DESIGN GUIDELINES FOR HIGHWAY RAILROAD GRADE CROSSING PROFILES IN FLORIDA

PROBLEM STATEMENT

In Florida, there have been several collisions between trains and vehicles that got stuck on highway railroad grade crossings. These collisions resulted in high property damage, equipment, and user costs, as well as injuries to individuals and contamination to the environment. In 1984, the Florida Department of Transportation (FDOT) developed the *Field and Office Manual for Profile Surveys of Highway - Rail At-Grade Crossings on Existing Paved Roadways* to be used for roadway profile evaluations and profile design evaluation. Use of this manual is limited to consideration of profile design near the rails; it does not include additional elements, such as surface material outside of the rail, that have contributed to vehicle hang-up. Designs of roadway facilities have in the past considered the length, height, and weight of a typical design vehicle as identified by AASHTO roadway design policy. The rationale has been to accommodate varying vehicle types in vertical and horizontal alignment and also to ensure that the road infrastructure so designed is capable of handling the traffic loading. Little attention has been paid to vehicles' ground–clearance as a design element.

OBJECTIVES

The goal of this research is to investigate the degree to which low clearance vehicles experience problems on highway-railroad grade crossings and develop appropriate design guidelines. Major tasks included the following:

1. Revise the existing FDOT's manual *Field and Office Manual for Profile Surveys of Highway-Rail At-Grade Crossings on Existing Paved Roadways.*
2. Develop a simple computer tool(s) for roadway designers, inspectors, railroad flagmen, and other appropriate audiences to evaluate existing highway railroad grade crossings for potential hang-up problems, i.e., to model the profile of sample grade crossings and develop procedure(s) and tool(s) that can be used to check whether a given class of vehicle can safely traverse a high–profile grade crossing
3. Develop a simple computer tool(s) for the Department's Permitting Office to evaluate oversized and over-length vehicles in relation to proposed routes.

FINDINGS AND CONCLUSIONS

Available literature and accident reports indicated the seriousness of the problems posed by the potential hang-up of low ground clearance vehicles at highway-railroad grade crossings. A questionnaire survey was conducted among state agencies and railroad companies; the results confirmed the need to address the problem.

The research team made considerable effort to utilize a laser profilometer to collect 3-D profile elevation data. An existing ICC profilometer was modified to enable researchers to collect three-profile data, and detailed profile data were collected at 28 grade crossings throughout central Florida. The research team determined, after much analysis (including a detailed comparison to the rod and staff leveling data), that the profilometer must be properly configured and further studied to yield a true ground elevation data. Alternative, less cost-effective methods of obtaining ground elevations were identified and utilized to collect some profile data.

Some basic geometric design criteria for highway railroad grade crossings were developed, along with a methodology for evaluating highway railroad grade crossings, which includes vertical crest and sag curves that can be used to prevent the hang-up of low clearance vehicles (based on the required approach tangents and the existing slope of the railway tracks plane).

Recommended changes to existing FDOT design guidelines are presented in the final report, along with the a new comprehensive profile documentation form that inspectors can use when performing field evaluations of grade crossings for the potential of vehicle hang-up. The research team developed a comprehensive computer software program and user's manual to serve as design and rehabilitation aids. Microsoft Excel Tools for performing simple hang-up evaluations were also developed.

An overall review of hump crossings in Florida indicated that that many of the critical crossings, in terms of potential hang-up by low clearance vehicles, are located near roadway intersections or a roadway curve and showed evidence of some rail maintenance resulting in asphalt buildup on the tracks.

Finally, researchers demonstrated the use of Geographic Information System (GIS) technology for network routing along roadways with grade crossings. This approach would rate crossings for hang-up potential and could also consider other roadway attributes such as the time and distance of travel.

BENEFITS

The major benefit of this study is that it will contribute to improved safety for both vehicles and trains at highway-grade crossings. Researchers developed aids for improving design and rehabilitation methodologies, in addition to simple computer tools for both office and field personnel to use to evaluate the potential of hang-up by low clearance vehicles.

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