I. TITLE

16-026 Exploiting Smartphone Data to Calibrate Bicycle Level of Traffic Stress and LOS Measures for Oregon

II. PROBLEM

There is a great body of knowledge and practice to measure motorized vehicle level of service (LOS). The Highway Capacity Manual (HCM) LOS methodology for motorized traffic is ubiquitous and widely accepted. The same cannot be said about bicycle LOS. Up to now, there are seven different methods, with various degrees of sophistication, that use the term Bicycle LOS or “BLOS”; however, the variables employed and the score estimation methods can vary significantly (1). The most widely accepted BLOS is the HCM BLOS; this method was developed utilizing video from Florida road and bicycle facilities. Clearly, the HCM BLOS method has some limitations because rating a facility based on a video is quite different than rating a facility that a rider actually rides. In addition, important variables such as trip purpose, trip frequency, rider socio-demographic data or cycling preferences are not taken into account. Furthermore, Florida’s facilities and users are not similar to Oregon’s facilities and users.

Some research suggests that utilizing “Levels of Traffic Stress” (LTS) measures and thinking about bicycle rider types can be more relevant for bicycle infrastructure evaluation and planning than BLOS methods. LTS methodologies are intuitive and relatively easy to implement with limited data but they have not been validated and calibrated with actual (revealed) bicycle rider data. ODOT has recently adapted one of the existing LTS methods for the new edition of the Analysis Procedures Manual (APM). One goal of this research is to employ real world bicycle route and rider data (collected using a smartphone app) to validate and calibrate ODOT’s LTS method.

The current ODOT SPR 768 project, “Evaluating the Use of Crowdsourcing as a Data Collection Method for Bicycle Performance Measures and Identification of Facility Improvement Needs” has developed a smartphone app called ORcycle [1]. ORcycle lets users record cycling trips, provide feedback regarding crashes, safety, or infrastructure issues, identify specific locations of concern on their route (uploading photographs or descriptions of the problems), and display maps of their rides. ORcycle is a platform that provides a unique data set that includes not only the GPS based location of users’ cycling routes, but also crash data (including near-misses), safety issues, and challenging locations as reported by the users. In addition data includes user socio-demographic data, biking preferences and attitudes, and rider comfort level after riding each recorded real-world route.

The ORcycle app can be downloaded from Google Play (android) or Apple’s App Store (iOS for iPhones); see the app website [http://www.pdx.edu/transportation-lab/orcycle](http://www.pdx.edu/transportation-lab/orcycle). In one week of data collection (Nov. 7 to Nov. 14), ORcycle has already gathered data from more than 200 users. This shows not only the potential of this smartphone app to collect data that otherwise is nearly impossible to collect but also the interest of riders to participate and provide feedback. Before ORcycle there was no practical and systematic way to collect high quality cycling data.

The goal of this research is to take advantage of the work, expertise, and unique revealed route and route comfort dataset begun in ODOT SPR 768 to validate and calibrate bicycle LOS and LTS measurements to Oregon riders and conditions. The questions included in ORcycle app were designed for this purpose.

This proposal responds to RAC priorities “Enhance transportation safety”, “Enhance mobility and/or access for citizens of Oregon” as well as Active and Sustainable Transportation ETG priorities: “1. Impact of land use and intermodal connectivity choices on safety and accessibility at the interface of transportation modes, especially impacts on bicycles and pedestrians”
and “4. Development of new technologies and integrated multimodal data warehouses for research and planning use, including new solutions to address gaps in bike/ped data”. This proposal also responds to Planning and Economic Analysis ETG categories “Plan and Policy Development” and “Project Selection”.

III. PROPOSED RESEARCH, DEVELOPMENT, OR TECHNICAL TRANSFER ACTIVITY

This research will develop a methodology to validate and calibrate LTS and BLOS measures for Oregon. The research will analyze data collected utilizing the ORcycle app to understand riders’ preferences based on:

- Crash severity or near-miss locations reported by participants along a route and alternative routes,
- Rider demographic data such as gender, age, and employment status,
- Rider biking attitude including car and bicycle ownership, riding, frequency and level of experience,
- Trip related data such as route length, trip duration, speed profile, and topography,
- Land use and environment (urban, suburban, rural, or mixed),
- Trip purpose and time of day/day of the week, and
- Rider user group, self-identified from level of comfort ratings and chosen route.

There are a few studies about bicycle route choice, but these studies have been conducted mostly in large urban areas and without including feedback from riders regarding safety problems and crash or near-miss locations. A goal of this research is also to identify the factors affecting LTS, rider comfort, and route choice in suburban or rural environments and as a function of rider socio-demographic data, route characteristics, and biking preferences.

IV. POTENTIAL BENEFITS

There are numerous potential additional benefits for ODOT from the proposed research. The combination of smartphones and crowdsourcing is the most cost effective and accurate bicycle usage data collection method. User data and LTS measurements can also identify the need for safety improvements before serious accidents take place or identify the need for multimodal and network connectivity improvements and help with project prioritization. The data gathered will also be useful to complement existing and future bicycle count data efforts and modeling in both urban and rural areas. This research can also support other multi-modal research such as the Travel Cost Index accessibility measure (ODOT SPR 760, [2]). Promoting cycling is also an effective way to reduce transportation carbon emissions by eliminating motorized vehicle trips.

This research will also help understand how bicycling behavior varies across the state. Bicycling behavior can be analyzed in rural, suburban and urban environments based on users’ revealed preferences, facility type, topography, presence of bicycle lanes, bicycle route designations, trip purpose, and collected demographic data. This research will facilitate the implementation of multimodal performance measures aligned with the Oregon Transportation Plan and inform the bicycle planning process.

V. IMPLEMENTATION

The results of this research can be directly employed to validate and calibrate bicycle LTS methods contained in the Analysis Procedures Manual (APM). Maps and the analysis of routes and riders’ preferences can be utilized to inform the development and implementation of ODOT’s Bicycle and Pedestrian Plan and identify investment priorities to improve network connectivity, maintenance needs, and unsafe locations. The Transportation Planning and Analysis Unit will be able to incorporate the collected data to their bicycle planning program and meet recommendations from ODOT’s bicycle data working group. The analysis of routes and trip purpose, time of day/week data will be also useful for ODOT’s traffic monitoring staff and to guide bicycle data collection programs.

VI. LIST OF REFERENCES

1. SPR 768 project, “Evaluating the Use of Crowdsourcing as a Data Collection Method for Bicycle Performance Measures and Identification of Facility Improvement Needs”, TASKS 1 to 3 Report.
2. SPR 760 project, “Multi-Modal Performance Measures In Oregon: Developing a Transportation Cost Index Based Upon Multi-Modal Network and Land Use Information”

VII. CONTACT INFORMATION

Your name: M. Figliozzi
Affiliation: Portland State University
Telephone: 503-725-2836
Email: figliozzi@pdx.edu

Person Responsible for Implementation: Brian Dunn
Affiliation: ODOT - TPAU
Telephone: 503-986-4103