



INDOT Research

# TECHNICAL *Summary*

Technology Transfer and Project Implementation Information

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Final Report

## CLASSIFICATION OF RAILROAD CROSSINGS IN INDIANA BY ROUGHNESS

### Introduction

One of the primary goals of the Indiana Department of Transportation (INDOT) has always been to provide its' users with a quality product, namely smooth, safe, durable roads. One of the characteristics measured to determine the quality of the Department's product is 'roughness'. Roughness is, in its' simplest definition, the measure of the traveling public's comfort for a defined section of road. It is measured in units of inches/mile (mm/km) and is evaluated using the International Roughness Index (IRI). By using the IRI to measure the roughness characteristics of a road surface, one is able to quantitatively compare and contrast various roads to assist in determining; repair strategies and priorities, and pavement performance over time.

To accurately determine a repair strategy, or pavement performance, the section of interest must first be defined. The way a section of road is currently defined is by the contract number most recently associated with its' configuration of materials and construction. The boundaries of the defined section are then stated using INDOT's 'Reference Post System'.

This method of defining a section of road works well for referencing various data by giving the user of the data the ability to physically locate, and identify the specific area where the data was collected.

Unfortunately, since the data is evaluated at the 'contract level', some features of a section of road are omitted when roughness data is analyzed, and thereby are not included in the overall results. The data necessary for calculating the roughness of these features is collected at the same time as the rest of the section, but it is omitted from the rest of the data when analyzed. Bridge decks, intersections, under-passes, and railroad crossings are all examples of features that are omitted when analyzing roughness data because they are not a part of the contract being evaluated.

Even though these features are omitted from the overall analysis of roughness for a specified section of road, they still contribute to general public's perception of roughness for that section of road.

### Findings

This report has shown the work that was performed in trying to develop a rating scale (RCI) for determining acceptable, and unacceptable, levels of roughness associated with railroad-highway grade crossings. This report has also shown the reasons why this study failed to produce the desired results. The following is a summary of the reasons why the study failed:

- The "Sensor Footprint", generated by the receiver-averaging board in the opticator's laser control box, averages a number of height readings together to generate one output value. By doing this, the receiver-averaging card attenuates fine details and sudden changes in height that are important in trying to locate railroad-highway grade crossings. This makes the rail-gap and gauge-spacing characteristics very difficult to locate with an acceptable degree of

confidence. This problem is compounded by the fact that since the opticators operate at a fixed frequency, the size of the sensor footprint varies with the speed of the profiler.

- The “Sample Interval” of the department’s profiler is too large to achieve the resolution necessary for identifying characteristics like the rail-gap and gauge-spacing. By not being able to collect data points at a closer interval, details necessary to identify a crossing could not be positively located in the data. This problem is compounded when the timing relationship between the output of the receiver-averaging card and the external-trigger pulse from the speed and mileage pulser is examined. Since these two signals are not synchronized, there is no guarantee that data from the receiver-averaging card will contain data from the areas of interest

(i.e. rail-gap, and gauge-spacing) or not, nor how many of the 64 averaged readings will be from the area of interest.

- Due to the geometry associated with the construction of railroad-highway grade crossings, the roughness of the crossing itself is nearly impossible to distinguish from the roughness of the approaches. For this reason, it is unlikely that data collected from any current profiler would be able to provide results sufficient enough to generate a rating scale based on this technology.

It is for these reasons that the department’s profiler was inadequate for use in this study, and also why the railroad-highway grade crossings were either located incorrectly or not at all.

## Implementation

As a result of this project failing to achieve its’ original goals, it should be noted that via a copy of this report to the Program Development Division of INDOT, who requested the study, and Mike Scime, manager of the Railroad section of the Multi-Modal

Transportation Division, that it is unlikely that railroad-highway grade crossings can be accurately found and rated using the Department’s profiler and the methodologies utilized in this study.

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