Predicting cyclists' perception of safety and comfort using ordinal logit regression modelling

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Keywords: Perception, Bicycle Comfort and Safety Prediction Model, Instrumented Probe Bicycle, Ordinal Logit Regression Model

1 INTRODUCTION

Increasing cycling offers significant advantages for public health, the economy and the environment. The health benefits of cycling outweigh the negative health impacts (including crash-related injuries and increased exposure to air pollution) by about 19 times [1], and increased cycling can help slow climate change [2]. The total economic cost per km for cycling has been shown to be 6 times less than the cost for driving [3] and the economic benefits of cycle networks are estimated to be at least 4-5 times the investment cost, making cycling one of the most beneficial transport modes to society [4].

Cyclists may consider many stress-related factors when choosing whether or not to cycle. The most crucial factors include the perceived safety and comfort of the cyclist's cycling experience. It can be difficult to quantify these human perceptions. Consequently, determining the expected desirability of cycling infrastructure can be challenging. The cycling experience comprises of the cycling environment, infrastructure, weather conditions, and vehicular traffic conditions. This paper outlines the construction of a Bicycle Comfort and Safety Prediction Model (BCSPM) using ordinal logit regression. BCSPMs will reliably predict a cyclists' perceived safety and comfort on a given segment of road. Such BCPSMs can be used to evaluate, design and manage planned and existing bicycle infrastructure by bringing improved understanding in the likely use of bicycle facilities, and improved decision making in the investment of public funds.

Data used to build the BCSPMs was collected from conducting experiments utilizing an Instrumented Probe Bicycle (IPB). The IPB was developed by the Sustainable Transportation Safety (STS) research laboratory at UBC using previous research around the globe[5][6][7]. The IPB collected time-stamped, position, velocity, and acceleration data for the cyclist during the bicycle ride. In addition, the IPB also collected data regarding adjacent vehicular traffic which included traffic volume, vehicle passing speed, vehicle lateral passing distance, and vehicle size. Go Pro Hero 3 cameras were mounted on the IPB to record footage of the cyclist and the road in front. The cyclists indicated their perceived level of safety and comfort as well as demographic information within questionnaires completed during the experiment.

The experiments were conducted over the summer of 2016 in Kelowna, British Columbia. 108 individual cyclists each rode between three and four road segments. Each road segment was selected to provide a vastly different cycling experience. Differences between cyclist perception due to personal preferences and experience is addressed using cyclist typology developed by Damant-Sirois [8]. Research results are compared with previous research findings by Winters who assembled a collection of motivators and deterrents for cycling [9], and research by Hood who developed a route choice model using data collected from bike share program in San Francisco [10].

1.1 References

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