Evaluation of 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 bicyclists 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 most 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 a turn-unsigned). 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 in Portland

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 are conducting 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.

Our approach will answer such research questions as:

• Do the bike boxes create any new or potential conflicts between motorized vehicles and bicycles?
• Do the bike boxes reduce conflicts or the potential for conflict between motorized vehicles and bicycles?
• How does motor vehicle driver and bicyclist behavior differ with and without the bike boxes?
• What design features affect behavior and conflicts?
• Do the bike boxes affect pedestrian safety, behavior, or conflicts with motor vehicles or bicyclists?
• What are the impressions of the drivers and bicyclists using the intersection about how the bike boxes affect safety and operations?

Two primary research methods will be employed: (1) before and after video surveillance of the intersections where bike boxes will be installed and appropriate control intersections; and (2) surveys of cyclists and drivers. The video surveillance will address most of the research questions in an objective manner.

Outreach and Education

The success of Portland’s bike boxes, in terms of providing a safe environment for cyclists and motorists, will depend in large part upon road users having an understanding of what the boxes are for and how to use them. To that end, Portland embarked on a $200,000 public relations campaign before and after the installation of the bike boxes. The campaign included explanatory posters, brochures, and billboards. In addition, the first round of bike boxes receiving a bright green coloring in order to stand out.

Portland DOT brochures provided explanations of the bike boxes.

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 take action to address this safety issue.

Bike boxes are meant to place cyclists at the front of the queue during red light phases. Motorists wait behind the green box, and thus 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.

Portland State Evaluation Methods

Timeline: Fall 2008 to Summer 2009
Current Stage: Literature Review and Preliminary Testing

Video Surveillance:

Portland Department of Transportation installed video cameras at intersections with bike boxes, and at appropriate control intersections. Video taken from before and after installation will be reviewed. Reviewers will code cyclist and motorist behaviors and interactions such as:

• Cyclist Utilization of, and positioning within, bike boxes
• Motorist Encroachment beyond stop line
• Actual or potential Conflict between motorist and cyclist

User Survey:

Cyclist Survey: A questionnaire will be administered to cyclists to understand their cycling experience, their use of the route and intersection, their knowledge about bike boxes, and their sense of safety and comfort with the altered intersection.

Motorist Survey: A questionnaire may also be administered to motorists. The survey would inquire as to their familiarity with the bike box road markings, and their sense of whether the altered intersection was more or less safe than before.

Collision Data:

The method of utilizing official crash data to examine collision incidents before and after bike box installation is being considered. However, because of substantial underreporting of accidents, in general, and accidents involving bicyclists, in particular, there may not be enough data to come to any meaningful conclusions.