Portland's Blue Bike Lanes: Adapting A European Treatment To A United States City

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Intersections and intersection-related locations account for 50-70 percent of bicycle-motor vehicle crashes in the United States (1). Colored pavement (either painted or dyed) is a countermeasure that has the potential for reducing conflicts and crashes at or near intersections and has been shown to be effective in other countries (2)(3)(4)(5).

In 1997 and 1998, the city of Portland marked ten conflict areas with blue paint and/or thermoplastic and an accompanying "yield to cyclist" sign. The objective of this study was to determine if the signing and blue paint highlighting these areas changed the behavior of the motorists and/or bicyclists and reduced the conflicts between the two modes.

Figure 1

1. Site Selection

Working with the city of Portland, a total of 10 bicycle-motor vehicle weaving areas near intersections were selected for inclusion in the study. The sites could be categorized into three groups, based on the maneuvers made by both the motorists and bicyclists at these sites. Group 1 generally required both the motorist and bicyclist to turn slightly as they approached the weaving or conflict area due to roadway curvature and other factors (see Figure 2).

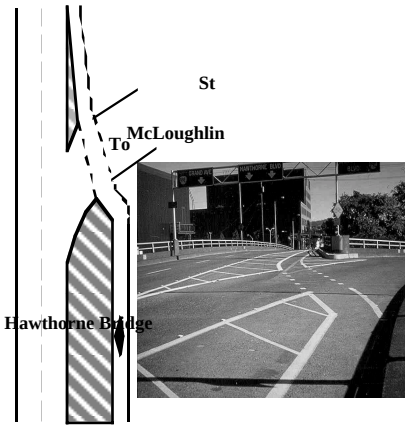

Figure 2

In most cases, the motor vehicle was *exiting the roadway or entering an exit ramp* at a relatively high speed. Group 2 involved the bicyclist traveling straight on the approach and the motorist weaving across the conflict area to enter an *auxiliary right turn lane* (Figure 3).

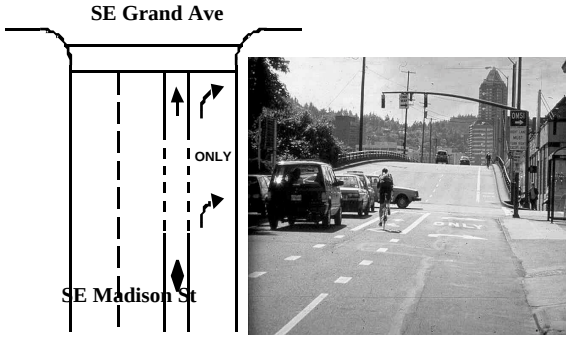

Figure 3

In Group 3 the motor vehicle was approaching from an *intersecting roadway or ramp* and tended to cross the conflict area at an angle approximating 90 degrees (Figure 4).

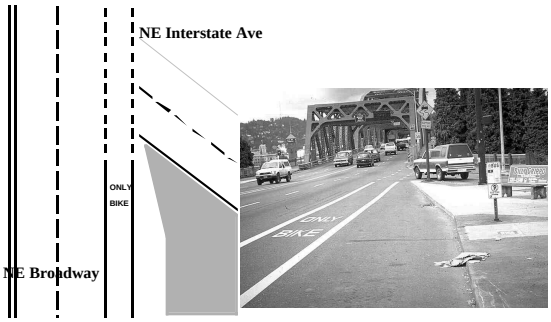

Figure 4

Prior to coloring the pavement, the conflict areas where the paths of the motorists and bicyclists were intended to cross had been outlined by dashed striping along both sides of the bicycle lane (refer to Figures 2, 3, and 4). These dashed conflict areas were the sections of the bicycle lane that were treated with the blue markings.

2. Data Collection

For each "before" and "after" data collection period, two hours of videotape were recorded, coded, and analyzed. The camera was always facing the oncoming cyclist so that estimates of cyclist age and gender could be made. While the camera was visible, it was set back from the roadway and a zoom lens was used to record bicyclist behavior over some 150-200 m. Opinions about the blue bicycle lanes were collected through an in-field, oral survey of bicyclists, as well as a mailback survey of drivers identified from their license plate numbers.

3. Color and Materials

The color selected for this application was light blue. This color was selected by Portland staff for several reasons, including effectiveness in studies elsewhere, and the ability to be detected relatively well in low-light and wet conditions, as well as by color-blind individuals.

The initial set of markings were painted with glass beads placed on the surface as the paint was being applied. The total cost, including materials and labor, for applying the paint was approximately $900. Unfortunately, the material lasted only two to three months due to high traffic volumes. Thus, for the second round of treatments, a thermoplastic material that was skid-resistant was selected and applied at eight locations. The cost for this application included $9,700 in materials and $6,300 in labor. Neither the paint nor the thermoplastic was found to be slippery, but neither material showed up at night as well as had been expected.

One other feature of the blue bicycle lane treatments was the use of rather novel signing in conjunction with the blue markings. One of the three different signs, as shown in Figure 5, was used depending on the motorist maneuver and the location of the bicycle lane.

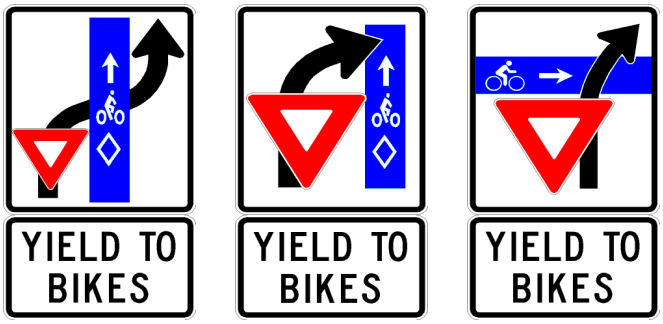

Figure 5

4. Data Reduction

From the "before" and "after" video data, a number of measures of effectiveness and other attributes were recorded. For each bicyclist, age and gender were coded along with information related to their scanning (looking for conflicting traffic) behavior, use of hand signals, use of the bicycle lane, and slowing/stopping behavior upon approaching the conflict area. For motorists, data were collected regarding their turn signal behavior and slowing/stopping behavior when approaching the conflict area in the presence of a bicyclist. With respect to interaction of the two modes, data were recorded with respect to which party yielded and whether there were conflicts such that one of the parties had to change direction or speed suddenly to avoid a collision. Data were captured for 846 bicyclists and 191 motor vehicles in the before period and 1,021 bicyclists and 301 motor vehicles in the after period.

5. Analysis Results

5.1 Bicyclist Behavior

Significantly more bicyclists approaching the conflict area turned their head to look for a motor vehicle before the blue pavement was put in place (43 percent before versus 26 percent after). Also, there were significantly fewer hand signals through the conflict area in the after period, although hand signals were infrequent in the before period as well (11 percent before versus 5 percent after). It should be noted that cyclists would not be expected to signal at sites where they were riding straight ahead (all but two sites).

In the before period, 85 percent of the bicyclists followed the marked path through the conflict area. During the after period, this percentage significantly increased to 93 percent. In addition, 11 percent of the bicyclists slowed or stopped in the before period compared to 4 percent after the blue pavement was in place. This result may reflect a feeling of increased comfort level on the part of bicyclists with the blue pavement in place.

5.2 Motorist Behavior

As with the bicyclists, several measures of effectiveness were coded pertaining to behaviors made by motorists approaching and crossing the blue pavement areas. One of those measures was the use of turn signals. Significantly fewer motorists signaled their intentions after the blue pavement had been installed (63 percent after versus 84 percent before).

Another measure obtained was related to the slowing or stopping behavior of motorists when approaching the conflict area. Whereas 71 percent of the motorists slowed or stopped in the before period, 87 percent slowed or stopped after the blue pavement was in place, a statistically significant difference.

5.3 Interaction Behavior

Significantly more motorists yielded to bicyclists after the blue pavement had been installed (92 percent in the after period versus 72 percent in the before period). Another measure

examined was the number of conflicts that occurred between motorists and bicyclists, where a conflict was defined as an interaction such that at least one of the parties had to make a *sudden* change in speed or direction to avoid the other, a rather stringent definition. Conflicts were infrequent (8 before and 6 after), and all but one was minor in nature.

5.4 Bicyclists' and Motorists' Opinions

In-field surveys were acquired for 216 bicyclists at one of the treatment locations. *Mailback* surveys from 222 drivers traveling across this same location were also received. In both surveys, opinions were solicited with respect to general safety and operational issues related to the blue pavement in the conflict areas. The results of the *bicyclists'* survey can be summarized as follows:

• Did the blue pavement markings increase the slipperiness of the road surface?

Five percent felt the road surface was more slippery, 2 percent less slippery, 39 percent the same as before, and 55 percent were not sure.

• Are motorists yielding to bicyclists more or less often with the blue pavement markings in place?

Some 58 percent felt motorists were yielding more than before, 0 percent less than before, 27 percent the same as before, and 15 percent not sure. Typical positive comments of the bicyclists were that the blue pavement made a big difference, that bicyclists were more visible to drivers, and that drivers were more aware of bicyclists. Typical negative comments were that bicyclists always felt nervous going through these areas, that more motorist education was needed, and that bicyclists still had to ride defensively.

• Do the blue pavement markings make the conflict areas more or less safe for bicyclists?

Overall, 76 percent felt the locations with blue pavement were safer, 1 percent less safe, 9 percent no different, and 13 percent were not sure. Typical positive comments were that motorists were more aware of the bike lanes, that motorists paid more attention to bicyclists, that the pavement made it clearer where bikes are supposed to go, and that the defined area was respected by motorists. There were only a few negative comments to this question. One said that bicyclists were lulled into a false sense of security, and another said that the blue pavement was not reflective enough in low light and/or rainy weather.

Of the *motorists* surveyed, approximately 70 percent noticed the blue markings and 59 percent noticed the accompanying sign. Of those who *noticed the sign*, 55 percent stated that the blue markings meant to "yield to bicyclists," while 45 percent responded that it meant to "be careful." Of those that *did not notice the signs*, only 38 percent stated that the blue markings meant to "yield to bicyclists," while 43 percent responded that it meant to "be careful." When asked whether the blue markings made the conflict areas more or less safe, 49 percent thought it was safer, 20 percent the same, 12 percent less safe, and the remainder were not sure. Several of the motorists surveyed thought the markings helped to increase awareness of the conflict areas, while others expressed concern about creating a false sense of security for bicyclists.

6. Conclusions and Recommendations

Taken as a whole, these findings tend to point to safer conditions for bicycling as a result of using blue pavement and novel signing to define conflict areas between bicycles and motor vehicles. Overall, the percent of bicyclists following the recommended marked path through the conflict areas increased in the after period, and the percent of motorists yielding to bicyclists increased in the after period.

However, there are some concerns. Significantly fewer bicyclists turned their head to the rear to scan for approaching motor vehicles, and significantly fewer bicyclists used a hand signal to indicate their movement through the conflict area. These two results in combination might indicate a false sense of security generated by the blue pavement and signing.

While colored pavement and accompanying signing appears to be one way to heighten awareness of both bicyclist and motorist, more evaluations should be performed and reported

to develop guidelines on when and where such applications are appropriate. Further study is also needed as it relates to the potential impact of the signing separate from the blue markings.

References

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