post-project period suggests that safety has improved on the corridor since project implementation, especially for people biking and driving. As these data are from relatively short time periods, longer-term monitoring of crash trends is recommended.

Figure 5: Summary of Pre- and Post-Project Crashes on Columbia Street



Motor Vehicle Speeds and Volumes

The 85th-percentile speeds were measured in May 2018[3], and Table 5 compares those speeds with data taken at one and 12month intervals post project (September 2022 and October 2023). The overall average 85th-percentile speed in 2018 was 25.8 mph, 25.9 mph in 2022, and 24.8 mph in 2023. Motor vehicle speeds changed little between pre-project and one-month post project period.2, The exception is southbound traffic north of W Mill Plain Boulevard, where the 85th-percentile speed increased by six miles per hour between 2018 and 2022. One possible explanation for the substantial increase seen at that location is that 2018 data were

[3] City of Vancouver Westside Bike Mobility Project Technical Documents, Traffic Speed and Volume Counts, email communication from Emily Benoit, City of Vancouver, November 2, 2023

recorded north of W Mill Plain Boulevard, while the 2022 data was recorded north of W 15th St. The 2023 85th-percentile speeds were similar to 2022 speeds.

As Table 5 shows, 12-month post-project speeds were either similar to or higher than pre-project speeds around Mill Plain Boulevard but lower near Fourth Plain Boulevard and 39th Street. Generally, there was less change in speeds on the corridor where parking was preserved in some form while speeds decreased more on the corridor where parking was removed. Longer-term speed monitoring could shed more light on speed trends on the corridor.

Table 5: Pre- and Post-Project 85th-Percentile Vehicle Speeds on Columbia Street

LOCATION	PRE-PROJECT (2018)		ONE MONTH POST-PROJECT (2022)		12 MONTHS POST-PROJECT (2023)		2023-2018 DIFFERENCE (MPH)
	NB (MPH)	SB (MPH)	NB (MPH)	SB (MPH)	NB (MPH)	SB (MPH)	
SOUTH OF MILL PLAIN BOULEVARD	21	24	21	24	22	24	NB: +1 SB: 0
NORTH OF MILL PLAIN BOULEVARD*	29	23	27	29	29	28	NB: 0 SB: +5
NORTH OF FOURTH PLAIN BOULEVARD	29	27	27	26	25	24	NB: -4 SB: -3
NORTH OF 39TH STREET	26	27	27	26	23	23	NB: -3 SB: -4

*Measured north of 15th Street in 2022 and between McLoughlin Boulevard and Fourth Plain Boulevard in 2023

Peak hour turning movement counts onto Columbia Street have also been compared between pre-project, and one-month and twelve-month post-project. Pre-project turning movements were collected in February 2021, a few months before Project implementation compared to most pre-project data collected in 2018. Table 6 depicts the substantial increase in vehicles accessing Columbia Street, particularly at Fourth Plain Boulevard and 33rd Street from pre-project conditions. The discrepancy may also be attributed to suppressed traffic volumes in early 2021 when the COVID 19 pandemic was impacting workplace commutes and overall trip behaviors.

Table 6: Peak Hour Northbound and Southbound Entering Vehicle Volumes

	PRE-PROJECT (2021)	ONE MONTH POST-PROJECT (2022)	12 MONTHS POST-PROJECT (2023)	2023-2021 % CHANGE
AM PEAK HOUR				
8TH ST	203	313	343	+69%
MILL PLAIN BOULEVARD	280	474	505	+80%
FOURTH PLAIN BOULEVARD	116	244	412	+255%
33RD STREET	93	176	318	+242%
PM PEAK HOUR				
8TH STREET	355	460	494	+39%
MILL PLAIN BOULEVARD	531	722	782	+47%
FOURTH PLAIN BOULEVARD	167	270	290	+74%
33RD STREET	112	200	224	+100%

Bicycle Conflicts at Key Intersections

Table 7 compares the right-turning motor vehicle volume with through- and right-turning bicycle volume for the northbound and southbound directions in the p.m. peak hour. These movements create potential conflicts, including "right-hook" crashes in which a motor vehicle turning right collides with a bicyclist or small mobility user going straight through, or turning right at the intersection. Areas of high potential conflict include the northbound right turns at the W 8th Street, Evergreen Boulevard, Mill Plain Boulevard, McLoughlin Boulevard, and Fourth Plain Boulevard intersections. Other areas of high potential conflict include the southbound right turns at the W 15th Street and Fourth Plain Boulevard intersections. Moderate to high conflict points due to the bicycle and vehicle volumes exist throughout the Columbia Street corridor so safety concerns are not limited to the busiest intersections.

Painted bike boxes are a safety intervention that can improve bicyclist and small mobility user safety at areas with high levels of potential conflict[4]. The northbound right turn at Mill Plain Boulevard is an especially high traffic volume (380 right-turning vehicles, with 15 through and right-turning cyclists), and the bike boxes installed as part of the Project are expected to improve safety at that location. Bike boxes may be warranted at other locations with high levels of potential conflict between people cycling and motor vehicles. The two bicycle-involved injury crashes that occurred in the year prior to Project implementation occurred at the W 36th St and W 39th St intersections. These intersections have lower bicycle and vehicle volumes, demonstrating crash history should also be considered in the placement of bike boxes.

Leading pedestrian intervals (LPIs) are common safety treatments that are proven to reduce crashes involving people walking and vehicle turning conflicts at intersections[5]. They function by giving pedestrians a green walk signal before allowing motor vehicles to proceed through the intersection, thereby allowing people walking to enter the intersection and become more visible to drivers who are turning across the crosswalk. Leading bicycle intervals (LBIs) function in the same way and can accompany LPIs. Bike-specific signal heads or "Bikes Use Pedestrian Signal" plaques may be used to provide LBIs at intersections to reduce turning conflicts[6].

[4] Bike Boxes, NACTO Urban Bikeway Design Guide (2014), https://nacto.org/publication/urban-bikeway-design-guide/intersection-treatments/bike-boxes/

[5] Leading Pedestrian Interval, US Federal Highway Administration, https://highways.dot.gov/safety/proven-safety-countermeasures/leading-pedestrian-interval

[6] Leading Bike Interval (LBI) and Lagging Left Turn, NACTO, https://nacto.org/publication/dont-give-up-at-the-intersection/signal-phasing-strategy/leading-bike-interval-lbi-lagging-left-turn/

Table 7: Potential Bicycle-Motor Vehicle Conflicts in the P.m. Peak Hour at Key Intersections on Columbia Street (12 Months Post-Project)

INTERSECTION	PEAK HOUR	BICYCLE VOLUME*		RIGHT-TURNING VEHICLES	
		NB	SB	NB	SB
COLUMBIA WAY	4:20-5:20 PM	9	5	0	108
W 8TH STREET	4:15-5:15 PM	11	6	27	43
EVERGREEN BOULEVARD	4:15-5:15 PM	8	3	34	18
MILL PLAIN BOULEVARD	4:15-5:15 PM	10	4	380	0
W 15TH STREET	3:40-4:40 PM	6	10	0	9
MCLOUGHLIN BOULEVARD	2:25-3:25 PM	7	4	24	9
FOURTH PLAIN BOULEVARD	4:20-5:20 PM	14	10	67	11
W 29TH STREET	2:45-3:45 PM	3	3	4	2
W 33RD STREET	3:40-4:40 PM	3	7	29	4
W 39TH STREET	2:25-3:25 PM	5	4	18	5
W 45TH STREET	2:25-3:25 PM	1	1	52	2

Note: *through and right-turning bicycles

Crosswalks & Lighting

New marked crosswalks were installed at the following locations on Columbia Street:

- W 28th Street
- W 30th Street
- W 31st Street
- W 32nd Street
- W 36th Street

Crosswalks require illumination, and post-project implementation the City adopted a pedestrian crossing policy setting standards for spacing and infrastructure. The City will

need analyze the lighting conditions at each of these crossings to assess whether additional lighting is needed to meet standards.

39th Street Signal

The City recently installed a traffic signal at the Columbia Street/39th Street intersection (previously the intersection was all-way stop-controlled) unrelated to this project. Continued monitoring of intersection may be warranted as travelers adjust to the new traffic control.

Service Providers, Operations and Parking Access

Parking Surveys Parking surveys were conducted in 2022 on a weekday (Thursday, September 29) and a weekend (Saturday, October 1) in the study area (seen in Figures 5 and 6). For streets with distinct, striped parking spaces, Google Streetview and aerial imagery were used to count the number of marked parking spaces. On streets without striped parking spaces, the parking capacity of street segments was estimated by dividing the length of segments by 20 feet (the assumed per-vehicle length) and multiplying the resulting by 0.7 to account for driveways. This calculated capacity was doubled for streets with parking on both sides. The parking occupancy percentages were calculated after entering the count data into a geographic information (GIS) system. Results are presented for the average of the a.m. and p.m. periods on each day (weekday and weekend).

- Field observation vehicle counts were conducted on each street during four periods on each day: 8 a.m., 10 a.m., 2 p.m. and 5 p.m.
- Results are listed for the average of the a.m. and p.m. periods on each day (weekday and weekend).
- Missing values in Figures 5 and 6 indicate either segments missed during counts, or where no street parking is available.
- Occupancy percentages over 100 percent were caused by illegal parking or higher density of parked vehicles than estimated capacity accounted for.
- Weekday occupancy was 33.6% in the morning and 34.5% in the afternoon; Weekend occupancy was 38.1% in the morning and 37.5% in the afternoon.
    - For both days, the highest occupancy was south of Mill Plain Blvd, moderate occupancy between Mill Plain Blvd and Fourth Plain Blvd, and lowest occupancy north of Fourth Plain Blvd.
    - Highest occupancy areas were near Esther Short Park (during weekend farmers market), and between W 20th St. and W Fourth Plain Blvd near Main St. (near numerous businesses)

- Overall, less than 50% of available parking is used in the study area, but certain segments near Esther Short Park saw 100% utilization on the weekends.
    - Follows trend of high weekend parking demand reflected in outreach survey responses.
- Observational parking utilization data was not collected in pre-project conditions.

Figure 6 Weekday A.m. (Left) and P.m. (Right) Parking Occupancy near Columbia Street

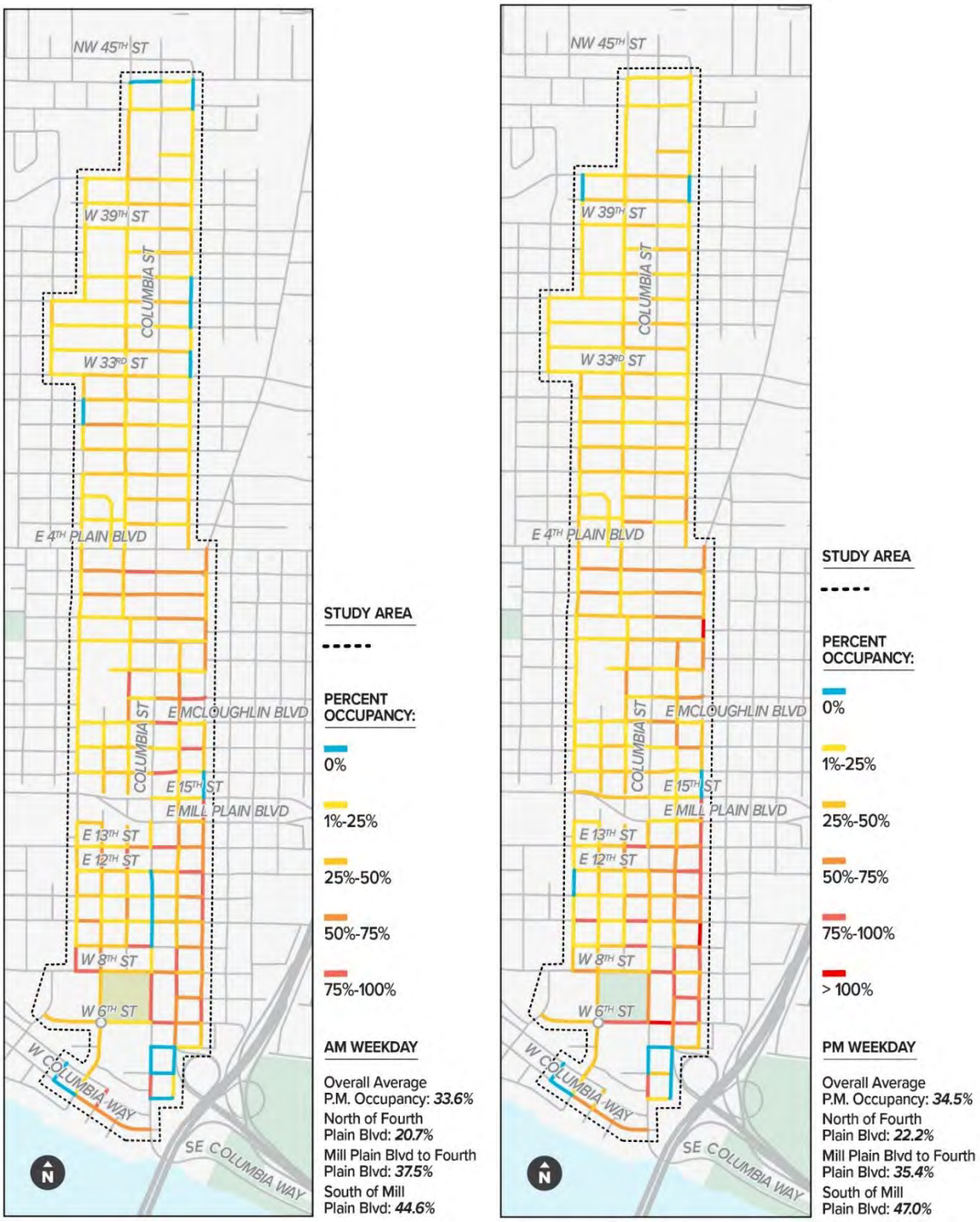
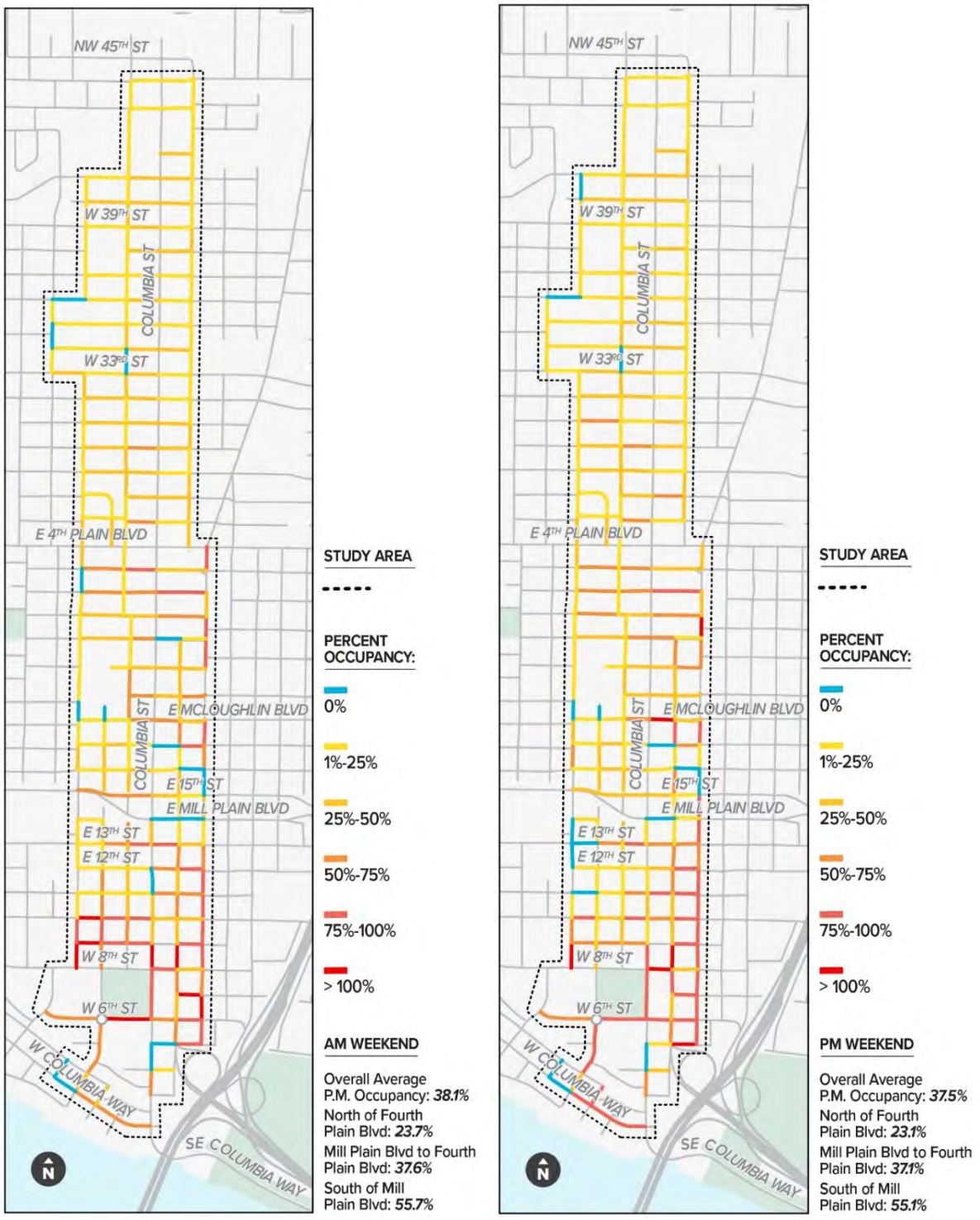


Figure 7: Weekend A.m. (Left) and P.m. (Right) Parking Occupancy near Columbia Street



Service Provider Feedback

Service providers were contacted in the fall of 2022 to assess the impact of this project on their operations. In general, feedback was positive and indicated either no change or positive impacts.

C-TRAN, Vancouver's transit agency, indicated that the mobility lanes and speed cushions on McLoughlin Boulevard did not adversely affect bus operations, including bus travel times and passenger access to bus stops. Bus operators reported that the buffered mobility lanes have made passing people bicycling or using small mobility devices easier[7].

The City of Vancouver's Solid Waste Division, whose waste collection contractor is Waste Connections, indicated that this project did not create any negative impacts on waste collection. The division's staff expressed appreciation for the project team's collaborative and proactive communication efforts as this project was planned and implemented[8].

Staff from Hough Elementary School, located at W 19th Street and W Daniels Street just west of Columbia Street, indicated they have not seen any detrimental impacts from this project. They commented that they had not observed a change in the number of students who walk or bike to and from school[9]. The Vancouver Fire and Police Departments also reported no negative impacts from this project[10].

Community Feedback

Two surveys were conducted to evaluate project impacts. The Corridor User Survey sought feedback from people who use the new facilities on Columbia Street. The Neighbor Survey sought feedback from neighbors and business owners in the project area via 1756 postcards mailed to residents and businesses addresses asking recipients to participate in the Neighbor Survey. The surveys were each open for about a month and administered during the one-month and 12-month post project analysis periods. The one-month period ran from October 15, 2022, through November 30, 2022, and the 12-month period ran from December 1, 2023 to December 31, 2023. Both surveys included questions that respondents answered on a numbered scale and included opportunities to provide open-ended comments.

[7] Email communication from Taylor Eidt, C-TRAN Planning Project Manager, on October 31, 2022.

[8] Interview conducted with Julie Gilbertson, Vancouver Public Works Solid Waste Neighborhood Liaison and Amanda Romero, Vancouver Public Works Logistics Coordinator, November 3, 2022.

[9] Email communication from Nicole Daltoso, Vancouver Public Schools Facilities Planning Manager, December 1, 2022.

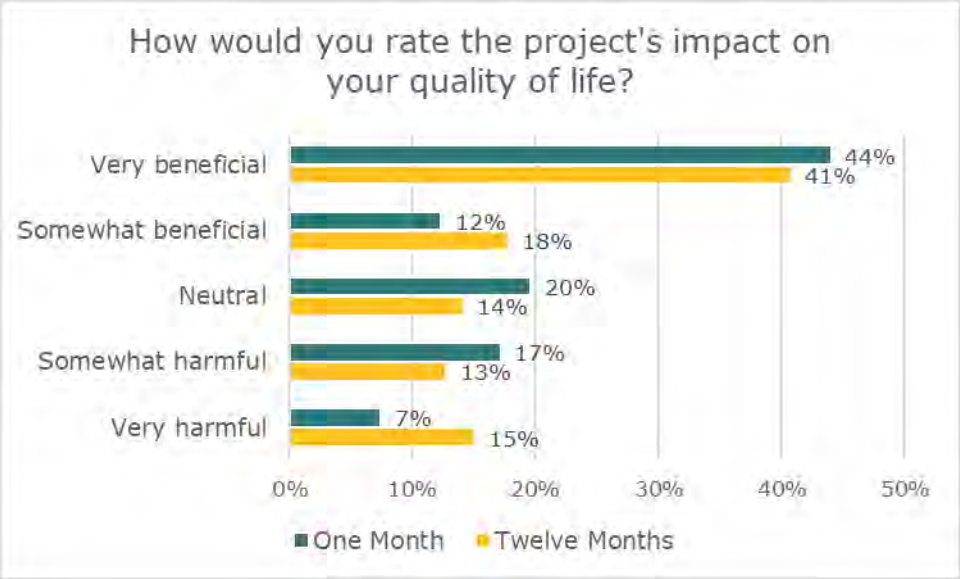
[10] Email communication from Chad Lawry, Vancouver Assistant Fire Marshall, October 31, 2022.

User Survey Findings

The Corridor User one-month post project survey received 41 responses, and the 12 month-post project survey received 441 responses. Responses in the one-month period included those recorded during in-person surveying and from online responses from QR codes that were posted on yard signs along Columbia Street and advertised by the City. The 12-month responses were primarily received via engagement with QR codes on digital and printed communications materials. Some findings include:

- Similar responses in both analysis periods, despite a much higher response rate in the 12-month period (seen in Figure 8).
- 59% of respondents in the 12-month period stated the project had a "very" or "somewhat beneficial" impact on their quality of life, compared to 28% who rated the project as "somewhat" or "very harmful."
- 34% of respondents in the one-month period and 27% in the 12-month period indicated they never used the Columbia Street mobility lanes.
- Of those who used the mobility lanes, 72% said they felt "somewhat" or "very safe" using them in the 12-month period.
- Written comments revealed an appreciation for the project but included some frustrations with on-street parking removal.
    - This was consistent with what was heard at different phases.
    - Some responses had concerns with keeping mobility lanes clear from fallen leaves and illegally parked vehicles.
    - Some noted the mobility lane gap in the northbound direction between 13th St. and Mill Plain Blvd.
- Vancouver Bicycle Club sent emails mentioning that Zicla lane dividers could be hard to see among fallen leaves, and taller vertical delineators would provide clearer separation between the mobility lanes and motor-vehicle lanes.

Figure 8: User Survey Results to Quality of Life Question



Neighbor Survey Findings

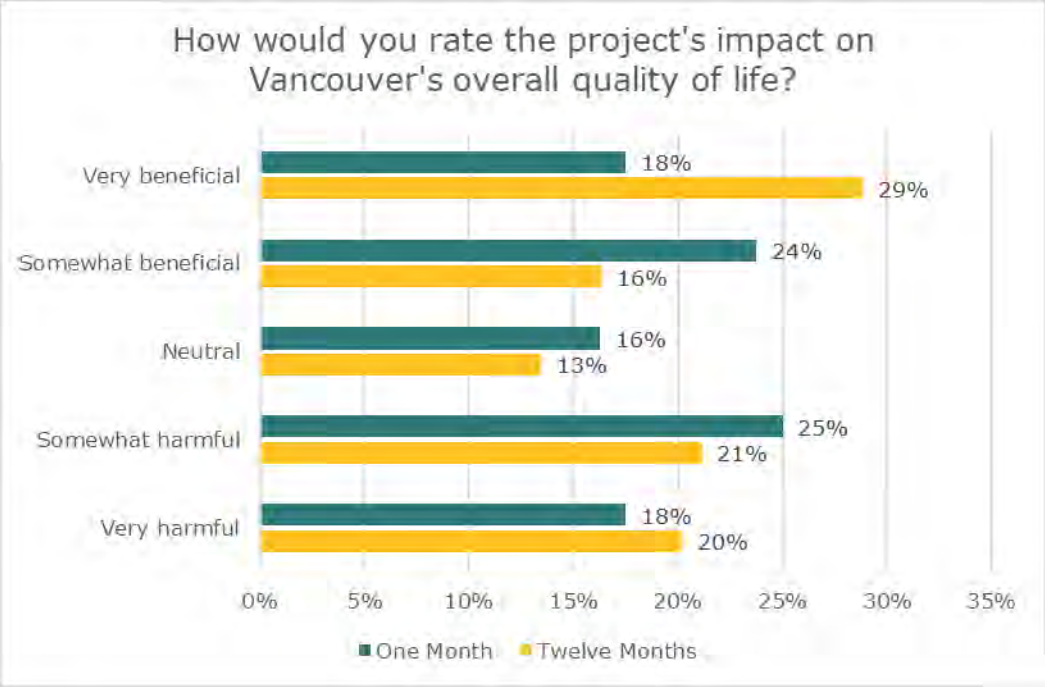
The Neighbor Survey was conducted in Fall of 2022 for the one-month post project period and received 80 responses, and 107 responses in the 12-month post-project period conducted in December 2023.

- 45% of respondents in the 12-month period and 42% in the one-month period stated the Project was beneficial to Vancouver's quality of life (seen in Figure 9).
    - Nearly an equal number in both periods indicated it had a negative impact.
    - Some residents and business owners continue to have concerns regarding parking removal.
- 12-month period survey included an additional question about added lighting near new marked crosswalks.
    - 51% said they were satisfied with lighting changes, compared to 15% who were dissatisfied. 34% were unsure.
    - Several written responses noted they were not aware of specific lighting changes.
- 24 respondents (14 in the one-month period and 10 in the 12-month period) indicated they operated a business/organization on Columbia St.

    - 79% of respondents in the one-month period and 60% in the 12-month period said the project had a negative impact on their organization.

- Many negative written responses were related to street parking removal near homes and businesses.
- Positive written responses were from mobility lane users expressing appreciation for enhanced safety provided.

Figure 9: Neighbor Survey Results to Quality of Life Question



Safety Concerns Identified in Outreach

The Corridor User Survey and Neighbor Survey revealed other concerns related to safety on Columbia Street. Comments on the Corridor User Survey noted the danger to mobility users posed by the gap in the northbound buffered mobility lane between W 13th Street and Mill Plain Boulevard. Several written responses to the Neighbor Survey noted drainage issues at intersections near the curbs, creating hazards for bicyclists and pedestrians. Several Neighbor Survey commenters also noted that high vehicle speeds were still an issue on Columbia Street, with one response noting that drivers often run red lights. In the Corridor User Survey, a few comments noted that the Ziclas did not provide sufficient separation between mobility lane users and cars, while other commenters said that the Ziclas posed a safety risk when people cycling needed to exit the mobility lanes quickly.

While conducting fieldwork in 2022 and corridor walks in 2023, staff continues to observe driver parking illegally, such as in the buffered mobility lane near the intersection of W 8th Street and no parking zone between Evergreen Boulevard and W 12th Street. This indicates that further signage, education, and traffic enforcement should be utilized to ensure the mobility lanes remain open for mobility lane users and sightlines are clear.

Appendix A: Complete Streets Monitoring Framework

The Complete Street Monitoring Framework (hereafter referred to as "the Framework") was created after adoption of the Complete Streets policy in 2017. The purpose was to assess the systemic benefits of the mobility and safety improvements implemented along a study corridor. The Framework includes several goals with evaluation metrics to track project outcomes. While evaluating the framework metrics provides a nexus with City strategic goals, the performance measures and metrics reported on in the body of the report more closely reflect impacts from the Project, and thus the following information was included as supplemental data.

Framework Goals

The six Framework goals are documented below.

Goal 1: Accessibility and Connectivity

The corridor is convenient and accessible and connects people to destinations throughout the city and beyond.

Goal 2: Safety

The corridor improves safety for people of all ages and abilities.

Goal 3: Climate

The corridor protects the natural, cultural, and developed environments and encourages healthy and active living for all through comfortable, convenient, and non-polluting transportation alternatives.

Goal 4: Equity

The corridor mitigates or reduces transportation-related disparities and barriers and is affordable for all users.

Goal 5: Fiscal Responsibility

The corridor is strategically designed, operated, and maintained to maximize assets, minimize costs, and enhance the surrounding community through right-sized infrastructure.

Goal 6: Collaboration

The corridor decisions are made in a transparent and collaborative manner, and the benefits and burdens of investments are distributed among all users.

Framework Performance Metrics

The Framework uses performance metrics measure the degree to which the corridor investments support City-wide priorities and goals. The metrics utilized for the Columbia Street Project are summarized in Table 1.

The Framework goals and metrics were modified from an earlier iteration of the Complete Streets Performance Metrics Framework to reflect data availability and better assess intended Project outcomes.

- The six goals were consolidated from the original seven goals of: Transportation Choice, Safety, Climate, Equity, Connectivity, Economy, and Maintenance.
- The original goals were paired with potential data sources and methodologies, but on application were determined to be impractical and not clearly tied to the project outcomes identified through planning work.[11]
- New metrics, shown in Table 1, were developed to provide a streamlined methodology for evaluating Complete Streets projects.

Framework Recommendations:

In performing this assessment, it became clear that assessing system-wide impacts from a single project investment is difficult and relies on assumptions that are hard to verify at such a small scale. Since the adoption of the framework, the City has adopted similar goals and metrics related to transportation, safety, livability and emissions through the 2024-2044 Transportation System Plan, Climate Action Framework and City of Vancouver Strategic Plan. In reporting on these metrics, the City is able to investments in Complete Streets projects on system-wide analysis that aligns more closely with data availability. For future Complete Streets Evaluation reports, the Project Team recommends that the City track and evaluate project impacts and outcomes based on the project goals as was outlined in the main body of this report. For example, the City should continue to track changes in crash data, traffic speeds and volumes, changes in pedestrians and bicycles and small mobility volumes and user experience, etc. For the other framework elements outlined in the Appendix, such as expected changes to Vehicle Miles Traveled, emissions, and so on, the City should evaluate and report these changes across all transportation project investments in the reporting mechanisms and intervals as outlined in the Plans and Framework cited above.

- [11] The original data sources included the Pedestrian Environmental Quality Index, Gehl's Public Life Data Protocol, the Environmental Protection Agency's stormwater calculator tool, retail sales and property tax information, and a curb occupancy toolkit developed by at the University of Washington.

Table 1: Performance Metrics, Targets, and Connection to Framework Goals

CORRIDOR PERFORMANCE METRICS	FRAMEWORK GOALS					
	Accessibility and Connectivity	Safety	Climate	Equity	Fiscal Responsibility	Collaboration
HOW DO PEOPLE TRAVEL ALONG THE CORRIDOR?						
MODE SHARE: Percent of walking, bicycling, and transit trips along the corridor. **Target:** Desired direction is to increase the number of people who walk, bike, or take transit along the corridor after project implementation.	●		●	●	●	◒
VEHICLE-MILES TRAVELED: Corridor-wide number of miles traveled. **Target:** Reduce vehicle-miles traveled along the corridor and improve air quality after project implementation.	●		●	●	●	◒
HOW EASILY, COMFORTABLY AND DIRECTLY CAN PEOPLE TRAVEL ALONG THE CORRIDOR?						
MULTIMODAL LEVEL OF TRAFFIC STRESS: Locations on the corridor that operate with an extreme or high multimodal level of traffic stress. **Target:** Desired direction is to decrease the miles along the corridor that operate with an extreme or high multimodal level of traffic stress after project implementation.	●	●	●	●	◒	◒
SYSTEM COMPLETENESS: Completeness of sidewalks, bikeways, and trails along the corridor. **Target:** Complete the sidewalk, bikeway, and trail networks.	●	●	●	●	◒	◒
HOW SAFE IS TRAVEL ALONG THE CORRIDOR?						
SAFETY: Transportation-related collisions, vehicle travel speeds and volumes, and conflicts along the corridor. **Target:** Reduce transportation-related collisions, fatalities, and serious injuries for all users after project implementation.	◒	●		◒	◒	◒

Notes: ● = Measure highly connected with achieving goal ◒ = Measure somewhat connected with achieving goal

Public Life

The Framework includes a metric on public life, which can be defined as "people moving and staying in public space,"[12] and multimodal investments can draw people in public spaces by making them feel more comfortable spending time in them (i.e., biking, rolling, or walking). The buffered mobility lanes, sharrow markings, and crosswalk improvements built as part of this Project are expected to improve people's subjective feelings of comfort in public spaces on Columbia Street by separating cars from other road users and reducing motor-vehicle speeds.

Several written responses to the Corridor User and Neighbor Surveys expressed appreciation for the enhanced safety that the buffered mobility lanes provide. For example, one respondent said: "[The Project is] great and makes our neighborhood more family friendly. We have kids that ride in a seat and tag along and I feel much safer teaching them to ride and in general in the dedicated bike lane. Also, my kids scooter ride on the sidewalks and before cars would zoom past at what felt like higher speeds, this gives us more space (real or imagined) and safer experience with young kids." This improvement in perceived safety may help more people feel comfortable spending time in public spaces on and near Columbia Street. While other comments expressed concerns about street parking and how safety could be improved along the corridor, the buffered mobility lanes and other elements of this Project appear to be improving many people's sense of comfort in the public realm.

Economy

Limited data is available on this Project's direct economic impacts. However, responses from the Neighbor Survey, as discussed above, provide some insight. Many of the written responses to that survey included concerns about the impact of on-street parking removal for residents, businesses, and non-profits near Columbia Street. 42 percent of the one-month and 67 percent of the 12-month respondents said that they had noticed a change in the way people get to their business or organization although people continued to visit these properties.

Perceived issues stemming from parking removal should be weighed against the potential benefits of increased pedestrian and bicycle use on Columbia Street. A 2020 study on the economic impacts of adding bicycle infrastructure in several U.S. cities, including the removal of on-street parking in some locations, found that these improvements had either positive or non-significant impacts on retail and food service employment and sales[13]. F Additional research included a review of 23 studies that found adding or improving pedestrian and

[12] Gehl Public Life Protocol, https://gehlpeople.com/tools/public-life-data-protocol-beta/

[13] Liu, Jenny H. and Shi, Wei. Understanding Economic and Business Impacts of Street Improvements for Bicycle and Pedestrian Mobility – A Multicity Multiapproach Exploration. NITC-RR-1031/1161. Portland, OR: Transportation Research and Education Center (TREC), 2020.

bicycle facilities had either positive or neutral economic effects on nearby retail and food service establishments[14].

Another study found that the health and carbon-reduction benefits of investing in active transportation by expanding walking and cycling infrastructure and implementing educational campaigns had a cost-benefit ratio of 11:1[15]. That study compared outcomes from two cities that expanded their active transportation networks in conjunction with campaigns to "share the road" to outcomes from similar cities that did not make similar investments.

Overall, this brief review of the studies on the economic impact of new active transportation infrastructure indicates that investments in the active transportation infrastructure can have economic benefits that extend beyond the immediate impacts of parking removal. They also highlight the need to collect more in-depth economic data over longer time periods and larger geographic areas to capture the true economic impact of individual Complete Street projects.

Equity Population near The Columbia Street Corridor

The City of Vancouver has created an Equity Index Map (references from the City's Collision Dashboard)[16] that scores Census tracts on several socio-economic indicators (using 2015-2019 American Community Survey data) to create an Index score, with higher scores indicating higher populations of historically marginalized and underserved communities. These indicators are:

- people of color,
- households with limited English proficiency,
- population below 200% of the Federal poverty level,
- educational attainment less than a bachelor's degree,
- population with a disability,
- population under the age of 18,
- population age 65 or older,
- renters, and
- median family income

[14] Volker, J. M., & Handy, S. (2021). Economic impacts on local businesses of investments in bicycle and pedestrian infrastructure: a review of the evidence. *Transport reviews*, *41*(4), 401-431.

[15] Chapman, R., Keall, M., Howden-Chapman, P., Grams, M., Witten, K., Randal, E., & Woodward, A. (2018). A cost benefit analysis of an active travel intervention with health and carbon emission reduction benefits. *International journal of environmental research and public health*, *15*(5), 962.

[16] https://city-of-vancouver-wa-geo-hub-cityofvancouver.hub.arcgis.com/apps/9d0363af1b7a418b9395373c97bcd9c4/explore

The tracts are grouped into Lowest (least disadvantaged), Low, Average, High, and Highest (most disadvantaged) categories.

The Columbia Street corridor runs through four Census tracts, with Equity Index categorizations of High, Average, Low, and Low, in order from south to north (tracts 53011042400, 53011042300, 53011042100, and 53011042000 in that order). These categories indicate that the Columbia Street corridor runs through areas with varying equity populations. The corridor also provides access to high-amenity areas in Downtown Vancouver and the Vancouver Waterfront, provides multimodal access south to the State of Oregon and connects with other mobility facilities, including on The Vine on Fourth Plain Boulevard and Mill Plain Boulevard, so residents and visitors from a variety of locations not just along the corridor are expected to benefit from the Project too.

Appendix B: Multimodal Level of Traffic Stress

Description: Pedestrian and bicycle level of traffic stress (LTS) evaluations provide a quantitative metric to understand a multimodal user's perception of the safety and comfort of the corridor. This method can be used to understand key gaps and barriers to walking and bicycling to be addressed through targeted improvements.

Measure(s): Pedestrian level of traffic stress; Bicycle level of traffic stress.

Target: Reduce the amount of the corridor that operates with an extreme or high multimodal level of traffic stress.

Data Sources: GIS; Field confirmation; WSDOT Design Bulletin

Multimodal Level of Traffic Stress Findings

Bicycle Level of Traffic Stress

The pre- and post-project bicycle level of traffic stress (LTS) was calculated for both travel directions along the Columbia Street corridor using a design bulletin published by the Washington Department of Transportation[17]. This methodology measures contributors to stress for people riding bicycles, including the speed limit, the number of traffic lanes, average daily traffic, and type of bicycle facility. LTS scores range from 1 (low stress for people biking) to 4 (extreme stress). 2019 estimates of daily traffic obtained from the Streetlight data platform were compared with 2023 tube-counts of daily traffic as part of this calculation.

Figure 11 shows the pre- and post-project bicycle level of traffic stress (LTS) for Columbia Street. The most significant change resulting from the Project occurred between W Mill Plain Boulevard and W 45th Street, where the LTS was reduced from 3 to 1 (low stress). This change stems from the addition of buffered mobility lanes as well as lower traffic volumes observed in 2023 compared to the 2019 volumes. The northbound bicycle LTS between W Mill Plain Boulevard and W 13th Street remained 3 (higher stress) due to the absence of separated mobility facilities there (only sharrow markings are present). The bicycle LTS did not change between W 8th St and 13th Street despite the addition of buffered mobility lanes because average daily traffic remained above 3,000, and the LTS methodology does not differentiate between facilities with and without buffered mobility lanes at that level of traffic volume.

[17] Washington Department of Transportation, Designing for Level of Traffic Stress Bulletin #2022-01 (2022), https://wsdot.wa.gov/sites/default/files/2022-06/DesignBulletin2022-01.pdf

Figure 10: Pre-Project (LEFT) and Post-Project (Right) Bicycle Level of Traffic Stress

Pedestrian Level of Traffic Stress

The pre- and post-project pedestrian LTS (shown on Figure 12) was calculated for both travel directions along the Columbia Street corridor using the same design bulletin used for the bicycle LTS evaluation[18]. This methodology considers the speed limit, the number of traffic lanes, average daily traffic, and type of pedestrian facility. Before project implementation, the pedestrian LTS was 2 on the entire corridor. After implementation, the pedestrian LTS remained 2 between W Columbia Way and W Mill Plain Boulevard and decreased to 1 north of W Mill Plain Boulevard. As no sidewalk improvements were planned or made as part of this Project, this improvement in pedestrian conditions was due to the lower traffic volumes observed in 2022 and 2023 compared to the 2019 Streetlight volumes.

[18] Washington Department of Transportation, Designing for Level of Traffic Stress Bulletin #2022-01 (2022), https://wsdot.wa.gov/sites/default/files/2022-06/DesignBulletin2022-01.pdf

Figure 11: Pre-Project (Left) and Post-Project (Right) Pedestrian Level of Traffic Stress

System Completeness

Description: This measure evaluates the completeness of the pedestrian and bicycle networks along the corridor.

Measure(s): Total miles and percentage of pedestrian, bicycle and trail networks completed.

Target: Complete the sidewalk, bikeway, and trail networks.

Data Sources: GIS; Field confirmation

System Completeness Findings

This Project added protected mobility lanes to Vancouver's mobility network on about 1.5 miles of Columbia Street between W Mill Plain Boulevard and W 45th Street. It also increased the level of protection on the bi-directional mobility facilities for much of the 0.60-mile corridor between W Mill Plain Boulevard and W Columbia Way. These additions to Vancouver's low-stress mobility network improve connectivity to the major destinations of Esther Short Park (the site of a weekly farmers' market) and the popular Vancouver Waterfront.

This corridor connects with mobility lanes on W McLoughlin Boulevard, Fourth Plain Boulevard, and 39th Street, as well as the multi-use paths on Columbia Way and the I-5 bridge into the State of Oregon. The corridor also provides connectivity with other community destinations, including Hough Elementary School, Our Lady of Lourdes Catholic School, Lincoln Elementary School, and the commercial area on Main Street near Fourth Plain Boulevard.

There is currently a gap in the northbound buffered mobility lane between W 13th Street and Mill Plain Boulevard. The buffered mobility lane drops on this block face to preserve on-street parking for the Clark County Veterans Assistance Center (VAC) located at 1350 Columbia Street. This gap requires people cycling northbound to use the general-purpose lane before re-entering the buffered mobility lane north of Mill Plain Boulevard. This is the only location on the corridor where sharrows were used and the only break in consistent mobility facility not at a signalized intersection. When new tenants occupy the building or the property redevelops, the City plans to install a buffered mobility lane consistent with the rest of the corridor to improve safety and connectivity.

Appendix C: Vehicle-Miles Traveled and Emissions

Description: This measure identifies how the corridor investments affect travel by motor vehicles, and its influence on air quality.

Measure(s): Vehicle-miles traveled (VMT)

Target: Reduce vehicle-miles traveled along the corridor and improve air quality after project implementation.

Data Source: Smart Growth America (SGA) tool

Vehicle Miles Traveled Findings

The Smart Growth America (SGA) spreadsheet-based tool[19] estimates the reduction in vehicle-miles travelled (VMT) based on an estimated change in the total number of motor vehicle trips that transition to bicycle trips after project implementation. The tool uses several inputs to estimate the number of new cyclists a bike facility may attract over a 20 year timespan, and calculates the estimated reductions in VMT and several air-pollutants based on those estimations. It multiplies the number of cycling trips by the average bike trip length to calculate the reduction in VMT and uses average motor vehicle speeds and data on air pollution to calculate emissions reductions. The average bike trip length of 2.46 miles was taken from the 2022 National Household Travel Survey[20]. Table 6 shows the projected annual reductions in VMT and several air pollutants at several points in time. 2023 was assumed to be "Year 0" because that is when the bicycle counts used as an input for the number of trips were recorded. This approach is limited in that it assumes that bike trips are replacing motor vehicle trips mile-for-mile, which is an assumption for this corridor as bike trips here may be for recreational purposes and do not replace car trips.

[19] Woodcock J, Givoni M, Morgan AS. Health Impact Modelling of Active Travel Visions for England and Wales Using an Integrated Transport and Health Impact Modelling Tool (ITHIM). PLoS One. 2013;8(1):e51462.

[20] National Household Travel Survey, Federal Highway Administration (2022), Average person trip length (Travel Day PT) by Trip mode, derived, https://nhts.ornl.gov/

Table 8: ESTIMATED REDUCTIONS IN VEHICLE-MILES TRAVELED (VMT) AND AIR POLLUTANTS FROM INCREASED CYCLING

	YEAR 5 (2028)	YEAR 10 (2033)	YEAR 15 (2038)	YEAR 20 (2043)
VEHICLE-MILES TRAVELED	28,047	66,870	119,946	191,830
CARBON MONOXIDE (TONS)	0.04	0.07	0.09	0.10
CARBON DIOXIDE (TONS)	19.396	46.082	82.366	131.264
NITROGEN OXIDES (TONS)	0.003	0.005	0.006	0.007

New Bike Trips

The SGA tool relies on several assumptions to calculate the number of new cyclists, including distance-weighted factors that are applied to the number of residents living within a certain distance around the new facility. This methodology yielded an estimate of new cyclists that was significantly higher than the observed bicycle counts. Because of this discrepancy, the tool was modified to use the observed cyclist counts on the Columbia Street Project corridor as a baseline input for estimated future cyclist growth and environmental benefits, rather than using the tool to estimate current and future cycling volumes. This modified methodology then applies a long-term growth rate to the number of observed cyclists to estimate the growth in cycling volumes over 20 years. The methodology also multiplies the number of daily cyclists by 365 to estimate the number of annual cyclist trips. The number of annual cycling trips is used calculate VMT and air pollution reduction benefits from increasing cycling.

The tool requires the input of assumed long-term annual cycling growth rate under no-build (no facility) and build conditions (with the facility). A report from the National Institute for Transportation and Communities found an increase of between 21 and 171 percent in the number of cyclists after the addition of new protected bike facilities in several U.S. cities[21]. However, this report found that 1 percent of survey riders on the new facilities said they

[21] Monsere, C., Dill, J., McNeil, N., Clifton, K., Foster, N., Goddard, T., Berkow, M., Gilpin, J., Voros, K., von Hengel, D., & Parks, J. (2014). *Lessons From The Green Lanes: Evaluating Protected Bike Lanes In The U.S.* (NITC-RR-583). National Institute for Transportation and Communities. Retrieved January 25, 2023, from https://bikeportland.org/wp-content/uploads/2014/06/NITC-RR-583_ProtectedLanes_FinalReportb.pdf

would not have made the trip without the new facility, 10 percent would have made the trip by another mode, 24 percent would have cycled on a different route, and 65 percent would have cycled on the same route without the facility. Additionally, 49 percent said they were biking more frequently because of the facility. This finding suggests that the majority of increased ridership seen on new project facilities does not consist of new cyclists. The wide range of ridership increases makes it difficult to make assumptions about how much ridership will grow over a period of 20 years and how many riders are simply shifting their route. However, the study's findings do indicate that the addition of protected bicycle facilities can produce ridership increases.

The following annual growth rates for build conditions were used in this analysis. They are intended to account for the relatively small percentage of non-riders who are assumed to start cycling or cycle more frequently with the addition of the facility, rather than riders who shift their route.

- An increase of 2 percent for sharrows.
- An increase of 3 percent for non-buffered mobility lanes.
- An increase of 4 percent for buffered mobility lanes.

In other terms, an increase of 2 percent under build conditions means the number of cyclists would increase by 2 percent more per year than under no-build conditions. These differential rates assume that facilities providing greater separation from traffic are likely to induce more cycling trips each year than facilities offering less protection. An annual long-term no-build growth rate of 1.5 percent was assumed. This growth rate is the linear annualized increase based on the State of Washington's 2022-2032 10-year population projections for Clark County[22]. An annual 4 percent increase over no-build conditions (for a final annual growth rate of 5.5 percent) was used in this analysis because most of the project corridor consists of buffered mobility lanes. However, actual changes in the number of cyclists are likely to vary, and continued monitoring of cyclist volumes on the corridor will provide clearer insights into changes over time. A base number of 136 cyclists was used as the starting year number of cyclists. This number is the average of the bi-directional (northbound plus southbound) 24-hour camera bicycle counts recorded in October 2023 shown in Table 1. 2023 was assumed to be "Year 0" because that is when the bicycle counts used as an input for the number of trips were recorded.

[22]Washington Office of Financial Management; Growth Management Act population projections for counties: 2020 to 2050, accessed December 1, 2023, https://ofm.wa.gov/washington-data-research/population-demographics/population-forecasts-and-projections/growth-management-act-county-projections/growth-management-act-population-projections-counties-2020-2050

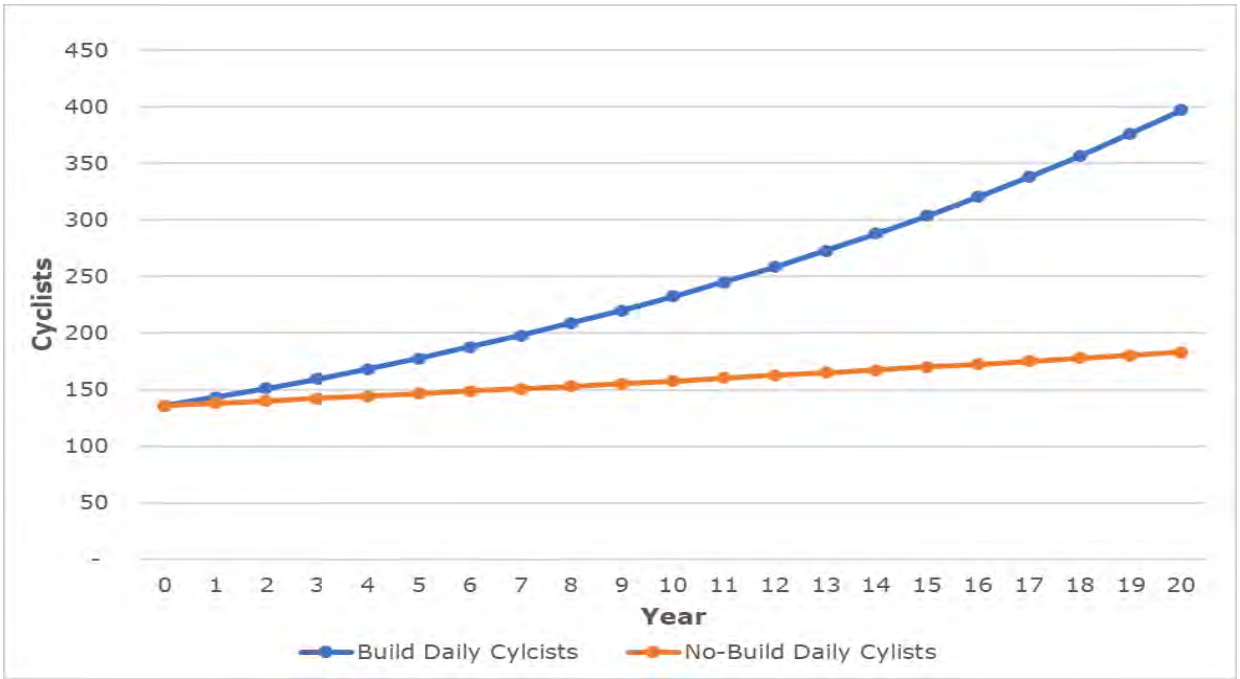
The tool applies the build growth rate over 20 years to calculate the total number of cyclists and biking trips. A summary of the tool's outputs is shown in Table 7. Figure 2 also shows the projected number of daily cyclists under no-build and build conditions. One limitation of the tool is that it applies a constant annual growth rate to post-project bicycle volumes, which likely overestimates the benefits associated with the Project by presuming a sustained and constant increase in the ridership over the next 20 years. Based on survey data collected, it is more likely that the project sees a larger bump in ridership shortly after the project's completion by absorbing existing riders taking nearby, less comfortable routes in addition to new riders. Subsequent years may attract additional new cyclists but would theoretically not continue to benefit from cyclist shifting to the new route at the same pace as opening year.

Table 9: Estimated Cyclists and Trips under Build Conditions

	YEAR 0 (2023 OBSERVED NUMBER)	YEAR 5 (2028)	YEAR 10 (2033)	YEAR 20 (2043)
CYCLISTS				
NUMBER OF DAILY CYCLISTS	136*	178	232	397
INCREASE FROM NO-BUILD CONDITIONS	N/A	+31	+74	+314
TRIPS				
ANNUAL BIKE TRIPS	49,640	64,877	84,792	144,837
INCREASE FROM NO-BUILD CONDITIONS	N/A	+11,401	+27,183	+77,980

*Average bidirectional observed cyclists in October 2023 on Columbia Street

Figure 12: Projected Build and No-Build Cyclists



Energy and Environmental Benefits

The SGA tool also estimates the air-quality benefits of tree planting along Columbia Street using the type and size of tree and climate zone as inputs. Table 10 below summarizes the projected cumulative 20-year benefits of the forty-six (46) trees planted as part of this project[23].

Table 10: Cumulative Projected ENVIRONMENTAL Benefits of Tree Planting ON Columbia Street

	ELECTRICITY SAVED (KWH)	NATURAL GAS SAVED (KBTU)	CO2 REDUCTION (TONS)	WATER RUNOFF SAVED (GALLONS)
5 YEARS	4,995	100,530	6.9	78,760
10 YEARS	9,990	201,060	13.8	157,520
20 YEARS	19,980	402,120	27.6	315,040

[23] Email communication from Jesse Batty, City of Vancouver Urban Forestry Specialist, December 13, 2022

Appendix D: Complete Streets Recommendations

From this Project and Framework evaluation application, the following items are recommended to improve safety and comfort for all users on future Projects and monitoring.

Considerations for Future Complete Streets Project Evaluation

- Procure continuous monitoring methods for bicycle and pedestrian volumes to avoid day-to-day and weather-related variability.

Considerations for Updating the Complete Streets Monitoring Framework

- Consider not using this same evaluation framework on future projects. Instead, the focus should rely on evaluation goals (crashes, trips, etc.)
- The Smart Growth America (SGA) Benefits of Complete Streets spreadsheet tool relies on a number of assumptions to estimate future bicycle trips and the resulting VMT and air pollution reduction benefits. The modified methodology described may not be sufficiently grounded in empirical data to provide useful long-term information.
    - An alternative approach could involve assessing future bicycle counts on the corridor for several years and comparing them to a similar corridor that did not receive additional facilities to generate a locally validated estimate of the effects of infrastructure improvements on bicycle ridership. That estimate could then be used to calculate VMT and air pollution benefits.
    - Local surveys that include detailed trip-making journals could also provide greater context for how individuals households change their travel behavior in response to complete streets projects[24].
- Several time-intensive data-gathering techniques, including the Pedestrian Environmental Quality Index and Gehl's Public Life Data Protocol are suggested but not realistic for the evaluation period or scope of projects.
    - Alternative measures, such as responses to questionnaires or condensed data-collection protocols may provide similar information with a lower commitment of time and resources.
- The Economy goal suggests using retail sales and/or property values as a metric. Such data can be difficult to obtain, and such measures may change slowly in response to Complete Streets projects, but could provide valuable insights into the impact of Complete Streets projects if sufficient resources are deemed necessary and available to gather it. However, this metric is not relevant to projects in primarily residential neighborhoods.
- Targeted business-owner surveys and interviews before and after the Project specific to the economy environment and business operations could also provide relevant information on the economic impacts of these projects.

[24] Keall, M., Chapman, R., Howden-Chapman, P., Witten, K., Abrahamse, W., & Woodward, A. (2015). Increasing active travel: results of a quasi-experimental study of an intervention to encourage walking and cycling. *J Epidemiol Community Health*.

- Other measures of economic change should be considered and piloted to determine the usefulness of this measure in the Framework.