

Making Protected Bike Lanes and Protected Intersections Work for *All* Pedestrians



Dylan Passmore, MScPl, P.Eng.
Senior Design Transportation Engineer

**Inclusive
Design &
Protected Bike
Lanes in
Vancouver**

Vancouver's Growing AAA Bike Network



*Inclusive
Design &
Protected Bike
Lanes in
Vancouver*

Vancouver's Growing AAA Bike Network



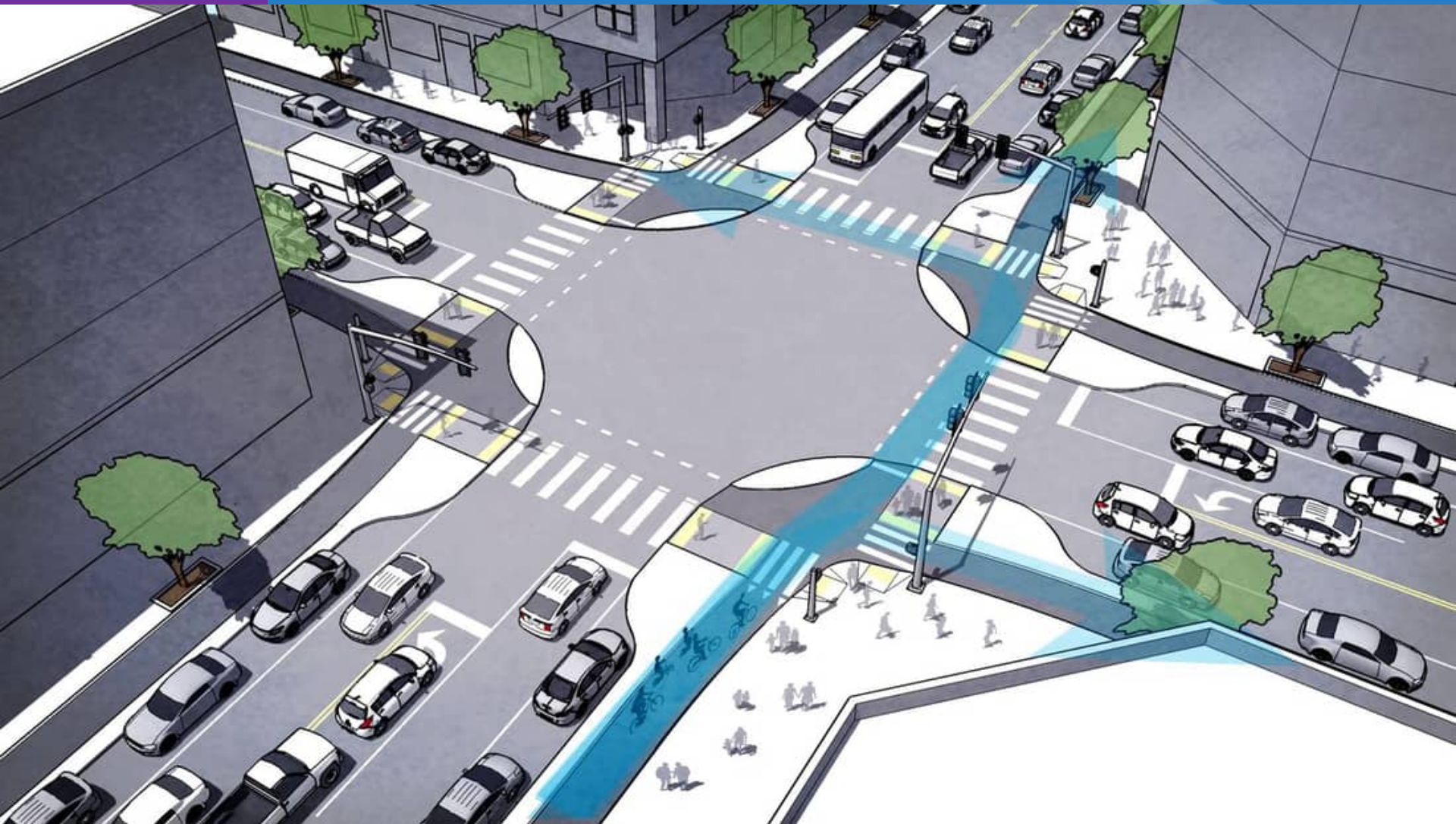
Vancouver's Growing AAA Bike Network The Old



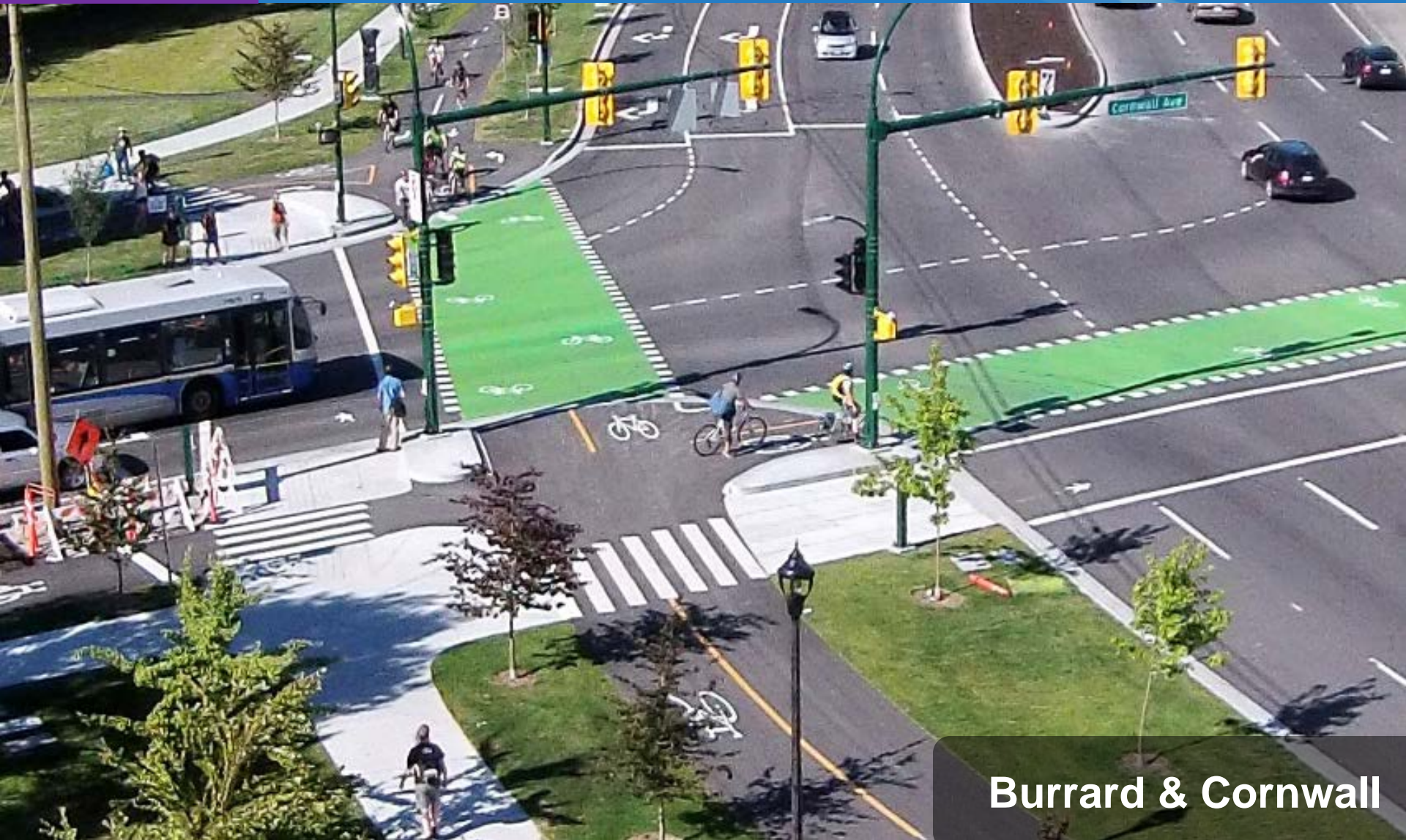
Vancouver's Growing AAA Bike Network The Old



“Protected Intersection” Design Approach



Protected Intersections on the Ground



Burrard & Cornwall

*Inclusive
Design &
Protected Bike
Lanes in
Vancouver*

Protected Intersections on the Ground

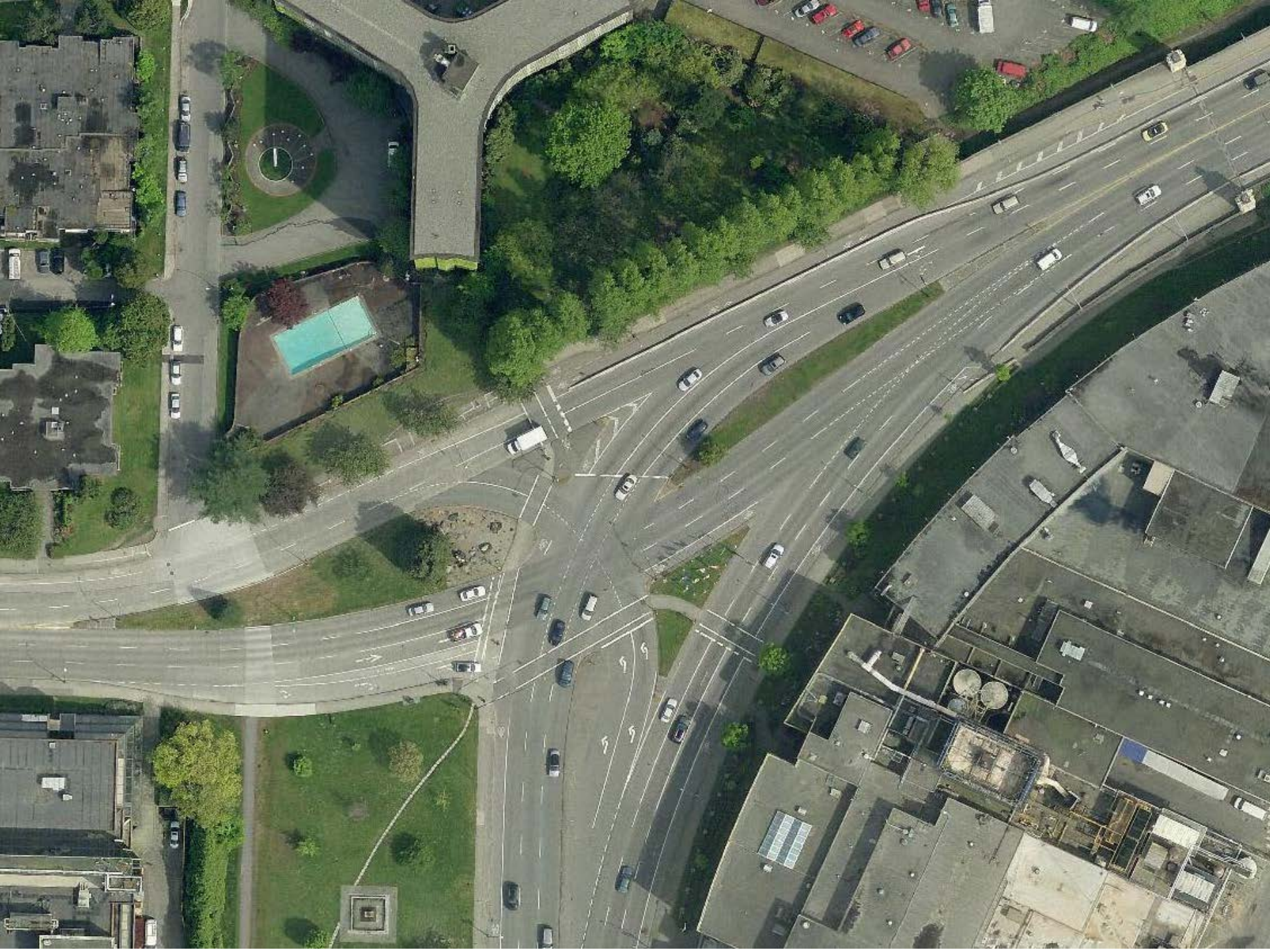


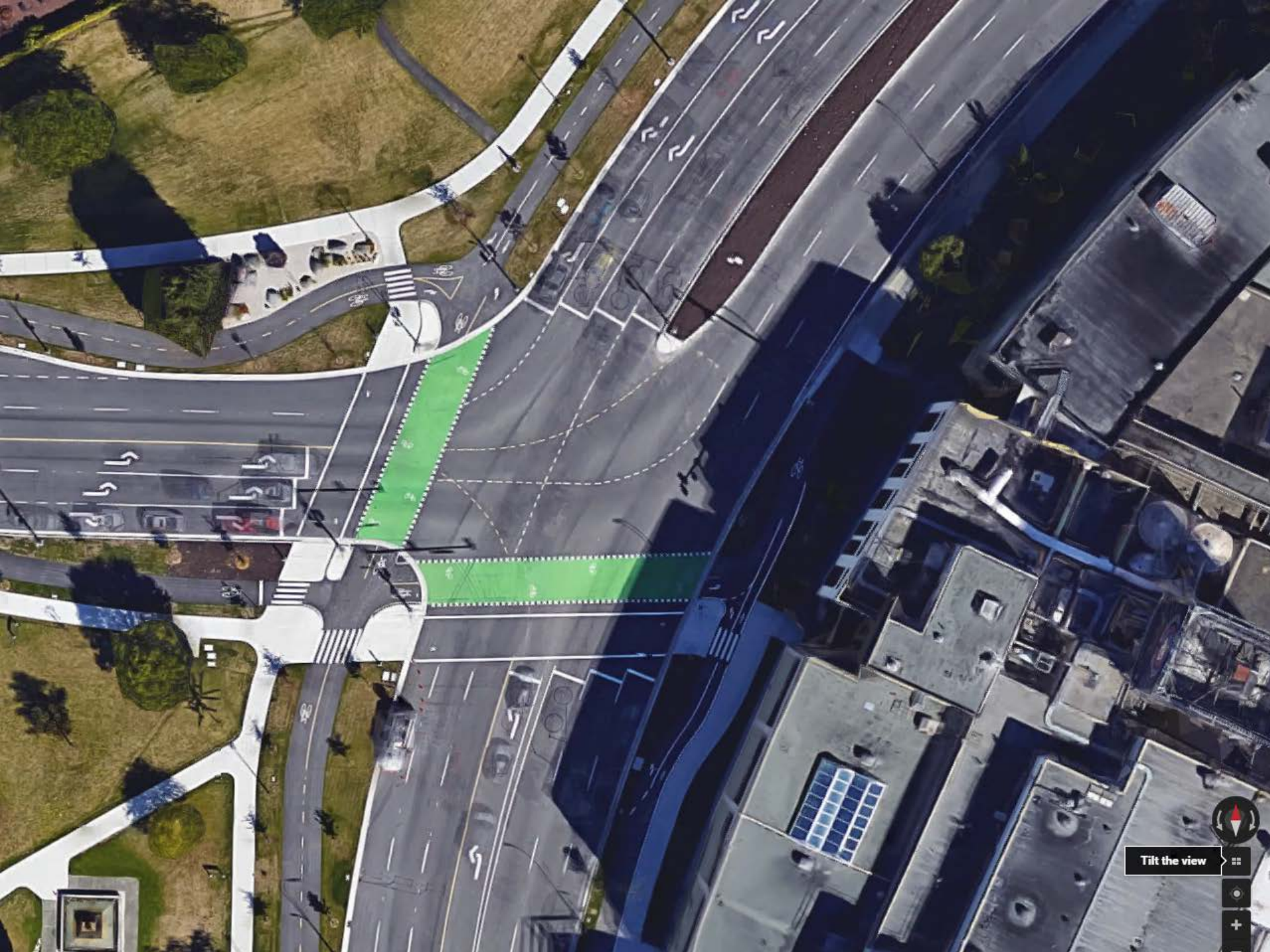
Burrard & Pacific

Protected Intersections on the Ground



What's the Problem?





Tilt the view



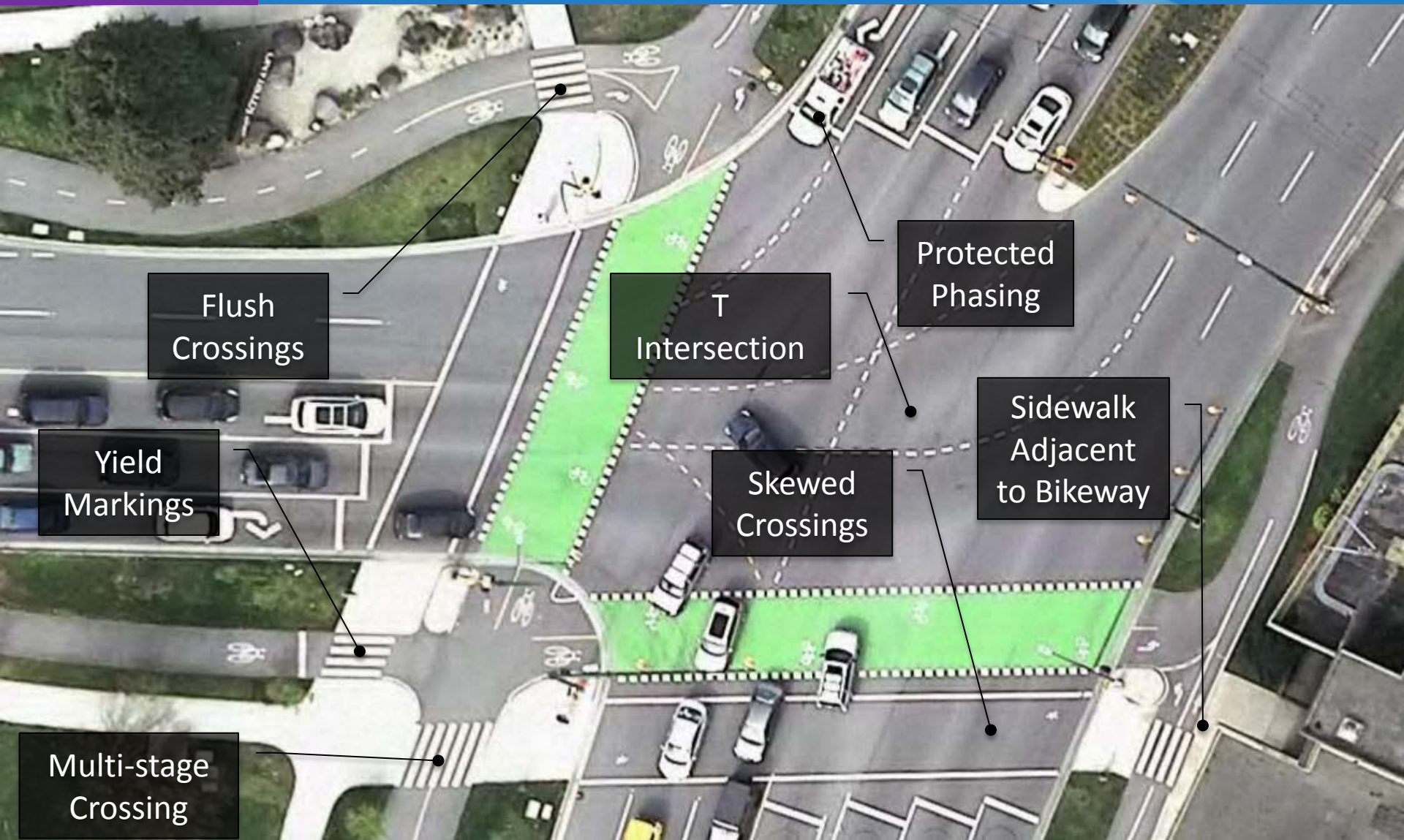
The Challenges



The Challenges – Protected Intersections



The Challenges – Protected Intersections



Expanding the Toolkit

On-going Stakeholder Workshops

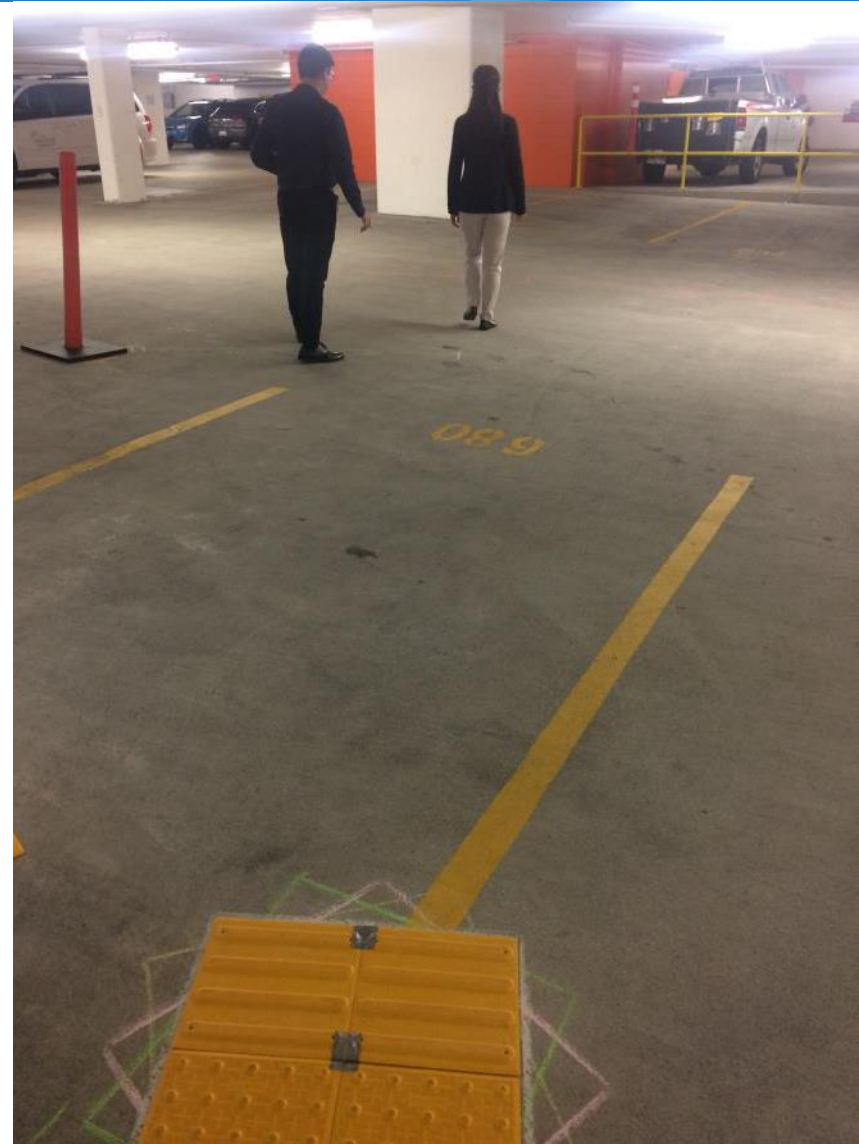


Coordinating with Similar Efforts in the U.S. ...

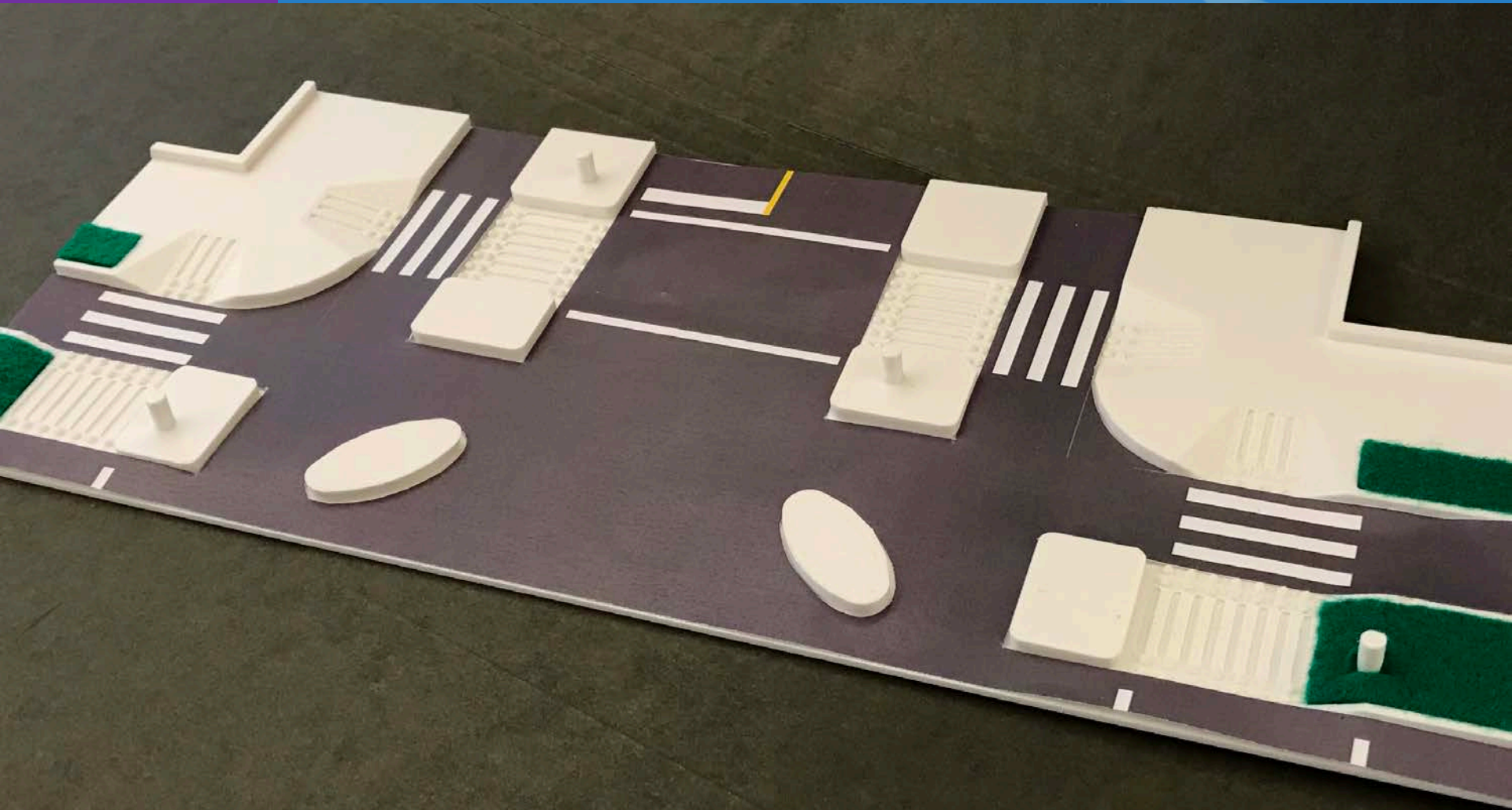
FHWA Workshop
in Seattle



Human Factors Research / Experimenting...



Testing New Tools for Engagement ...



Testing New Tools for Engagement ...



Our Key Challenges

The Key Challenges

Expanding Our Toolkit

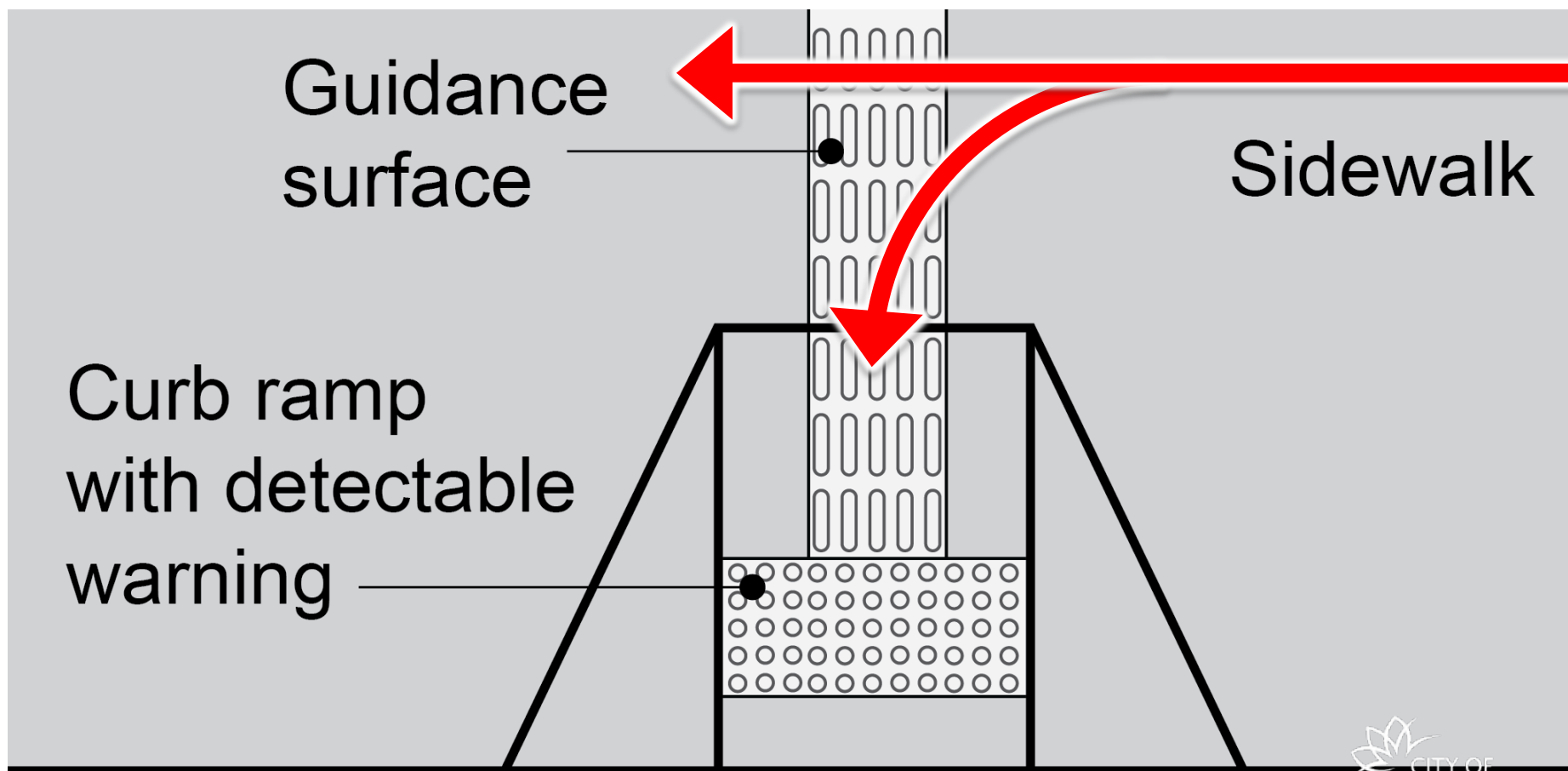
1. Adjacent Sidewalk and Protected Bike Lane
2. Flush Pedestrian Crossings
3. Signalized Crossings in a Protected Intersection
4. *Accommodating Passenger Loading and Bus Stops*
5. *Finding Mid-Block or T-Intersection Crossings*
6. *Providing Alignment Cues*

Are there off-the-shelf solutions?

No: international examples are fraught with inconsistency and solutions that don't work well



Are there off-the-shelf solutions?



Are there off-the-shelf solutions? Testing Negotiability of Guidance Surfaces

**Bars perpendicular vs.
parallel to direction of
travel**



1. Adjacent Sidewalk and Protected Bike Lane

Adjacent Sidewalk and Bikeway



Adjacent Sidewalk and Bikeway

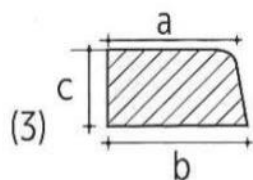
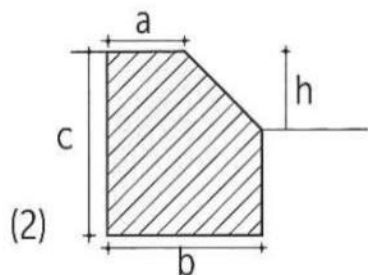
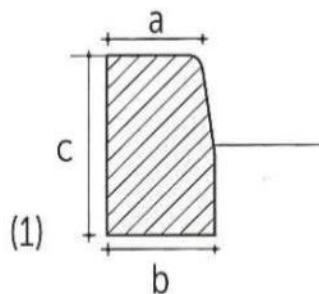
We wanted...

- Intuitive delineation
- No hazard
- Narrow profile
- Detectable
- Mountable in a wheelchair
- Easy to construct & maintain

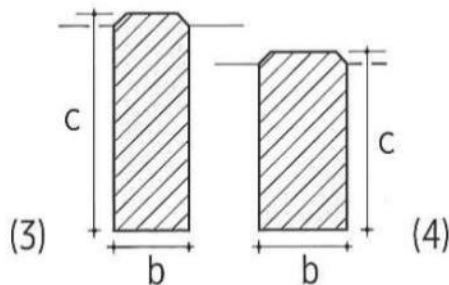
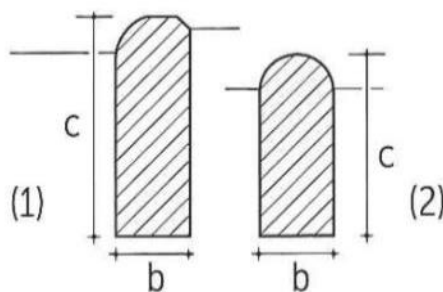


Adjacent Sidewalk and Bikeway

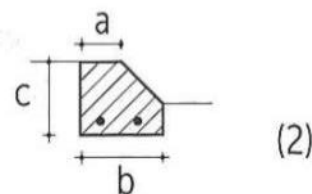
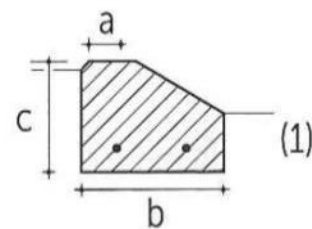
(A) half-battered:
pavement-cycle path or
cycle path-carriageway



(B) bull nose kerb:
unsurfaced cycle path

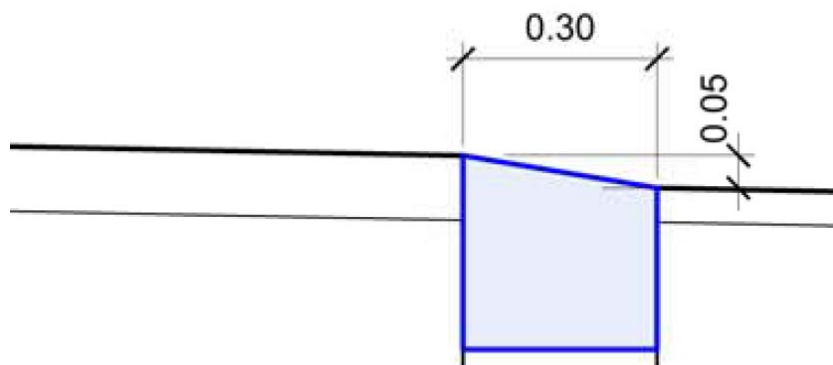


(C) splayed:
pavement-cycle path

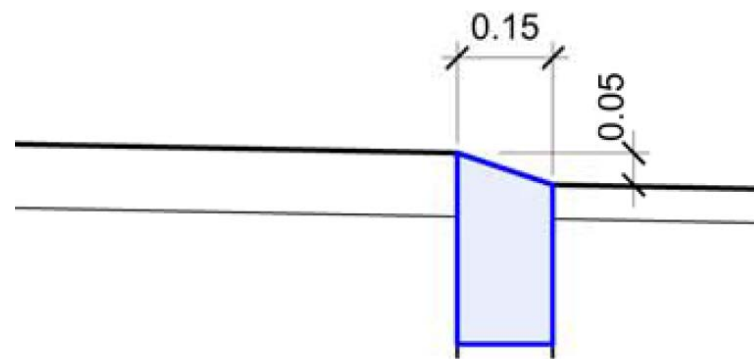


Adjacent Sidewalk and Bikeway

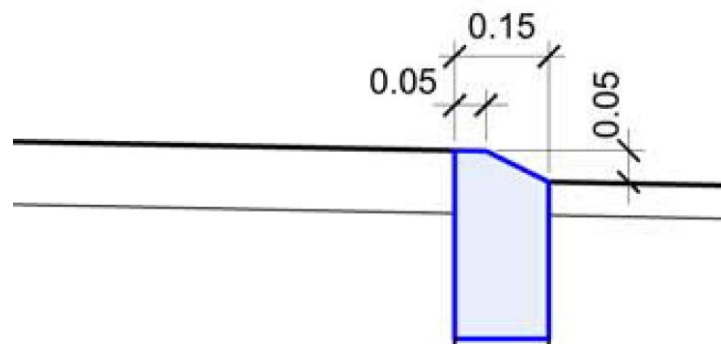
Curb A



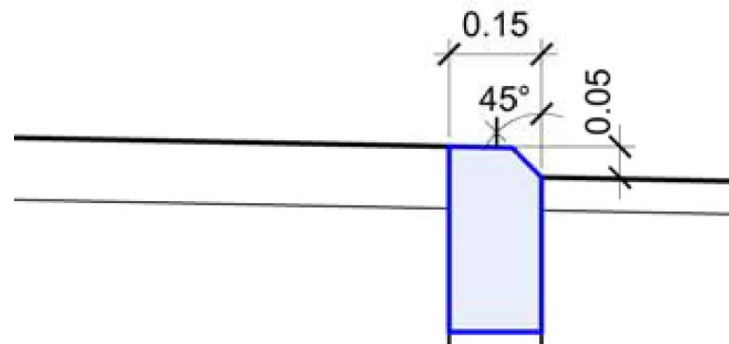
Curb B



Curb C



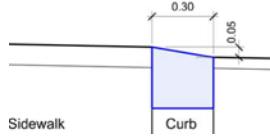
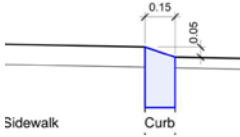
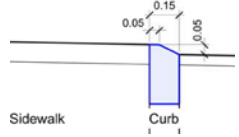
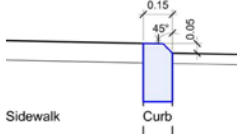
Curb D



Adjacent Sidewalk and Bikeway



Adjacent Sidewalk and Bikeway

| | Curb A | Curb B | Curb C | Curb D |
|--|---|---|---|--|
| Category: |  |  |  |  |
| 1. Intuitive Delineation of Space | Poor Vertical separation is very subtle so does not provide meaningful separation | Good Easy to see and detect the vertical separation | Good Easy to see and detect the vertical separation | Best Sharp angles make the vertical separation very easy to detect |
| 2. Space Impacts | Moderate Width of curb cuts into cycle track space | Low | Low | Lowest Flat top surface allows for slightly wider sidewalk space |
| 3. Potential Hazard for Pedestrians and Cyclists | Lowest Slope poses little very hazard | Low Slope poses minimal trip hazard | Medium Moderate slope may pose some trip hazard | High Steep slope is easy for bike tires to catch and is a possible trip hazard for pedestrians |
| 4. Cues for People with Limited Vision | Poor Difficult to detect for white cane users | Good Sufficient slope to allow for easy detection | Good Sufficient slope to allow for easy detection | Good Sufficient slope to allow for easy detection |
| 5. Accessibility for Wheelchair Users | Best Very easy for wheelchair users to negotiate | Good Relatively easy for wheelchair users to negotiate | Medium Some challenges to climb in wheelchair | Poor Difficult to climb in wheelchair. Possible tipping hazard |
| 6. Constructability | Easy | Moderate Challenging to operate asphalt roller so it does not damage bottom of curb | Difficult Sloped area and curb top needs to be manually troweled | Moderate Extra step to frame in 45 degree slope |

Adjacent Sidewalk and Bikeway



Adjacent Sidewalk and Bikeway



2" Bevel Curb:

- Easy to detect and intuitive
- Good delineation of space
- Subtle enough to cross by wheelchair if needed



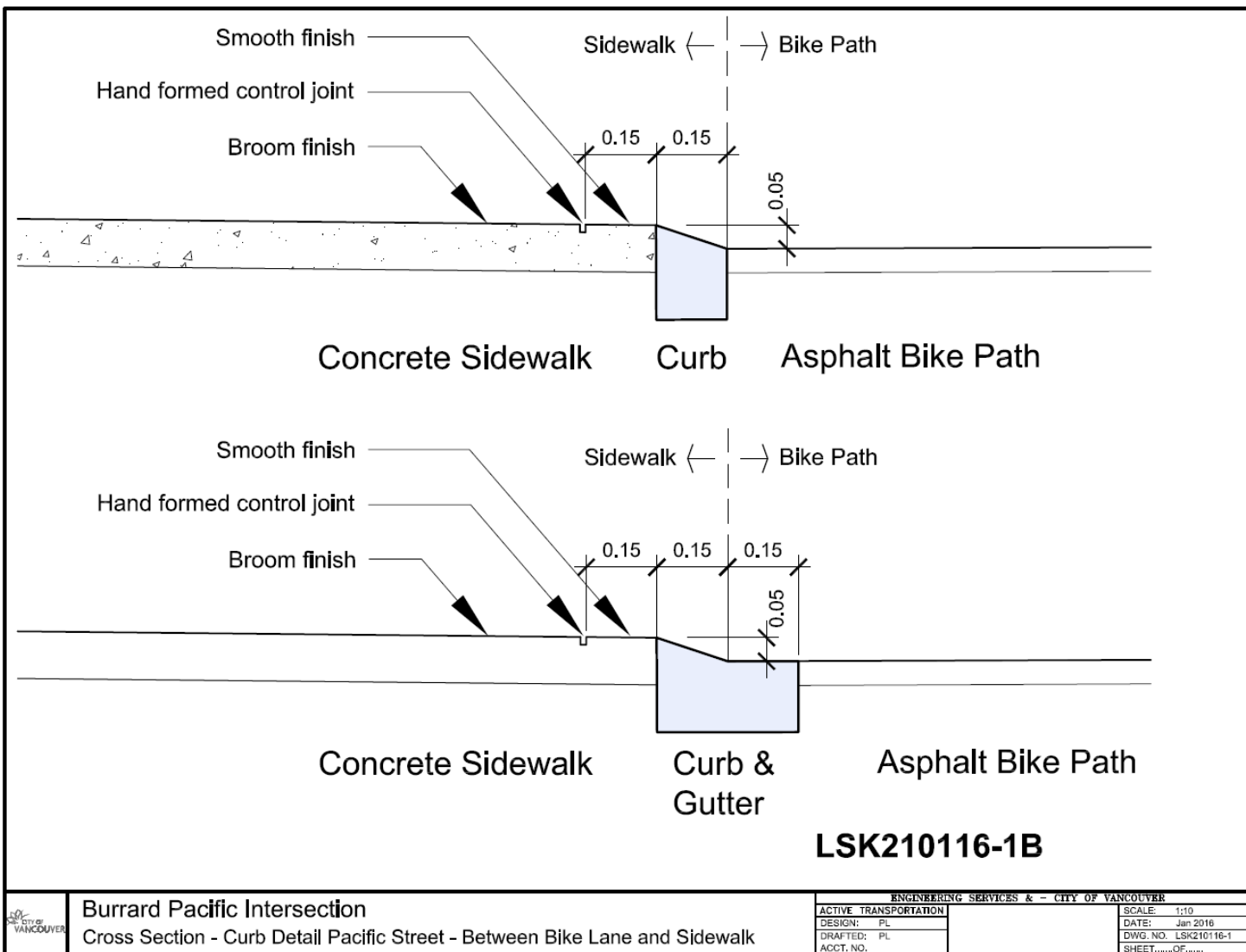
Adjacent Sidewalk and Bikeway



Adjacent Sidewalk and Bikeway



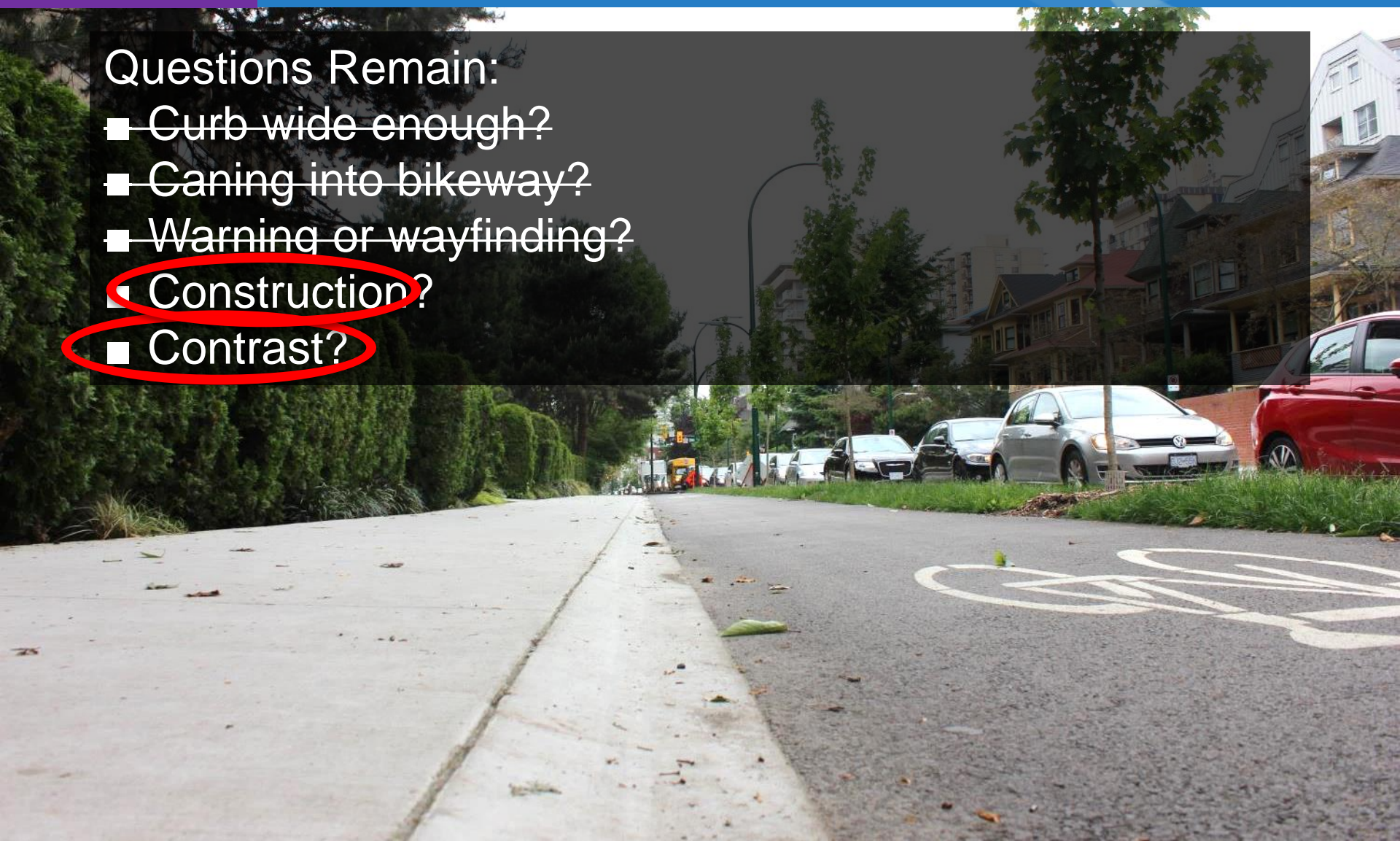
Adjacent Sidewalk and Bikeway



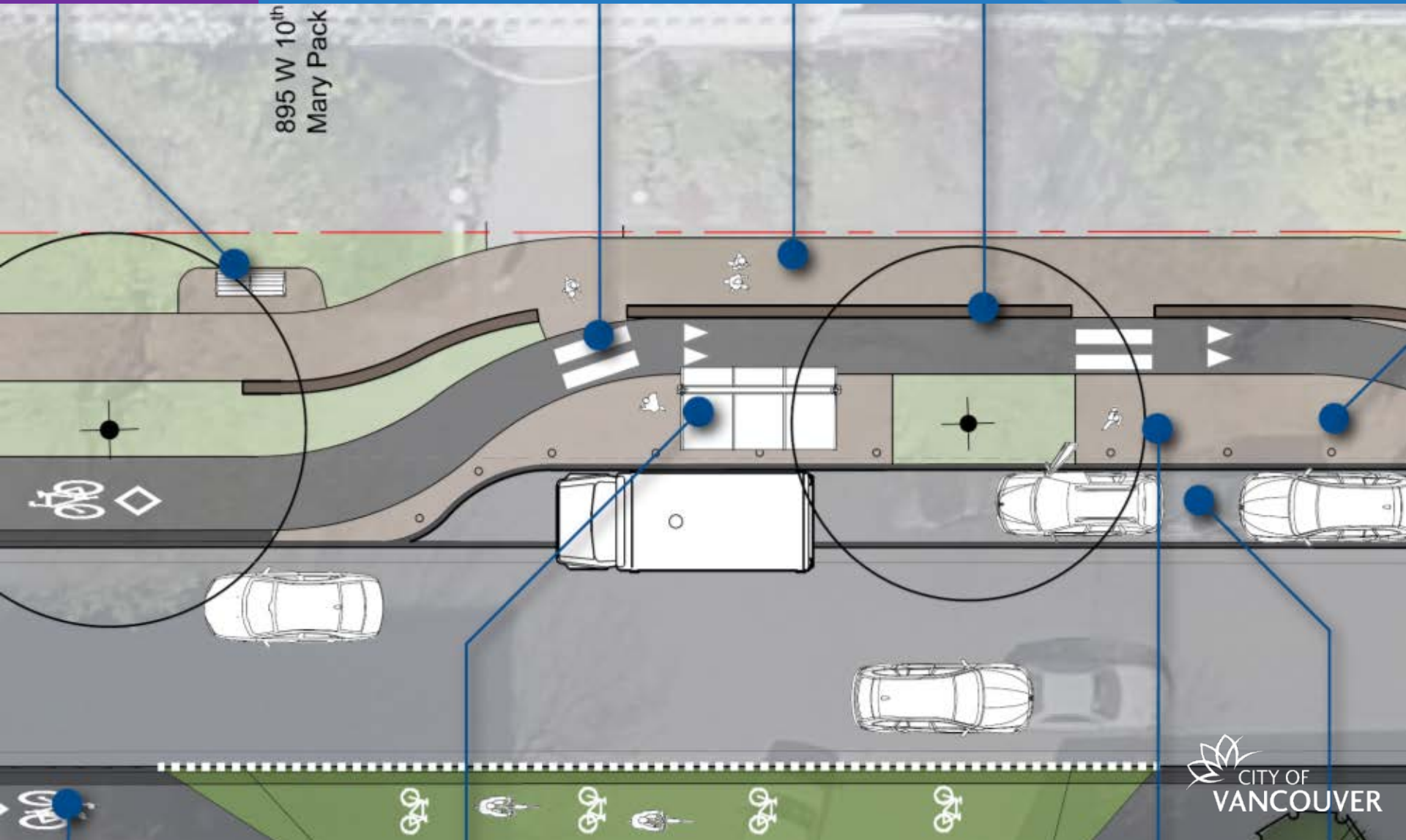
Adjacent Sidewalk and Bikeway

Questions Remain:

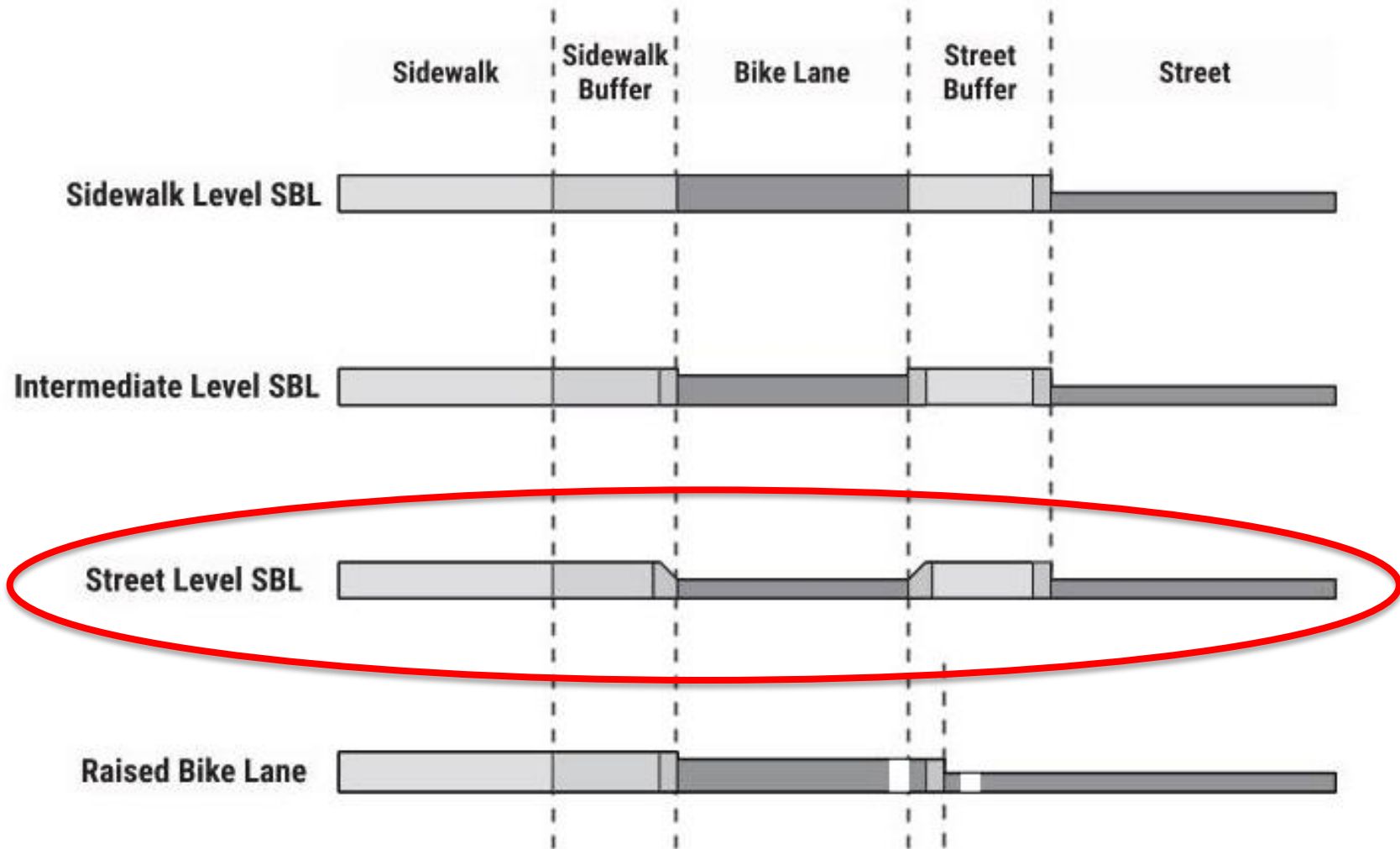
- ~~Curb wide enough?~~
- ~~Caning into bikeway?~~
- ~~Warning or wayfinding?~~
- **Construction?**
- **Contrast?**



Behaviour at Unsignalized Pedestrian Crossings



Accessible Sidewalk Design Elements



2. Flush Pedestrian Crossings

Flush Pedestrian Crossings

Navigation vs. Warning



Photo: Toole Design Group

VANCOUVER

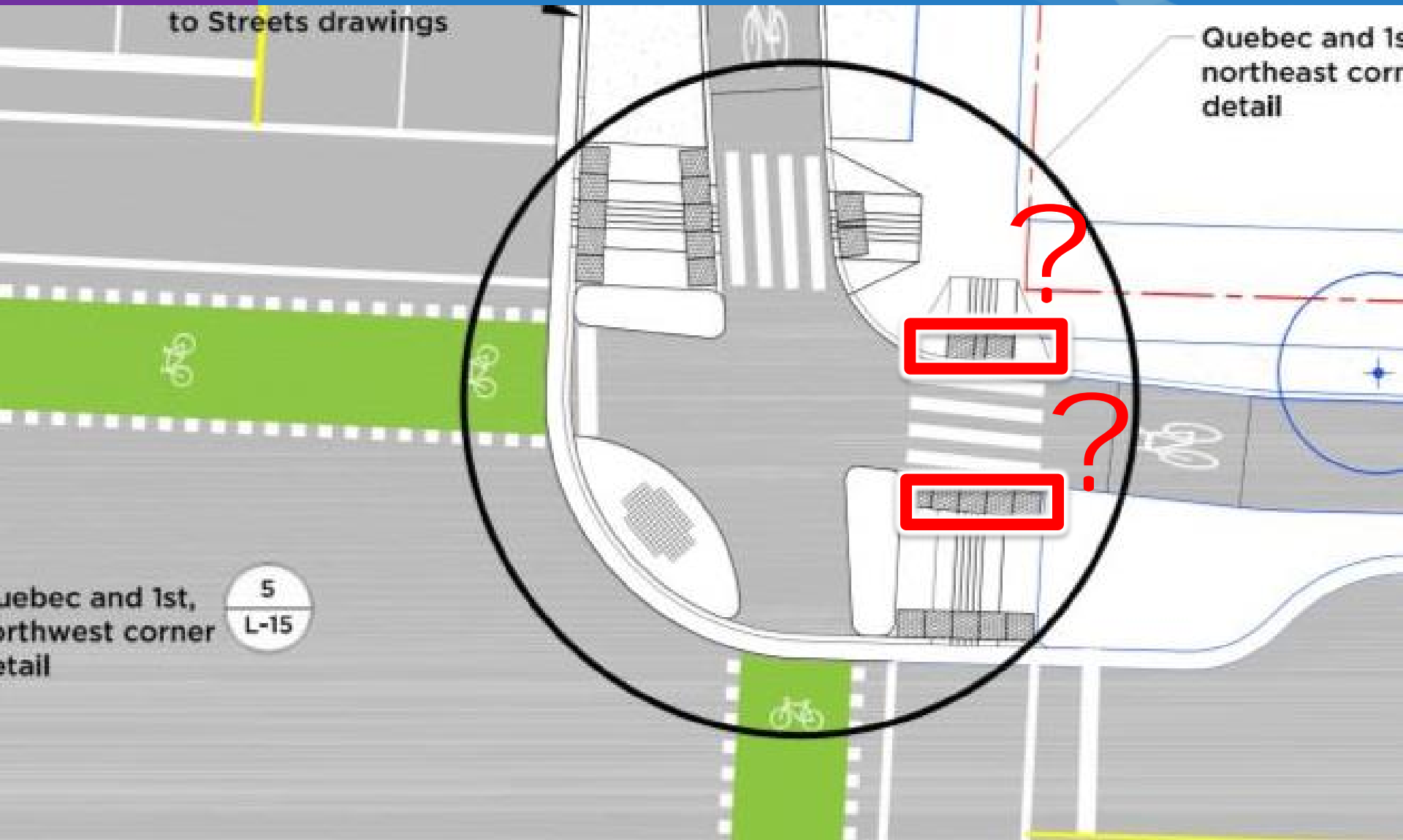
*Inclusive
Design &
Protected Bike
Lanes in
Vancouver*

Tactile Warning at Bikeway Crossings? Burrard & Cornwall Pilot



Does Bikeway Crossing Warrant a Warning?

Tactile Warning at Bikeway Crossings?



Tactile Warning at Flush Crossings



3. Signalized Crossings in a Protected Intersection

Why Accessible Pedestrian Signals?



Advantages of Pushbutton-Integrated APS

- Locator tone helps find pushbutton
- Tactile arrow indicates which crosswalk
- Beacon tone helps complete crossing
- Tactile arrow vibrates during WALK to aid vision disabled pedestrians with hearing loss

APS at Protected Intersection

- Locator tone provides important information about crossing stages



Signalized Crossings

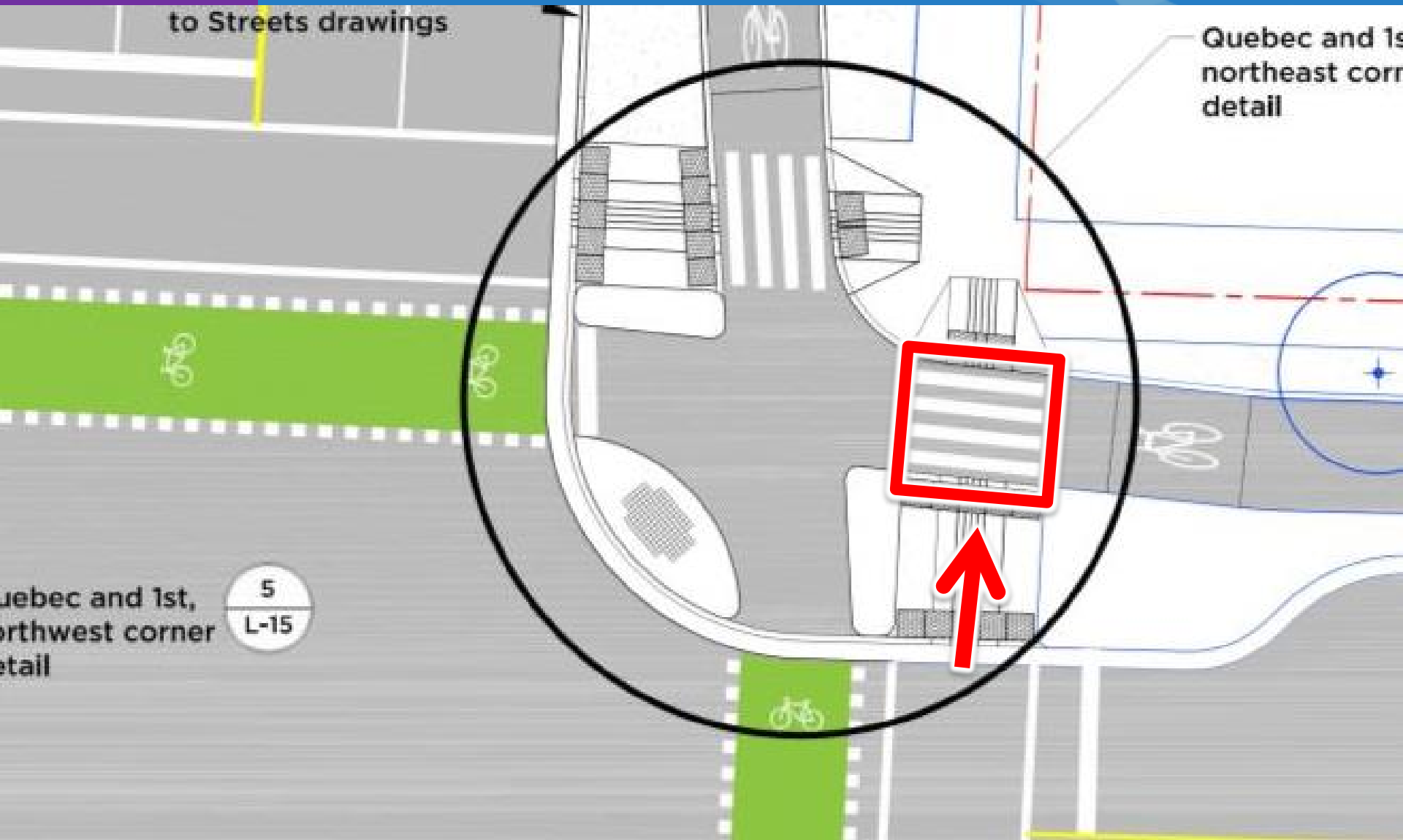
Challenges with APS Installation

- **Setting volume appropriately**
- Technology challenges with signals that dwell in one direction (with walk on)
- Fixed time signal does not require push button, but then lose ability to adapt in late hours.
- Consistent implementation



What About Behaviour at Unsignalized Pedestrian Crossings?

Behaviour at Unsignalized Pedestrian Crossings



Fear



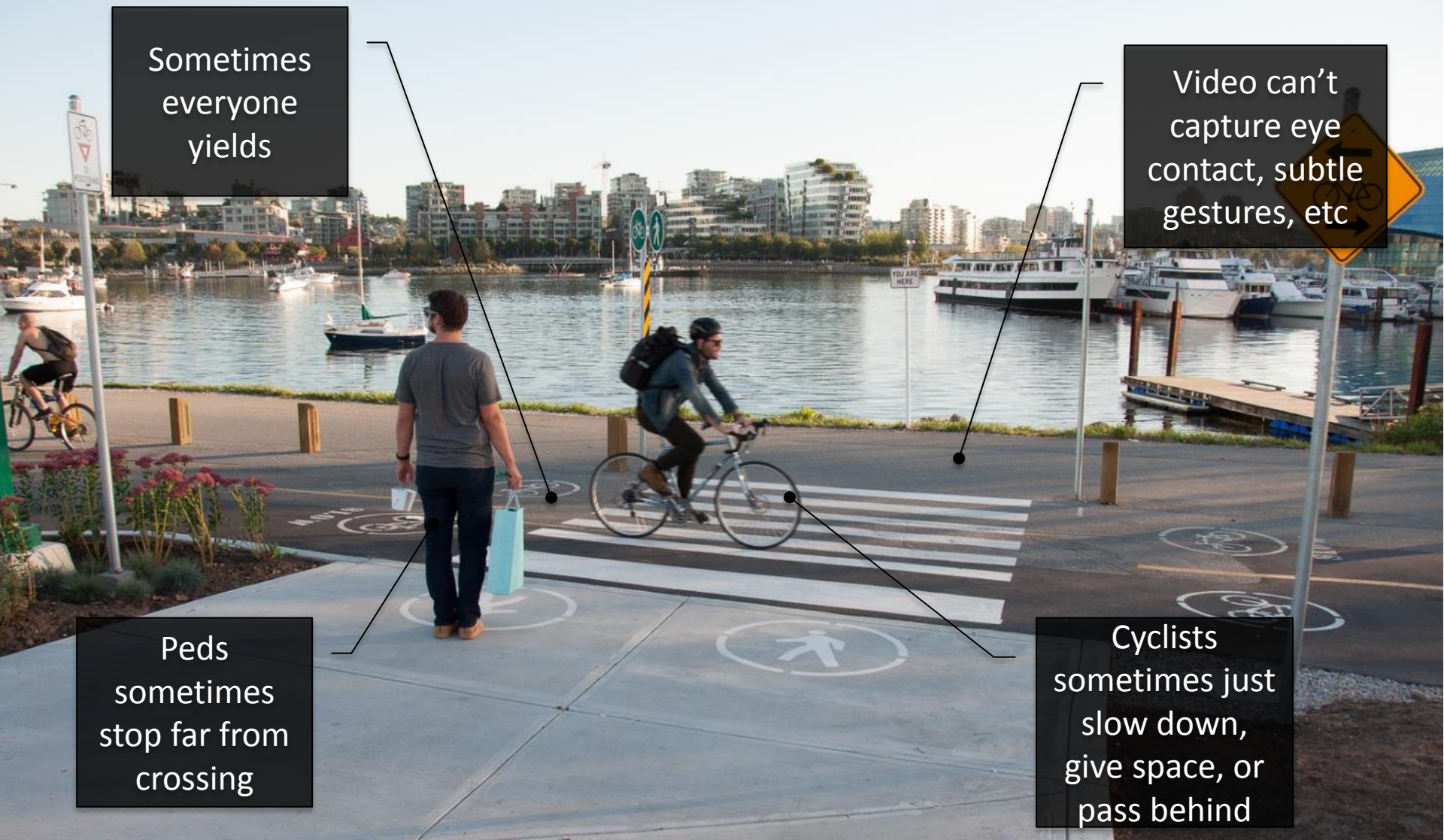
Interactions between People Walking and Biking

Sometimes everyone yields

Video can't capture eye contact, subtle gestures, etc

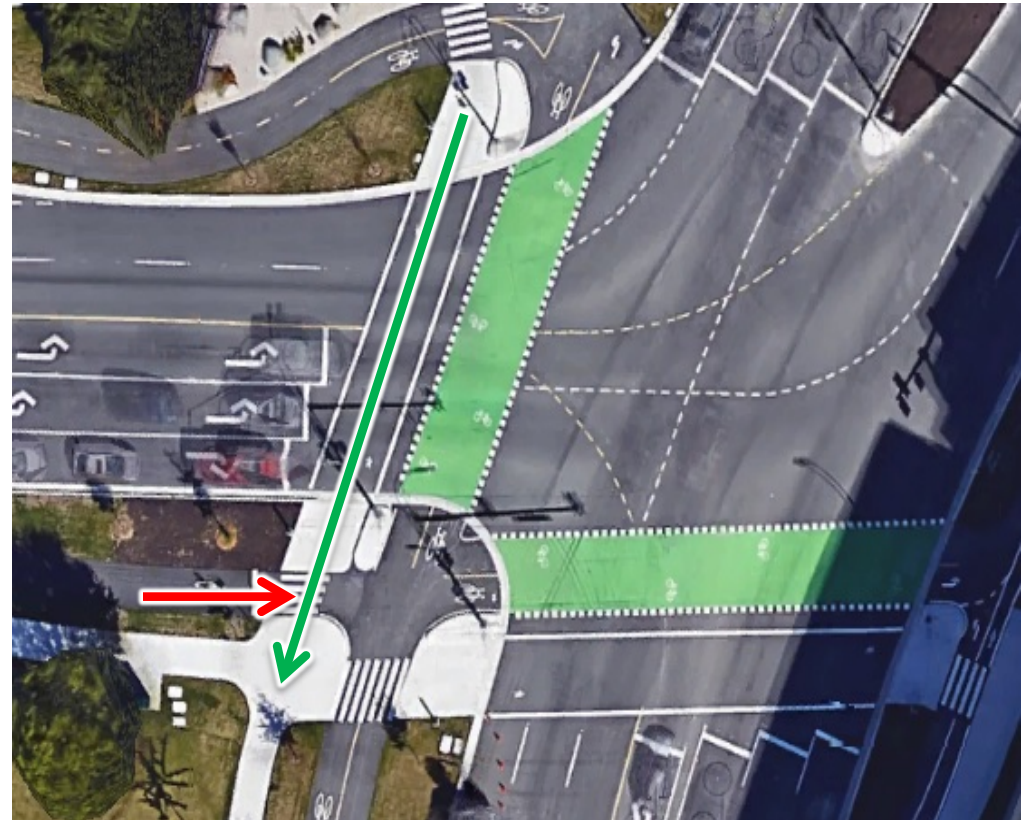
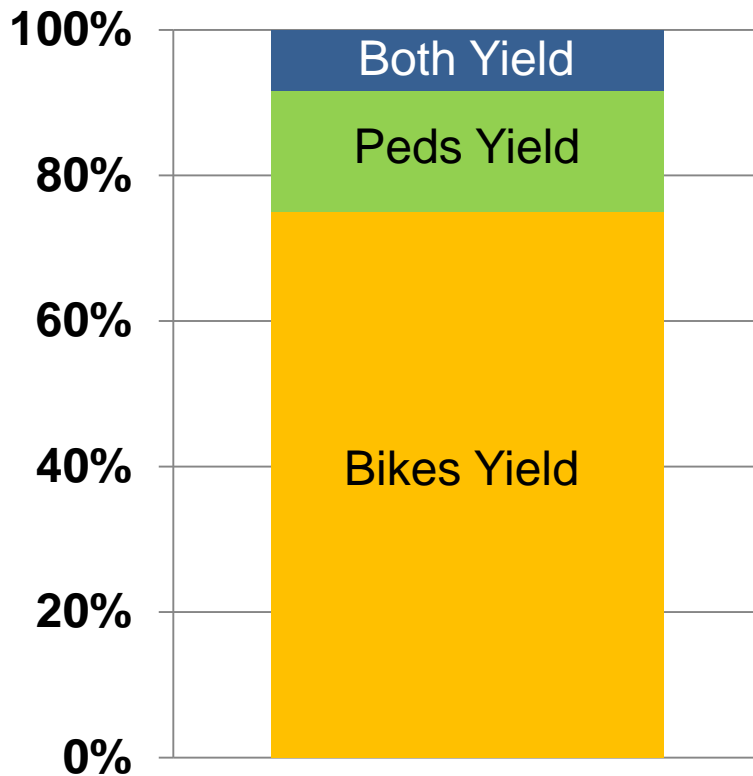
Peds sometimes stop far from crossing

Cyclists sometimes just slow down, give space, or pass behind



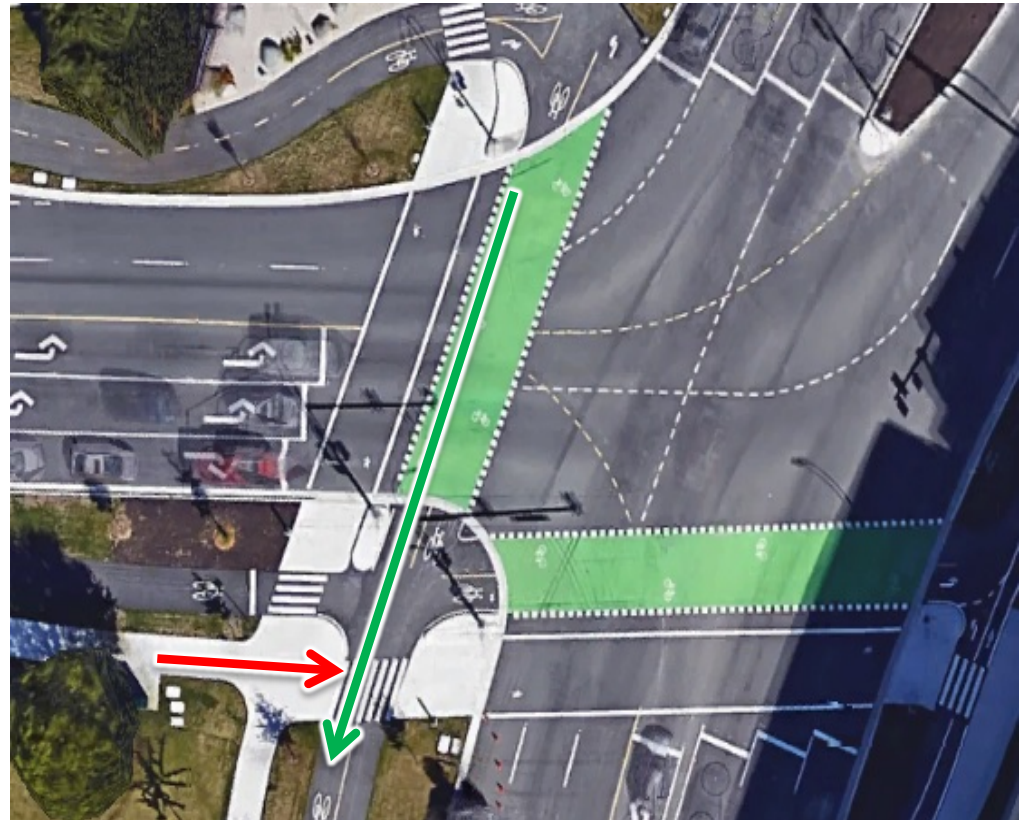
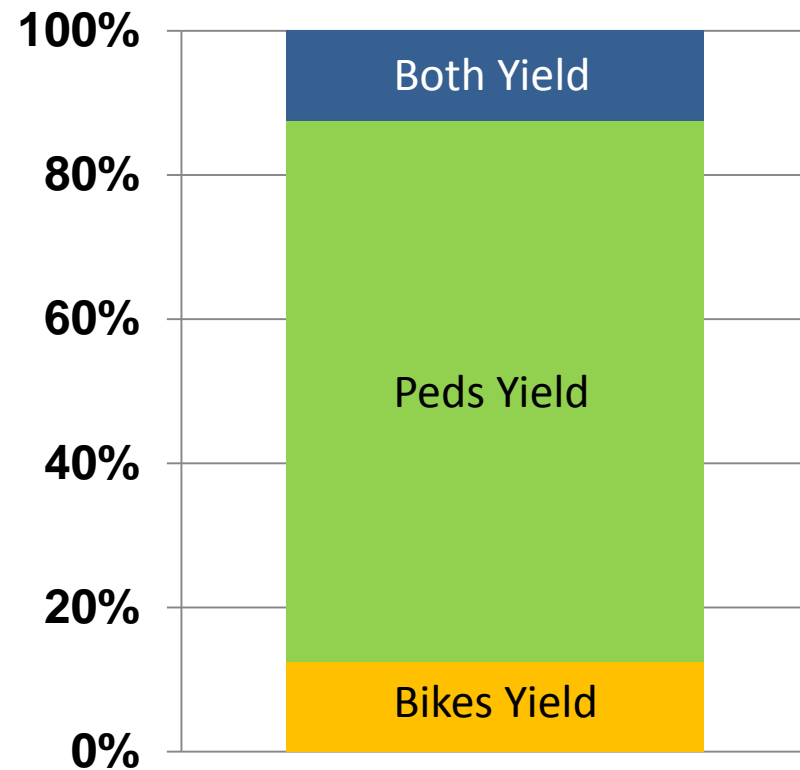
Signal Phase Impact on Yielding – Burrard Cornwall

Bikes Arriving
on Red



Signal Phase Impact on Yielding – Burrard Cornwall

Bikes Leaving Green



How Can We Influence Behaviour?

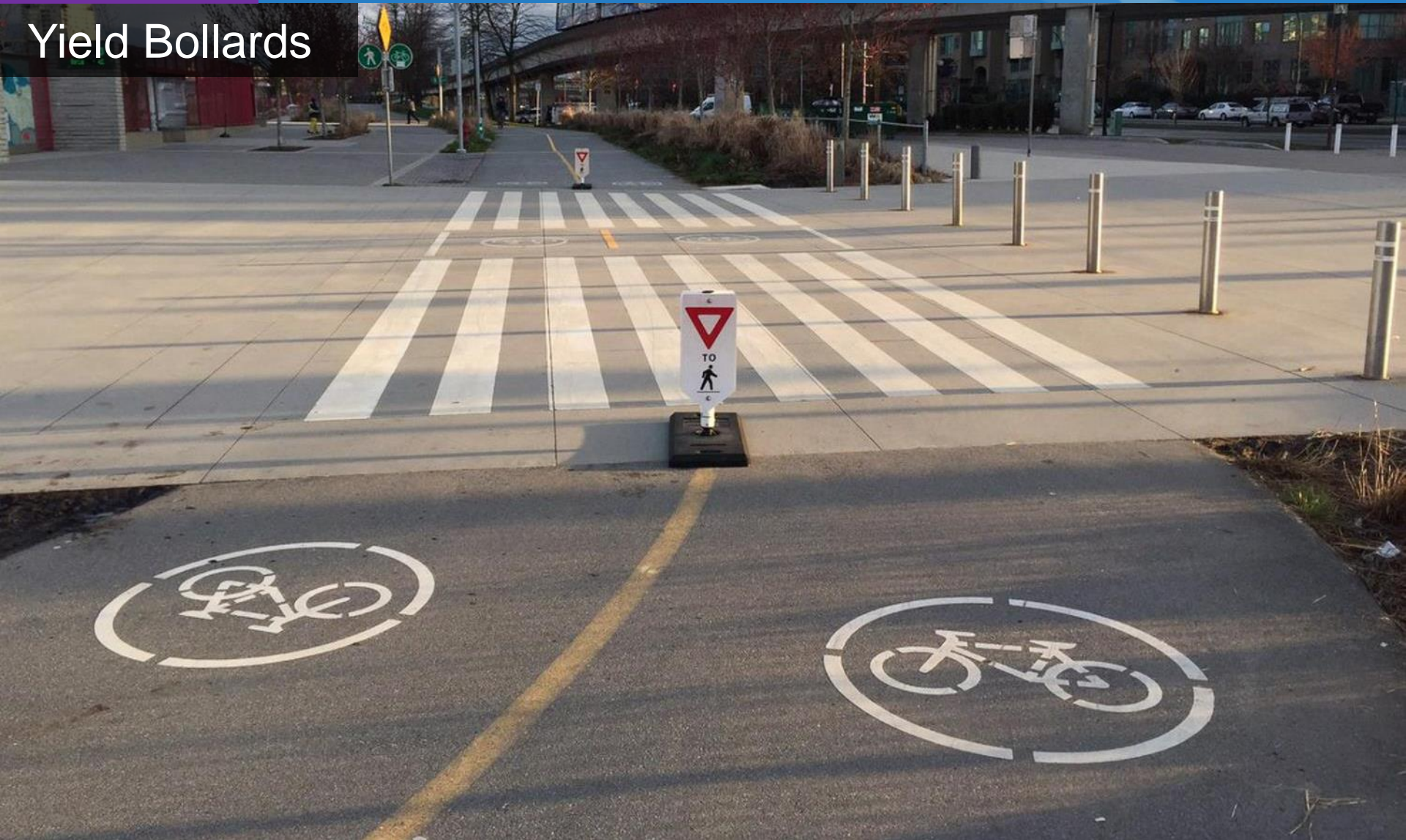
Yielding at Science World Crossing

Baseline



Yielding at Science World Crossing

Yield Bollards



Yielding at Science World Crossing

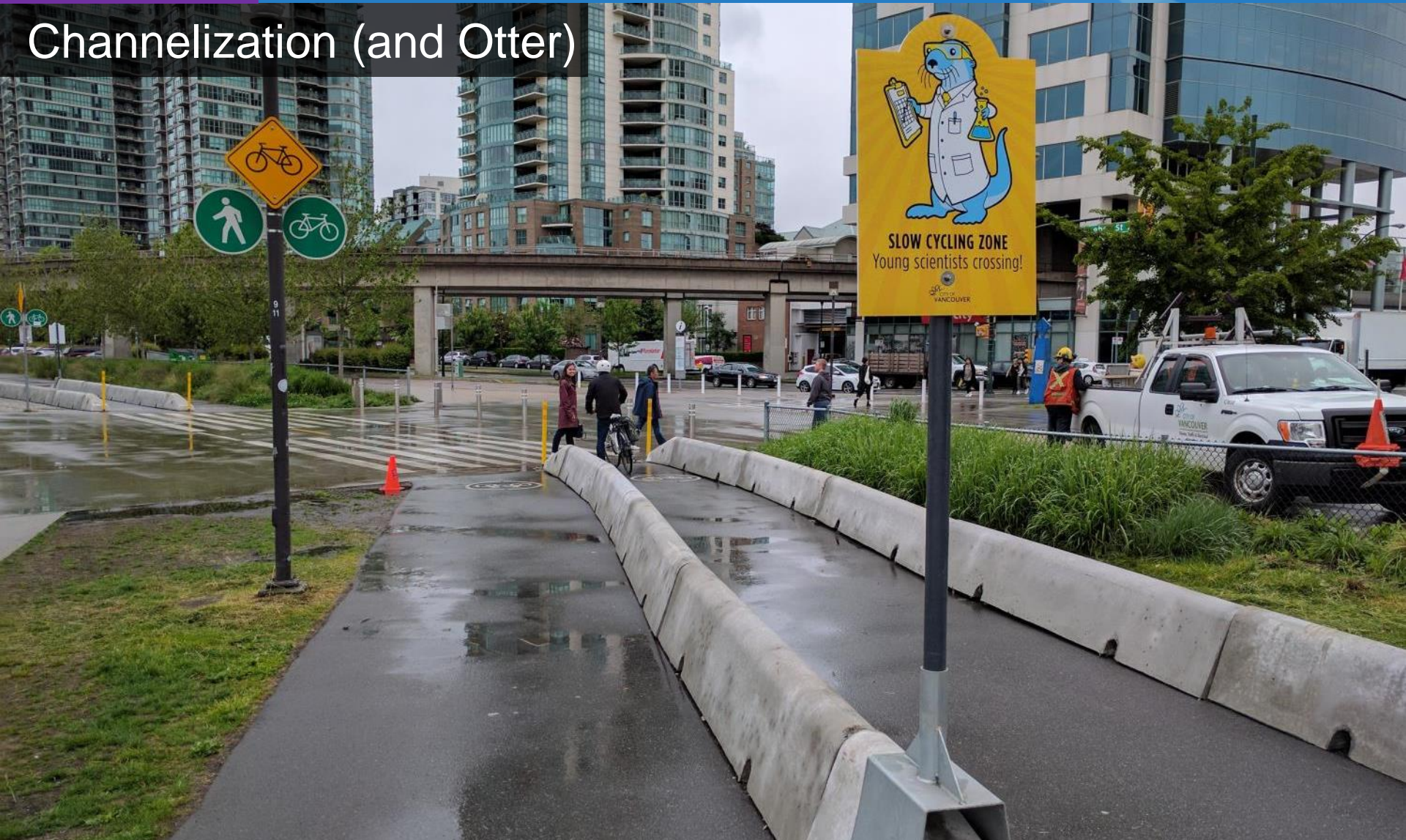
Yield Bollards



+5 to 10%

Yielding at Science World Crossing

Channelization (and Otter)



Yielding at Science World Crossing

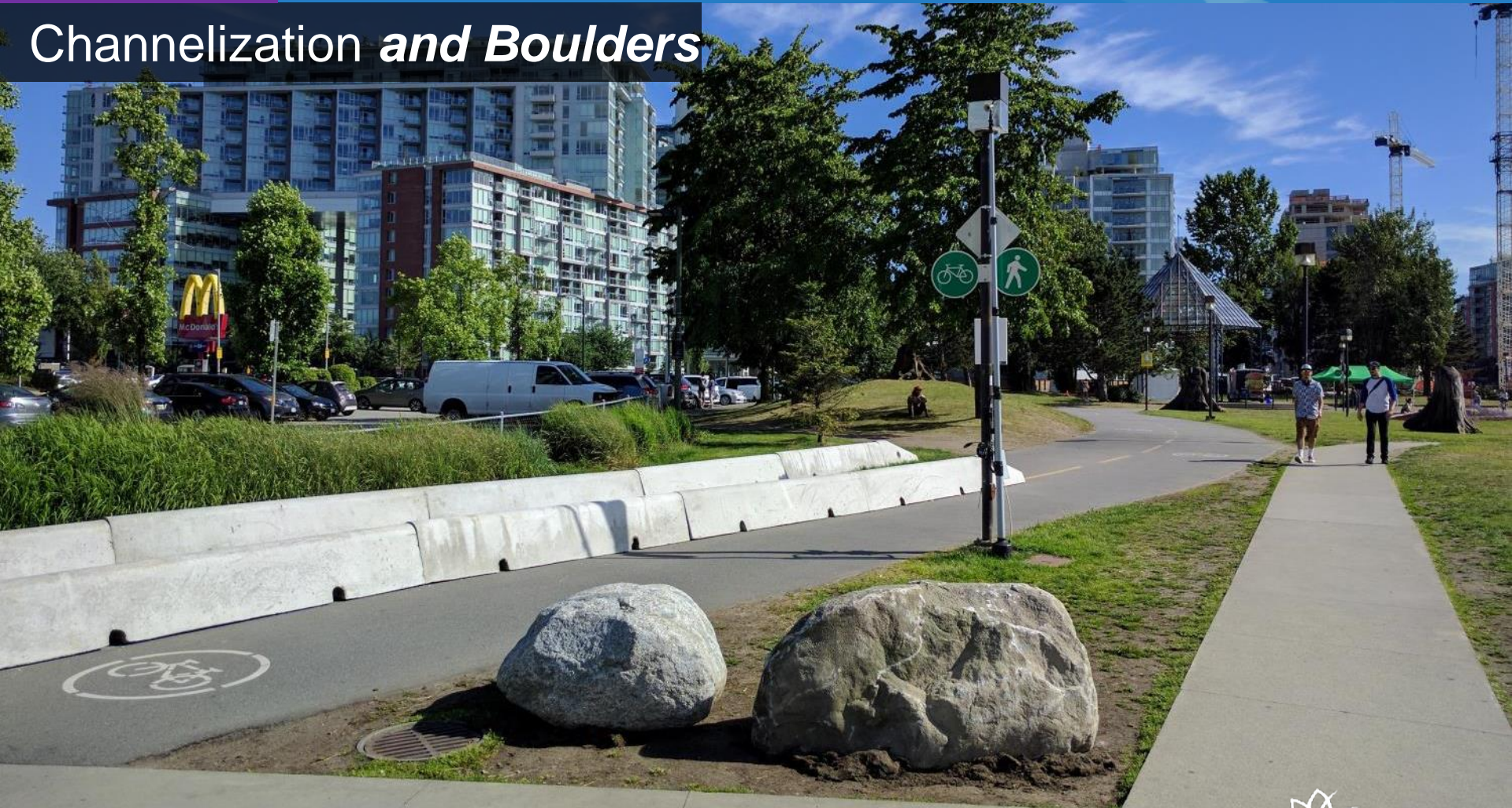
Channelization (and Otter)



+15%

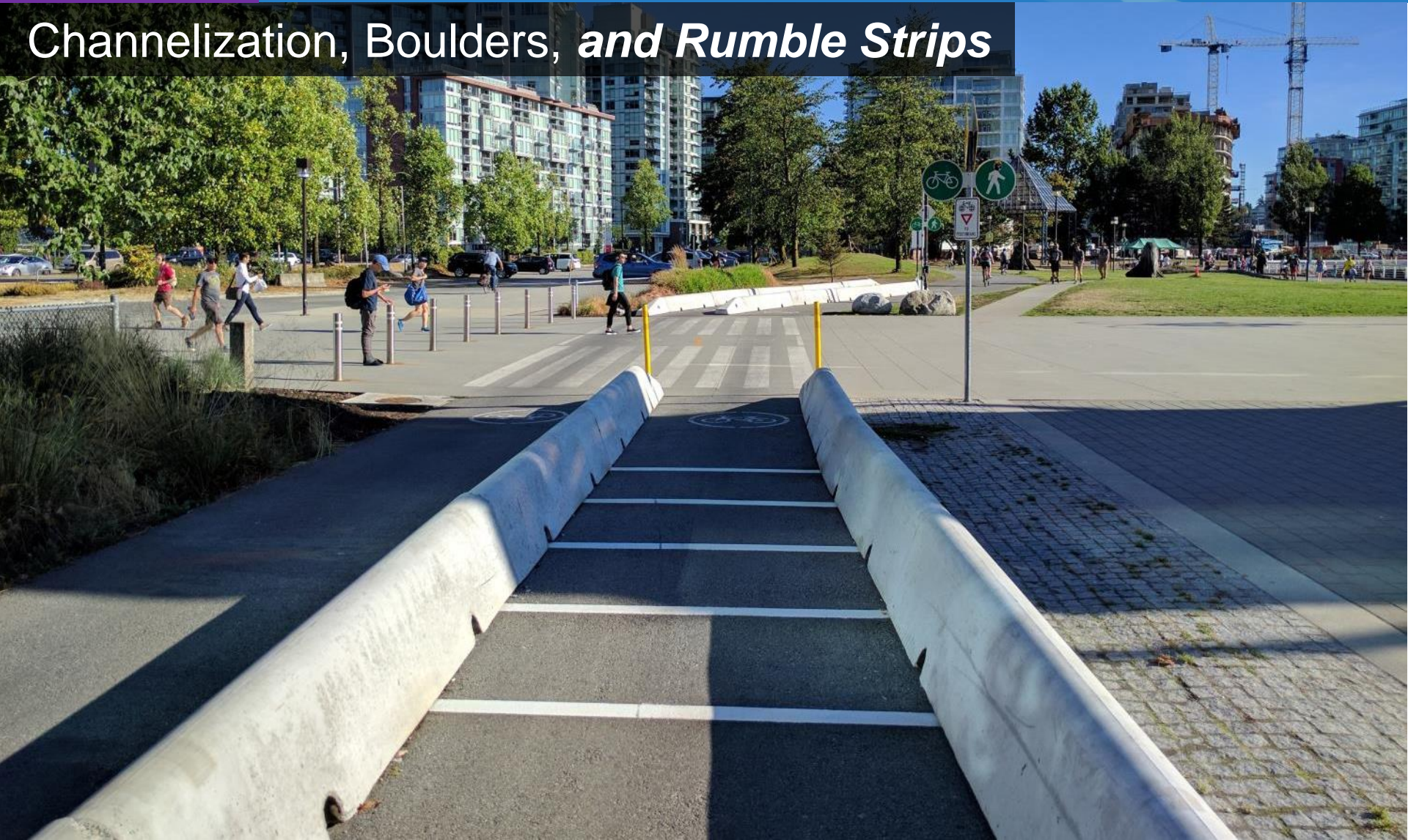
Yielding at Science World Crossing

Channelization *and* Boulders



Yielding at Science World Crossing

Channelization, Boulders, *and Rumble Strips*



Yielding at Science World Crossing

Channelization, Boulders, Rumble Strips, and Stickers



Yielding at Science World Crossing

Channelization, Boulders, Rumble Strips, Stickers, *and Benches*



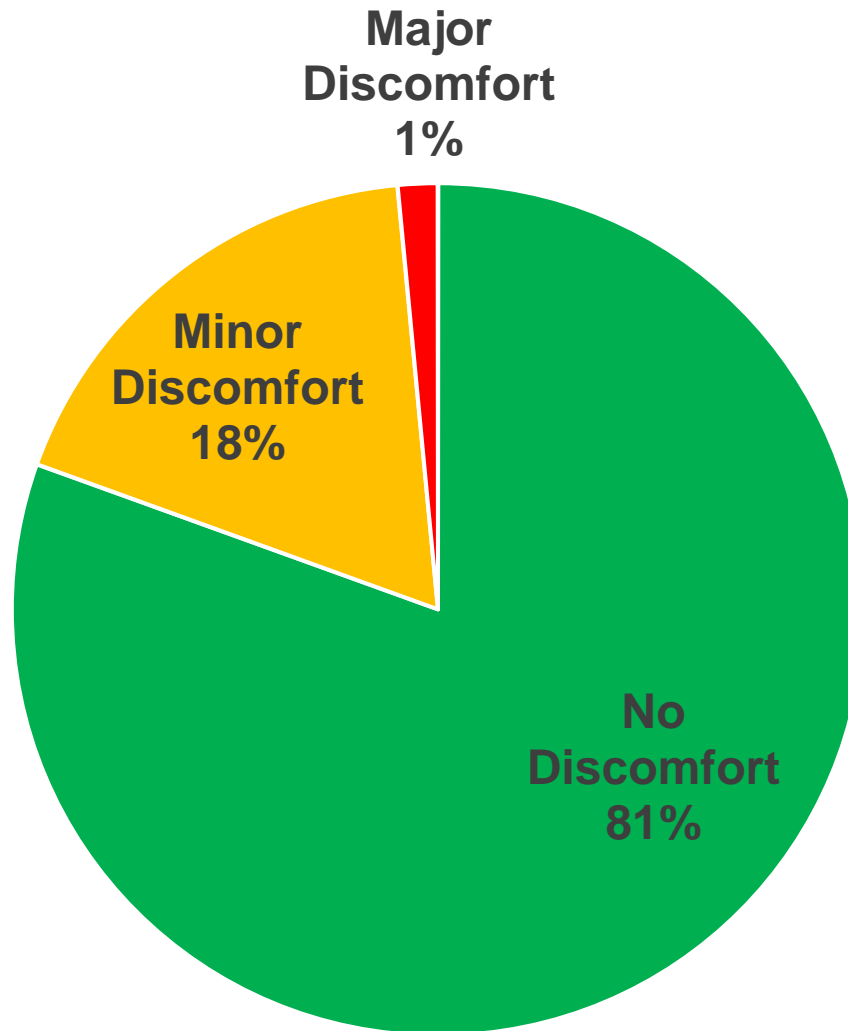
Yielding at Science World Crossing

Channelization, Boulders, Rumble Strips, Stickers, *and Benches*



Important to Keep Perspective

Keeping Perspective



Keeping Perspective

60 collisions per
year involving injury



Keeping Perspective Education is Part of the Picture as Well





Questions and Discussion



bike vancouver