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Review Paper: The Bicycle Compatibility Index and Bicycle Level of Service Concept for Urban Street

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ABSTACT

Bicycle level of service (BLOS) methodologies has been developed for suburban, urban, and rural road segments. The utilitarian bicyclist today requires access to suburban, urban, and rural environments in order to safely travel between home and work. This study uses qualitative analysis to develop a methodology for determining BLOS and the Bicycle Compatibility Index (BCI) to complement BLOS methodologies that include mental stressors along road segments. Qualitative analysis is concerned with real-time human perceptions, such as bicyclist's level of satisfaction while riding down the road. A survey of bicyclists is used to determine their level of satisfaction or the road's compatibility with bicyclists. Bicyclists are asked questions about safety, visibility, and convenience. A large number of bicyclists are polled, and their responses are recorded in the form of ratings. These ratings can be graphically represented to give a clear picture of bicyclist satisfaction with road compatibility. The inverse variance method is used to calculate BCI, and then BLOS is determined, ranging from BLOS-A to BLOS-F. Though qualitative and quantitative analysis collects different types of data, the results of both will be very different. The BCI determines which intersection approaches in a jurisdiction are most in need of bicycle safety improvements. The model can be used to evaluate existing roads, redesign existing roads or design new roads and it allows traffic planners and others to rate roadways based on how satisfied bicyclists are.

Keywords: Bicycle level of service, Bicycle Compatibility Index, Bicycle Lane,

INTRODUCTION

Engineers, planners, and bicycle coordinators currently have no widely accepted methodology for determining how compatible a roadway is for efficient operation of both bicycles and motor vehicles. The first step in determining a roadway's bicycle compatibility is to determine how existing traffic operations and geometric conditions influence a bicyclist's decision to use or not use it. The BCI methodology was created for urban and suburban roadway segments (i.e., midblock locations outside of major intersections) and included the variables that bicyclists use to assess a roadway's "bicycle friendliness" (e.g. curb lane width, traffic volume, and vehicle speed). The BCI model and the subsequent Bicycle level of service (BLOS) designations enable practitioners to assess their roadways for compatibility with shared use operations by motorists and bicyclists, as well as plan for and design bicycle friendly roadways. The BCI model is used for the application: Operational Assessment - Existing roadways are assessed using the BCI model to determine the amount of bicycle LOS on all segments. These types of assessment are beneficial in a number of ways. First, a bicycle compatibility map for bicyclists can be created to show the LOS they can expect on each roadway segment. Second, road segments or "links" that are being considered for inclusion in the bicycle network system are evaluated to see which ones are the most bike-friendly. Refer to the companion document for more information on the models research and development. The Bicycle Compatibility Index was created as a Bicycle level of service concept. Bicyclist's perspectives were obtained by having them participate in the development of the BCI.

LITERATURE REVIEW

Khashayar Kazemzadeh et al. (2020), the goal of this study was to provide guidance to decision-makers and planners by focusing on user perceptions of comfort. The investigation of segments and nodes was followed by a network analysis. Aside from these studies, a variety of variables have been used to depict users' perspectives within the BLOS field, as well as other cycling research domains that have looked into user preferences at the same time. This review looks at the variables and indices used in the BLOS area in relation to bicycle flow and comfort research. Despite widespread agreement among existing BLOS variables and indices, there are still a number of significant research gaps.

Michael Hardinghaus et al. (2020), in this paper providing a suitable route environment is critical for ensuring fair and safe cycling, as well as encouraging cycling as a sustainable mode of transportation. At the same time, a better understanding of cyclists' preferences for route features and infrastructure requirements is critical for evaluating current infrastructure improvements or the development of new infrastructure. The research has two goals. The first is to use a choice experiment based on a stated preference survey to look into cyclists' route preferences. The second goal is to compare cyclist preferences in two countries with very different cycling cultures. Multinomial mixed logic discrete choice models were developed within the context of statistical analyses, allowing us to quantify the trade-offs of interest while distinguishing between the preferences of different user groups.

Sambit Kumar Beura et al. (2018), in this study model the correlation coefficient between the actual and predicted perceived ratings was extremely high (i.e., 0.93 and 0.92 in the training and testing phases, respectively). Garson's algorithm and connection-weight approaches were used to discover that the effective width of the outermost lane has the greatest impact on urban street BLOS. The BLOS criteria are divided into six groups (A–F) based on their importance using the self-organizing map in the artificial neural network cluster technique (excellent–worst). The majority of the studied segments are found to be providing average to poor services in their current state. As a result, in order to achieve better service levels efficiently, the influencing variables should be heavily prioritized in the planning process.

Diana C. Parra et al. (2018), the goal of this exploratory study was to determine the distribution and distance to the city network of bicycle lanes by neighborhood SES in flat terrain urban blocks. We carried out a spatial analysis. Secondary data from geographic information systems was used to conduct an ecological analysis from government databases. We calculated the shortest route between the centroids of each urban neighborhood block and the nearest bicycle lane network access point. The median distance from the urban block centroids to the bicycle lane network was 444 meters. The results show a wide variation in bicycle lane distribution by SES, especially in the most disadvantaged areas. Expanding the number of bike lanes in a more equitable way could help to improve cycling conditions. The creation of a network of bicycle lanes for people who live in underserved areas.

N. Kiran Kumar et al. (2017), this research has attempted to model the level of service provided to cyclists through movement at urban signalized intersections with a mix of traffic. A large number of quantitative attributes (geometric, traffic, and built-environmental) are gathered from 35 different sources. Four Indian mid-sized cities' intersection approaches are thoroughly examined from the perspective of a bicyclist. Satisfaction levels of approximately 160 cyclists on an extensive perception survey are used to evaluate each intersection approach.

S.N. DucNghiem et al. (2016), the researchers developed a model to predict cyclists' preferences for on-street (curb, traffic lane, and bike lane (BL)) versus off-street facilities (sidewalks). The Bayesian Model Averaging method was used to select the best model. It was then put through internal and external checks. Apart from the aforementioned factors, bike facility choice was found to be significantly influenced by the width of traffic lanes, the presence of a real-time stopping vehicle, the type of bike, the presence of a bus stop, and in-group cycling. After weighing their relative importance, the presence of a bus stop, effective sidewalk width, and the type of bike were identified as potential predictors. In addition, if one exists, a framework for predicting BL usage was created. The application's predictive performance was put to the test in the real world. By comparing predicted and actual BL usage figures, the analysis demonstrated good predictive performance. This study's findings can help developers, planners, and designers make better investment decisions and design better bike facilities.

LaMondia and Duthie (2012), in these researchers studied the effects of the roadway environment, motorist, and bicyclist activities on bicyclist or motorist interactions using video footage of traffic movements during peak commuting hours at four locations in Austin, Texas. The authors used three different ordered probity regression models to describe bicyclist lateral location, bicyclist or motorist interaction movement, and bicyclist or motorist distance, taking into account the 22 interactions.

Giulio Dondi et al. (2011), in this study the researcher can blend in with traffic flow while taking up less space than other vehicles due to their small size and low cost. Cyclists, on the other hand, are among the road users who are most vulnerable. As a result, creating safe infrastructure for all modes of transportation, including cyclists, becomes a top priority. The use of a Context Sensitive Design approach can help you achieve these goals. In fact, a project or an existing road can be examined in this way, with crash potential and safety performances reported, as well as flaws detected, while taking into account the communities and lands it passes through. The authors of this paper start at the beginning and work their way to the end. Designers, builders, and maintenance crews can benefit from the data collected on a bike lane in Rimini.

Ann Forsyth & Kevinkrizeek (2011), this paper compares the characteristics of cyclists to those of pedestrians and motorists, based on a review of international literature and practice, and finds that cyclists have a significant number of advantages. The paper provides a framework and central considerations for cycling-oriented urban design by focusing on four issues: community layout, cycling facilities, analysis and design processes, and detailed design. It concludes with a plea to consider cycling's experience in urban planning. This entails going beyond a concern for safe and convenient facilities and comprehensive networks to a larger interest in the view of the environment through the eyes of a cyclist.

Harkey et al. (1998), in these paper midblock locations on urban and suburban roadways, a Bicycle Compatibility Index (BCI) have been developed. The BCI was created by bicyclists watching a videotape of various roadway segments and rating how comfortable they would feel riding on each segment.

CONCLUSIONS

1. The BLOS model, which has been calibrated for the Indian context, has lower coefficient values for values A to F with highest value at A and lowest at F.
2. The number of motorized vehicles, vehicle speed, and the percentage of heavy vehicles all have a negative impact on bicycle LOS, while the width of the outside through lane and pavement condition rating have a positive impact.
3. The lack of a separate bicycle lane and highly heterogeneous traffic flow on urban road corridors with varying geometry in contribute to poor service quality.
4. Use of bicycles and bicycle lanes can improve sustainable ways of moving in cities.
5. Bicycles can be considered as a climate friendly mode of transport, as it concerns sustainability as well as people health.
6. The findings shows that bicycle lane in city will reduce bicycle crash risk which is a major problem in India as well as other developing and developed nations.
7. Creating a dedicated bicycle lane in and around the region to improve satisfaction with utilitarian cycling.

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