Abridgment

Driver Reaction to Improved Warning Devices at a Rural Grade Crossing

Eugene R. Russell, Kansas State University
Harold L. Michael, Joint Highway Research Project, Purdue University
Thomas A. Butcher, Lincoln, Nebraska

In early 1972, the Indiana State Highway Commission sought an immediate solution to a grade-crossing problem because of pressure by the press and local citizens due to the high accident and death rates at the site. In addition to taking immediate steps to correct the problem, the State Highway Commission wanted an evaluation of improvements that were made in the warning system.

Spot speed at specific points on the approaches was selected as the parameter most likely to be related to the degree of improvement. Determining the speeds of approaching drivers at several points provided an approach-speed profile for each driver. Inferences from the evaluation of these approach-speed profiles and changes in them due to each improvement or to change of conditions within a particular system were used to evaluate the effectiveness of the improvements.

Time and budget constraints led to the implementation of a photographic system employing a 16-mm variable-speed movie camera. The camera setup position for each approach was approximately 225 m (750 ft) from the roadway and 180 m (600 ft) from the railway track. By filming a vehicle at a set film speed and by counting the number of frames it took a vehicle to traverse a pair of markers that intersected the line of sight from the camera to a 16.5-m (55-ft) speed trap, the average speed of the vehicle between marker pairs could be calculated from the frame counts. This average speed was assumed to be the spot speed of the vehicle at the center of the trap.

The primary objectives of the research were

1. To analyze the effect on motorists of improving the warning devices at a rural grade crossing with a high accident rate, by replacing 20.3-cm (8-in) flashers on automatic gates with 30.5-cm (12-in) flashers activated by a Marquardt speed predictor and supplemented by additional strobe lights;
2. To evaluate and analyze suitable parameters;
3. To study accident history and site conditions before and after system improvement and relate these changes to motorist reaction to the system; and
4. To evaluate the data collection system itself.

Spot speeds were taken at eight points on each approach to obtain an approach-speed profile for various groups under various conditions after the signal system was improved. These were compared with similar data taken before system improvement. It was shown that an activated gate arm can be as effective in slowing the average approaching vehicle as can seeing a train. The strobe lights made the warning system more visible after activation.

Most drivers approach a grade crossing safely. Although analysis of the mean speeds of various groups showed some useful trends, these are relatively weak parameters for testing effectiveness of the changes because they do not isolate the occasional unsafe driver. The percentage of reduction in speed of the fastest vehicles, along with observation of individual speeding vehicles, provides a better measure of improved effectiveness than do mean speeds and deceleration. Other conclusions included the following.

1. All free-flow plots and several statistical tests showed a consistent lowering of mean entry speeds 330 m (1100 ft) from the crossing. This implied that drivers became aware of the crossing sooner after the improvement was made, probably because of the greater visibility of the gate arms in the raised position.
2. Both before and after installation of signals, the approach speeds of following vehicles were more affected by other vehicles than by the signal, and vehicle approach-speed profiles were independent of signal type.
3. Both before and after upgrading the protection at the grade crossing there were no deceleration rates that could be classified as emergency stops. There were deceleration rates that could be classified as undesirable, but the numbers were too small to permit statistical comparison.
4. Deceleration rate is a weak parameter for determining effectiveness of the new signals.

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