Research Report Summary

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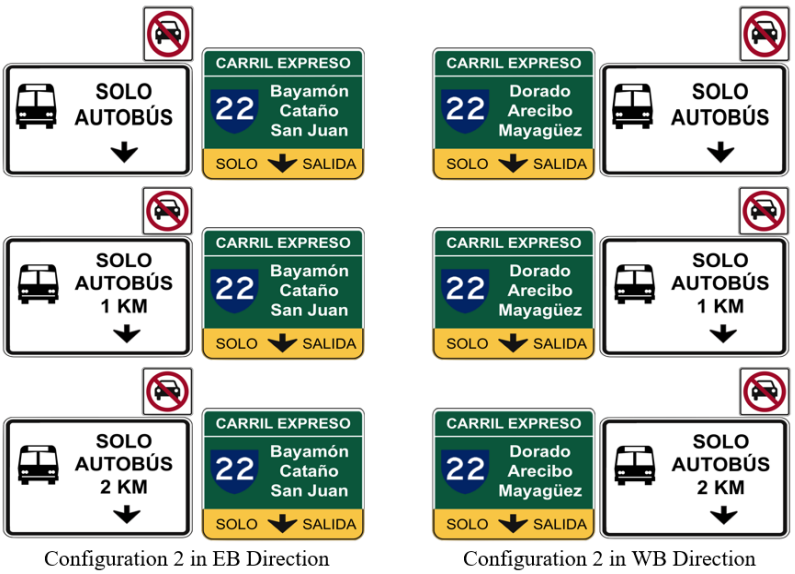
Phase III Operational and Safety-Based Analyses of PR-22 Dynamic Toll Lane

BACKGROUND

The Puerto Rico dynamic toll lane (DTL) is a managed reversible lane that shares travel lanes with a bus rapid transit (BRT) system. The managed lane is located in the median of a segment of Freeway PR-22, providing access in and out of the San Juan Metropolitan Area (SJMA) of Puerto Rico. Operational and safety issues are present in the DTL since there are drivers who perform last-minute lane changes or wrongly use the BRT exit lane.

This research study is focused on the evaluation of alternative signage and the incorporation of in-lane pavement marking as a potential treatment to improve



Configuration 2 in EB Direction | Configuration 2 in WB Direction

Figure 2. Proposed signs for both EB and WB travel directions

Figure 1. UPRM cockpit driving simulator equipment

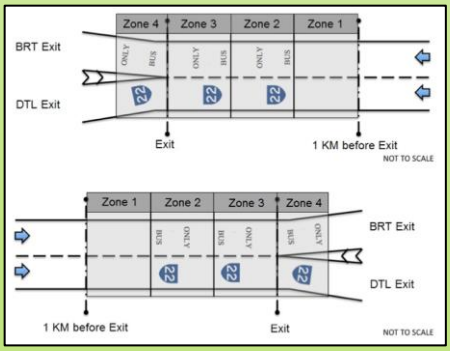


Figure 3. Evaluated zones of PR-22 DTL exit for both travel directions

driving behavior on PR-22 DTL using UPRM driving simulator equipment (Figure 1). Results of previous research indicated that the use of the high-occupancy vehicle (HOV) diamond-shaped symbol did not improve driving performance (Ruiz et al., 2017). Therefore, an online survey was developed to gather drivers' understanding of signs and pavement markings for managed lanes following the MUTCD. A combination of signs (Figure 2) and pavement markings was proposed within the zones evaluated (Figure 3) for the driving simulation (Configuration 2). The results were compared with drivers exposed to the current conditions of PR-22 DTL (Configuration 1).

"This research focused on the operational and safety evaluation of alternative signs and in-lane pavement marking treatments for the PR-22 reversible dynamic toll lane that have the potential to improve driving performance and decision making."

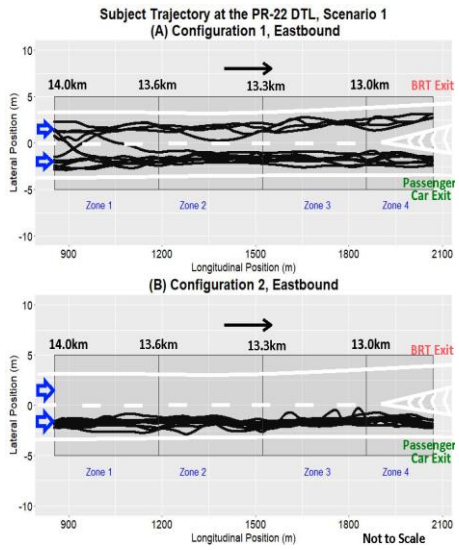


Figure 4. Subject trajectory at the PR-22 DTL exit for Scenario 1

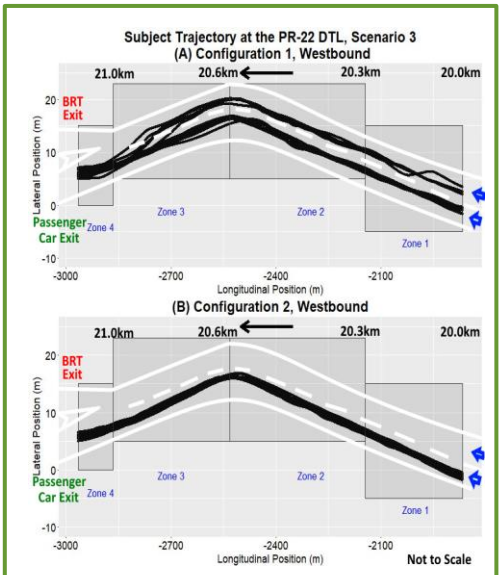


Figure 5. Subject trajectory at the PR-22 DTL Exit for Scenario 3

OBJECTIVES

1. Perform an online survey to gather drivers' understanding of traffic control devices (TCDs) in managed lanes.
2. Develop a treatment based on the MUTCD and drivers' understanding.
3. Evaluate driving behavior when approaching the PR-22 DTL exit when exposed to the existing conditions and the proposed treatment.
4. Provide recommendations that improve the operation and safety of PR-22 DTL.

MAJOR RESEARCH FINDINGS

1. Online survey results revealed that the HOV diamond-shaped symbol was misunderstood by 65% of the participants.
2. 50% of the participants exposed to the existing condition on PR-22 DTL used the BRT exit lane incorrectly (Figures 4 and 5).
3. Decision making of subject drivers was improved when exposed to the proposed treatment. (Figures 4 and 5)

RESEARCH RECOMMENDATIONS

1. Proposed Configuration 2 has the potential to improve driving decision making before the exit of the DTL lanes, thus improving the DTL's operation and safety.
2. In-lane pavement markings using the PR-22 shield for the express exit and the words BUS ONLY for the BRT-exclusive lanes should be considered to complement existing overhead signage.

REFERENCES

Federal Highway Administration (2009). *Manual on Uniform Traffic Control Devices for Streets and Highways*. Washington, D.C.: Federal Highway Administration.

Ruiz, B., Valdés, D., Colucci, B., Ruiz, J., Colón, E., & García, R. *Operational and Safety Based Analysis of a Pavement Marking Treatment in Puerto Rico Dynamic Toll Lane*. Paper presented at the 8th International Conference on Applied Human Factors and Ergonomics (AHFE 2017) and the Affiliated Conferences, Los Angeles, CA.

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