Making Protected Bike Lanes and Protected Intersections Work for *All* Pedestrians
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
“Inclusive Design & Protected Bike Lanes in Vancouver

“Protected Intersection” Design Approach
Protected Intersections on the Ground

Burrard & Cornwall
Protected Intersections on the Ground

Burrard & Pacific
Protected Intersections on the Ground

Inclusive Design & Protected Bike Lanes in Vancouver
What’s the Problem?
The Challenges – Protected Intersections

Inclusive Design & Protected Bike Lanes in Vancouver
The Challenges – Protected Intersections
Inclusive Design & Protected Bike Lanes in Vancouver
The Challenges

Inclusive Design & Protected Bike Lanes in Vancouver
The Challenges – Protected Intersections

Inclusive Design & Protected Bike Lanes in Vancouver
The Challenges – Protected Intersections

- Flush Crossings
- Skewed Crossings
- T Intersection
- Protected Phasing
- Sidewalk Adjacent to Bikeway
- Multi-stage Crossing
- Yield Markings

Inclusive Design & Protected Bike Lanes in Vancouver
Expanding the Toolkit
On-going Stakeholder Workshops
Coordinating with Similar Efforts in the U.S. ...

FHWA Workshop in Seattle
Testing New Tools for Engagement …
Testing New Tools for Engagement …

Inclusive Design & Protected Bike Lanes in Vancouver
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
No: international examples are fraught with inconsistency and solutions that don’t work well
Are there off-the-shelf solutions?

Guidance surface

Curb ramp with detectable warning

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

Bars perpendicular vs. parallel to direction of travel

Courtesy: Accessible Design for the Blind
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

<table>
<thead>
<tr>
<th>Curb A</th>
<th>Curb B</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="image1" alt="Curb A Diagram" /></td>
<td><img src="image2" alt="Curb B Diagram" /></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Curb C</th>
<th>Curb D</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="image3" alt="Curb C Diagram" /></td>
<td><img src="image4" alt="Curb D Diagram" /></td>
</tr>
</tbody>
</table>
Adjacent Sidewalk and Bikeway
## Adjacent Sidewalk and Bikeway

### Category:

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

Concrete Sidewalk    Curb    Asphalt Bike Path

Concrete Sidewalk    Curb & Gutter    Asphalt Bike Path

LSK210116-1B
Adjacent Sidewalk and Bikeway

Inclusive Design & Protected Bike Lanes in Vancouver

Questions Remain:
- Curb wide enough?
- Caning into bikeway?
- Warning or wayfinding?
- Construction?
- Contrast?
Inclusive Design & Protected Bike Lanes in Vancouver

Behaviour at Unsignalized Pedestrian Crossings
Accessible Sidewalk Design Elements

EXHIBIT 3C: Bike Lane Elevation

2. Flush Pedestrian Crossings
Flush Pedestrian Crossings

Navigation vs. Warning

Photo: Toole Design Group
Tactile Warning at Bikeway Crossings?

Burrard & Cornwall Pilot
Does Bikeway Crossing Warrant a Warning?
Tactile Warning at Bikeway Crossings?
Tactile Warning at Flush Crossings

Inclusive Design & Protected Bike Lanes in Vancouver
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
Locator tone provides important information about crossing stages
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

Inclusive Design & Protected Bike Lanes in Vancouver
Fear

Inclusive Design & Protected Bike Lanes in Vancouver
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

- Bikes Yield
- Peds Yield
- Both Yield
Signal Phase Impact on Yielding – Burrard Cornwall

Bikes Leaving Green

- 100% Both Yield
- 80% Peds Yield
- 20% Bikes Yield

Inclusive Design & Protected Bike Lanes in Vancouver
How Can We Influence Behaviour?
Baseline

Yielding at Science World World Crossing

Inclusive Design & Protected Bike Lanes in Vancouver
Yielding at Science World Crossing

Yield Bollards

Inclusive Design & Protected Bike Lanes in Vancouver
Yielding at Science World Crossing

Yield Bollards

Inclusive Design & Protected Bike Lanes in Vancouver

+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

Inclusive Design & Protected Bike Lanes in Vancouver
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

Inclusive Design & Protected Bike Lanes in Vancouver

- No Discomfort: 81%
- Minor Discomfort: 18%
- Major Discomfort: 1%
Keeping Perspective

60 collisions per year involving injury
Inclusive Design & Protected Bike Lanes in Vancouver

Keeping Perspective
Education is Part of the Picture as Well
Questions and Discussion