Designing Separated Bikeway Treatments from a Safety and Public Health Perspective

Karla Kingsley, Kittelson & Associates, Inc.
How does transportation impact health?

- Physical Activity (walking & biking)
- Traffic Crashes
- Air Pollution

Public Health
How does transportation impact health?

- Infrastructure & Urban From
- Physical Activity (walking & biking)
- Traffic Crashes
- Air Pollution

Public Health
Cycle track?

Protected Bike Lane?

Separated Bike Lane?
FHWA
Separated Bike Lane Planning and Design Guide
What are Separated Bike Lanes?

A separated bike lane is an exclusive facility for bicyclists that is located within or directly adjacent to the roadway but is physically separated from motor vehicle traffic with a vertical element.
What are Separated Bike Lanes?
Why build Separated Bike lanes?

- Convenience and comfort for bicyclists
- Can attract less confident riders
Who does the bike facility serve?

Four Types of Cyclist

- Strong & Fearless: <1%
- Enthusiastic & Confident: 7%
- Interested but Concerned: 60%
- No Way No How: 33%

Level of Traffic Stress (LTS)

<table>
<thead>
<tr>
<th>Level</th>
<th>Strong &amp; Fearless</th>
<th>Enthusiastic &amp; Confident</th>
<th>Interested but Concerned</th>
<th>No Way No How</th>
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<tbody>
<tr>
<td>4</td>
<td>3</td>
<td>4</td>
<td>2</td>
<td>1</td>
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</tbody>
</table>

Separated bike lanes generally are LTS “1” sometimes with a higher LTS at intersections.

Source: Roger Geller, City of Portland
Why build Separated Bike lanes?

SBLs create more opportunities to incorporate “active transportation” into daily trips
Why build Separated Bike lanes?

Demographic shifts and economic benefits
Why build Separated Bike lanes?

SBLs can contribute to greater mobility at a low cost
Safety Performance

- Limited sample size
- Bicycle crashes are low
- Lack of standardized data
Safety Performance

- Limited sample size
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Overall crashes

Bicycle volumes

Bicycle crashes

Bicycle crash rates
Safety Performance

• Limited sample size
• Bicycle crashes are low
• Lack of standardized data

Overall crashes

Bicycle volumes

Bicycle crashes

Bicycle crash rates

• Increase in portion of bike crashes at intersections
### Missoula, Montana

#### Higgins Avenue

<table>
<thead>
<tr>
<th></th>
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</thead>
<tbody>
<tr>
<td>Average Annual Total Crashes</td>
<td>17.5</td>
<td>16.0</td>
<td>-9%</td>
</tr>
<tr>
<td>Average Annual Crashes Involving Bicycle</td>
<td>0.0</td>
<td>1.0</td>
<td>NA</td>
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</table>

<table>
<thead>
<tr>
<th></th>
<th>Before</th>
<th>After 2011-2013</th>
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<tbody>
<tr>
<td>Bicycle Average Annual Daily Traffic</td>
<td>255.0</td>
<td>673.7</td>
</tr>
<tr>
<td>Average Annual Bicycle Crashes per Average Annual Daily Bicycle Traffic (x1,000)</td>
<td>3.9</td>
<td>0.5</td>
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</table>

*2010 is construction year.
## New York City (8th Avenue)

<table>
<thead>
<tr>
<th></th>
<th>Before</th>
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<th>% Change Before-After</th>
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<tbody>
<tr>
<td><strong>New York, NY: 8th Avenue</strong></td>
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<tr>
<td>Average Annual Total Crashes</td>
<td>151.1</td>
<td>134.5</td>
<td>-11%</td>
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<tr>
<td>Average Annual Crashes Involving Bicycle</td>
<td>13.8</td>
<td>20.5</td>
<td>+49%</td>
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<tr>
<td></td>
<td>Before</td>
<td>After</td>
<td></td>
</tr>
<tr>
<td></td>
<td>2006-2007</td>
<td>2011-2012</td>
<td></td>
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<tr>
<td>Average Hourly Bicycle Volume</td>
<td>100.1</td>
<td>125.2</td>
<td>+14%</td>
</tr>
<tr>
<td>Average Annual Bicycle Crashes per Average Hourly Volume (x 1,000)</td>
<td>164.9</td>
<td>163.8</td>
<td>-1%</td>
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</table>
# Washington DC, L Street

<table>
<thead>
<tr>
<th></th>
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<th>After</th>
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</thead>
<tbody>
<tr>
<td>Average Annual Total Crashes</td>
<td>125.0</td>
<td>101.0</td>
<td>-19%</td>
</tr>
<tr>
<td>Average Annual Crashes Involving Bicycle</td>
<td>8.7</td>
<td>2.0</td>
<td>-77%</td>
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<tr>
<td>Average Hourly Bicycle Volume</td>
<td>38.4</td>
<td>70.0</td>
<td>+82%</td>
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<tr>
<td>Average Annual Bicycle Crashes for Period per Average Hourly Volume for Stated Years (x1,000)</td>
<td>221.0</td>
<td>28.6</td>
<td>-87%</td>
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Piloting Separated Bike Lanes

- “...until various configurations have been implemented and thoroughly evaluated on a consistent basis, design flexibility will remain a priority.”

- Data collection and evaluation is critical!
Piloting Separated Bike Lanes

- Provides ability to “tweak” designs
- Great public outreach tool
- Low-risk, low-cost trial
- “Pilot to permanent” can be timely and cost-effective
Piloting – Better Block and PBOT
Separated Bike Lanes and Roundabouts?

Modern roundabouts in the US

Number of U.S protected bike lanes:

- Quadrupled in the U.S. since 2010
- 210 predicted by the end of 2014

- Known Year
- Estimated Year
- Known Site but Unknown Year
- Assumed Unknown Site

City projects:
- Green Lanes Project
- Urban Bikeway Design Guide Released
- NYC starts building modern protected lanes

Kittelton & Associates, Inc.
Transportation Engineering/Planning

Moving Forward Thinking
FHWA Separated Bike Lane Design Guidance

- Direction and Width
- Separation
- Midblock considerations
- Intersections
Step 1: Direction and width
Direction and width
Direction and width
Step 2: Separation – delineator posts
Step 2: Separation – raised lane
Step 2: Separation – concrete barriers
Step 2: Separation – parking stops
Step 2: Separation – planters
Step 2: Separation – raised median
Step 2: Separation – parking and delineator posts
Step 2: Separation – parking and raised lane
Step 3: Midblock Considerations (Driveways)
Step 3: Midblock Considerations (Driveways)
Midblock Considerations (Loading and Transit)
Midblock Considerations (Loading and Transit)
Midblock Considerations (Loading and Transit)
Midblock Considerations (Loading and Transit)
Step 4: Intersection - Bend-in/lateral shift
Step 4: Intersection - Bend-in/lateral shift
Step 4: Intersection - Mixing zone
Step 4: Intersection – Mixing Zone
Step 4: Intersection - Bicycle signal

- Taper length depends on traffic speed
- Queue storage length depends on volume and operations
- 4 ft Min
- Near Side Bike Symbol
- NOT TO SCALE

MOVING FORWARD THINKING
Step 4: Intersection - Bicycle signal
Step 4: Intersection – Bend Out

Acceptable sidewalk width (context dependent) must be maintained

1:10 slope

Raised crosswalk

15 ft - 25 ft Speed table

MOVING FORWARD THINKING
Step 4: Intersection - Bicycle Box
Step 4: Intersection – Two-stage left turns
What about.... Dutch-style intersection design or “Protected intersections” in the US?
Race to Build a Protected Intersection – Davis, CA!

Covell Blvd and J St

Photo: City of Davis via Streetsblog
Race to Build a Protected Intersection - Davis

- Bike Ramp: Provides convenient access between bike lanes and shared use paths.
- Forward Waiting Area: Dedicated waiting area for crossing cyclists in high visibility location. Provides head start for cyclists when light turns green, minimizes crossing distance.
- Corner Refuge Island: Encourages safer turning movements, tighter turns reduce vehicle speeds and eliminate high speed collisions. Drivers must "square up" before encountering cyclists, improving visibility and increasing reaction time. Waiting space for turning cars reduces delay for through traffic.
- Flexible Options for all Cyclists: Cyclists may choose to use protected marked crossings for two-phase left turn. Similar to more traditional intersections, cyclists may choose to utilize bike lane and vehicular turning lane for left turns.
- Setback Crossing: Physically separates cyclists from cars while traveling through intersection. Separates cyclists and pedestrians at crosswalk to minimize conflict areas. Reduces "right hook" danger for cyclists using shared use path.
Protected Intersection - Austin

Manor Rd and Tilley St
Protected Intersection – Vancouver, B.C.

Burrard St and Cornwall Ave

Photo: Edmonton Bikes
Protected Intersection - Austin

51st St and Berkman Dr
Protected Intersection – Salt Lake City

200 West at 300 South
Protected Intersections – applying Dutch design

- Vancouver
- Salt Lake City Rendering
- Davis
- Junction design the Dutch way
- Junction design in the Netherlands
- Protected intersection
Questions? Discussion?

- As practitioners, what are other ways you think about the relationship of transportation and public health?
- Thoughts on separated bike lanes and intersection designs?
- Any concerns with certain design elements?
  - Liability?
  - Safety?
  - Lack of design consistency?
- Ideas for implementing other pilot projects?
Upcoming Active Transportation Research

- FHWA Pedestrian and Bicycle Performance Measures
- NCHRP 03-120 Assessing Interactions Between Access Management Treatments and Multimodal Users
- Addressing Bicycle-Vehicle Conflicts with Alternate Signal Control Strategies
Thank you!