ASSESSMENT OF PUBLIC PERCEIVED ROADWAY SMOOTHNESS

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ABSTRACT: International Roughness Index (IRI) has been widely used by state DOTs to quantify pavement smoothness. When pavement condition falls below certain IRI thresholds, corresponding pavement maintenance treatments should be considered for application. Selection of appropriate IRI thresholds is essential to tactical allocation of limited resources to improve the conditions of states' roadway systems. This selection process is often challenging, however, because IRI thresholds are largely determined by Perceived Ride Quality (PRQ), and PRQ differs in each state. In this paper, a framework is proposed to address this problem. Passenger raters will be randomly selected from predetermined geographic locations, and their PRQ ratings collected. Taking this perceived ride data, along with other data collected, a statistical analysis will be conducted to establish the relationship between measured IRI values and PRQ. Appropriate IRI thresholds will then be determined. Once this framework is implemented, state DOTs could make informative maintenance decisions, which are expected to greatly enhance the public perception of pavement conditions in today's challenging economy.

Keywords: International Roughness Index (IRI); Perceived Ride Quality (PRQ); Pavement; Smoothness

1. INTRODUCTION

In today's budget constrained environment, state Department of Transportation (DOT's) use IRI as one metric to determine candidate roadways for rehabilitation combined with PRQ. IRI values range from 0 inches per mile to several hundred. The majority of public roadways typically have values between 0 and 200 inches per mile. IRI is calculated using pavement elevation data, typically acquired by inertial profilers. This measurement is typically obtained during state DOT annual pavement surveys. This recently measured IRI combined with other pavement condition indicators are analyzed and used to identify maintenance treatments.

2. LITERATURE REVIEW

In 1999, Fernando and Lee studied the relationship between ride quality and IRI [1]. The results indicated that the speed, pavement type, vehicle type, and individual evaluators were significant factors; however the evaluators were not randomly selected.

In a 2002 study completed by Shafizadeh and Mannering [2] investigated individual-specific, pavement-specific, and vehicle-specific data, and developed a probit model to link users' roughness rankings to measured IRI values and other factors on urban highways. This study has several limitations. Public participants were selected from the traffic stream close to the University of Washington campus and thus might not represent the typical roadway users. Only "smooth" roadway sections were studied; including "poor" pavements might provide more useful results.

A recent study [3] was conducted to assist the Minnesota Department of Transportation (MN/DOT) develop an implementable specification for the use of the International Roughness Index (IRI) for smoothness incentives and disincentives on Portland Cement Concrete (PCC) Pavements." In this study the researcher did not use participants to identify if the roadway was smooth versus rough. The relationship between perceived ride quality and measured IRI was not investigated; instead the study focused on why IRI is currently a better roughness indicator than Profilograph Index.
water status monitoring, and energy management services.

3. PLANNING AND DESIGN

This proposed study includes several steps, as illustrated in Figure 1.

First, a group of research participants will be randomly selected from several counties in a state. The counties and participants should be carefully chosen to ensure a geographic and demographic balance. Roadway sections will be selected based on differing speed limits and smoothness. Ideally, these participants are familiar with the predetermined roadways. Research participants will ride in a vehicle as passenger raters and provide their

perception of roadway smoothness. Once the PRQ data is collected for each roadway, the measured IRI ratings will be collected by the state DOT.

In addition, pavement conditions will be collected in order to complete a categorical data analysis. These techniques will be used to develop either logit or probit regression models.

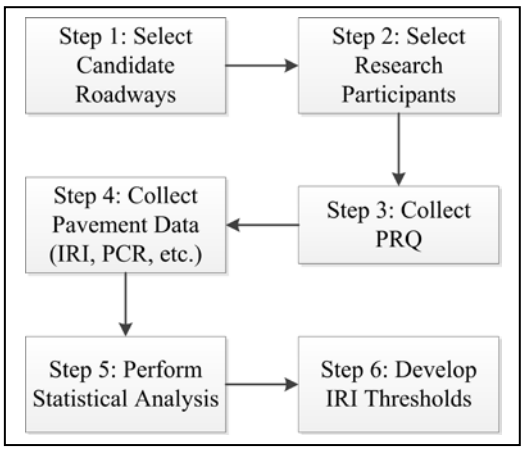

Figure 1: Research Flow Chart

4. EXPECTED RESULTS

Expected results from this study include:

- A statistical model that represents the relationship between ride quality and measured IRI
- Appropriate thresholds for state DOT's that are used to trigger the rehabilitation of certain roadways.

Each state DOT can take the locally calibrated IRI thresholds and assign appropriate treatments to each specified roadway in the state it is located, while also optimizing pavement design. Along with this threshold, each state can use the relationship between the initial IRI and failure IRI to determine if this is an acceptable criterion for its particular state.

5. CONCLUSIONS

In summary, the researchers will be completing a number of objectives that correspond with the relationship between perceived ride quality of the public and measured IRI. There have been many case studies that indicate a close relationship, however, these studies appear to have constraints that have caused the data to be somewhat biased. This proposed study can effectively address these limitations. The researchers plan to collect all the appropriate data, complete a statistical analysis on the data including other factors, meanwhile keeping it complete unbiased, or as unbiased as possible. The significance of this study revolves around helping state DOT's determine the perceptions of the ride quality from the public and relate them with recently measured IRI values. This will allow for proper allocating of funding for the DOT's.

The following are recommendations that can be used for future research;

- Keep the selection of participants close to the roadway in question but have a variety of age ranging from 20 to 65 years old.
- Keep the participants to equal numbers of men and women.
- The survey itself needs to be written in a way that does not lead the participants in any direction and requires the participants to choose one side or the other, smooth or rough.
- It would ideal if the participants come from households that have a variety of income and professions but this is not a strong factor in this study.
- Keep the vehicles being used in the study as the same year, make and model with very similar mileage on them.
- Complete the study while in the same season, summer, fall, winter or spring.

REFERENCES

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