

# Bike Boxes at Signalized Intersections

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## Abstract

Bicycle use as a primary means of commuting to work increased 145% (American Community Survey, US Census Bureau) from 1996 to 2006 in Portland, Oregon; however, recent surveys have found that more than half of Portland residents limit their bicycling due to traffic safety concerns. In Portland, 68% of bicycle crashes occur at intersections, (PDOT, 2004) which is consistent with national trends (Hunter et al., 1996), and a common crash pattern is the "right-hook" where right-turning motorists collide with through or stopped bicycles.

To partially address these conflicts between bicycles and right-turning motor vehicles, the City of Portland installed 12 "bike boxes" at signalized urban intersections. The box is located in front of the stop line for motor vehicles and behind the pedestrian crosswalk, and the typical installation consisted of an advanced stop line, green textured thermoplastic marking with bicycle stencil, intersection striping, and regulatory signage (including no-turn-on-red). These installations also include colored bicycle lane markings in the intersection, which is unique. This combination of traffic control is hypothesized to reduce conflicts between motor vehicles and bicyclists and make motorists aware of a potential conflict, with a secondary outcome of encouraging more bicycling by enhancing safety and priority at an intersection.

Bike boxes and similar advanced stop lines are used extensively in the United Kingdom, the Netherlands, Denmark, and other European countries. However, bike boxes are rare in the United States and extremely limited research has been conducted on their effectiveness. We conducted a comprehensive, classical, observational before-after study of the effectiveness of the installed experimental traffic control devices and responses of all system users impacted by the installation of the bicycle boxes.

Preliminary results indicate that both cyclists and motorist felt the bike boxes improved safety. Both also preferred the green bike boxes. Most motorists understood and obeyed the rules of the new treatment. Instances of conflict decreased slightly after the bike boxes were installed, but not to a statistically significant degree. No significantly different levels of conflicts were observed between green and unpainted bike boxes.

## Acknowledgements

Funding for the study comes from OTREC, the City of Portland, and Portland State University (Civil & Engineering and Urban Studies & Planning).

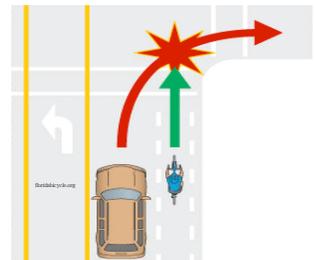
## Why Bike Boxes?

Two Portland bicyclists were killed in "Right Hook" collisions in October 2007. In both collisions, large trucks were stopped at red lights and proceeded with right turns when the light turned green. Neither saw the cyclists riding through the intersection in the bike lane. The accidents catalyzed Portland to address this issue.

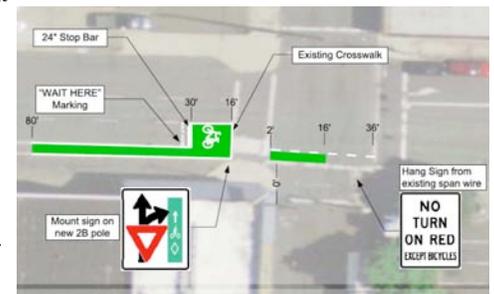
Bike boxes are meant to place cyclists at the front of the queue during red light phases. Motorists wait behind the bike box - cyclists should be more visible. However, bike boxes are not effective during the green light phase.

Limited research has been done on the efficacy of bike boxes in increasing safety or motorist awareness of cyclists.

Right Hook Collision:



Typical Bike Box Layout:



## Video Collected and Reviewed



- 48 hours collected per location
- 10 bike box locations (7 green, 3 uncolored) & 2 control locations
- 6 hours reviewed per location:
  - Pre-Treatment - 2 peak, 1 off peak hour
  - Post-Treatment - 2 peak, 1 off-peak hour.

## Surveys Administered



- Intercept survey of bicyclists directing them to an online survey.
  - 5 bike box intersections
  - 47% response rate (468 of 997)
- On-line survey of motorists - emailed to workers in the downtown Portland area
- 24% response rate (717 of 3,020)

# Bike Box Locations in Portland

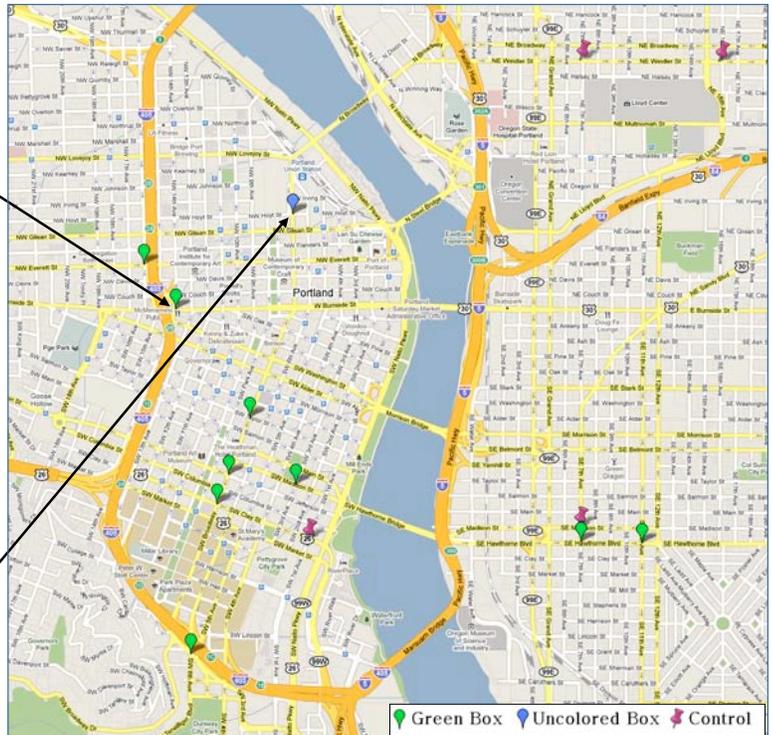
PBOT installed Green Bike Boxes at 11 location in Portland, including this one at West Burnside and 14<sup>th</sup> Avenue.



PBOT installed three uncolored bike boxes. This one is at NW Broadway and Hoyt.

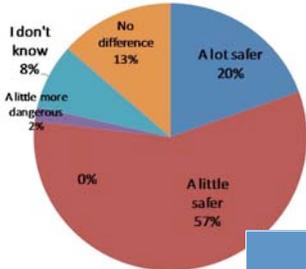


Bike box locations in downtown Portland:



## Survey Findings

**Increased sense of safety:** Both cyclists and motorists indicated they felt the bike boxes made the intersection safer.

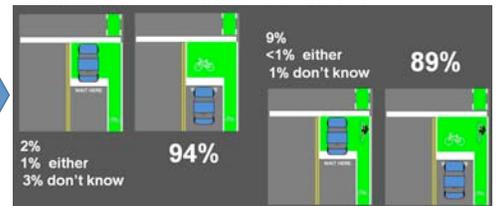


**Cyclists:** Do you think the bike box has made the intersection safer for you as a cyclist?

**Motorist understanding of new treatment:**

Motorists understood that they should stop prior to the bike box.

**Motorists:** If you approached an intersection with a red light, where should you stop your car?



**Motorists:** Do you think the bike box has made driving safer or more dangerous at the intersections?

	All motorists	Motorists who have never biked through bike box
A lot safer	16%	14%
A little safer	36%	31%
No difference	18%	19%
A little more dangerous	9%	10%
A lot more dangerous	3%	3%
Don't know	18%	22%
n	717	490

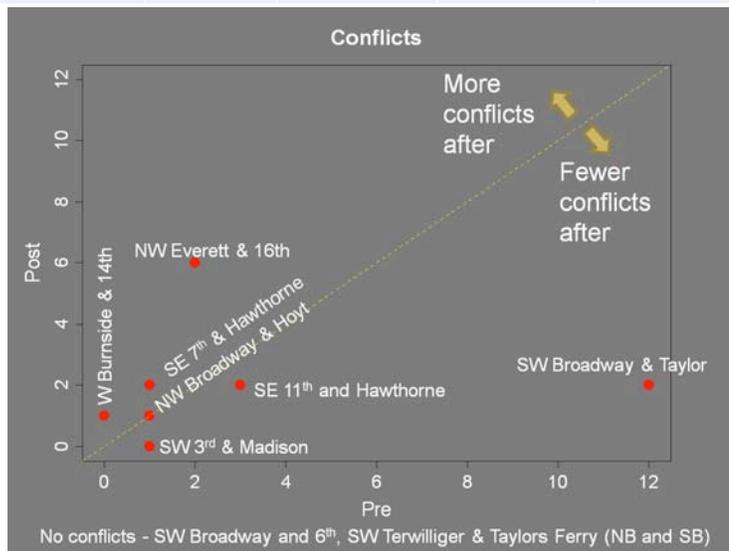
**Motorist color preference:** Motorists preferred the green bike boxes to the uncolored bike boxes..



**Motorists:** As a driver, do you think one of the pavement marking designs is better than the other?

# Video Conflict Analysis

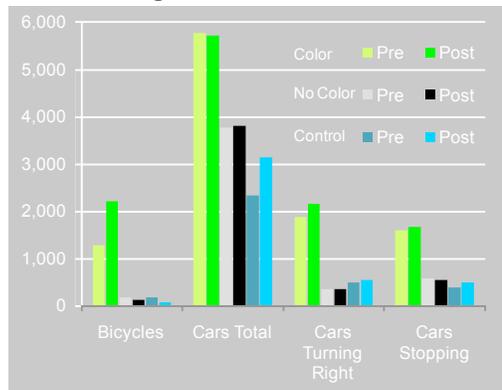
Period	Conflicts	Cyclist	Vehicles Turning Rt.	Vehicles Thru
Pre	20	1,471	2,365	8,106
Post	14	2,301	2,711	8,855



Overall, the number of conflicts was lower in the after period, however no significant difference was noted. Most Conflicts were minor in nature. The chart shows that conflicts at some locations increased slightly while conflicts at other locations decreased slightly. Currently further analysis of the video is being carried out in an effort to gather more conflict points.

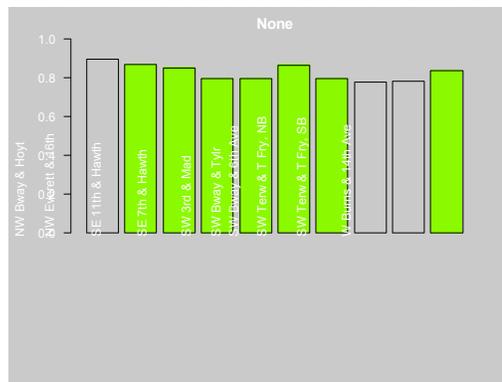
# Video Data Results

Count Changes



The number of cyclists increased in the after period, while the number of cars remained steady

Motor Vehicle Encroachment in Bike Box

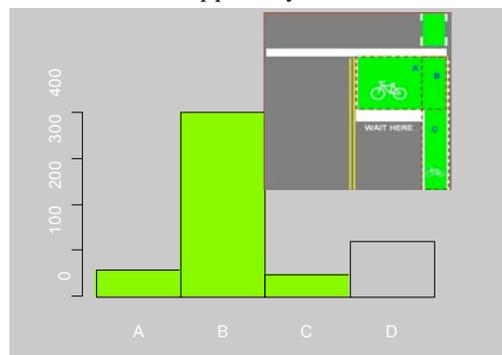


When stopping for a red light, fewer than 20% of the motorist entered the bike box.

## Key Bicyclist Survey Findings

- 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

Location of Stopped Cyclist in Box



When stopped at red lights, most cyclists stopped in the bike lane and ahead of the motorist stop bar



Initiative for Bicycle & Pedestrian Innovation

