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Title: ADVANCED YIELD MARKINGS AND DRIVERS' PERFORMANCE IN RESPONSE TO MULTIPLE-THREAT SCENARIOS AT MID-BLOCK CROSSWALKS

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Abstract:

This study compares on a simulator drivers' performance (eye fixations and yielding behaviors) at marked, midblock crosswalks in multi-threat scenarios when the crosswalks have advance yield markings and pedestrian crosswalk prompt signs with their performance in such scenarios when the crosswalks have standard markings. Uncontrolled mid-block crosswalks at multilane streets are associated with a type of pedestrian-vehicle conflict defined as a multiple-threat crash scenario. A pedestrian is struck by a vehicle (first threat) traveling in the same direction as a vehicle (second threat) that is yielding or stopped for a pedestrian in the crosswalk. Vehicles yielding or stopped too close to the crosswalks often block the driver's visibility in the approaching vehicle (traveling in the adjacent lane) of the pedestrian in the crosswalk. Previous field studies have shown that the use of advance yield markings and the "Yield Here for Pedestrian" prompt sign increase drivers' yielding distance while reducing the number of conflicts at multilane, midblock crosswalks. However, these changes might occur solely in scenarios where the pedestrian is visible in the crosswalk. There is no way to determine from the data whether any of the scenarios included multiple threats. To date, no studies have shown whether the use of advance yield markings and prompt signs actually increases the likelihood that drivers will look for pedestrians obscured by a yielding or stopped vehicle in an adjacent travel lane.

Thirty-six drivers participated in the study conducted in a driving simulator. Eighteen subjects were assigned to the control group (traditional markings) and eighteen to the advance yield markings and prompt sign group. The virtual environment consisted of a two-way/four-lane road with stop-controlled intersections and vehicles traveling in the opposite direction, approaching from the right or left, and entering/leaving parking lots. Participants followed a lead vehicle to an unknown destination. Advance yield markings and prompt signs were placed 30 feet upstream of the crosswalks to indicate the point at which the yield is required to be made. Traditional markings consist of stop bars located 10 ft before the crosswalk. The scenarios of interest include situations where the driver approaches an uncontrolled, mid-block crosswalk with an obstruction on either the right lane or left lane (i.e., three vehicles in queue, vehicles with turning signal activated). Two sessions were presented to each subject. Each scenario (obstruction on right or left lane) was included once within a session. Pedestrians were included in the simulation (e.g., pedestrians completing street crossings at selected intersections) to show the driver that it is possible to encounter such an event elsewhere in the simulation. However, a pedestrian was never present in any of the experimental scenarios included in the first session but always present in the last scenario of the second session.

In the first session, drivers in the advance yield markings group looked for pedestrians 69% of the time and drivers in the control group looked for pedestrians 47% of the time. The location of the obstruction (left versus right) did not affect the probability that a driver would look for a

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pedestrian. In the second session, consider just the last scenario when a pedestrian emerged from behind a stopped vehicle in the travel lane. The time-to-crosswalk at which a driver first looked for a pedestrian was 2.2 seconds for the advance yield markings condition and 1.0 seconds for the standard markings condition, a difference which was statistically significant.. Additionally, none of the subjects yielded for the pedestrian in the control group. However, when advance yield markings were used, 61% of the drivers yielded or stopped for the pedestrian. The difference (61%) is statistically significant. Thirty-six percent of the subjects that stopped completed an evasive maneuver to avoid a collision (steering left or sudden deceleration). This abrupt response is an unintended consequence that deserves further investigation since it may result in an increase in rear-end (vehicle-vehicle) collisions. In summary, advance yield markings and prompt signs in multiple threat scenarios lead to changes in drivers' behaviors which are likely to reduce pedestrian-vehicle conflicts.