

ABSTRACT

The Determination of the Advanced Sign Placement Distance Based on a Human Factors Evaluation of the Exiting Process. (December 1976)

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The objective of this research effort was to determine on the basis of driver performance the distance, upstream of the exit gore point, at which an exit direction sign should be located on a freeway or interstate facility. The distance was expected to vary with a number of situational variables, several of which were investigated in this research.

To determine the placement distance a model was developed relating the various components of the exiting process to the sign placement distance. These various components are: sign reading distance, decision distance, lane maneuvering distance, and deceleration distance. In terms of the model, the best estimate of sign placement distance is equal to the sum of the decision distance, lane maneuvering distance, and deceleration distance minus sign reading distance.

To obtain actual freeway distances associated with components of the model an instrumented vehicle study was performed. Twenty drivers from Houston, Texas, drove sections of two freeways near downtown Houston.

One freeway (I-45) was used for the lane maneuvering study. All

drivers were required to drive a three and four-lane section of the freeway and maneuver from the extreme left lane to the extreme right lane in light, medium and heavy traffic conditions. To determine an estimate of maneuvering distance, each driver was required (as by instructions) to perform in succession three lane-change maneuvers on both the three and four-lane sections in each of the three traffic volumes.

The distances were determined indirectly by recording the time required for a particular test and the speed of the test vehicle during each particular test. Deceleration to 40 mph was computed using the initial speed of the vehicle as it entered the extreme right lane.

On a different freeway (I-10), the sign reading tests were conducted. Drivers were required to read six signs, three containing exit panels above the sign and three without exit panels. Under one condition, drivers were instructed to find a particular exit panel and read the corresponding message. Under the other condition drivers were instructed which sign they must read. This test was designed to determine the average daylight reading distance and also the additional distance, if any, required for a driver to search for a particular exit sign when he was uncertain which sign presented the information.

The drivers also read two overhead signs at night. One sign was illuminated by vehicle headlamps only and the other was illuminated by fluorescent bar lights. This test was designed to determine the effect various types of illumination had on sign reading at night and to determine an average night sign reading distance.

A pollution study was conducted in which five pollutants, carbon monoxide, ozone, nitrogen dioxide, and hydrocarbons, were correlated with sign placement distance.

The major finding of this research was a set of empirically-determined lead distances based on driving performance which could be used as sign placement distance criteria. Rather than a single value, the research findings offer several distances appropriate under various assumptions regarding the number of lanes, traffic volumes and speed, visibility, driver familiarity, and the percentage of drivers to be accommodated by the distance.

The results indicate that traffic volumes and the number of lanes have a significant effect on maneuvering distance. Another finding was that when traveling at low speed in heavy traffic, the distance required to maneuver is significantly less than when the speed of the vehicle is higher. It was also determined that search time, and ambient light had a significant effect on sign reading distance. The product-moment correlation between the sign reading distance and the various levels of the four pollutants indicated there was no significant correlation between the levels of pollution and the sign reading distance. It was concluded that the model is a useful tool for developing sign placement criteria.