Project Summary

Texas Department of Transportation

0-5157: Operational and Safety Impacts When Retrofitting Bicycle Lanes

Background

A bicycle facility – a bike lane or a wide outside lane – added to an existing roadway without changing the curb-to-curb width is often referred to as a "retrofit." These facilities have become increasingly common in urban environments where right-of-way is constrained and measures to reduce motor vehicle congestion and air pollution are most needed. AASHTO's *Guide for the Development of Bicycle Facilities* provides a range of options for designing on-street bicycle facilities, but provides no evidence of the consequences for cyclists and motorists of choosing one option over another. Research was conducted to obtain such evidence and associated guidance for the design of retrofit bikeways.

What the Researchers Did

The best way to examine the effects of bicycle facility design on cyclists and motorists is to observe directly how these two groups behave when sharing a roadway. To ensure an adequate sample of observations on roadways with low bicycle volumes, and to observe the behavior of the same cyclists at sites with varying characteristics, 31 cyclists were hired to ride at roadway sites in Austin, Houston, and San Antonio. The cyclists were men and women ages 18 to 54 with varying cycling experience. The 24 test sites selected were on roadway segments with existing retrofit bikeways (either wide outside lanes or a designated bike lane). Since the widths of the bicycle facility and the adjacent vehicle lane(s) are key factors in retrofit design, the sites were selected to ensure that substantial variation in these factors could be observed.

Observations taken from field video included: the lateral position of the bicyclist (LPB) relative to the curb, the change in lateral position of the motorist (CLP) in the course of passing the cyclist, and whether or not the motorist encroached into the adjacent motor vehicle lane. Through econometric analysis of the data, the researchers estimated an equation for each of these three measures of behavior. The analysis was designed to answer questions about the significance and magnitudes of various influences on each measure – for example, to what extent does a change in the width of a bicycle lane affect the lateral position of the cyclist (LPB)? Employing these econometric techniques allowed the researchers to examine each influence separately holding other factors constant.

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To supplement the econometric findings, the researchers also obtained evidence from other sources:

- An extensive review of related literature on bicycle facility and roadway design;
- A statistical analysis of 2,712 bicycle-car crashes in the Houston-Galveston area of Texas between 1998 and 2001; and
- The Bicycle Compatibility Index (BCI) developed in 1998 for the Federal Highway Administration by researchers at the University of North Carolina at Chapel Hill.

What They Found

From their analysis, researchers found that the presence of bicycle lanes and their widths affected cyclist and motorist behavior in the ways one would expect. Other influences that proved significant varied between equations according to the aspect of behavior being considered. The presence of residential development and the skill level of the cyclist influenced the lateral position of the cyclist, which in turn was found to significantly affect motorist behavior. The width of the motor vehicle lane was also found to affect motorist behavior, along with the presence of a two-way left turn lane (TWLTL), which provides motorists two more likely opportunities to encroach into the TWLTL lane, versus the presence of oncoming traffic in the adjacent vehicle lane, which reduces the amount by which motorists swerve around cyclists (the change in lateral position). In particular, one general conclusion that leaps out from the results is that for both cyclists and motorists, bike lanes provide greater comfort and a better operating environment than wide outside lanes.

What This Means

This project enabled researchers to produce a Microsoft Excel application that supports a range of tasks in the planning of on-street bicycle facilities:

- evaluating multiple proposed retrofit designs;
- evaluating existing roadways for choosing a bicycle route through a given corridor;
- making a bicycle map, or producing a community assessment of bicycle accessibility; and
- designing bikeways for new or reconstructed roadways that are in the planning stage.

The application is a decision support tool. It conveys the ramifications of various decisions available to planners, engineers, and designers, who can combine this information with their local knowledge (including traffic and roadway characteristics that are not included in the program) and sound engineering judgment to develop better bikeways.

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