

Driver Expectancies at Freeway Lane Drops

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Motorists frequently encounter situations on high-speed freeways where the lane that they are driving on and, in some cases, the route that they are following are not continued on the through lanes beyond an interchange. It is currently believed that, in these situations, driver expectancies of interchange configuration may be violated for at least two basic reasons. First, the driver may expect an option to continue through an interchange when, in fact, remaining in a lane forces an exit. Second, the driver may have false expectancies regarding the facility and route relationship. That is, he or she may expect a major route to continue on a facility when it does not. In the interest of gaining information on how current and variations of current forms of signing affect drivers' expectancies in situations where expectancies are violated, two experiments were undertaken. Both were conducted in the Human Factors Laboratory at Fairbank Highway Research Station, which is part of the Traffic Systems Division, Office of Research, Federal Highway Administration.

DESIGN OF EXPERIMENT 1

Experiment 1 included a consideration of the extent to which variations in sign characteristics affect expectancy. Four exit panel messages were compared. They were MUST EXIT, EXIT ONLY, ONLY, and EXIT LANE. These messages were also compared to panels that had no message but did have a directional arrow. Also considered were the effects of sign position (whether the sign was positioned over the right or left lane). Expectancies were divided into those regarding interchange geometrics and those relevant to routes and destinations.

Twenty subjects participated in the experiment. Each subject was seated in a chair and faced a rear projection screen. To measure geometric expectancies as dependent on exit direction messages, eight 35-mm slides depicting a three-lane Interstate highway with different exit

sign messages were randomly presented to the subject (Figure 1). Immediately after each slide presentation, a slide of five geometric configurations was presented (Figure 2). The subject was instructed to choose the geometric configuration that he or she would expect to see at the approaching exit as determined by the message content and the positioning of the sign previously presented. The subject then verbally indicated the relative certainty of his or her response on a five-point scale. The experimenter recorded the subject's choice, response time (the time between the slide presentation and a subject response), and certainty for each trial.

A second slide set was presented to the subject to identify his or her route and destination inconsistencies as applied to choice of appropriate path at exits. The subject was first given instructions regarding the route to follow and destination. A slide of the highway with the exit approach sign that contained route and destination information was presented and was immediately followed by the presentation of a slide with four route and destination combinations. The subject indicated his or her expectancy of the route and destination combinations and verbally indicated the certainty of the response after each trial.

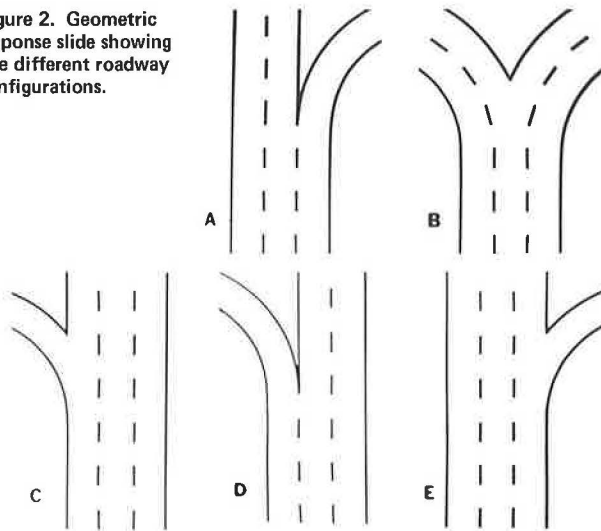
RESULTS OF EXPERIMENT 1

The results of experiment 1 indicate the superiority of the MUST EXIT and EXIT ONLY panels in terms of the data collected. This is especially apparent in the geometric portion of the study. The results of geometric accuracy seem to indicate not only that a worded exit message appears to convey a more definitive message to the driver regarding interchange geometrics but also that a great disparity exists between the psychological meaning of the words chosen. The words "must" and "only" evidently have a large influence on the accuracy of driver choices for lane drop geometrics. The other worded exit panels, although significantly improving accuracy choices over panels containing arrows, were not significantly different from one another. This would imply that there may be other words whose psychological impact is strong enough to substantially increase the accuracy of drivers' predictions. Of course, there may

Figure 1. Stimulus slide showing roadway scene and exit direction sign.



Figure 2. Geometric response slide showing five different roadway configurations.



be symbols or combinations of words and symbols that also would be effective.

The results of the route and destination portion of experiment 1 are fairly inconclusive. The MUST EXIT panel had a significant advantage in influencing correct judgments for reaching a destination. There appears to be no obvious explanation for this effect. The MUST EXIT panel was significantly better than all other panels for latency, and there were no significant differences between the panels for the certainty measure.

Each subject, after the experimental sessions, was asked to interpret the meaning of the panels. Between 90 and 95 percent of the subjects made correct judgments for MUST EXIT and EXIT ONLY panels respectively and only 50 to 65 percent chose correctly for the ONLY and EXIT LANE panels respectively.

Exit panels, in general, appear to be more effective in influencing interchange geometric expectancies of the driver and appear to have little effect on route and destination expectancies. It may be that, in situations where the route leaves the facility, the facility leaves the route, and so forth, this information could be more meaningfully conveyed by some alternate information source.

DESIGN OF EXPERIMENT 2

In experiment 2 the MUST EXIT and EXIT ONLY panels were retained, and, for comparison, a no panel condition was included. Sign position was also retained. The third consideration dealt with the effects of diagrammatic signs. Diagrammatic signs and major splits were included in the design to (a) contrast the diagrammatic sign efficiency with the efficiencies of conventional signs at exit configurations and (b) test the effectiveness of exit panel messages when used in conjunction with diagrammatic sign content. The procedure for experiment 2, with the exception of the slides presented, was the same as that for experiment 1.

RESULTS OF EXPERIMENT 2

The effects of the exit panels as used in the exit lane drop situations were clear cut. The primary element that influences the expectation of a lane drop configuration at exits seems to be the presence or absence of an exit panel message. In experiment 2, no significant differences were found between MUST EXIT and EXIT ONLY panels for any measures. The inclusion of either panel on a sign yielded significantly better results than a sign with no exit panel at all. The advantages of the panels were particularly notable when they were used in conjunction with conventional signs, although the diagrammatic sign performed equally well whether an exit panel was present or not. Because a portion of the content of a diagrammatic sign is essentially a diagram of the interchange configuration, drivers may require no information other than that provided by the diagram to identify a lane drop situation. The conventional sign, on the other hand, does not have this advantage; therefore, an additional exit panel may be needed to inform the driver of the impending dropped lane.

The use of exit panels at major split configurations is contraindicated. The only significant results regarding panels as split configurations were found in the certainty measures where no panel yielded more assured responses than either MUST EXIT or EXIT ONLY. At the same time, on every measure, the diagrammatic signs proved to be significantly better than the conventional signs at the split configurations.

Although diagrammatic and conventional signs at exit lane drop configurations yielded comparable results on both certainty and lane drop expectation measures, there was a significant difference in the reaction time measure and diagrammatic signs yielded quicker responses. This may result from the nature of the diagrammatic sign, which requires for geometric purposes symbol matching rather than word interpretation. The relatively shorter time for matching compared with that for interpretation could easily yield a similar relationship between the respective reaction times without reducing the comparability of certainty and expectation scores.

Reaction times were shorter for signs indicating a left exit than for those indicating a right exit. It is interesting to note that more drivers indicated that they expected a lane to be dropped at a left exit than at a right exit. This tendency is not present for driver expectations at split configurations. Although drivers are not generally thought to expect lane drops, it may be that, when a left hand exit is known in advance, a lane drop is more likely to be expected.

CONCLUSIONS

In general, the data indicate that the selection of exit panels for specific applications should be influenced by the type of sign selected (diagrammatic or conventional)

and the direction in which the exit diverges from the roadway (EXIT ONLY panels are superior to MUST EXIT panels at left exits). Based on the research to date, it seems clear that exit panels significantly improve the correctness of driver expectations of freeway interchange geometrics in terms of lane drop configurations. Of all messages tested, the MUST EXIT and EXIT ONLY panels were the most helpful in correctly influencing expectations. The difference in efficiency of these messages seems small, and probably either one could be adopted. In the interest of improving the accuracy of driver expectancies, it would seem that only one exit panel message should be used.

Diagrammatic signs appear to have influenced expectancies favorably, but the cost factors associated with installing this type of sign where conventional signs now exist may make their use prohibitive in the near future. Exit panels affixed to existing conventional signs may offer a sufficient short-term solution.