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Evaluating Cyclist Ride Quality on Different Bicycle Streets

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Extended Abstract

Introduction

Traffic problems are a major concern in many cities worldwide, leading to congestion, long commute times, air pollution, and road accidents. To address these issues, cities are implementing solutions such as better public transport, new roads, and alternative modes of transportation to solve these problems. Cycling is widely used as sustainable means of transportation and is a crucial component of any urban mobility strategy. It also helps reduce traffic congestion, improve air quality, lower carbon emissions, and lead to more liveable and sustainable cities. Worldwide, the number of cyclists is rising in many cities and countries, i.e., E.U. countries and some regions of the USA and Canada. Cycling should be prioritized alongside other active means of transportation to develop attractive, pleasant, secure, and healthy communities.

Governments can encourage more people to take cycling as a regular mode of transportation in cities by providing safe and convenient infrastructure, financial incentives, and promoting a positive culture and attitude towards cycling. However, psychological factors, location, employer, income, safety, comfort, ride quality along bicycle paths etc., affect whether people use bicycles. Pavement conditions, bicycle safety, and ride quality are increasingly important for cyclists and city planners. It is well-recognized that pavement surface profile characteristics, such as roughness, texture, and deflection, influence the ride quality of motor vehicles. Given the similarities between the physical interactions between a bicycle and a road surface, it is predicted that pavement surface profile characteristics also significantly affect the quality of a bicycle ride. In addition, Researchers argue that inadequately maintained bicycle paths, such as rough or uneven surfaces, can cause bikers discomfort, fatigue, and reduced ride quality for cyclists. As a result, there is a decreased possibility that they will use their bicycles as a means of transportation. Therefore, bike lanes and roads designated explicitly for cyclists should be flat and smooth, forcing the cyclist to exert the least effort possible. In addition, other factors such as environmental and land use and road geometry can also impact the bicyclist ride quality along the paths and streets,

Various methods have been used to assess the bicycle environment, such as the Dynamic Comfort Index (DCI), Pavement Condition Index (PCI), and the International Roughness Index (IRI). These indices account for frequent and dynamic acceleration readings, which are crucial in establishing the comfort level of a road surface. Because in some cases, the subjective measures used in combination with PCI, DCI, and IRI, such as rider perception, may be affected by individual differences and biases. For example, a rider may have a higher tolerance for roughness and discomfort, which may skew the results. This study developed regression models that demonstrate a correlation between various factors subjectively assessed for the ride quality of bicyclists.

Methodology

The study is conducted in Hasselt, Belgium, a city in the province of Limburg. With a population of around 75,000, Hasselt is the perfect location to conduct this study and evaluate the ride quality of cyclists. Hasselt is a small city with a high percentage of bicycle share as a mode of transport. Second, Hasselt is considered a bikeable city with a well-developed bicycle infrastructure that includes a variety of pavement types, such as asphalt, concrete, cobblestone, and paving slabs. This variety of pavement types meets the study's objective to evaluate the ride quality for cyclists on different types of streets. Questionnaires were used to collect bicyclists' perception data. Twenty cyclists were recruited to participate in the study for data collection.

The ride quality on a bicycle path varies among bicyclists and is subjective. To evaluate the ride quality of each pavement segment, 20 volunteers completed a questionnaire and provided a rating for variables and overall ride quality experienced after the ride was completed. The Cronbach's test was used to determine whether the responses provided in the questionnaires could be relied upon. Cronbach's alpha coefficient of more than 0.7 indicates

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consistency, indicating that the questionnaire's responses are consistent. A high level of dependability also implies that the study's findings are likely to be robust and reliable, providing confidence in the data's conclusions.

Results

Twenty participants took part in the study, thirteen male and seven female. The age range of participants was between 18 and 54 years, with the majority falling into the 25-34 age group. 20% of the respondents are from the 35-44 age group, and 5% of the sample population is in the 45-54 age group. Half of the participants have a Bachelor's degree, with Master's degrees being the second most common level of education. The most common response for weekly cycling frequency was 3 and 5 times per week (25%). 30% of the participants reported cycling a distance of 2-5 km per day

An evaluation was done to see the level of ride quality experienced by volunteers in connection to variables. Bicycle path scenery, bicycle path geometry, and pavement positively correlated with bicyclist overall ride quality (r=0.326, r=0.375, and r=0.687). The Pearson correlation analysis showed that vibration was the most critical factor affecting cyclists' ride quality, followed by pavement type of bicycle paths. In contrast, vibration has a strong negative (r=-0.746) correlation. The correlation shows that vibration is the most critical factor affecting cyclists' ride quality, followed by pavement type of bicycle paths. However, bicycle path scenery and geometry were seen as having a smaller impact on cyclists' ride quality.

Tukey's HSD test was conducted to compare bicyclists' ride quality among different bicycle street pavement types. The test revealed a statistically significant difference between pavement types. Asphalt provides a better overall ride quality than concrete. The mean difference in ride quality between concrete and small paving slabs was insignificant. However, the mean difference between concrete and paving slabs (p =.037) and between concrete and cobblestone (p .001) was significant, with concrete having a lower ride quality in both instances.

A multiple linear regression model was used to predict the dependent variable overall ride quality along the bicycle path based on the four independent variables (vibration on the street, Scenery along bicycle path/streets, bicycle path geometry, and type of pavement material). The model appears to have a satisfactory fit, according to the adjusted R-squared value of 0.59. The beta value of -0.525 indicates that increased vibration on the street correlates with a decline in overall bicycle ride quality. In contrast, bicycle infrastructure pavement type has a beta of 0.203, indicating that higher ratings for infrastructure types are linked to higher average ride quality.

Conclusion

This research aimed to evaluate bicycle ride quality on various bicycle streets. Twenty volunteers completed a questionnaire and rated factors and ride quality after they completed the ride. The Cronbach's Alpha value was 0.791, so the questionnaire responses are reliable. Volunteers' ride quality was assessed based on questionnaire data, including Scenery, vibration on riding streets, road/bicycle path geometry, and pavement type. This study conducted a preliminary investigation of the link between the ride quality of cycling and factors such as vibration, the Scenery along the bicycle route, the kind of bicycle pavement, and the geometry of the bicycle path.

Scenery, geometry, and pavement positively correlate with ride quality (r=0.326, 0.375, and 0.687). Vibration is strongly and negatively correlated (r=-0.746). A multiple linear regression model was built to estimate overall ride quality. Based on the Cronbach alpha test, the findings are considered accurate, but there is space for improvement in the findings' accuracy and representativeness. The model can be improved by adding more variables. Also, the number of volunteers who participated in the tests to determine their perceptions of the ride quality was relatively low. In addition, we chose four variables for the multiple linear regression model; nevertheless, other variables can influence the overall ride quality of a bicyclist on a specific route, and the model can be improved by adding more variables.

Keywords: ride quality; perception of bicyclists; bicycle planning