BELLEVUE
PEDESTRIAN
& BICYCLE
IMPLEMENTATION INITIATIVE

DOWNTOWN DEMONSTRATION
BIKEWAY ASSESSMENT REPORT

March 2019

DRAFT

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PROJECT BACKGROUND

At its February 5, 2018 meeting (see agenda materials), the Bellevue City Council voiced support for the Transportation Commission's recommendation to implement a demonstration bikeway project in which temporary and low-cost treatments are made to 108th Avenue Northeast between Main Street and Northeast 12th Street (see Commission Transmittal Letter to the City Council). Councilmembers concurred with the Transportation Commission that a before-and-after study should be conducted to assess outcomes for all street users, including people bicycling, walking, driving, using transit, and transporting goods, based on data and community engagement (see minutes).

At its April 12, 2018 meeting the Transportation Commission endorsed an assessment framework for the 108th Avenue Northeast Demonstration Bikeway project informed by input from the Bellevue Downtown Association, industry best practices, and guidance documents from other communities (see memo). The assessment framework provides insights into community outcomes in safety, efficiency, and livability.

At its May 7, 2018 meeting (see agenda memo) the City Council awarded the construction contract for the 108th Avenue NE (Main Street to NE 12th Street) Bike Lanes Project in the amount of $365,933.70, plus all applicable taxes. The project was fully funded by the Neighborhood Safety, Connectivity and Congestion Levy approved by voters

in November 2016, to implement bicycle facility improvements Citywide as well as a Downtown demonstration bikeway corridor.

On July 31, 2019 the City of Bellevue celebrated the grand opening of the 108th Avenue Northeast Demonstration Bikeway Project that provides the first protected bike lanes running the length of downtown (see flyer). Leading up to and following the grand opening celebration staff were in evaluation mode, leveraging loop detectors, bluetooth readers, thermal sensors, video analytics, attitudinal surveys, street level and video observations, and conversations with residents, businesses, coach operators, and other stakeholders.

In November 2018 a rapid build bus platform was installed on 108th Avenue Northeast, south of Northeast Second Street. The platform creates an elevated path for buses to pull up to without having to cross into the bike lane. The platform has a ramp on both sides that allow cyclists to cross without having to dodge a bus. The platform also reduces the amount of time buses need to stop at the location because it is easier to pull up to the stop and leave once all the riders have boarded. The project was funded with a $55,000 grant from King County.

This Downtown Demonstration Bikeway Assessment Report and the Technical Appendix Report details the results of the 108th Avenue Northeast Demonstration Bikeway Project. These reports recognize that the City of Bellevue must consider the broader context within which its transportation network evolves — how it preserves and enhances economic vitality, community character, human health, and environmental resources — in addition to serving peoples' mobility needs. It is in this context that the assessment report provides insights into community outcomes in safety, efficiency, and livability.

The City of Bellevue's Mayor, Deputy Mayor, and City Councilmembers at the July 31, 2018 grand opening celebration.

The new bus platform is installed on 108th Avenue NE, south of NE Second Street. It is made of 300 interlocking plastic panels that snap together, allowing for its rapid installation.

DEMONSTRATION BIKEWAY ASSESSMENT FRAMEWORK

SAFETY
- Collisions
- Perceptions of Safety
- Traffic Conflicts and Interactions

EFFICIENCY
- Motor Vehicle Travel Time
- Bus Delay
- Automobile Delay
- Network Assessment

LIVABILITY
- Facility Use
- User Satisfaction
- Bicycle Level of Service
- TNC and Freight Delivery
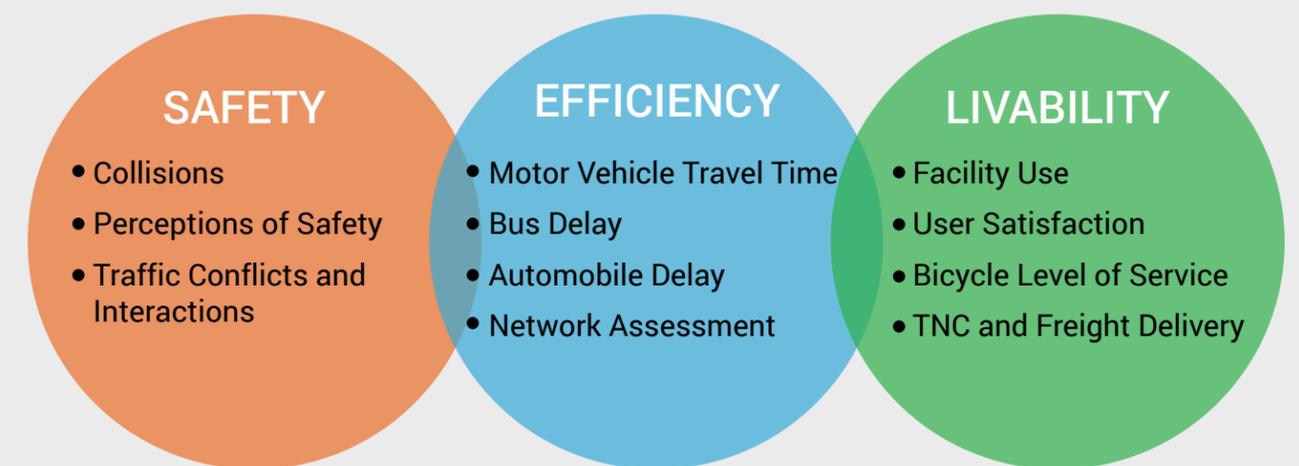
New strategies for transportation require new measurements of success. Working with the Transportation Commission, City of Bellevue staff developed a performance-based assessment framework that measures results that can help inform choices for future projects.

SAFETY

COLLISIONS

MEASURE
Number of reported collisions

BASELINE PERIOD
5-year history of January 2013 – December 2017

BEFORE PERIOD
July – December 2017

AFTER PERIOD
July – December 2018

LOCATION
108th Ave from Main St to NE 12th St

BACKGROUND
Safety is an important goal for the 108th Ave Bikeway Demonstration. The installation of separated and protected bicycle facilities aims to increase ridership while not increasing collisions. For this measure, collisions along this corridor were reviewed both by mode and severity.

Typical before and after studies of collisions look at three to five years of data. Although only 6 months of collision data are available for this assessment, Transportation staff will continue to monitor the corridor.

Key Takeaways & Facts:

- Since the bikeway has been installed, there have not been any reported bicycle collisions along the 108th Ave

- The average number of collisions in the previous 5 years was 28.8 collisions/year for the entire corridor. In the 6 months, after period there were 14 collisions, all modes, which roughly equals the before average if expanded to a full year.

Technology & Methodology

The collision data comes from law enforcement officers and is reviewed by Transportation Staff before being entered into a database maintained by the Transportation Department for data analysis. The data includes all reported collisions that took place in the public right of way. The data includes all intersections and segments between the intersections of 108th Ave/Main St and 108th Ave NE/NE 12th St.

Reported Collisions by Injury

Reported Collisions by Mode

Reported Collisions by Type

■ Before (July-Dec 2017)
■ After (July-Dec 2018)

Total Number of Collisions
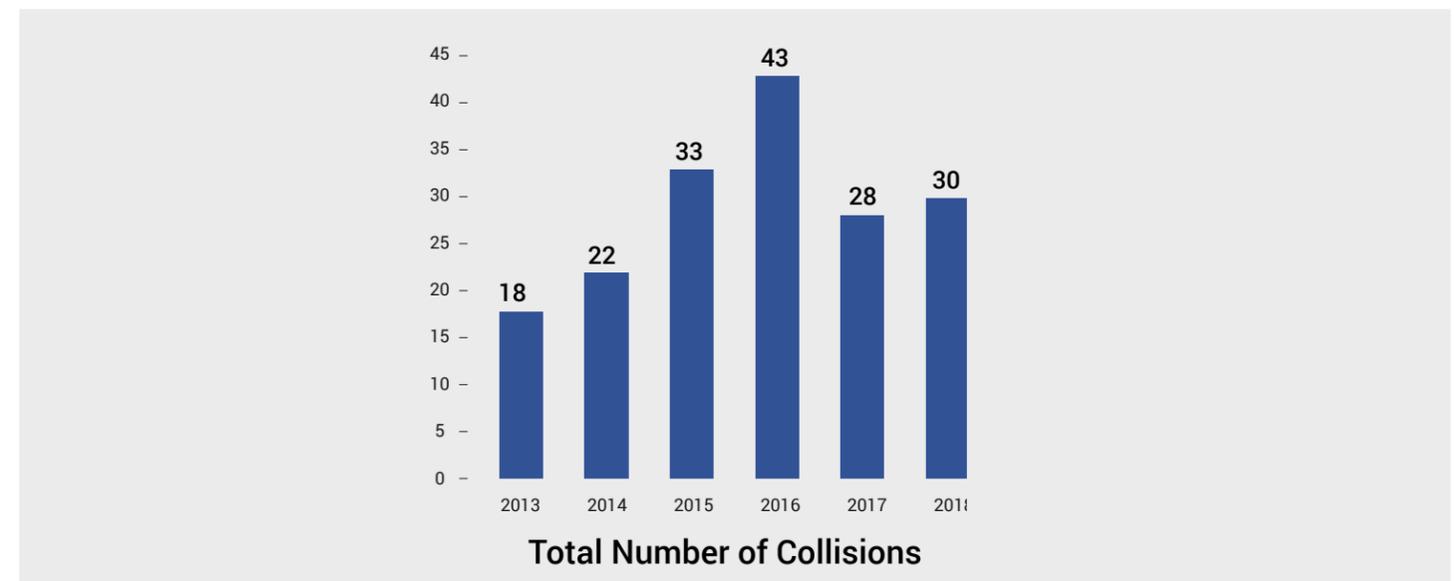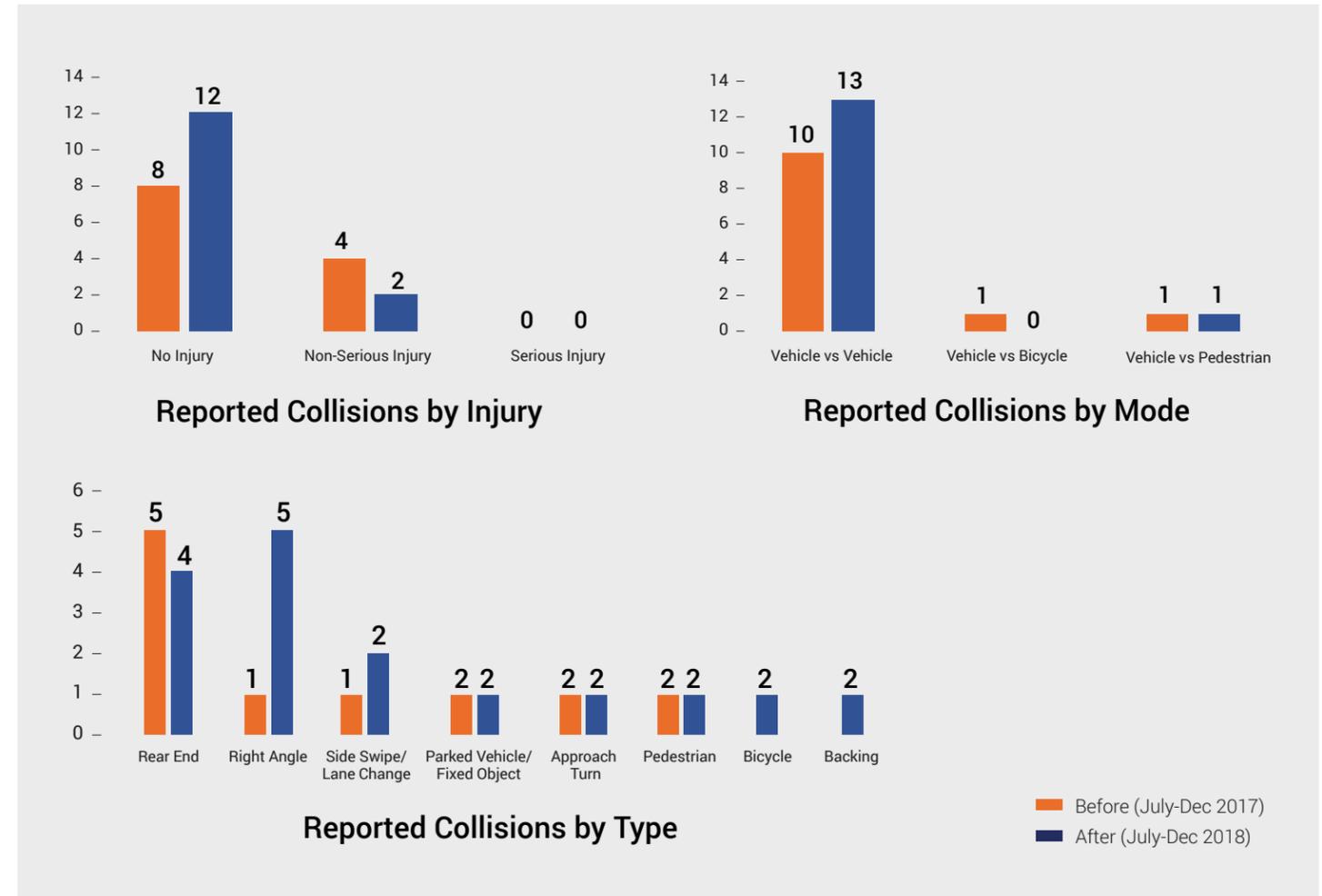
TRAFFIC CONFLICTS AND INTERACTIONS

DOWNTOWN DEMONSTRATION
BIKEWAY ASSESSMENT/
SAFETY

CITY OF BELLEVUE
NEIGHBORHOOD
SAFETY,
CONNECTIVITY &
CONGESTION LEVY

MEASURE
Bicyclist usage of different facility types

Observed conflicts and interactions between different modes

BEFORE PERIOD
May 4th and June 7th, 2018

AFTER PERIOD
July 17th, August 9th, and Oct 11th, 2018

LOCATION
Observations: Main St & 108th Ave, NE 4th St & 108th Ave NE, NE 8th St & 108th Ave NE

BACKGROUND
An important goal of this demonstration bikeway is to improve safety on the corridor for all modes of transportation. There were several points of interest to understand the effectiveness of the bikeway's design – sidewalk interactions, curbside interactions, and roadway interactions.

Prior to the installation of the demonstration bikeway, NE 4th St in the northbound direction was the only intersection with a separated bike facility. In addition to just observing the different types of interactions, this measure is intended to capture if providing dedicated bicycle facilities reduced amount of people that choose to ride on sidewalk.

Key Takeaways & Facts:

- Average bicycle sidewalk riding reduced by 18% at NE 8th St and 8% at NE 4th St

- 85% of bicyclist use the bike lanes at NE 4th St and NE 8th St

- Main St had less sidewalk riding to begin with but also saw minimal change

LANE USAGE		SIDEWALK	BIKE LANE	ROAD
NE 8th	BEFORE	28.3%	0%	71.7%
	AFTER	10.7%	85.3%	4.0%
NE 4th	BEFORE	13.5%	41.4%	45.1%
	AFTER	5.1%	85.6%	9.3%
Main St*	BEFORE	13.6%	*	86.4%
	AFTER	11.6%	*	88.4%

Bicycle Usage by Facility Type

*At Main St, bike facility does not have continuous separated facilities through the entire intersection, so bikes must mix with traffic (when sharrows are present on the roadway). Because of this, all bikes on the roadway were considered "in road".

Technology & Methodology

Manual observations of video from traffic cameras were used to collect this data. For the sidewalk riding and general observations of conflicts, video was observed from 7am to 7pm at three intersections along the corridor that have traffic cameras – Main St, NE 4th St and NE 8th St. Video observations were also collected for locations where delivery and pick up/drop off was occurring in the bike lanes. *Please see the section on TNC and Freight Delivery for more on curbside interactions.*

FUTURE OF CONFLICT ANALYSIS

In recognition of the need for an enhanced method of deriving insights on traffic conflicts (beyond interns observing video footage) the City of Bellevue has been working on the initiative of Video Analytics Toward Vision Zero. Although the technology is still in development, in February 2019 the City of Bellevue and Brisk Synergies entered into a strategic partnership to use the City's existing traffic camera system for predictive analysis of near-miss events. For upcoming and future evaluations, this new system could replace limited manual observations and provide deeper insights to the rate and severity of conflicts and interactions between people driving, walking and biking.

4th St & 108th Ave **Continuous**

Heatmap from Brisk Synergies video intelligence algorithms reflecting turning movements at 108th Ave NE and NE 4th St.
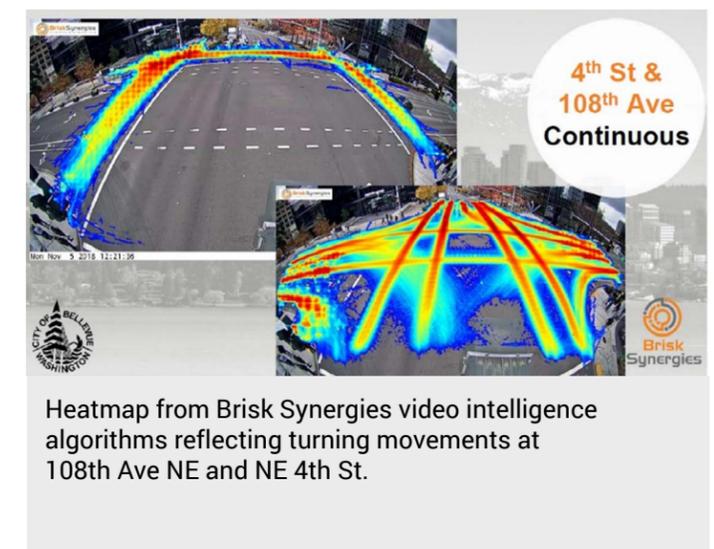
TRAFFIC CONFLICTS AND INTERACTIONS

Motorcyclist Using NB Bike Lane at NE 4th St

Vehicle Loading/Unloading in Bike Lane Before Vertical Separation was Added

Vehicle Improperly Stopping in Bike Box

8 Bicyclists observed using general travel lanes to make left turns to and from NE 8th St

7 Bicyclist observed using crosswalk cuts of pedestrian

6 Vehicles observed loading/unloading in NB bike lane, less instances after vertical separate installed

5 Bicyclist observed riding in the wrong direction in bike lane

4 Motorcyclist observed using NB bike lane

3 Vehicles observed loading/unloading in front of Expedia, less instances after vertical separation installed

2 Vehicles observed passing northbound bike in one lane section

1 Vehicles observed stopping in bike box and bicyclist must maneuver around

NE 8TH ST

NE 6TH ST

NE 4TH ST

NE 2ND ST

MAIN ST

Meydenbauer Center

Bellevue Transit Center

Bellevue City Hall

Bellevue Square Shopping Center

Bellevue Arts Museum

Compass Plaza

Safeway

Downtown Park

106TH AVE NE

108TH AVE NE

110TH AVE NE

112TH AVE NE

114TH AVE NE

405

Observed Conflicts and Interactions

PERCEPTION OF SAFETY

DOWNTOWN DEMONSTRATION
BIKEWAY ASSESSMENT/
SAFETY

CITY OF BELLEVUE
NEIGHBORHOOD
SAFETY,
CONNECTIVITY &
CONGESTION LEVY

MEASURE
Public response to online questionnaires

BEFORE PERIOD
Nov. 10, 2017 through Jan. 1, 2018 – 1,262 respondent

AFTER PERIOD
Sep. 1 through Nov. 1, 2018 – 1,232 respondents

BACKGROUND
This measure aims to understand the extent to which the demonstration bikeway has changed how safe and comfortable people feel when bicycling, driving, and walking along the corridor.

This qualitative measure is related to several quantitative measures—collisions, exposure to conflicts, and Bicycle Level of Traffic Stress (LTS)—and provides experiential insight to complement the outcomes and gaps in those measures. Crashes are infrequent, and less severe incidents are often unreported, so reported crash data is sparse and tends to highlight only the worst-case scenarios. Near-misses and other uneasy user experiences can impact how safe the street feels even if no crash occurs. Incidents are more likely to occur at locations with greater exposure to conflicts, but two conflict points that appear similar on paper may feel different because of other physical or user behavioral factors. Bicycle LTS offers a useful guide for network planning, but other characteristics, such as slope, pavement condition, and the presence of heavy vehicles, may affect the level of stress a person experiences.

Comparing responses from before and after the project was implemented helps to provide deeper insight into these quantitative measures, explain why the changes matter, and highlight areas that may warrant additional attention.

Key Takeaways & Facts:

BEFORE

- Most respondents…
  - » felt unsafe (29% somewhat, 28% very) riding a bicycle in Downtown
  - » felt uncomfortable (26% somewhat, 37% very) driving next to people bicycling in Downtown
  - » felt uncomfortable (31% somewhat, 34% very) walking along 108th Ave with bikes sharing the sidewalk
  - » supported bike lanes in Downtown to improve safety (9% somewhat, 60% strongly)
  - » felt 108th Ave was an unsafe and uncomfortable place for people to bicycle (40% somewhat, 23% very)

AFTER

- All user groups feel safer and more comfortable on 108th Ave.
  - » People bicycling: 43% agree, 44% strongly agree
  - » People walking: 25% agree, 12% strongly agree
  - » People driving: 30% agree, 13% strongly agree
- People bicycling on 108th Ave feel driver behavior is safer and calmer (41% agree, 24% strongly agree).
- Among respondents overall…
  - » 75% feel that people should not bicycle on sidewalks
 - » 75% feel that bike lanes should be available to make roads safer
  - » 66% feel that bike lanes should be separated from motor vehicles
  - » 65% feel that more bike lanes should be installed at other locations in Downtown

PERCEPTION OF SAFETY

BEFORE

1. Do you feel that 108th Ave NE is a safe and comfortable street for people bicycling today?

- 6%
- 22%
- 40%
- 23%
- 10%
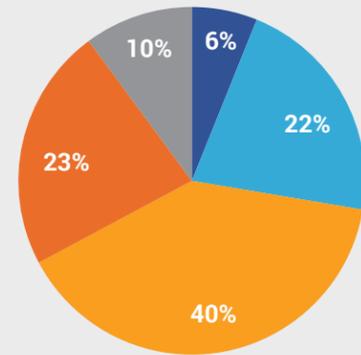
2. How comfortable do you feel driving next to people bicycling in Downtown Bellevue?

- 10%
- 21%
- 37%
- 26%
- 6%
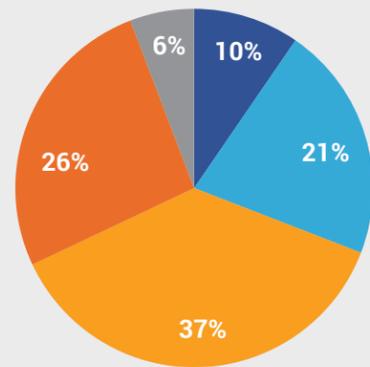
3. When walking along 108th Ave NE, how comfortable are you with people on bicycles sharing the sidewalk?

- 10%
- 19%
- 31%
- 34%
- 2%
- 5%
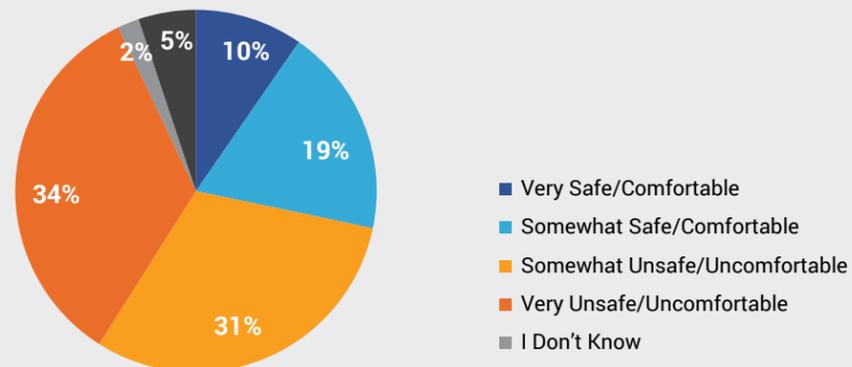
Legend:
- ■ Very Safe/Comfortable
- ■ Somewhat Safe/Comfortable
- ■ Somewhat Unsafe/Uncomfortable
- ■ Very Unsafe/Uncomfortable
- ■ I Don't Know

AFTER

1. As a person who rides a bicycle on 108th Avenue, do you agree or disagree with the following:
It feels safer and more comfortable riding a bicycle on 108th Avenue

- 44%
- 2%
- 4%
- 7%
- 43%
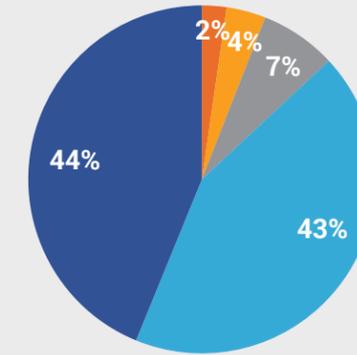
2. As a person who drives a motor vehicle on 108th Avenue, do you agree or disagree with the following:
It feels safer to drive a motor vehicle on 108th Avenue

- 13%
- 20%
- 17%
- 20%
- 30%
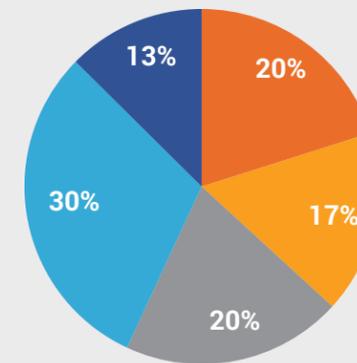
3. As a person walking on 108th Avenue, do you agree or disagree with the following:
It feels safer and more comfortable to walk on 108th Avenue

- 12%
- 11%
- 16%
- 35%
- 25%
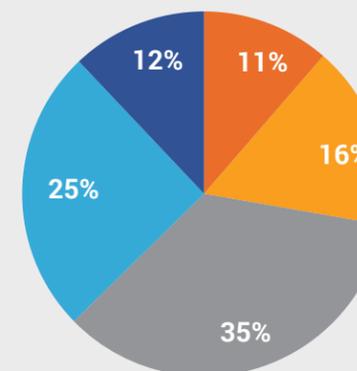
Legend:
- ■ Agree strongly
- ■ Agree
- ■ Undecided
- ■ Disagree
- ■ Disagree strongly

EFFICIENCY

MOTOR VEHICLE TRAVEL TIME

MEASURE
Bluetooth-captured Travel Time

BEFORE PERIOD
June 4th-8th, 2018

AFTER PERIOD
June 19th – October 31st, 2018

LOCATION
Bluetooth travel time collection hardware was installed at 4 locations between Main St and NE 10th St (see map)

BACKGROUND
The demonstration bikeway required changes to the roadway to accommodate people riding bicycles however it was desired to still limit the impact on people driving. One measure to observe the potential impact of the demonstration bikeway is to review travel time along 108th Ave. It is easy for a person driving along a corridor to measure how long it takes to get from one point to another. This measure reports the average time it takes for a person to drive between detection points along the corridor.

The traffic signals along 108th Ave NE is not synchronized along the entire corridor in the north-south direction. In downtown, NE 4th St and NE 8th St are coordinated in the east-west direction. Vehicle travel time along corridors that are not synchronized can be more random and dependent on congestion at intersections.

Key Takeaways & Facts:

- Vehicle travel time changed by less than a minute. The average midweek travel time from north of NE 8th St to south of NE 4th St has decreased from 2.5 to 2.1 minutes southbound and 2.6 to 2.3 minutes northbound.

- It is worth noting that during the month of June, there was construction and road closures on 106th Ave NE at NE 6th St which may have impacted travel times one 108th Ave NE in the before period.

- Travel time from north of NE 8th St to south of NE 4th St averaged between 1.5 minutes to 2.5 minutes in after installation

Technology & Methodology

Bluetooth travel time detectors passively detects radio signals for passing by vehicles and matches them between devices along a corridor. The units use a time stamp and a portion of the MAC address (for security reasons) to create matches and calculate travel time. The data is collected in 15-minutes intervals and only Monday-Friday was used in the study. Additionally, the week in which the bike lanes were striped was not included in the average. For this study BlueTOAD detectors were used.

The Bluetooth detection devices use algorithms to exclude outliers but this requires meeting a threshold of matches to calculate a result with statistical confidence. Although 4 devices were installed between Main St and NE 10th St, there were only enough matches for the segment from south of NE 4th St to south of NE 10th St could be used (travel between devices 1,2 and 3).


BlueTOAD Travel Time Unit on the Street Light Pole

|	AM PEAK (7am-10am)	PM PEAK (4am-7pm)	Daily Average (7am-7am)
Northbound			
BEFORE	1.9 min	3.1 min	2.6 min
AFTER	1.9 min	2.6 min	2.3 min
Southbound			
BEFORE	1.8 min	3 min	2.5 min
AFTER	1.8 min	2.4 min	2.1 min

Vehicle Travel Time
from south of NE 4th St to north of NE 8th St (Locations 1 to 3)
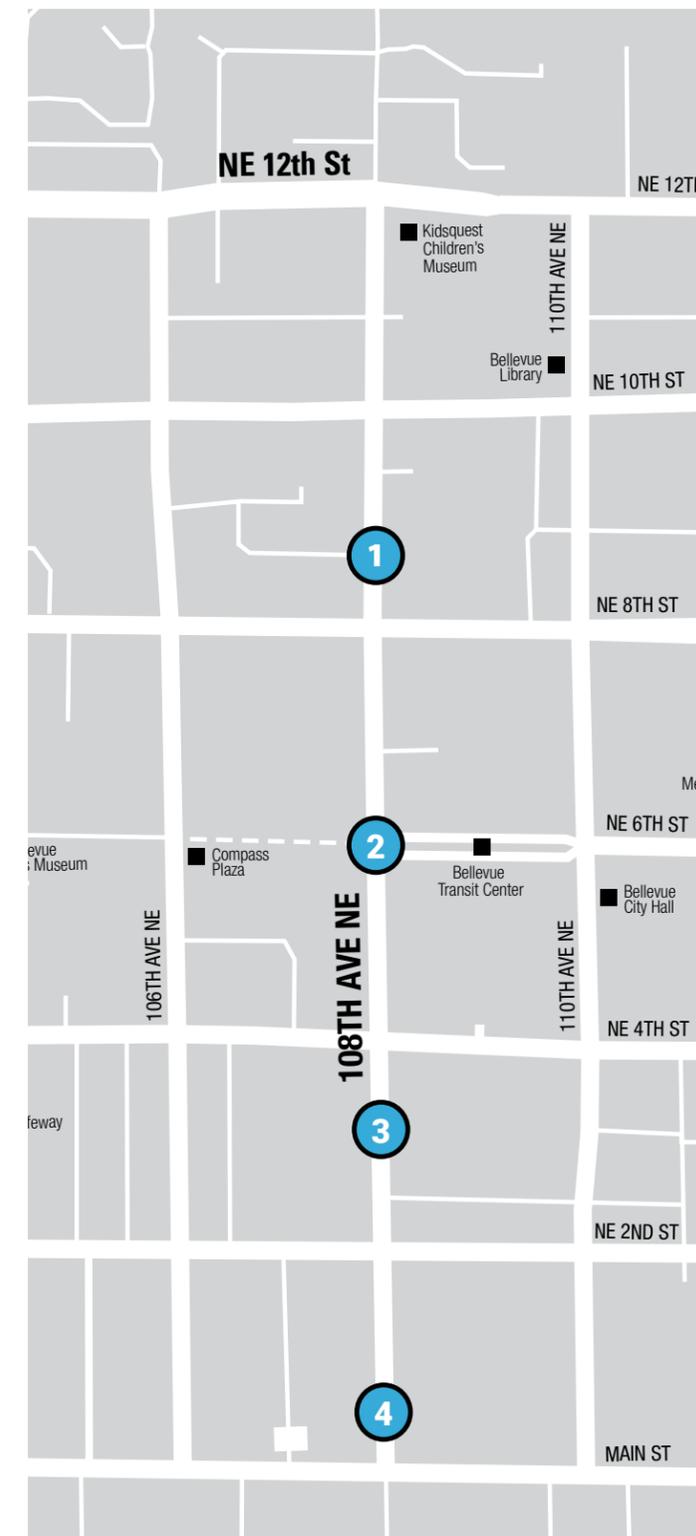
BlueTOAD Travel Time Unit Installations

MOTOR VEHICLE TRAVEL TIME

DOWNTOWN DEMONSTRATION
BIKEWAY ASSESSMENT/
EFFICIENCY

CITY OF BELLEVUE
NEIGHBORHOOD
SAFETY,
CONNECTIVITY &
CONGESTION LEVY
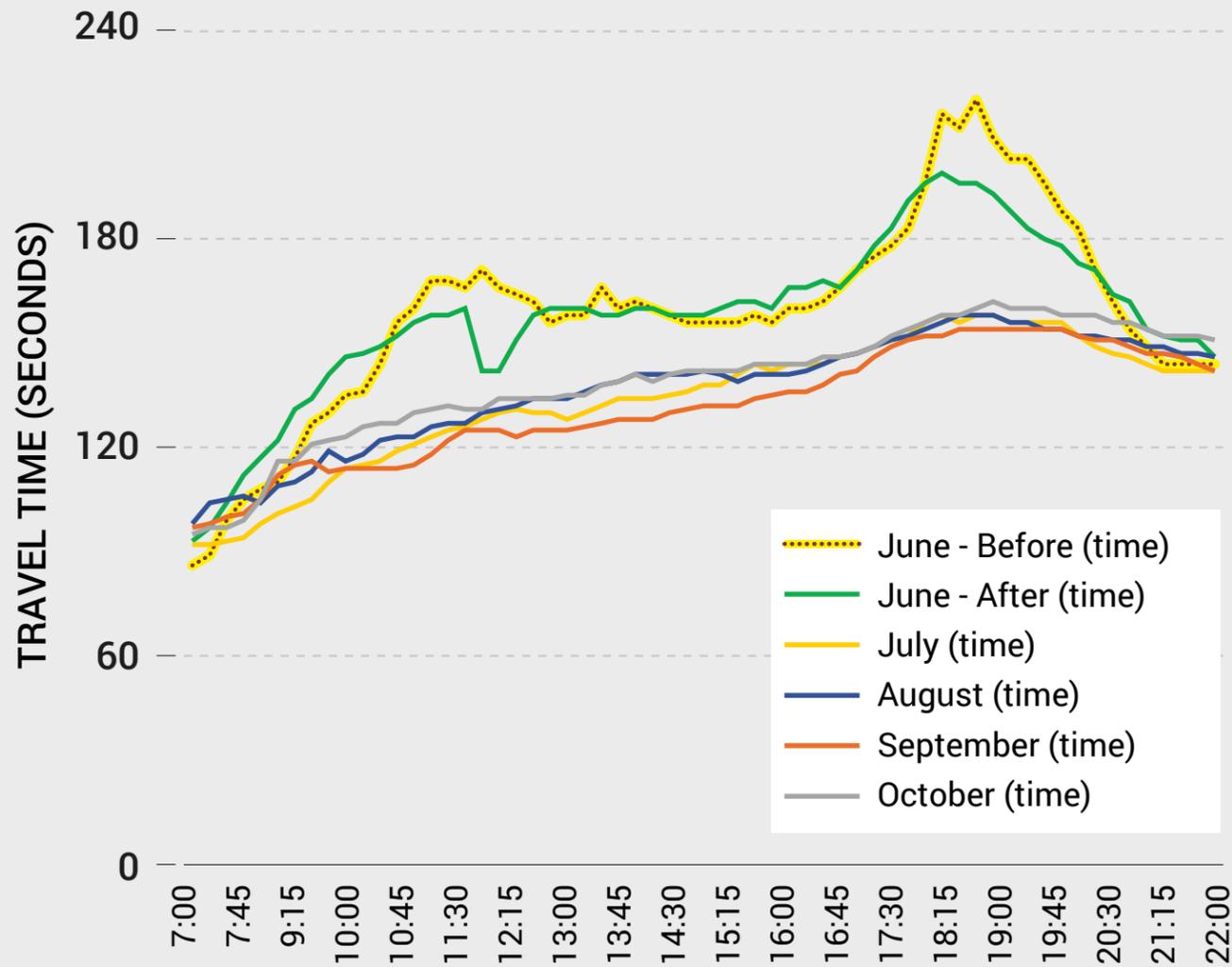
Northbound Travel Time
108th Ave - NE8th St to NE4th St
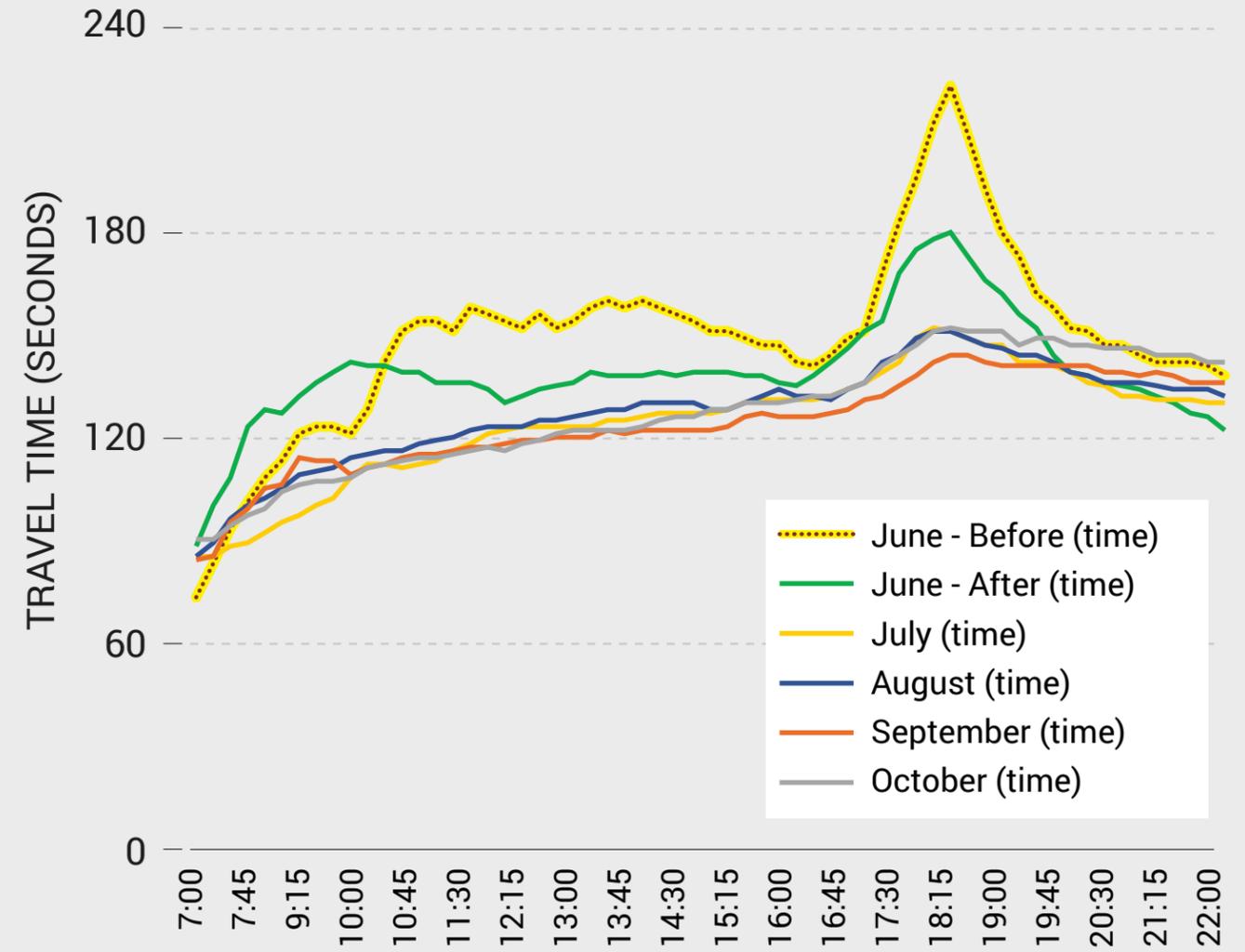
Southbound Travel Time
108th Ave - NE8th St to NE4th St

BUS DELAY

MEASURE
Average dwell time

Operator feedback

BEFORE PERIOD
April 23rd - May 4th, 2018

AFTER PERIOD
Oct 8th-19th, 2018

LOCATION
Key transit movements at NE 8th/108th Ave, NE 6th/108th Ave, NE 4th/108th Ave

BACKGROUND
This measure aims to understand the impact of the 108th Ave Bikeway on transit efficiency. The Bellevue Transit Center is located in the middle of the corridor. One consideration of this project was to minimize the disruption of regular bus operation. While only a few routes travel north-south along the entire corridor, many of the popular routes have turning movements onto and off of 108th Ave.

At the Transit Center, Northbound and Southbound bus signals were installed to create a queue jump for transit vehicles exiting the layover and bus stops zones along 108th Ave. There were no modifications to the access into and out of the transit center itself. At NE 4th St, a new right turn lane was channelized and an overlap was added for the WB to SB movement.

Key Takeaways & Facts:

OBS DATA

- Overall, the average bus delay did not increase after the installation of the 108th Ave Bikeway.

- The addition of the southbound to westbound right turn overlap reduced average bus dwell time by over 30% or roughly 15 seconds.

OPERATOR FEEDBACK

- Most common feedback from transit operators was:
  - » the space better defines where to expect bicyclist
  - » the new configuration is too narrow and tight
  - » the bus queue jump is helpful when traffic was heavy but confused some drivers
  - » there is a potential conflict with bicyclists and the NB to EB right turn at NE 12th St

Technology & Methodology

Data was provided by King Country Metro from their Onboard System (OBS). This data captures instances where a bus stops for more than 5 seconds. The data was filtered to exclude instances when a bus was stopped with its doors open or at an actual bus stop because that infers passenger loading and unloading.

The data was filtered based on the GPS data to only data within 300ft of the intersection in question for each route. The movement chosen were for the frequent transit movements by route along the 108th Ave Bikeway. The dwell time was averaged for both the AM peak (7am-10am) and PM peak (4pm-7pm) for Monday-Friday.

Feedback from the transit operators was collected at the King County East Base on October 15th and October 22nd, 2018. Staff set up a table and asked for feedback from transit operators that drove routes along the 108th Ave corridor. Detailed feedback provided by over 16 transit operators can be found in the technical appendix.

Image of bus signal at NE 6th St

Image of new sensor for the bus signal

ROUTE 271 EB to SB	AM	PM
BEFORE	36.3	52.2
AFTER	37.3	42.2
CHANGE	3%	-18%

ROUTE 271 NB to WB	AM	PM
BEFORE	65.2	70
AFTER	57.7	69.4
CHANGE	-11%	-1%

ROUTE 240 241 246 SB	AM	PM
BEFORE	43	43.9
AFTER	41.7	44.2
CHANGE	-3%	1%

ROUTE 240 241 246 NB	AM	PM
BEFORE	42.1	42
AFTER	32.9	42.6
CHANGE	-22%	1%

ROUTE 550 EB to NB	AM	PM
BEFORE	46.3	51.5
AFTER	45.8	49.5
CHANGE	-1%	-4%

ROUTE 550 SB to WB	AM	PM
BEFORE	53.5	41.9
AFTER	36.5	29
CHANGE	-32%	-31%
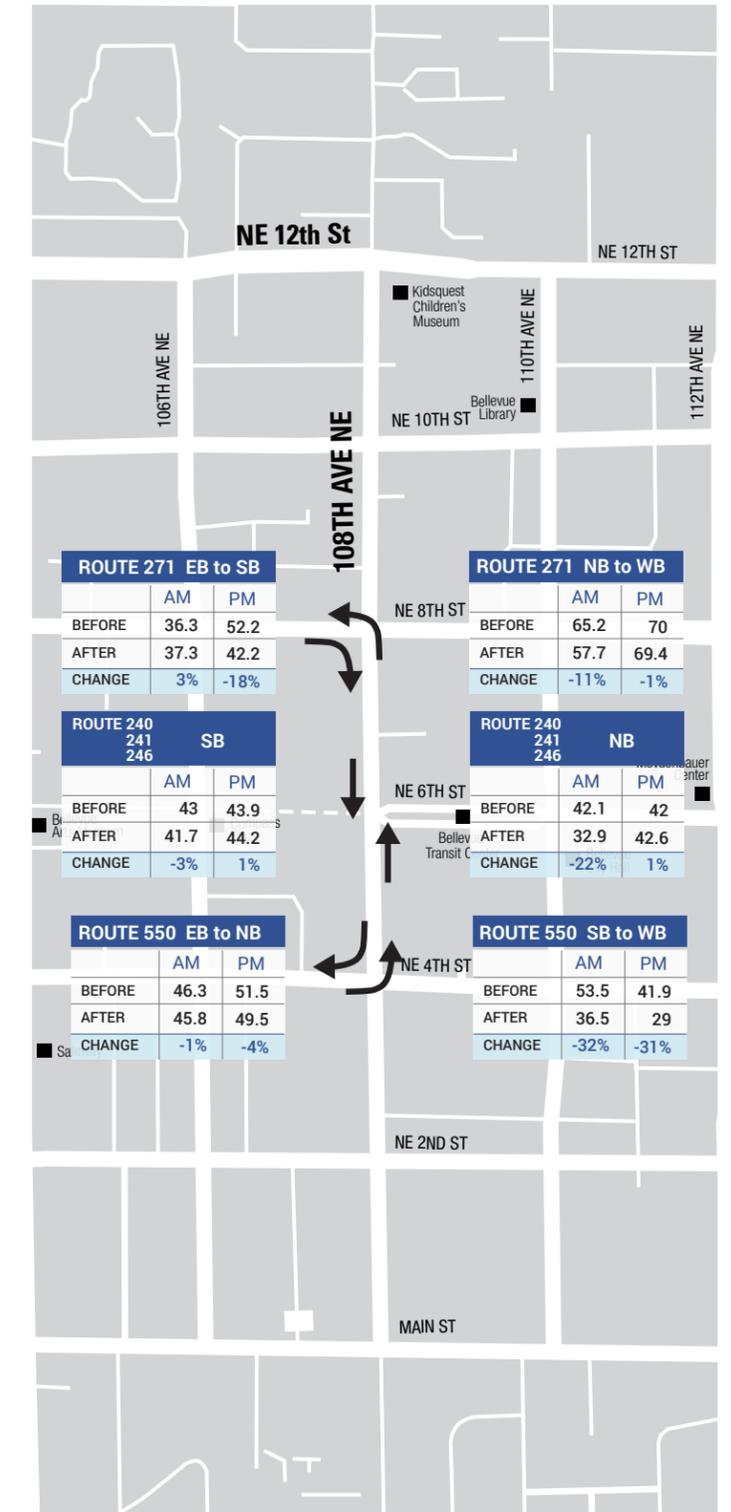
Average Bus Dwell Time (seconds) for Key Transit Movements

AUTOMOBILE DELAY

DOWNTOWN DEMONSTRATION
BIKEWAY ASSESSMENT/
EFFICIENCY

CITY OF BELLEVUE
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MEASURE
Total intersection delay in seconds per vehicle

BEFORE PERIOD
October 2017

AFTER PERIOD
October 2018 (for After-Updated)

LOCATION
All signalized intersections on 108th Ave between Main St and NE 12th St

BACKGROUND
A Synchro traffic model was initially developed to compare alternative design options for the 108th Ave Demonstration Bikeway. The model was created using volumes from 2017 and a microsimulation was used to determine the intersection delays for each signalized intersection along the corridor. The Before and After conditions show the calculated delay and the corresponding level of service that were reviewed by the Transportation Commission during the decision-making process.

For this measure, the model was updated to match the final design. The "After-Updated" model includes several new design features such as a bus queue jump at NE 6th St and also was updated with volumes collected after the installation of the demonstration bikeway to reflect any changes in travel patterns.

Level of service (LOS) is the summation of the flow ratios for all critical lane groups at an intersection. City code uses LOS standards for mobility management areas as part of the review process. All of the intersections under study meet the concurrency standards but LOS can be used as a measure for comparing changes to the operation of an intersection.

Key Takeaways & Facts:

- Overall, the calculated delays for the "After-Updated" conditions were consistent with what was predicted in the initial Before and After modeling.

- The model showed slight changes in delay that were consistent with changes in volumes observed in the after condition.

- The NE 6th St and 108th Ave intersection indicated slightly more delay in the After-Updated condition due to the added bus jump.

Technology & Methodology

The traffic model was developed using Synchro and SimTraffic software by Trafficware. Before conditions used existing signal timing and phasing based on the historical averages for the adaptive signal system. The After-Updated condition revised traffic signal timing based on historical averages. The model was calibrated based on observed conditions and included pedestrian volumes and major driveways.

SimTraffic was used to capture the impact of queuing and delay at adjacent intersections. Intersection delay and level of service is based on the Highway Capacity Manual. This is a calculated value, not a measure of actual conditions.
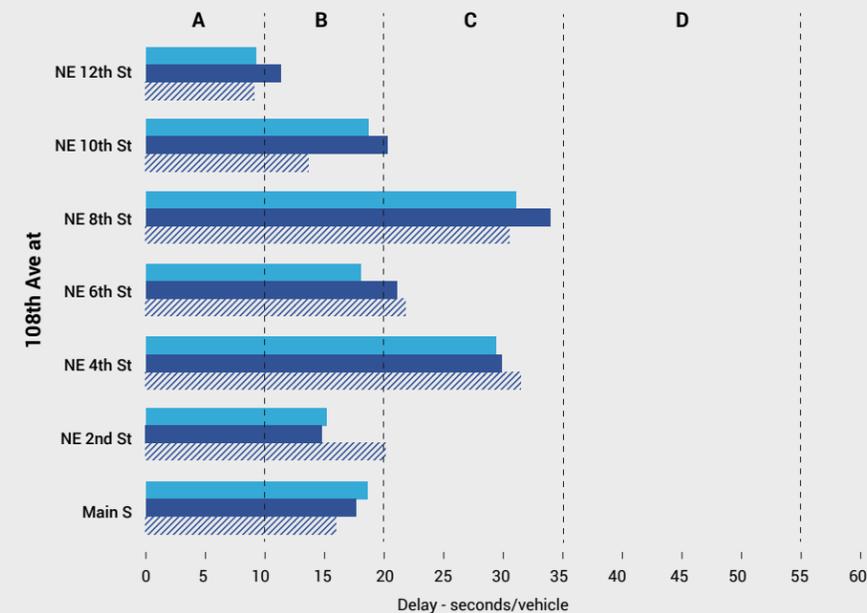
Traffic Model - Intersection Delay AM Peak

Legend: Before / After / After - Updated 2018
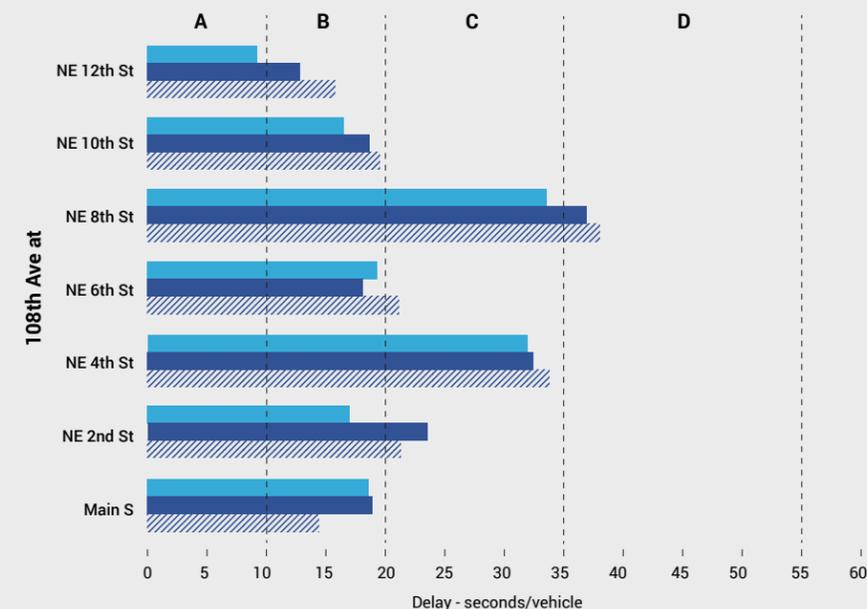
Traffic Model - Intersection Delay PM Peak

SIGNALS NETWORK ASSESSMENT

MEASURE
Percent of time the adaptive signal system is measuring above 100 degrees of saturation

BASELINE PERIOD
August - Oct 2017

BEFORE PERIOD
April - May 2018

AFTER PERIOD
August - Oct 2018

LOCATION
Signalized intersections on NE 4th St and NE 8th St between 110th Ave NE and 106th Ave NE

BACKGROUND
108th Ave is just one street in the downtown transportation network and modifications on a corridor may not be limited to just the street immediately changed. This measure aims to understand the impact that the 108th Ave bikeway project has on the surrounding transportation network.

The City of Bellevue started deploying an adaptive signal system called SCATS in 2010 and it is now deployed citywide. An adaptive signal system reacts to the changes in volumes to adjust the amount of green time given to each movement. The system will adjust timings based on real-time conditions, so modification to 108th Ave could impact other corridors such as NE 8th St and NE 4th St.

It is important to understand if the changes to 108th Ave NE are impacting other intersections not included in our evaluation. By looking at the degree of saturation at the surrounding intersections, we can infer whether there is new congestion on other corridors as a result of this project.

Key Takeaways & Facts:

- None of the locations showed a significantly increased in percent of time with a degree of saturation over 100

- 110th/NE 4th was more saturated during the before period, which was likely attributed to the full road closure of 110th Ave NE south of NE 6th St

Technology & Methodology

The measure of degree of saturation is calculated by Bellevue's adaptive signal system (SCATS) and is used to make real-time adjustments to signal timing. To determine this outcome, historical data was pulled from the adaptive signal system for each approach. The approach averages were weighted based on turning movement volumes to calculate the intersection average. The historical average was based on eight days before and eight days after and the peak periods evaluated were 7am to 10am (AM Peak) and 4pm to 7pm (PM Peak).

WHAT DOES DEGREE OF SATURATION OVER 100 MEAN?

As degree of saturation (DS) approaches 100, it is inferred that the approach is becoming congested. In general, this means that there is a queue of vehicles at the beginning of the green but traffic flows through the intersection is maintained. There could be vehicles at the end of the green. When degree of saturation is over roughly 120-130, drivers may experience gridlock or it may take multiple cycles to clear the queue.
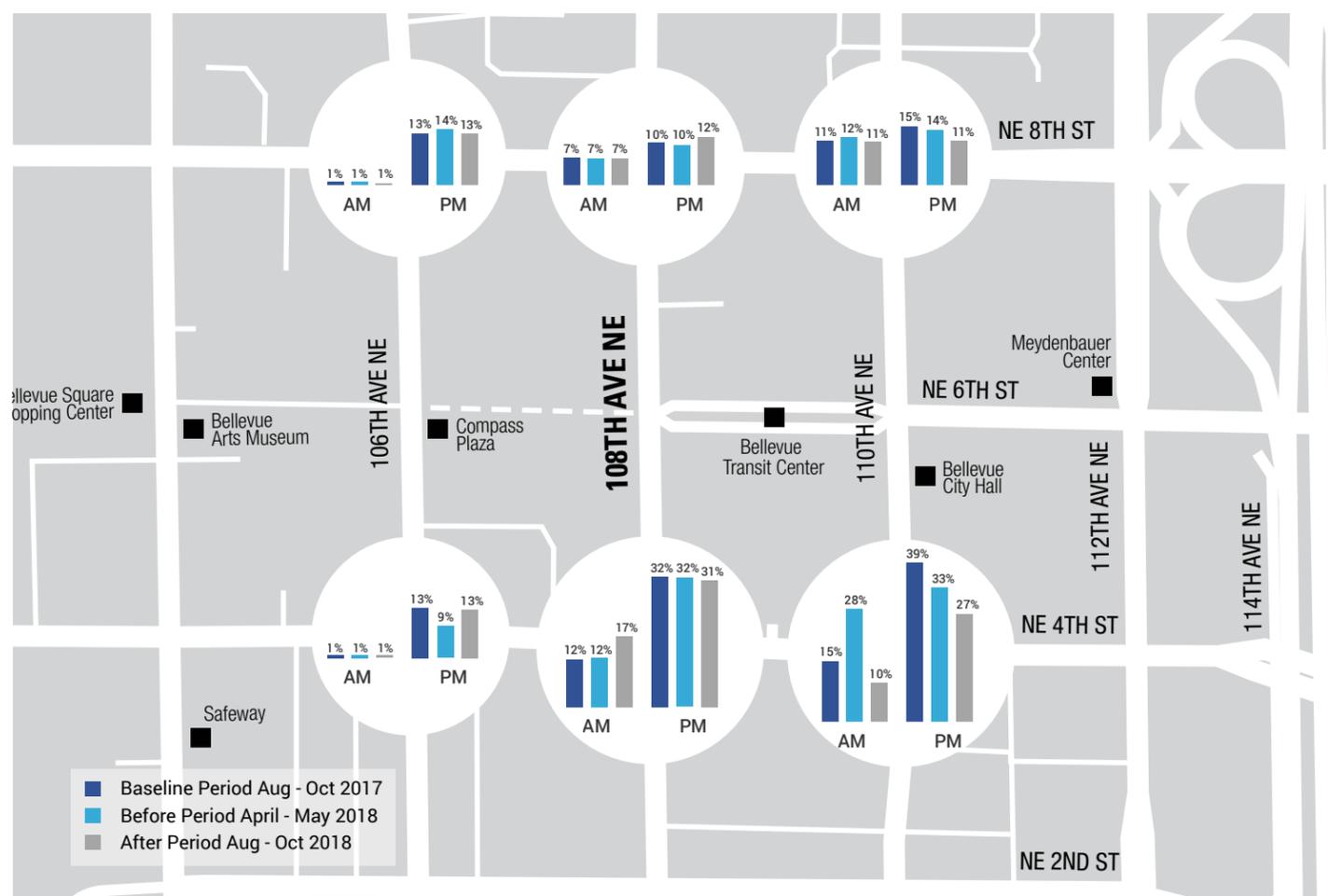
Percent of Time over 100 Degrees of Saturation
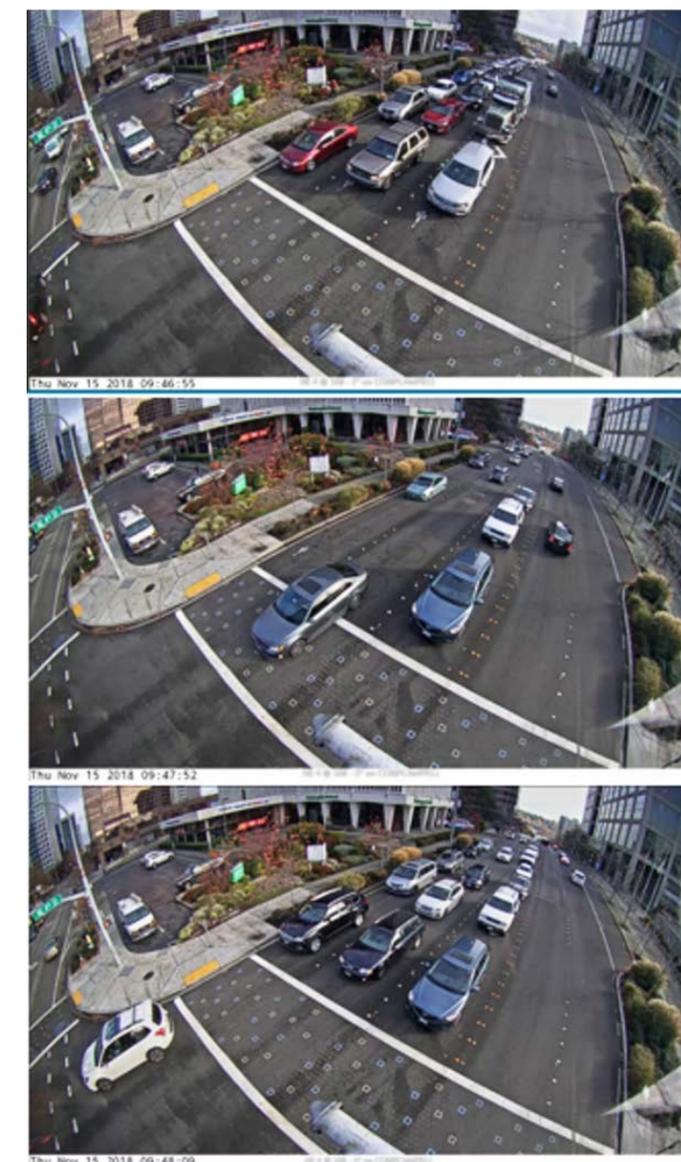
LIVABILITY

FACILITY USE - BICYCLE VOLUMES

MEASURE
Bicycle count along 108th Ave

BEFORE PERIOD
May 23rd- June 11th, 2018

AFTER PERIOD
June 15th – October 31st, 2018

LOCATION
Northbound and Southbound at NE 4th St and 108th Ave

BACKGROUND
This measure is one of the outcomes for livability and aims to understand how the demonstration bikeway impacts mobility – particularly multimodal opportunities. Bellevue aspires to accommodate all modes of transportation as identified through the City's Pedestrian and Bicycle Implementation Initiative. This demonstrationproject aims to increase the attractivness of biking Bellevue so it is important to measure if ridership increases after.

Historically bicycle counts have typically been collected during peak hours. This demonstration provided 24/7 counts and also was an opportunity to pilot the latest technology in bicycle counting.

A midweek average was used because bicycle patterns on the weekend and weekday vary significantly. The volume is for the entire day (24 hr count).

It is also worth noting that the month of May is Bike Everywhere Month so the before period is likely reflective of a high bike volume time period, similar to the summertime


0.9   1.25

Key Takeaways & Facts:

- Average daily bicycle ridership increased by 35%

- Highest number of bicycles recorded in one hour was 32

- Part of August saw lower ridership as a result of poor air quality but it was included in August average. In the smoky period was excluded, the weekday average daily ridership would have been 147 in August.

Technology & Methodology

Bicycle volumes were collected using thermal video detection. Two units were installed, one for northbound and one for southbound at NE 4th St on 108th Ave NE as bicyclist exited the intersection. A midweek average was used because bicycle patterns on the weekend and weekday vary significantly. The volume is for the entire day (24 hr count).

The cameras used were Trafisense2 and have the latest technology for differentiating vehicles and bicycles on the roadway. Accuracy was validated through manual observation and finetuning.

Average Mid-Week Bicycle Volume per Day

before May/June	after June	July	August	Sept	October
92	126	121	135	134	104
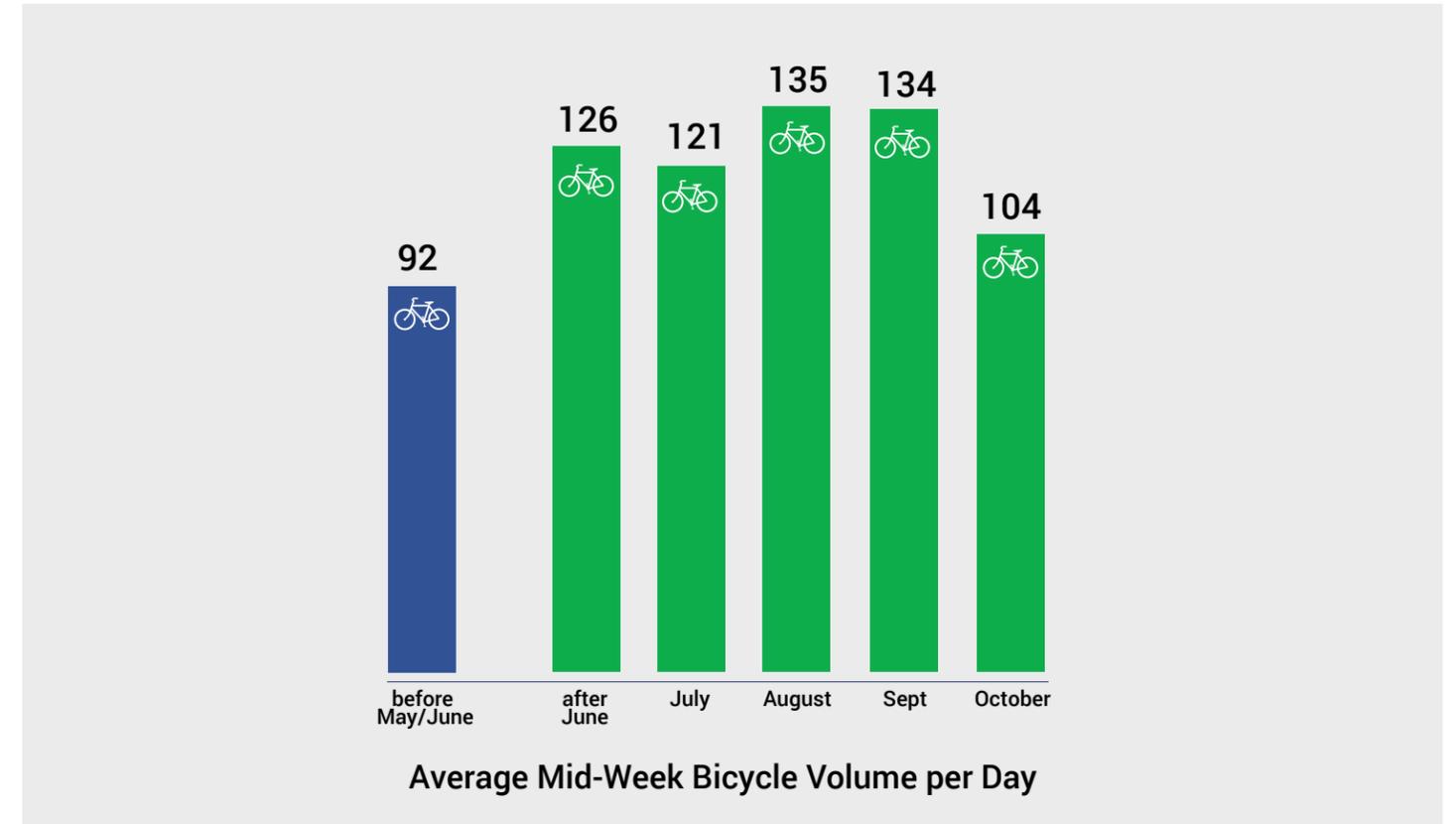
Only full days of data was included. There were occasional losses of data due to network communication errors, but partial days of data were not included. Southbound before data was collected for the curb travel lane because there was not a dedicated bike lane.

TrafiSense2 SB

FACILITY USE - BICYCLE SHARE

DOWNTOWN DEMONSTRATION
BIKEWAY ASSESSMENT/
LIVABILITY

CITY OF BELLEVUE
NEIGHBORHOOD
SAFETY,
CONNECTIVITY &
CONGESTION LEVY

MEASURE
Travel patterns by people using dockless bike share

SIX-MONTH DATA PERIOD
July 31, 2018 – January 31, 2019

TOTAL TRIPS
27,905

TOTAL USERS
6,297

BACKGROUND
Bellevue launched a dockless bike share pilot on July 31, 2018—the same day as the opening of the demonstration bikeway on 108th Ave NE. The electric-assisted bicycles are available for use citywide, with the greatest density of bikes available in Downtown. Between 100 and 400 bicycles were available citywide during the first six months of the pilot, growing steadily from launch through November and then declining during the winter months less favorable to bicycling.

Of the 27,905 trips taken during the first six months, more than 55 percent began in Downtown Bellevue (15,607), just over 50 percent ended in Downtown (14,162), and almost 40 percent both started and ended within Downtown (10,990).

Key Takeaways & Facts:

- 108th Ave NE is the most used corridor by bike share users in Downtown
  - » At least 16% of all bike share trips (4,487) used 108th Ave
  - » At least 6% of all bike share trips started (1,775) and just under 6% ended (1,622) along 108th Ave
- 108th Ave NE is the most commonly used route for trips wholly within Downtown
  - » 24% of trips that started and ended within Downtown used 108th Ave (2,685 out of 10,990 trips)
  - » 60% of all bike share trips that used 108th Ave NE both started and ended in Downtown
- West Bellevue and Northwest Bellevue were the most common neighborhood origins and destinations outside of Downtown
  - » 35% of all trips that started or ended outside of Bellevue ended or started in Downtown (904 out of 2,904 trips)

- 25% of people who used bike share in Bellevue traveled along 108th Ave NE at least once
- Bike share use along 108th Ave NE is comparable on weekdays and weekends, increasing steadily beginning in the early morning, peaking in the late afternoon, and declining steadily thereafter
- Bike share trips that used 108th Ave NE lasted 12 minutes and 47 seconds on average; the median trip duration was 7 minutes and 17 seconds

Technology & Methodology

All bike share bicycles are GPS-enabled and collect data about trip origins, waypoints, and destinations, recording where and when people use bike share. This data provides broader insight into comparative route preferences than static bike counters at specific locations can; however, it reflects only ridership by bike share users, not people riding personal bicycles.

Start and end points are recorded for all trips. Mid-trip waypoints are logged only periodically, so a modest number of bike trips likely traveled along a corridor for a short enough period that no location report (ping) occurred while the bike was within the geographic boundary used for this analysis. Usage estimates for all specific corridors, including 108th Ave NE, are likely somewhat lower than the actual number of trips that used each corridor.

FACILITY USE - BICYCLE SHARE
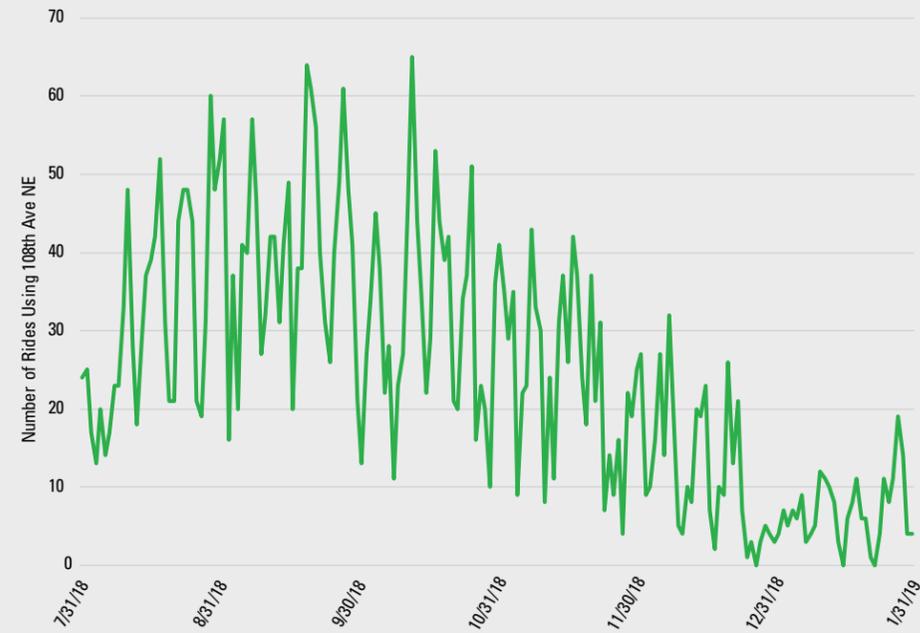
Number of Daily Bike Share Rides Using 108th Ave NE
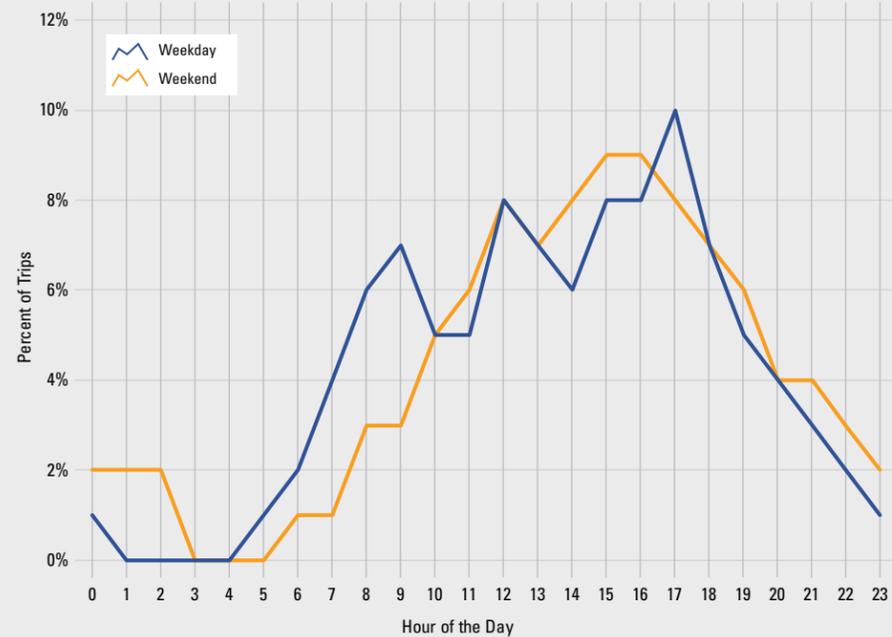
Fraction of Bike Share Trip Starts on 108th Ave NE by Time of Day
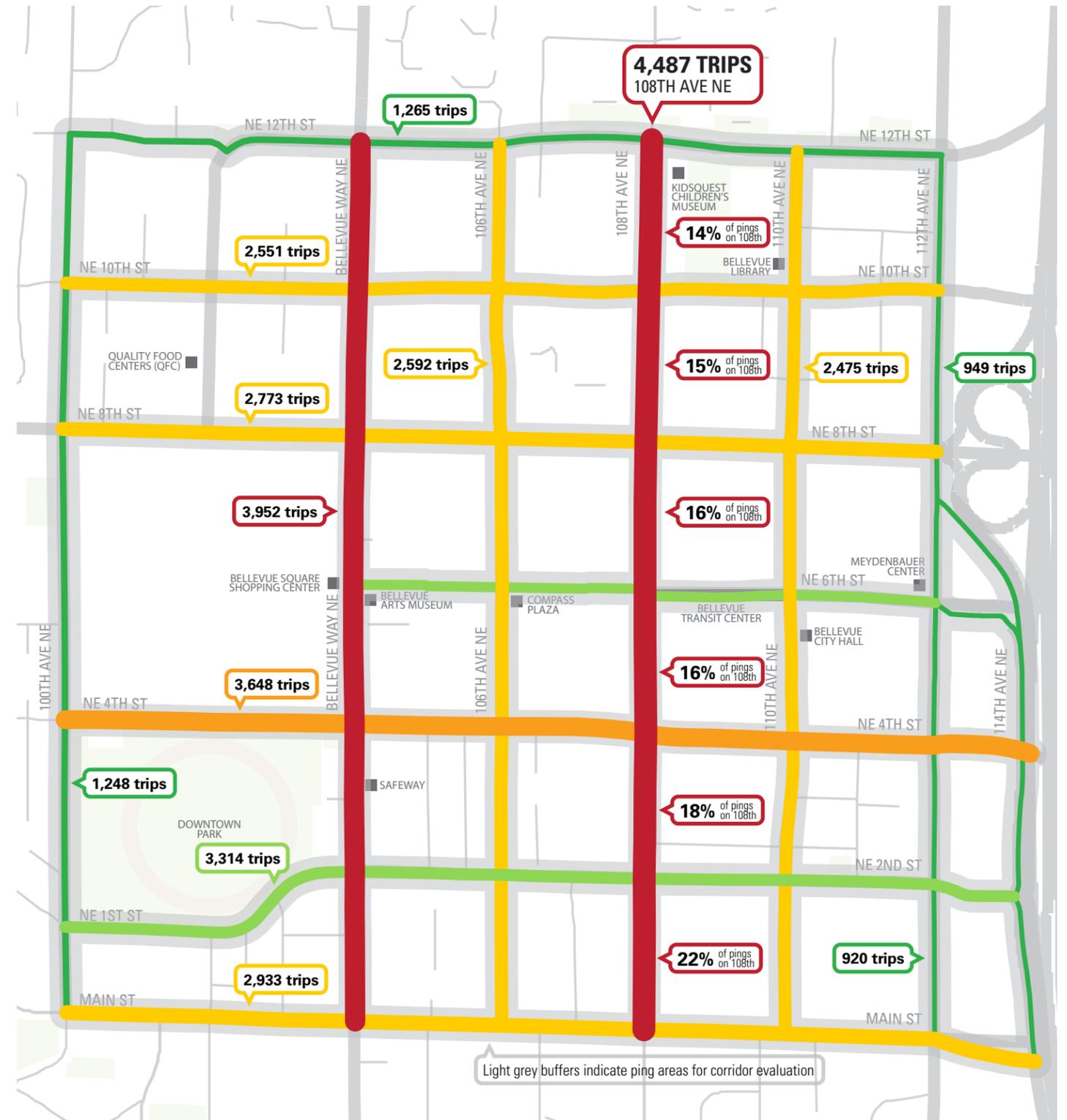
Number of Bike Share Trips by Downtown Corridor

FACILITY USE - VEHICLE VOLUMES

MEASURE
Turning movement counts for the AM and PM peak hour

BEFORE PERIOD
April 24, 2018

AFTER PERIOD
October 16, 2018

LOCATION
Signalized intersections on 108th between Main St and NE 12th St

BACKGROUND
Manual turning movement counts were collected in the spring before 108th Ave Bikeway as installed and then again in the fall after once all construction was completed and school was back in session.

These volumes were not only used to measure any change in vehicle volumes but were also used to calculate vehicle delay. Knowing the actual vehicle volume at each intersection is also imporant in comparison without measures in he assessment. Understanding the change in volumes can be a benchmark for some of the other measures such as vehicle travel time and delay. Similar to bike cycle volumes, vehicle volumes also could impact the safety of the corridor.

Key Takeaways & Facts:

- The change in peak hour vehicle volumes varied by intersection but overall was not significant for most intersections

- Volumes decreased north of NE 6th St in the AM peak but increased in the PM peak. The trend was the opposite for intersections south of NE 6th St.

Technology & Methodology

A consultant was hired to count the individual turning movement (left, through, right) for each intersection for both AM and PM peak hours. Both before and after were collected on a Tuesday with no precipitation and school was in session. Construction impacts were avoided as best as possible and the data was collected when there were no construction activities on the corridor.
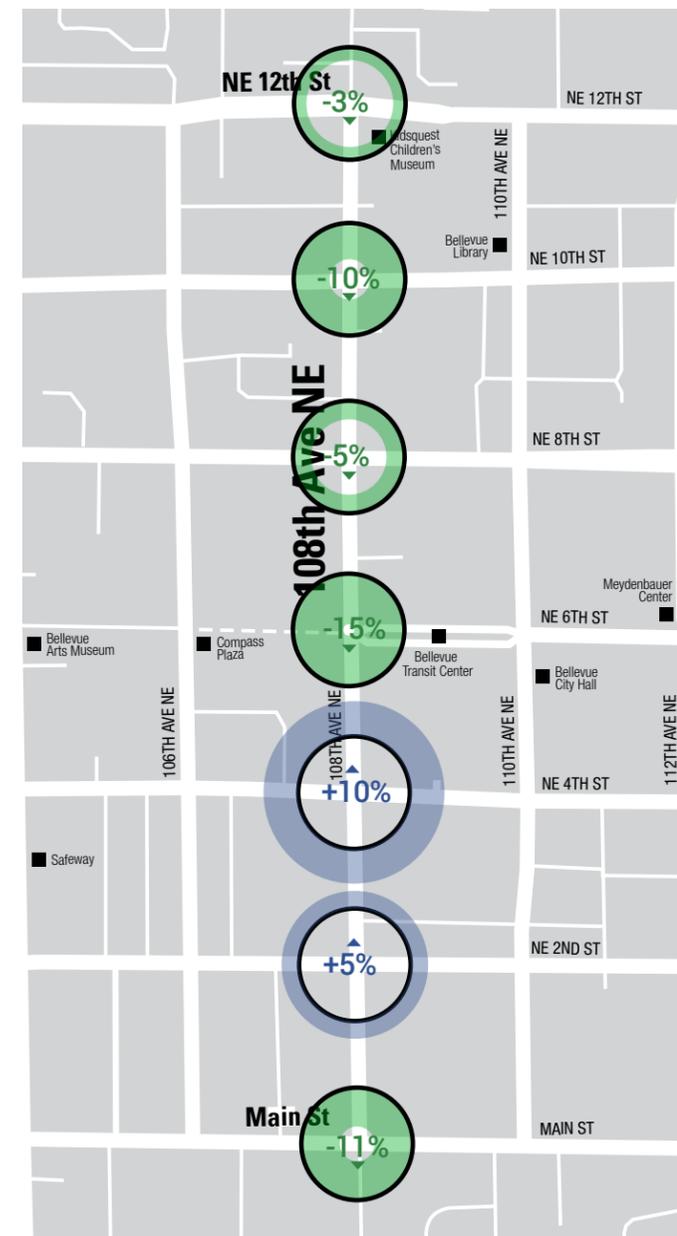

AM Peak Hour	Total Intersection Vehicle Volume		
INTERSECTION	BEFORE	AFTER	% CHANGE
NE 12th St	1752	1700	-3%
NE 10th St	1214	1087	-10%
NE 8th St	2553	2417	-5%
NE 6th St	819	699	-15%
NE 4th St	2099	2307	10%
NE 2nd St	1090	1144	5%
Main St	1999	1785	-11%
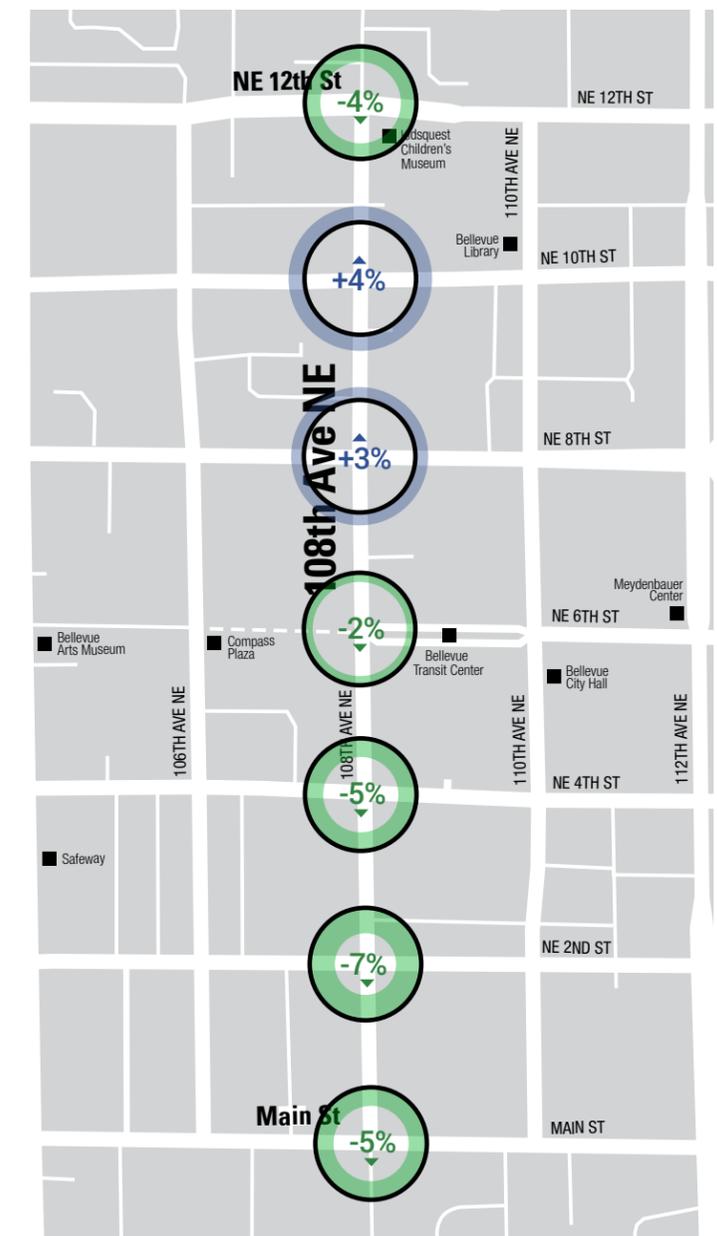
PM Peak Hour	Total Intersection Vehicle Volume		
INTERSECTION	BEFORE	AFTER	% CHANGE
NE 12th St	2161	2081	-4%
NE 10th St	1784	1849	+4%
NE 8th St	3288	3387	+3%
NE 6th St	1058	1034	-2%
NE 4th St	2683	2561	-5%
NE 2nd St	1556	1444	-7%
Main St	2142	2025	-5%

FACILITY USE - VEHICLE VOLUMES
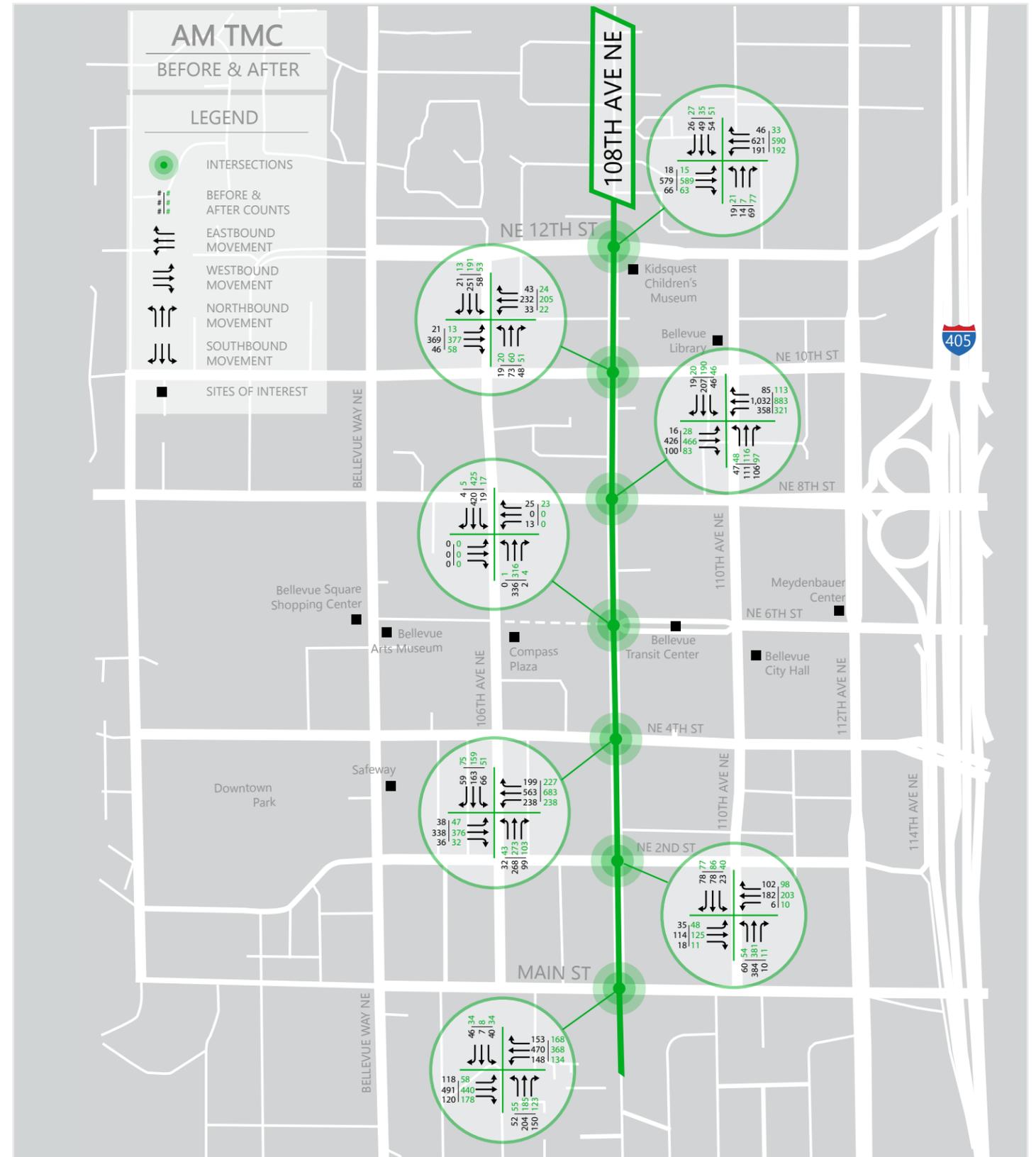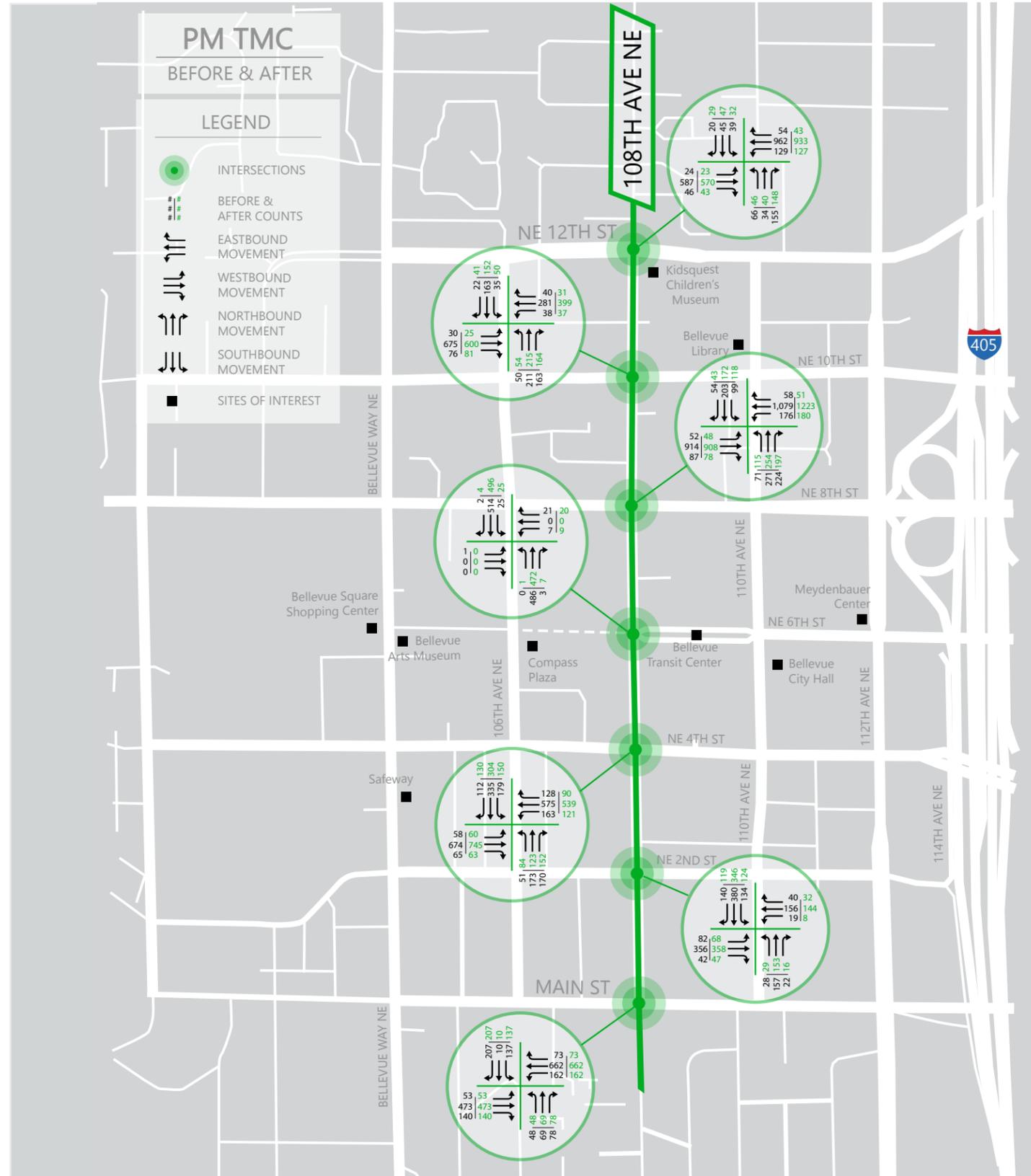
USER SATISFACTION

DOWNTOWN DEMONSTRATION
BIKEWAY ASSESSMENT/
LIVABILITY

CITY OF BELLEVUE
NEIGHBORHOOD
SAFETY,
CONNECTIVITY &
CONGESTION LEVY

MEASURE
Online questionnaires

BEFORE PROJECT
Nov. 10, 2017 through Jan. 1, 2018 – 1,262 respondents

AFTER PROJECT
Sep. 1 through Nov. 1, 2018 – 1,232 respondents

BACKGROUND
This measure aims to understand the public's perception of 108th Ave NE and their level of support for bicycle facilities along the corridor and in Downtown more broadly before and after implementation of the demonstration bikeway. Responses to multiple questions were cross-referenced to determine how perspectives compare across different groups—for example, among those who have biked versus driven along the corridor, and among those who are confident versus more concerned riders.

Key Takeaways & Facts:

BEFORE

- A plurality of respondents (42%) never rode a bike in Downtown during the summer months, and many respondents (35%) rode only once a week or less.
- Most respondents (62%) said they would ride a bike in Downtown more often if streets had safe and comfortable bike lanes.
- Most respondents (62%) felt that some tradeoffs to motor vehicle traffic flow are acceptable to provide safe facilities for people who bike in Downtown (17% agree, 45% strongly agree).
- Most respondents (80%) felt that new bike lanes on 108th Ave would help people on bikes get where they want to go in or through Downtown (25% agree, 55% strongly agree).

AFTER

- Most people agree that the design of 108th Ave strikes the right balance to address the needs of all street users (30% agree, 16% agree strongly, 20% undecided).
  - » People who have biked along the corridor are especially supportive (44% agree, 31% strongly agree, 13% undecided).
- Most people who have biked along 108th Ave agree that additional physical separation is warranted to enhance the bicycling experience (25% agree, 31% agree strongly, 24% undecided).
  - » People who identified themselves as "enthusiastic and confident" or "interested but concerned" riders are more strongly supportive of additional physical separation (60% and 62% in favor, respectively) than those who identify as "strong and fearless" cyclists (49%).
- Most people—regardless of how they typically travel in Bellevue—support building more bicycle lanes at other locations in Downtown Bellevue (13% agree, 52% agree strongly, 7% undecided).
- People bicycling on 108th Ave…
  - » feel the added expense of purchasing and maintaining planter boxes is worthwhile (23% agree, 52% strongly agree)
  - » commonly experience motor vehicles parked or waiting in the bike lane (26% very often, 43% sometimes)
- People driving on 108th Ave…
  - » like that bikes and cars are more separated (27% agree, 37% strongly agree)
  - » claim it is easier to see people bicycling in the new bike lanes (35% agree, 23% strongly agree)
  - » say it is unacceptable for a motor vehicle to use the bike lane as a pick-up/drop-off zone (20% agree, 40% strongly agree)
- Most respondents are satisfied with the City's efforts to solicit input from the community on the 108th Ave project. Among people who have…
  - » biked on the corridor: 40% agree, 45% agree strongly
  - » driven on the corridor: 29% agree, 29% agree strongly
  - » walked on the corridor: 32% agree, 28% agree strongly

USER SATISFACTION

The design of 108th Avenue strikes the right balance to address the needs of all street users

Overall	47% n=1,217	👍	
Have Biked on 108th	75% n=463	👍👍	
Have Not Biked on 108th	46% n=694	👎	
Have Driven on 108th	43% n=869	👍	
Have Not Driven on 108th	54% n=342	👍	
Have Walked on 108th	45% n=732	👍	
Have Not Walked on 108th	51% n=399	👍	
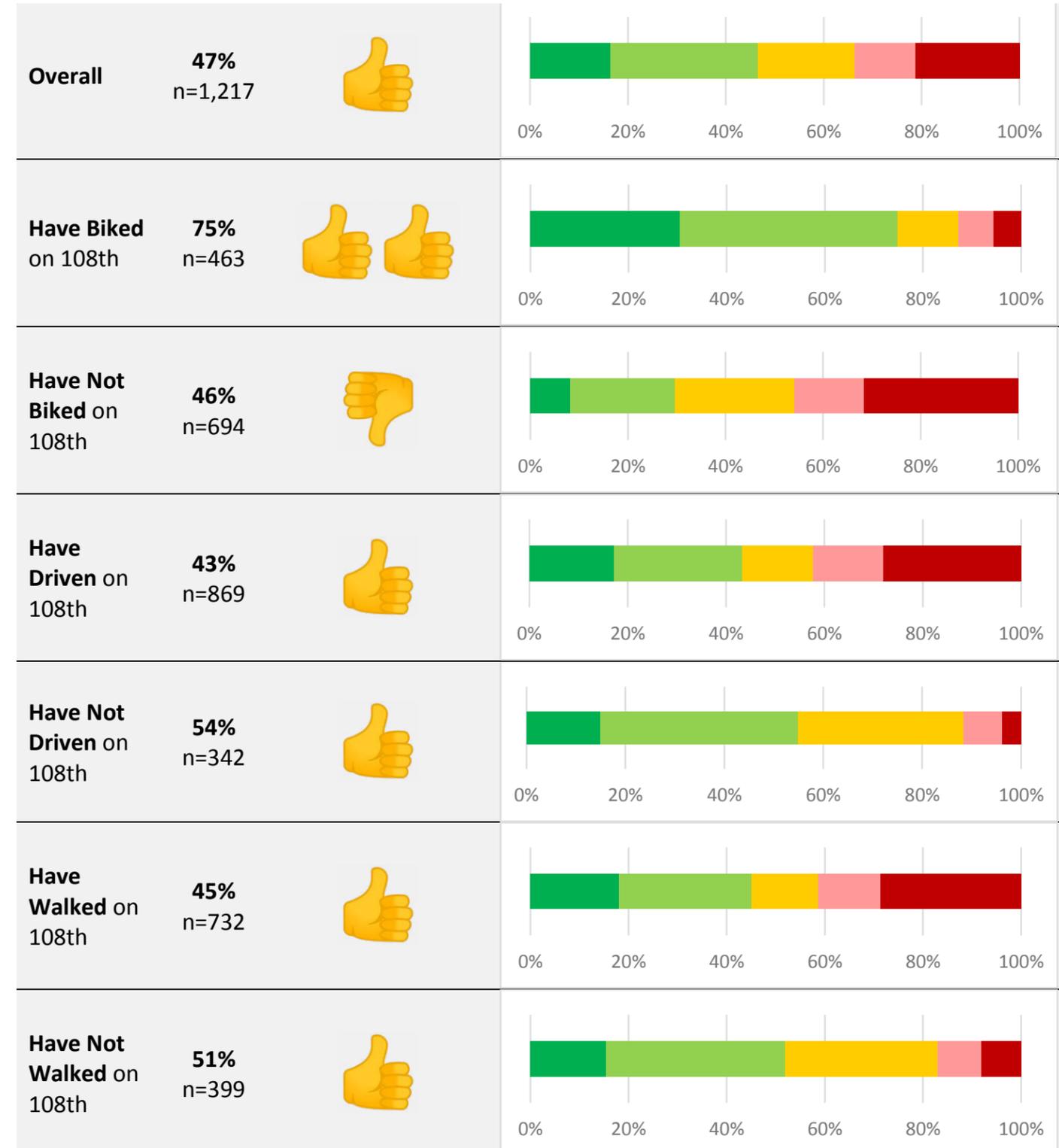
Additional physical separation is warranted on 108th Avenue to enhance the bicycle riding experience

Overall	41% n=1,216	👍	
Have Biked on 108th	56% n=463	👍	
Interested but Concerned Rider	62% n=55	👍👍	
Enthusiastic and Confident Rider	60% n=244	👍👍	
Strong and Fearless Rider	49% n=156	👍	
Have Not Biked on 108th	47% n=694	👎	
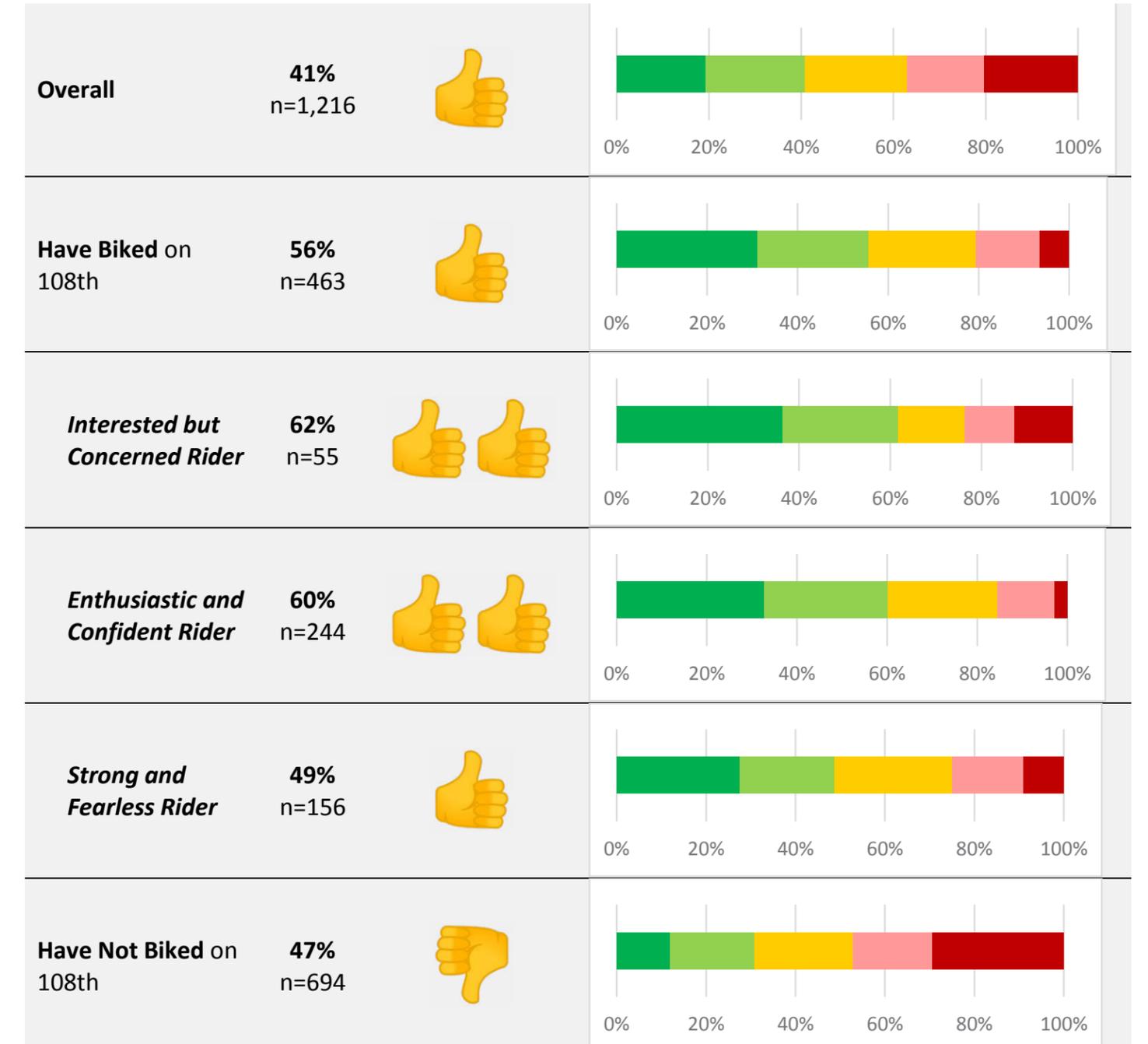
Overall, I would support building more bicycle lanes at other locations in Downtown Bellevue

Modes of travel respondents typically use in Bellevue...

Overall	**65%** n=1,223	👍👍
Personal Bicycle	**95%** n=519	👍👍
Bikeshare Bicycle	**98%** n=64	👍👍
Personal Motor Vehicle	**58%** n=878	👍
Walking	**67%** n=676	👍👍
Public Transit	**78%** n=413	👍👍
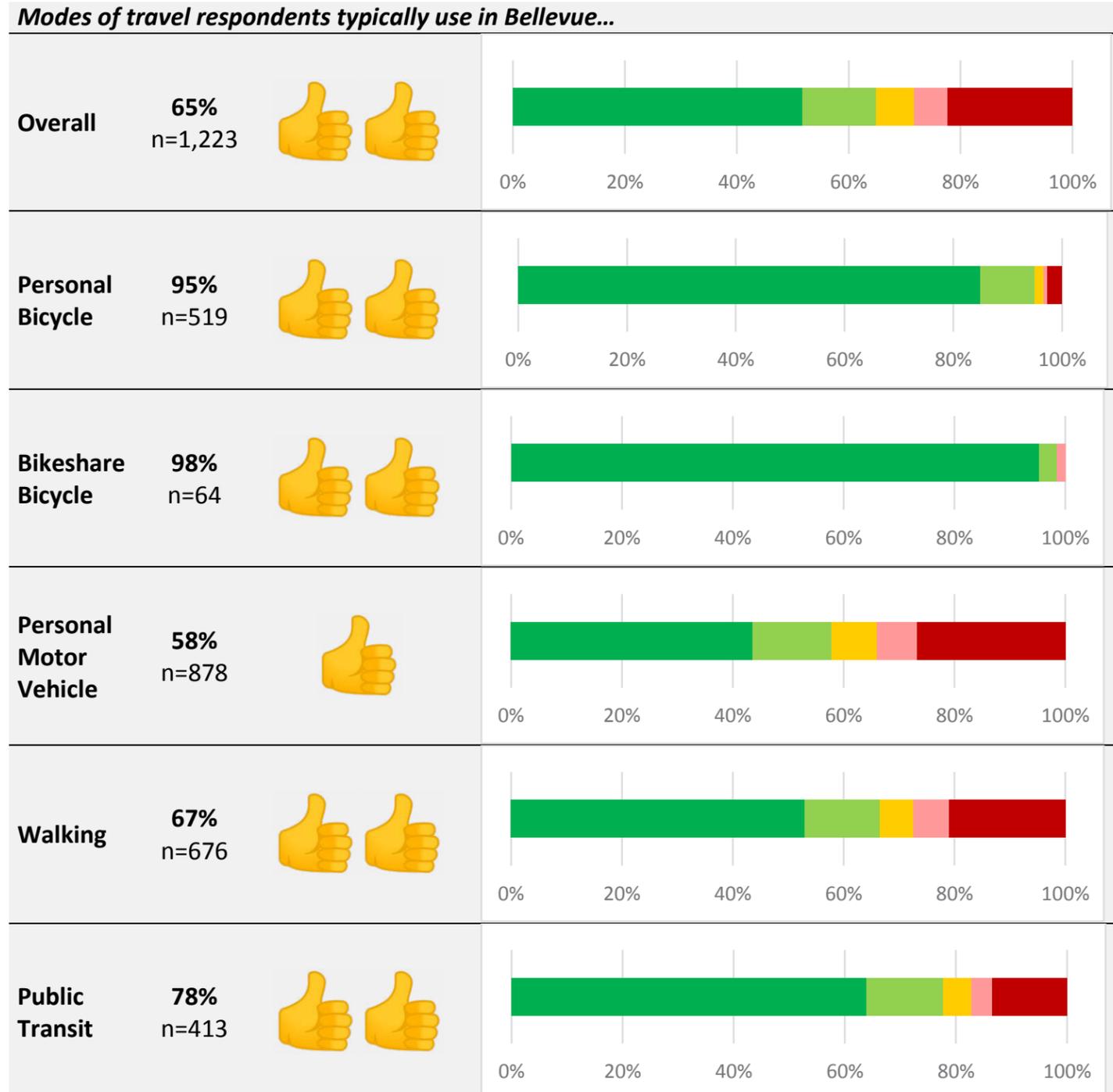
BICYCLE LEVEL OF TRAFFIC STRESS

MEASURE
Target bicycle user group based on motor vehicle traffic and bicycle facility characteristics

SPEED LIMIT
30 MPH

TRAFFIC VOLUMES (2015 DATA)
Main St to NE 4th St – 9,500
NE 4th St to NE 8th St – 11,400
NE 8th St to NE 12th St – 6,200

BACKGROUND
This measure rates traffic stress for street segments and intersections based on different types of bicyclists' presumed comfort level riding near motor vehicle traffic.

Bicycle Level of Traffic Stress (LTS) is based on the concept of the maximum level of traffic stress that will be tolerated by specific groups of existing and potential people bicycling: strong and fearless (LTS 4), who are comfortable riding in mixed traffic; enthused and confident (LTS 3), who can tolerate some stress but choose less stressful routes when available and convenient; interested but concerned (LTS 2), which includes most adults; and all ages and abilities (LTS 1), including children and older adults.

Multimodal Level-of-Service Guidelines approved by the Transportation Commission in 2017 establish a target of LTS 1 for Bicycle Priority Corridors in designated Activity Centers.

Key Takeaways & Facts:

BEFORE

- All street segments (superblocks) were LTS 4—no blocks had continuous bike lanes.

- Only two intersections were LTS 3—southbound at Main St (green through bike lane) and northbound at NE 4th St (through bike lane to the left of right turn lane).

- Most questionnaire respondents believed bicycle facilities in Downtown should be designed to serve...
  - » most adults interested in riding a bike (39%), or LTS 2
 - » people of all ages and abilities (28%), or LTS 1.

AFTER

- 75% of street segments (superblocks) are LTS 2

- 25% of street segments (superblocks) are LTS 3

- All intersections are LTS 3—most feature skip striping and bike lanes to the left of right turn lanes, one has a green bike box (northbound at Main St).

- Among questionnaire respondents, people bicycling and driving alike...
  - » feel more comfortable traveling along bike lanes that are buffered, physically separated, and painted green
  - » feel least comfortable along street segments with sharrows, where bikes and cars share the lane

Methodology

LTS is based on two key characteristics of vehicle traffic—speed and volume—together with the type of bicycle facility present. As traffic speed and volume increase, more robust bicycle facilities employing more protective measures are required to maintain a level of traffic stress that is tolerable for most adults (LTS 2) and especially for children and older adults (LTS 1).

LTS is calculated separately for each direction of travel. Street segments (superblocks) and intersections are classified based on their most stressful feature.


BICYCLE LEVEL OF TRAFFIC STRESS (LTS)

STREET SEGMENT LTS
- LTS 1 - All Ages and Abilities
- LTS 2 - Most Adults
- LTS 3 - Confident Adults
- LTS 4 - Fearless Adults

BICYCLE FACILITY
- PBL — Protected Bike Lane (Curb, Post, Planters)
- BBL — Buffered Bike Lane (Painted Buffer)
- SBL — Striped Bike Lane
- SLM — Shared Lane Marking

INTERSECTION LTS
- LTS 3 Intersection

BICYCLE LEVEL OF TRAFFIC STRESS

DOWNTOWN DEMONSTRATION
BIKEWAY ASSESSMENT/
LIVABILITY

CITY OF BELLEVUE
NEIGHBORHOOD
SAFETY,
CONNECTIVITY &
CONGESTION LEVY

What is your comfort level when riding a bicycle on the following facilities on 108th Avenue?
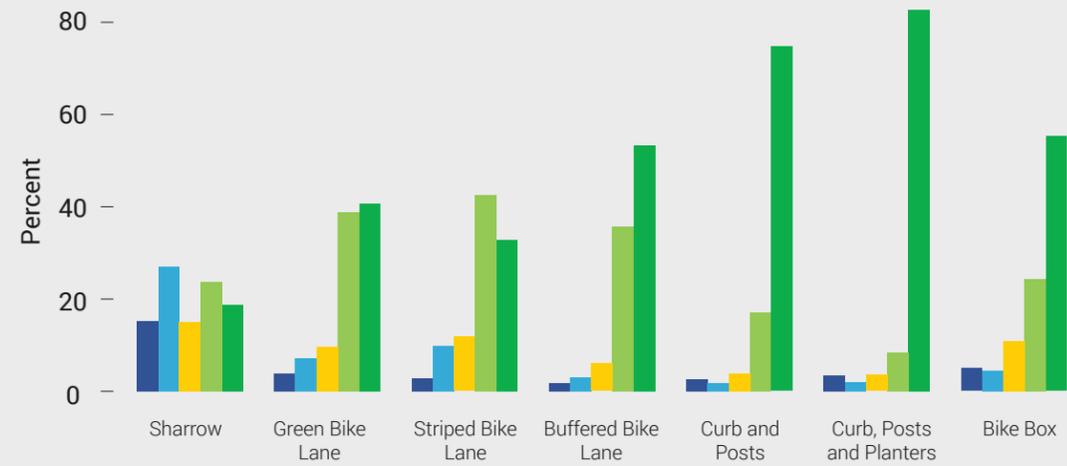
What is your comfort level when driving a motor vehicle next to these bike lane accommodations on 108th Avenue?
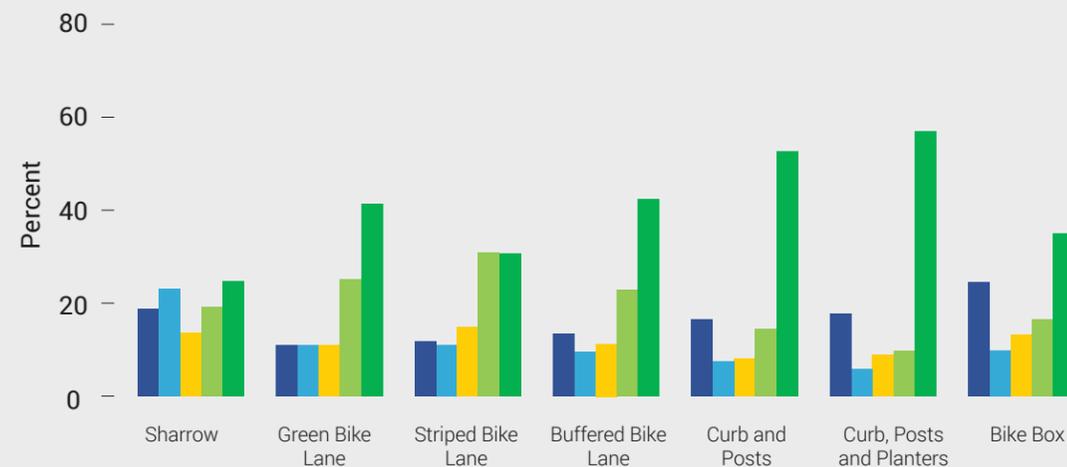
- Very Comfortable
- Somewhat Comfortable
- Neutral
- Somewhat Uncomfortable
- Very Uncomfortable

Sharrow

Green Bike Lane

Striped Bike Lane

Buffered Bike Lane

Separated Lanes

Curb, Post, and Planters

Bike Box

Bellevue Level of Traffic Stress (LTS) Categories

TNC AND FREIGHT DELIVERY

MEASURE
Percent of time bike lane was blocked

BEFORE PERIOD
No before data was collected

AFTER PERIOD
Before installation of vertical elements –
June 28th
After installation of vertical elements –
September 25th & 27th, October 2nd

LOCATION
Entire corridor with specific observations on
108th Ave immediately north of NE 6th St

BACKGROUND
In Bellevue, TNC passenger load/unload activity has been identified as an ongoing and growing issue citywide, especially in dense areas like downtown. Vehicles have been observed stopping in not just bike lanes, but also travel lanes and bus stops. Curbside demand management is a challenge accross the US and new resources are emerging such as the Curbside Management Practitioners Guide produced by The Institute of Transportation Engineers (ITE).

This measure aims to quantify both the impact of load and unloading on the bikeway, but impact of the bikeway on load and unload activities.
During development of the demonstration bikeway, staff explored opportunities to reduce bike-vehicle conflicts on the curbside along the corridor, specifically with freight delivery and passenger load/unload activities from Transportation Network Companies (TNCs).

Key Takeaways & Facts:

- The installation of vertical dividers reduced the amount of time that the bike lane was blocked by vehicles by 93%, from 81.9 minutes in a 3-hour period to 5.9 minutes. Gaps in the vertical dividers resulted in there still being instances where the bike lane was still blocked.

- Staff worked with TNC providers to designated load zones in the vicinity.

- New curbside passenger load/unload zones were established on both on 108th Avenue NE and on nearby cross streets, such as NE 4th Street.

Technology & Methodology

Video observations were also utilized to collect data for the amount of time the bike lane was blocked by taxi, freight and TNC activities on the segment of 108th Ave NE immediately north of NE 6th St on the east side of the road which had previously been used for load/unload. Observations were collected for the morning commute between 7am to 10am.

A flyer was created which provided information about nearby legal curbside loading zones. These flyers were handed to surrounding property managers as well as both TNC drivers and freight delivery personnel which were illegally blocking the bike lane to better inform about nearby options
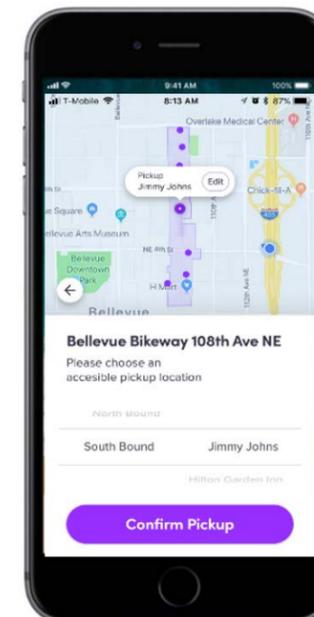
To minimize hazardous passenger pick-up and drop-off activity on the demonstration bikeway, traffic engineering staff worked with Uber and Lyft to create a geofence along 108th Avenue NE so that passengers were required to hail a TNC ride at designated load zones in the vicinity.

MEASURES	BEFORE	AFTER AVERAGE	REDUCTION
BLOCKAGE TIME	1 hr 21 min 52 sec	5 min 52 sec	93%
AVERAGE PICK-UP	3 min 52 sec	2 min 46 sec	29%
AVERAGE DROP-OFF	47 sec	20 sec	58%
AVERAGE NUMBER OF VIOLATORS	45	10.3	77%

DRAFT