# Level-of-Service in Bellevue

***Toward a Multimodal Approach to Mobility***

# MMLOS
# IDENTIFYING PROJECTS AND WEIGHING TRADEOFFS

## DECEMBER 14, 2017

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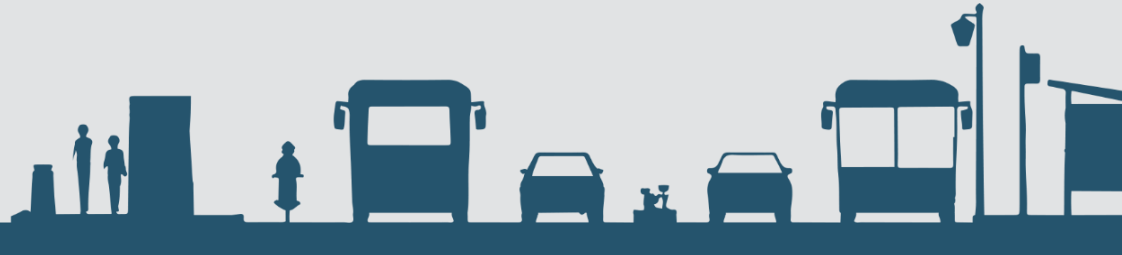
Fehr & Peers





# AGENDA

1. **Expectations for Tonight**
2. **Task 1 – Identifying Projects and Weighing Tradeoffs**
   - What Project to Build?
   - Understanding the Project Context
   - Acknowledging the Tradeoffs

# EXPECTATIONS FOR TONIGHT'S MEETING

- **Using MMLOS to identify projects**
  - How to identify LOS gaps for each mode
  - How MMLOS identifies potential projects to improve LOS
- **Discuss land use context and relationship to projects and level-of-service expectations**
- **Review potential framework to weigh tradeoffs between modes**
- **No Action is requested of the Transportation Commission at this meeting**

# WHAT PROJECT TO BUILD?

1. **Identify the expected LOS for each mode (MMLOS standards and guidelines)**
2. **Analyze MMLOS and compare to expectations**
3. **If there is a gap, then:**
   - Consider the components or facility improvements needed to attain the expected LOS
   - Weigh context and modal impacts to identify project details

# TWO EXAMPLE CORRIDORS ANALYZED

## Bellevue Way

**Between NE 24th Street to 103rd Avenue NE**

**(Northtowne Neighborhood Shopping Center)**

## 156th Avenue NE

**Between NE 8th Street to NE 20th Street**

**(Crossroads Activity Center)**

# ANALYZE MMLOS

# VEHICLE LOS

**LOS Metrics:**

- Volume/capacity ratio at System Intersections
- Corridor travel speed/time

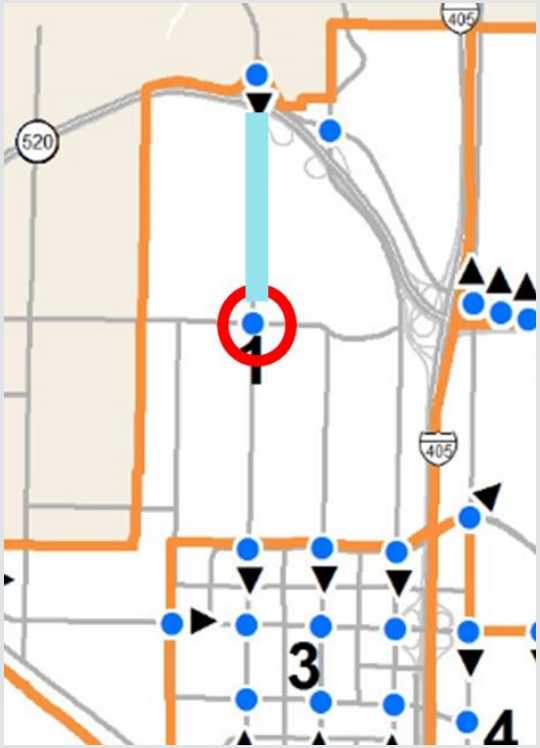
# VEHICLE LOS - V/C RATIO RESULTS

## Bellevue Way & NE 24th Street

- ✓ Intersection v/c=0.72

Standard for MMA 1: Average v/c=0.85

Existing v/c Average for MMA 1 is .460




**Conclusion:** No Vehicle V/C LOS Gap

# VEHICLE LOS - V/C RATIO RESULTS

**156th Ave NE & NE 8th Street**

- ✓ **Intersection v/c=0.72**

**156th Ave NE & NE 20th Street**

- ✓ Intersection v/c=0.81

**Standard for MMA 5: Average v/c=0.90**

**Existing v/c Average for MMA 5 is .620**

**Conclusion: No Vehicle V/C LOS Gap**

# VEHICLE LOS- CORRIDOR TRAVEL TIME/SPEED

| LOS | Average Speed Along a Defined Corridor Segment Based on 40% of Posted Speed Limit* |
|---|---|
| ● | <90% of typical urban travel time, >1.1 times speed |
| ● | 90-110% of typical urban travel time, 1.1-0.9 times speed |
| ● | 110-155% of typical urban travel time, 0.9-0.65 times speed |
| ● | 155-200% of typical urban travel time, 0.65-0.5 times speed |
| ● | >200% of typical urban travel time, <0.5 times speed |

| LOS | Recommended Corridor LOS Guidelines |
|---|---|
| ● | North Bellevue, South Bellevue, Richards Valley, East Bellevue, NE Bellevue, Bridle Trails, Newport Hills |
| ● | Wilburton, Crossroads |
| ● | Downtown, BelRed, Factoria |



* Based on the Highway Capacity Manual – Chapter 16

# VEHICLE LOS- CORRIDOR TRAVEL SPEED

## Bellevue Way

### PM Peak Travel Speed: 30 mph

- ✓Few stops due to only one signalized crosswalk in corridor, uncongested conditions
- ✓Guideline is 13 - 15 mph

**Conclusion:** No Vehicle Travel Speed LOS Gap

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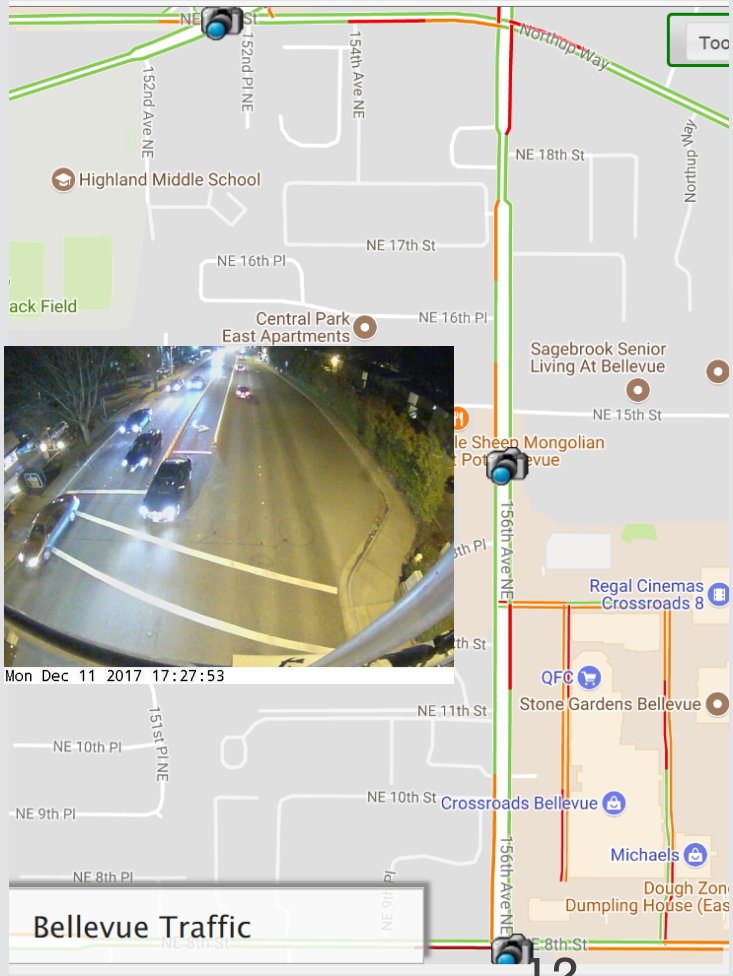
# VEHICLE LOS- CORRIDOR TRAVEL SPEED

## 156th Avenue NE

**PM Peak Travel Speed: 14 mph**

- ✓ Multiple signalized intersections, moderately congested conditions
- ✓ Guideline is 8 - 9 mph

**Conclusion:** No Vehicle Travel Speed LOS Gap

# VEHICLE LOS SUMMARY

| | V/C | Speed | Conclusion | Project |
|---|---|---|---|---|
| **Bellevue Way** | | | | |
| NE 24th Street | Existing 0.72<br>**LOS 0.85** | Existing 30 mph<br>**LOS 13-15 mph** | No gap in v/c | None |
| | | | No gap in vehicle speed LOS | None |
| **156th Avenue NE** | | | | |
| NE 8th Street | Existing 0.72<br>**LOS 0.90** | Existing 14 mph<br>**LOS 8-9 mph** | No gap in v/c | None |
| NE 20th Street | Existing 0.81<br>**LOS 0.90** | | No gap in vehicle speed LOS | None |

# VEHICLE LOS – EXAMPLE WITH POOR LOS: 150TH AVE SE

**150th Ave SE & SE 37th St (EB Off Ramp)**

✗ **Intersection v/c=0.938**

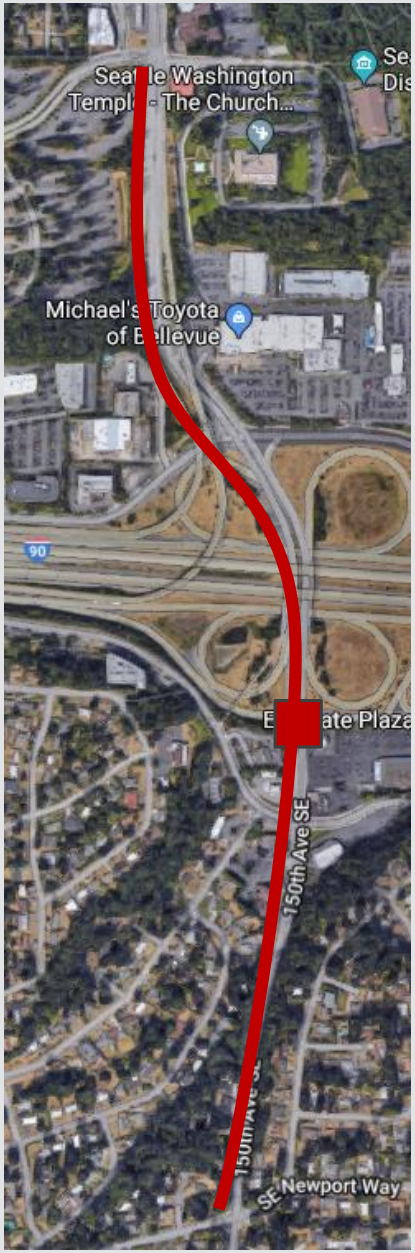
**MMA average = 0.701**

✓ • Standard for MMA 10 is 0.90

**150th (SB, SE 28th St to Newport Way)**

✗ **Corridor travel speed: 6 mph**

- Multiple signalized intersections, heavily congested conditions
- Guideline is 9 mph



# PEDESTRIAN LOS STANDARDS AND GUIDELINES

| Context: / Component | Downtown | Activity Centers (Crossroads) | Neighborhood Shopping Center (Northtowne) | Pedestrian Destinations | Elsewhere |
|---|---|---|---|---|---|
| Sidewalk Width and Landscape Buffer Width | Downtown Land Use Code | BelRed Land Use Code* or 16 feet for other Activity Centers | 13 feet total adjacent to shopping center | 13 feet total at pedestrian destination or within 100 feet of a FTN stop | Bellevue Transportation Design Manual |
| Arterial Crossing Frequency** | Downtown Transportation Plan | ≤ 800 feet: Factoria ≤600 feet: Elsewhere | One crossing every 600 feet or less within shopping center area | Within 600 feet of destination's primary entrance. Within 300 feet of bus stop pair on FTN. | Not Applicable |
| Signalized Intersection Treatment | Downtown Transportation Plan (>/= 300 Feet) | BelRed Corridor Plan or Downtown Transportation Plan Enhanced type | Bellevue Transportation Design Manual | Bellevue Transportation Design Manual | Bellevue Transportation Design Manual |

* Meets BelRed Land Use Code in BelRed Subarea

** Must be an appropriately marked and potentially signalized crossing at locations determined by the Transportation Department

# PEDESTRIAN LOS STANDARDS

## Bellevue Way

### Sidewalk & Landscape Buffer Width

✓ • Met on west side

✗ • No landscape buffer on east side

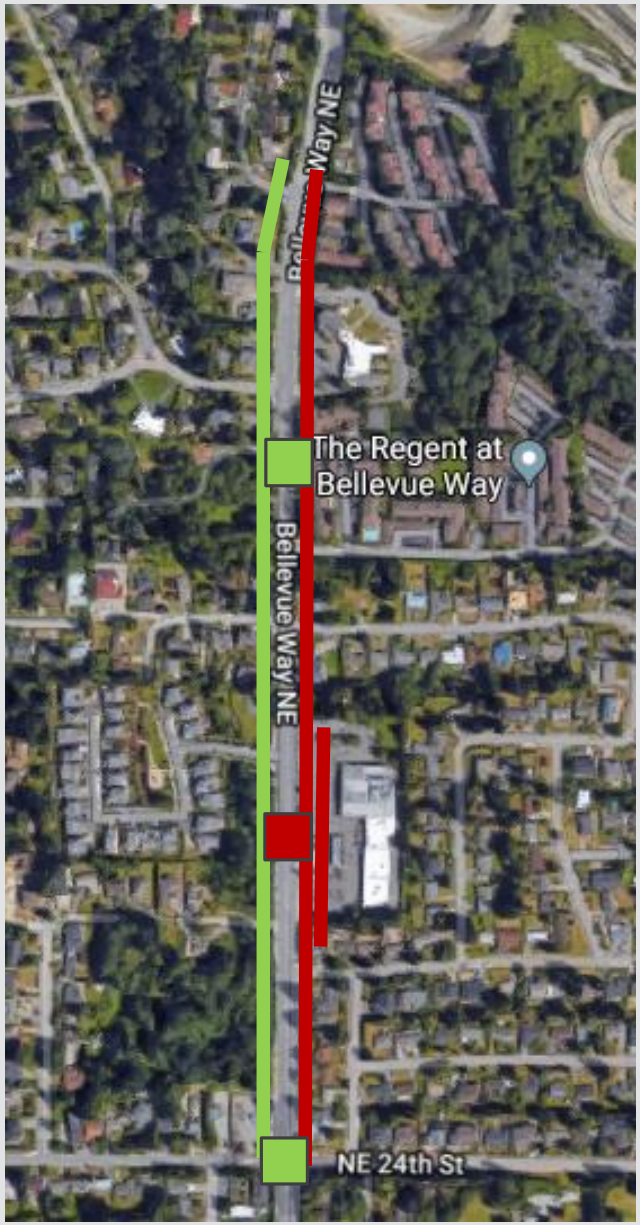
✗ • Not wide enough adjacent to shopping center

### Signalized Intersection Treatment

✓ • Two crossings meet the standard

### Arterial Crossing Frequency

✗ • None are adjacent to shopping center



# PEDESTRIAN LOS STANDARDS

## 156th Avenue NE

### Sidewalk & Landscape Buffer Width

✗ • No buffer, sidewalks only 5-8 feet wide

### Signalized Intersection Treatment

✓ • NE 8th Street & NE 10th Street have Enhanced Intersection treatment

✗ • Remaining intersections not enhanced

### Arterial Crossing Frequency

✓ • Crossings are spaced about 600 feet within the activity center

# BICYCLE LOS CORRIDOR GUIDELINES

| Roadway Characteristics | | Bicycle Facility Components: Guideline to Achieve Intended Level of Service/Level of Traffic Stress | | | | | |
|---|---|---|---|---|---|---|---|
| Speed Limit (MPH) | Arterial Traffic Volume | No Marking | Sharrow Lane Marking | Striped Bike Lane | Buffered Bike Lane (Horizontal) | Protected Bike Lane (Vertical) | Physically Separated Bikeway |
| </= 25 | <3k | 1 | 1 | 1 | 1 | 1 | 1 |
| | 3-7k | 3 | 2 | 2 | 2 | 1 | 1 |
| | >/=7k | 3 | 3 | 2 | 2 | 1 | 1 |
| 30 | <15k | 3 | 3 | 2 | 2 | 1 | 1 |
| | 15-25k | 4 | 4 | 3 | 3 | 3 | 1 |
| | >/=25k | 4 | 4 | 3 | 3 | 3 | 1 |
| 35 | <25k | 4 | 4 | 3 | 3 | 3 | 1 |
| | >/=25k | 4 | 4 | 4 | 3 | 3 | 1 |
| >35 | Any | 4 | 4 | 4 | 4 | 3 | 1 |

Crossroads

Northtowne

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# BICYCLE LOS INTERSECTION STANDARDS

| Bicycle LOS/LTS | Bike Signal | Street Crossing | Approach to Intersection | Approach to Intersection with Right Turn Lane |
|---|---|---|---|---|
| LOS 1 | Bike Signal | Green solid or skip-stripe | Green bike box | Curb ramp to wide sidewalk, Dutch Intersection |
| LOS 2 | Bike Signal | Skip stripe | Bike box | Green bike lane to left of turn lane |
| LOS 3 | Green Cycle Length | Sharrow lane markings | Automatic signal actuation | Bike lane to left |
| LOS 4 | No specific design guidleine for LTS/LOS 4 | | | |
| Trail or Mid-Block Crossing | Full signal or HAWK or RRFB | Green solid or skip-stripe | N/A | N/A |

Both Areas



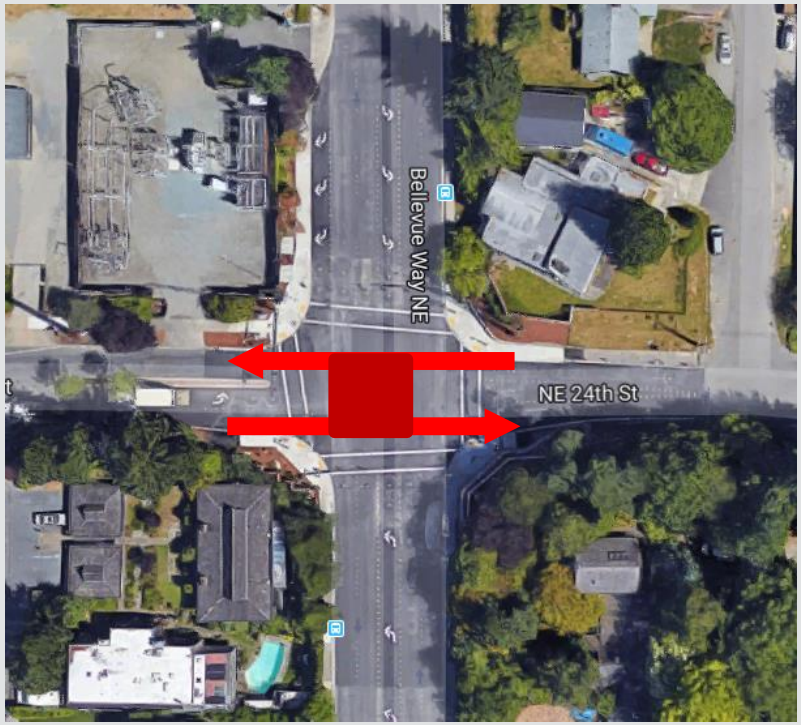
RRFB – **R**ectangular **R**apidly **F**lashing **B**eacon
HAWK - **H**igh-intensity **A**ctivated cross **W**al**K**

# BICYCLE LOS

## Bellevue Way

N/A **Exempt corridor for Bicycle LOS along Bellevue Way**

- ✗ NE 24th Street has an east/west LTS3 intersection with Bellevue Way which is not currently met



# BICYCLE LOS

## 156th Avenue NE

- ✗ Along 156th Avenue NE: LTS=4 due to 30 mph speed limit and moderate traffic volume and there is no bicycle facility (LTS 3 is the expectation)
- ✗ NE 20th Street has an east/west LTS3 intersection which is not currently met
- N/A NE 8th St is exempt west of 156th Ave NE

# TRANSIT LOS: STOPS/STATIONS GUIDELINES

Northtowne

Crossroads

| Context / Component | Local Transit Stop | Primary Transit Stop | Frequent Transit Network Stop RapidRide Stop |
|---|---|---|---|
| Weather Protection | Yes, Priority with 25+ daily boardings | Yes | Yes |
| Seating | Yes, Near pedestrian destinations | Yes | Yes |
| Paved Bus Door Passenger Zone | Yes, Zone length 25-30 feet | Yes, Zone length 40 feet | Yes, Zone length 60 feet |
| Wayfinding | Optional | Yes | Yes |
| Bicycle Parking | Optional | Yes | Yes |

# TRANSIT STOP LOS

## Bellevue Way- Local Transit Stop

**Weather protection**

✗ • None

**Seating**

✓ • One stop has seating

**Wayfinding**

N/A • None (Optional)

**Bike Parking**

N/A • None (Optional)

# TRANSIT STOP LOS

## 156th Avenue NE - RapidRide Stops

**Weather Protection**

✓ • Provided

**Seating**

✓ • Provided

**Paved bus zones**

✓ • Provided

**Wayfinding**

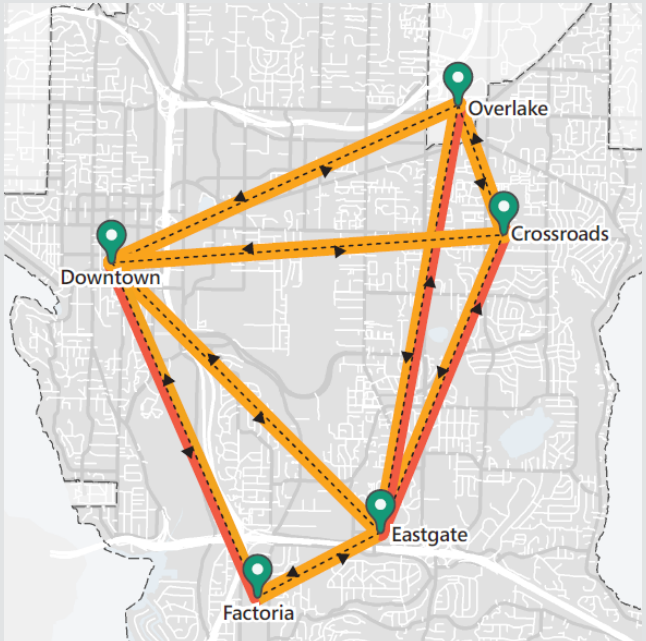
✓ • Provided

**Bike parking**

✓ • Provided

# TRANSIT LOS: SPEED STANDARDS

1. Applied to Frequent Transit Network (FTN) Connections between Activity Centers
2. Based on target speeds in Transit Master Plan
3. Standard: 14 mph or faster on FTN connections



Existing (2016) Transit Speeds

| LOS Rating | Speed |
|---|---|
| | <10 mph |
| | 10-14 mph |
| **Crossroads** | >14 mph |

# TRANSIT SPEED LOS

## Bellevue Way

N/A • No Frequent Transit Network service on Corridor

## 156th Avenue NE

✗ • Northbound RapidRide Speed from Crossroads to the Overlake Park & Ride is about 10 MPH

✗ • Southbound RapidRide speed from Overlake Park & Ride to Crossroads is about 9 MPH

# IDENTIFYING PROJECTS
# PRIORITIZING
# ACKNOWLEDGING TRADEOFFS

# BELLEVUE WAY PROJECTS

## Vehicle

- LOS standards and guidelines met – **no projects**

## Pedestrian

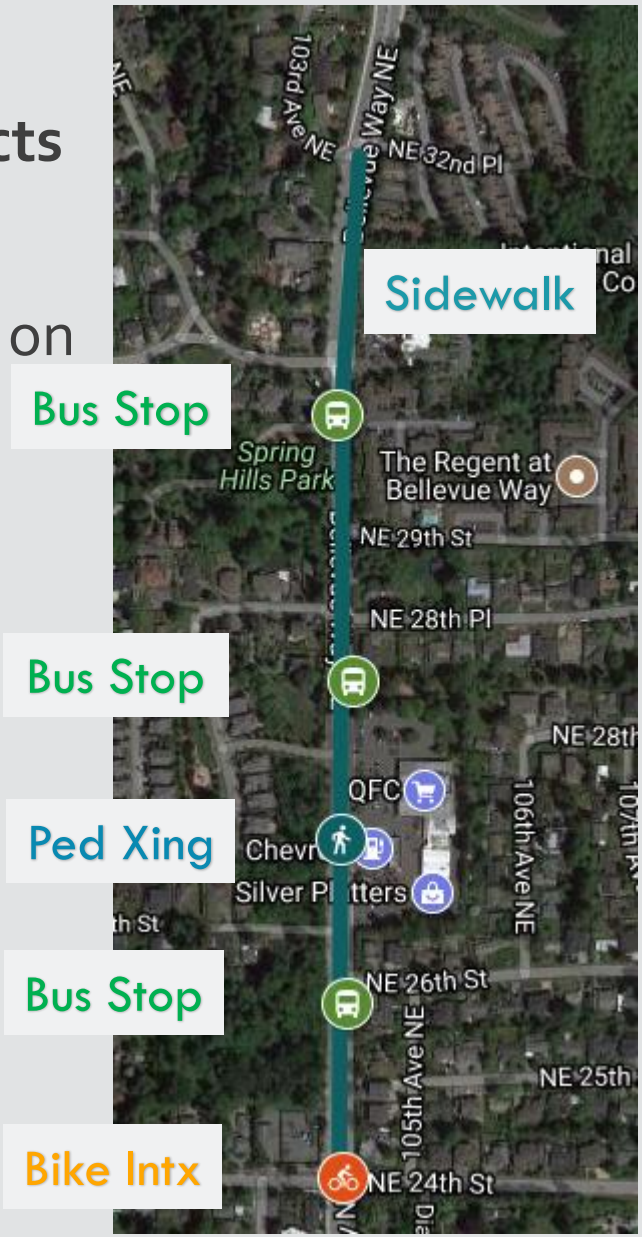
- Increase sidewalk width/add landscape buffer on east side of street
- Add a pedestrian crossing at the Northtowne Neighborhood Shopping Center

## Bicycle

- NE 24th Street & Bellevue Way needs LTS 3 intersection treatment for east/west travel

## Transit

- Enhance bus stops with weather protection and seating



# PROJECT CONTEXT – BELLEVUE WAY

| Mode | Land Use Context<br>Greater Modal Priority → Less Modal Priority | | |
|---|---|---|---|
| **Vehicle** | Rest of city | Crossroads, Eastgate, Wilburton | BelRed, Northup, Downtown, and Factoria |
| **Pedestrian** | Downtown/ Activity Center | Neighborhood Shopping Center/ Pedestrian Destination | Rest of city |
| **Bicycle** | Bicycle Priority Corridor | On Bicycle Network | Not on Bike Network/Exempt |
| **Transit** | RapidRide/Light Rail Station | Frequent Transit Network | Local Transit |

# BELLEVUE WAY PROJECTS- LOS TRADEOFFS

| Mode To Be Improved | Project | Auto-Intersection | Auto-Corridor | Ped-Sidewalk | Ped-Crosswalks | Bicycle | Bus Stop | Bus Speed* | ROW/ Land Use |
|---|---|---|---|---|---|---|---|---|---|
| Pedestrian | Widen sidewalks, add landscape buffer (behind current curb) | | | ++ | | | | | - |
| Pedestrian | Add Mid-block Crossing adjacent to Northtowne Shopping Center | | - | ++ | | | | | |
| Transit | Include Bus stop features such as weather protection and seating | | | | | | ++ | | |

*Bus Speed only applicable to frequent transit corridors

# 156TH AVENUE NE PROJECTS

## Vehicle

- LOS standards and guidelines met – **no projects**

## Pedestrian

- Increase sidewalk width/ add landscape buffer on both sides of street
- Improve pedestrian crossings to "Enhanced" type at 3 locations

## Bicycle

- Add bike facility (striped bike lane or better)
- Add bike intersection improvements:
  - Sharrows through intersections
  - Right turn lane enhancement at NE 8th Street

## Transit

- Increase transit speed (queue jump identified in TMP, other improvements possible)

Ped Xing
Bike Intx

Sidewalk
Bike Lane

Ped Xing
Bike Intx

Ped Xing
Bike Intx

Bike Intx

Bike Intx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# 156TH AVENUE NE PRIORITIZING MODES

| Mode | Land Use Context<br>Greater Modal Priority → Less Modal Priority | | |
|---|---|---|---|
| **Vehicle** | Rest of city | Crossroads, Eastgate, Wilburton | BelRed, Northup, Downtown, and Factoria |
| **Pedestrian** | Downtown/ Activity Center | Neighborhood Shopping Center/ Pedestrian Destination | Rest of city |
| **Bicycle** | Priority Corridor | On Bicycle Network | Not on Bike Network/Exempt |
| **Transit** | Rapid Ride/ Light Rail Station | Frequent Service Transit Stop | Local Transit Stop |

# 156TH AVE NE PROJECTS - LOS TRADEOFFS

| Mode To Be Improved | Project | Auto-Intersection | Auto-Corridor | Ped-Sidewalk | Ped-Crosswalks | Bicycle | Bus Stop | Bus Speed* | ROW/ Land Use |
|---|---|---|---|---|---|---|---|---|---|
| Pedestrian | Widen sidewalks, add landscape buffer (behind curb) | | | ++ | | | | | - |
| Pedestrian | Improve intersections to Enhanced type | | | | + | | | | |
| Bicycle | Add Bike Facility behind curb (Striped Bike Lane or Better) | | | | | ++ | | | - |
| Bicycle | Add Bike Facility via rechannelization (Striped Bike Lane or Better) | -- | -- | | | ++ | | -- | |
| Bicycle | Provide Bike Intersection Treatments | | | | | ++ | | | |
| Transit | Increase transit speed (Queue Jump) | - | | | | | | + | - |
| Transit | Increase Transit Speed (Widen for bus lane) | + | + | | | + | | ++ | -- |
| Transit | Increase Transit Speed (Remove GP lane for bus lane) | -- | -- | | | + | | ++ | |

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# FURTHER QUESTIONS AND DISCUSSION

# NEXT STEPS

## SPRING 2018: PRIORITIZATION AND IMPLEMENTATION

# THANK YOU!