Evaluation of Bike Boxes at Signalized Intersections: Initial Findings

Tom Maze Transportation Seminars
InTrans, Iowa State University

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Outline

- Background
- Methods and Results
  - Video observation
  - Surveys
- Preliminary Conclusions
Increasing Bicycle Use

1992: 83 miles of bikeways, 2,850 daily trips
2004: Smarttrips program expands
2008: 274 miles of bikeways, 16,711 daily trips

Source: Roger Geller, Bicycle Coordinator, Portland Bicycle Plan for 2030 Oregon ITE Section Meeting, March 18, 2010, Portland, OR
Why Bike Boxes?

Right Hook Collision

Bike Box Layout
4 Types of Transportation Cyclists

- Strong & Fearless
- Interested but Concerned
- No way No How
- Enthused & Confident

Source: Roger Geller, Bicycle Coordinator, Portland Bicycle Plan for 2030, Oregon ITE Section Meeting, March 18, 2010, Portland, OR
9 - Green Bike Boxes

3 - Uncolored Bike Boxes
International Bike Boxes

Amsterdam

United Kingdom

Christchurch, NZ
West Hollywood, CA
Installed ~1998
Video Data Collection Summary

- 936 hours of video collected
  - ~48 hours per location
- Before video
  - Jan to March 2008
- After video
  - April to June 2009
- Both Pre-Post video
  - 10 bike box (7 green, 3 uncolored)
  - 2 control
Education and Enforcement

WHAT IS A BIKE BOX?

The bike box is an innovation safety device to separate bicyclists from drivers, especially those turning right and drivers going straight. It is a green box on the road with a white bicycle symbol inside. It includes green bicycle lane approaching and exiting from the box.

PROTECT GREEN

Although Portland is known for its blue bike lane,分级 transportation officials thought the bike box could be something new. It also adds another color to indicate dedicated parking. A quick tip:我市 makes it easy to see the standard color for bicycle lanes and boxes.

Get Behind It

THE BIKE BOX

Portland's new green space

Get Behind It

THE BIKE BOX

Please be safe and courteous. There's a lot riding on it.
Video Data Analysis

- All video digitized and stored on central server (after video was digital)
- For each location
  - 2 peak hours
  - 1 off-peak hour
- Three research assistants viewed and coded video
- 7 hours of video randomly selected to test for reliability among the reviewers
## Preliminary Results

### Counts
- Total Cars
- Observed Bicycles
- Total Cars Turning Right
- Total Cars Stopping

### Behaviors
- Motor vehicle and cyclist encroachment in crosswalk
- Motor vehicle encroachment in bike box and bike lane
- Cyclist location stopping in bike box
- Preliminary conflict analysis
Pre-Post Behaviors

- **Figures**
  - (Post count/normalizing) – (Pre count/normalizing)
  - Y-axis label gives normalizing value

- **Color legend**
  - Grey – Uncolored bike box
  - Green – Colored green bike box
  - Blue – Control
Cyclist Stopping in Crosswalk

Change per Cyclist Arriving on Red

+ 

-
Motor Veh. Encroachment in Crosswalk

- Up to 25% of vehicle across line
- Up to 50% of vehicle across line
- More than 50% of vehicle across line

Minor | Moderate | Major
Motor Veh. Encroachment in Crosswalk

Up to 25% of vehicle across line

Up to 50% of vehicle across line

More than 50% of vehicle across line

Change per Stopping Vehicle

+  

-  

<table>
<thead>
<tr>
<th>Location</th>
<th>Up to 25%</th>
<th>Up to 50%</th>
<th>More than 50%</th>
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<tbody>
<tr>
<td>NW Bway &amp; Hoyt</td>
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<tr>
<td>NW Everett &amp; 16th</td>
<td></td>
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<tr>
<td>SE 11th &amp; Hawth</td>
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<tr>
<td>SE 7th &amp; Mad</td>
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<td></td>
<td></td>
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<tr>
<td>SW 3rd &amp; Mad</td>
<td></td>
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<tr>
<td>SW Bway &amp; Tylr</td>
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<tr>
<td>SW Bway &amp; 6th Ave</td>
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<td>SW Terw &amp; T Fry</td>
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<td>SW Terw &amp; T Fry</td>
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<td>W Burns &amp; 14th Ave</td>
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<td>NE 16th &amp; Wiedler</td>
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<tr>
<td>NE 7th &amp; Weidler</td>
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</table>
Comparing Compliance

- **All Enchroachments**
  - Crosswalk: 16%
  - Bike Box: 14%

- **Moderate and Major Enchroachments**
  - Crosswalk: 6%
  - Bike Box: 6%
Prior to Intersection  While making turn  While stopped at light

In post review we considered a “virtual” bike lane
Location of Stopped Cyclist in Box

![Diagram of Location of Stopped Cyclist in Box]
All potential conflicts were identified in video review

- Identified actions by cyclist and motorist
  - Precautionary braking, Precautionary change of direction, Emergency braking, Emergency change of direction, Full stop

- Rated severity of conflict (by panel)
  - Major (2); Substantial (5); Minor (27)

<table>
<thead>
<tr>
<th>Period</th>
<th>Conflicts</th>
<th>Cyclist</th>
<th>Vehicles Turning Rt.</th>
<th>Vehicles Thru</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pre</td>
<td>20</td>
<td>1,471</td>
<td>2,365</td>
<td>8,106</td>
</tr>
<tr>
<td>Post</td>
<td>14</td>
<td>2,301</td>
<td>2,711</td>
<td>8,855</td>
</tr>
</tbody>
</table>
Video of conflicts
Conflicts

No conflicts - SW Broadway and 6th, SW Terwilliger & Taylors Ferry (NB and SB)

More conflicts after

Fewer conflicts after

1. SW Broadway & Taylor
2. NW Everett & 16th
3. SE 11th and Hawthorne
4. SE 7th & Hawthorne
5. SW 3rd & Madison
6. W Burnside & 14th
7. NW Broadway & Hoyt
8. SW Broadway & Taylor
Pre-Post % of Interacting Right-Trn Vehicles Yielding

- NW Broadway & NW Hoyt
- SE Hawthorne & SE 7th
- NE Weidler & NE 7th
Methods: Surveys

- Intercept survey of bicyclists
  - 5 bike box intersections
  - 47% response rate
    (468 of 997)

- On-line survey of motorists
  - 24% response rate
    (717 of 3,020)
Motorist Knowledge

If you approached an intersection with a red light where should you stop your car?

- 94% wait at the stop line
- 9% <1% either don’t know
- 2% 1% either don’t know
- 3% don’t know
- 89%
As a driver, do you think one of the pavement marking designs is better than the other?

6% 89%
Do you think the bike box has made driving safer or more dangerous at the intersections?

<table>
<thead>
<tr>
<th></th>
<th>All motorists</th>
<th>Motorists who have never biked through bike box</th>
</tr>
</thead>
<tbody>
<tr>
<td>A lot safer</td>
<td>16%</td>
<td>14%</td>
</tr>
<tr>
<td>A little safer</td>
<td>36%</td>
<td>31%</td>
</tr>
<tr>
<td>No difference</td>
<td>18%</td>
<td>19%</td>
</tr>
<tr>
<td>A little more dangerous</td>
<td>9%</td>
<td>10%</td>
</tr>
<tr>
<td>A lot more dangerous</td>
<td>3%</td>
<td>3%</td>
</tr>
<tr>
<td>Don’t know</td>
<td>18%</td>
<td>22%</td>
</tr>
<tr>
<td>n</td>
<td>717</td>
<td>490</td>
</tr>
</tbody>
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Motorist Survey

- Of the motorists who have not biked in a bike box...
  - 40% think drivers drive more safely because of the bike boxes
  - 43% think the bike boxes make driving less convenient at the intersections
  - 37% feel more comfortable driving through the intersections (16% less comfortable)
  - 55% think the bike boxes make drivers more aware of bicyclists generally
  - 37% think the City should install more boxes
  - 13% think the City should remove some or all
Do you think the bike box has made the intersection safer for you as a cyclist?

- A lot safer: 20%
- A little safer: 57%
- No difference: 13%
- A little more dangerous: 2%
- I don't know: 8%
- No difference: 13%
- A lot safer: 20%
- A little safer: 57%
37% think most motorists understand the purpose of the box
  - 35% do not think they do
81% think motorists are more aware of cyclists because of the boxes
83% think the bike boxes make for a better environment for bicycling
72% think the City should install more
Most motorists understand and obey the boxes
Pedestrians may benefit from reduced encroachment
Fewer cars entering the bike lane prior to the intersection, but more are cutting the corner closer
Very few conflicts before or after
Preliminary Conclusions

- Improved perceptions of safety on the part of both motorists and bicyclists
- More data analysis to come
  - Project report in the winter
Acknowledgements

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