

DEPLOYING AN ITS WARNING SYSTEM FOR NO-PASSING ZONES ON TWO LANE RURAL ROADS

Jamal El Zarif

Abstract

A new safety application, as part of ITS Advanced Rural Transportation System (ARTS), has been developed to be deployed on a two-lane rural road (Route 114), in Southwest Virginia. The route segment under study is subject to significant head-on accidents, as a result of two main conditions:

- 1- **Illegal passing maneuvers** crossing solid yellow line, and
- 2- A short passing sight distance due to the **road vertical profile**.

Head-on collisions amount nationwide to about 3% of the total number of crashes, mostly due to limited visibility. A limited number of studies have addressed these crashes with the intent of providing ITS safety countermeasures. The majority of these studies dealt with implications of environmental causes (e.g. nighttime and weather conditions) and geometric design causes.

The main objective of this research is to design a video detection-based warning system by installing an affordable and efficient system on the vertical crest curve on Route 114, capable of performing the following two main functions:

1. Detect vehicles that attempt to violate the no-passing zone restriction (i.e. when crossing into the opposing direction).
2. Warn the drivers violating the restriction in order to discourage them from continuing their maneuvers.

Other objectives, which could be of equal importance, are to:

1. Identify violators through license plate recordings and warn repeat violators by mail.
2. Collect data on vehicle volumes and speeds and drivers' behavior.

System architecture as well as detailed system design was developed. Equipment was selected based on detailed specifications for the video camera detection system with the central processor; the warning panel and the enforcement system lower cameras. A system simulation was conducted with the use of a special software program written with MATLAB. The simulation was applied for both “with” and “without” the system cases. The simulation runs showed that the system could virtually eliminate all head-on collisions, should violators obey the early warning messages displayed.

Several sensitivity tests were made for different scenarios. The output examined in all these tests showed a high degree of robustness of the system performance, and no single unavoidable crash resulted in all “with the systems” runs.

Finally, the viability of the system was evaluated from economic point of view. The financial analysis revealed high economic indicators in terms of benefit-cost ratio BCR (38.9) and modified internal rate of return MIRR (65%) over the 10-year lifetime of the system.