International Journal of Research
Available at https://edupediapublications.org/journals
e-ISSN: 2348-6848
p-ISSN: 2348-795X
Volume 05 Issue 12
April 2018

Estimation of Bicycle Los For Indian Roads

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Abstract

Bicycle levels of service (BLOS) methodologies have been developed for suburban and urban as well as for rural road segments. Although, today, the utilitarian bicyclist requires access to suburban, urban, and rural environments to safely travel between home and work. In order to complement BLOS methodologies which incorporate mental stressors along road segments, this study develops a methodology by which BLOS and Bicycle compatibility Index (BCI) can be found out by qualitative analysis.

Qualitative analysis deals with real-time human perceptions taking into account the satisfaction level of bicyclists while riding along a road. The satisfaction level of the bicyclist or the compatibility of the road for bicyclists is derived from a survey where bicyclist are asked questions based on their perception about safely, visibility and convenience. The survey is conducted on numerous bicyclists and their view are taken down in the form of ratings. These rating can be represented in a graphical form so as to give a clear picture of satisfaction level of bicyclists with respect to the road compatibility. BCI is computed using inverse variance method and finally BLOS, ranging from LOS-A to LOS-F, is found out.

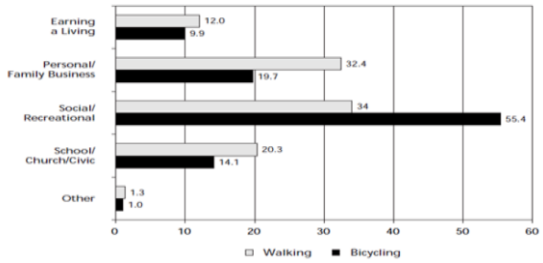
Qualitative analysis though differs from quantitative analysis in terms of its surveyed data, the result of both will differ to a much extent. The BCI identifies which intersection approaches have the maximum priority for bicycle safety improvements within a particular jurisdiction. The model provides traffic planners and others the capability to rate roadways with respect to bicyclists' level of satisfaction, and can be used in the process of evaluating existing roads, redesigning existing roads or designing new roads.

Introduction

Bicycling is a fundamental form of transportation that is at times overlooked in this age of high-tech motorized travel. Higher levels of bicycle based transportation would eventually result in significant benefits in terms of the environment, health and physical fitness and transportation-related effects.

To develop roadways for shared use by the two modes of transportation i.e. bicycle and motor vehicles, one must begin by evaluating existing roadways and determine what can be considered user-friendly from the perspective of a bicyclist. Currently, there is

no methodology that can be widely accepted by planners, engineers or bicycle coordinators that will allow them to determine how much compatible a roadway can be for allowing efficient accommodation of bicycles and motor vehicles together. Determination of how existing traffic operations and geometric conditions affect a bicyclist's decision whether to use or not use a specific roadway is the first step in determination of the bicycle compatibility of that roadway.



Walking and Bicycle trips by purpose

Objective

The main objective of this thesis is to develop a methodology for deriving a bicycle compatibility index (BCI) that could be easily used by traffic engineers, bicycle coordinators, transportation planners, and others to evaluate the capability of specific roadways to accommodate both modes of transport i.e. bicyclists and motor vehicular traffic in urban areas.

A BCI can be determined using a combination of pictures and video, and surveys of bicyclists of different abilities. It gives the advantage of surveying multiple bicyclists at once, irrespective of weather and is much less time consuming than inventorying entire corridors, highways or regions. Video capture can be quickly executed and preserved for a long time before performing a survey and eventually analyzing.

Level of Service

The Highway Capacity Manual has defined levels of service (LOS) as "qualitative measures that characterize operational conditions within a traffic stream and their perception by motorists and passengers." LOS (designated as A through F, with LOS F being the least desirable) includes speed, travel time, freedom to manoeuvre, interruptions in traffic, comfort and convenience. The LOS concept was introduced to qualify the characteristics associated with various levels of vehicles and people passing a given point during specified time periods. Hence, LOS has been a qualifier of conditions relating to vehicle or person throughout rather than a qualifier of conditions relating to individual comfort level.

The Bicycle LOS Model is like a "supply-side" criterion. It is an evaluation of safety as perceived by bicyclists with respect to the motor vehicle traffic. Bicycle level of service can be defined as the assessment of the suitability of a road segment to accommodate motor vehicle and bicycle traffic safely. Nowadays, methodologies to assess bicycle level of service do so by the perceived comfort report on specific road segments by cyclists. Assessment metrics of cyclist comfort now are available for road segments for urban and suburban areas as well as those found in rural areas. To date the research for developing a level of service methodology for road networks and not only road segments, in urban and suburban as well as in rural areas is not clearly evident in the literature. BLOS helps to

identify the quality of service for bicyclists that currently exists within the roadway environment.

Factors affecting LOS

The factors affecting level of service are as follows:

1. *Traffic volume*: It is observed that as the traffic volume increases the BLOS consequently tends to decrease. One can observe that during heavy traffic the bicyclists are more apprehensive of their safety than any other time.

2. *On street parking*: This factor influences BLOS positively as it acts as a buffer in between the bicyclist and the traffic hence providing a sense of security. Since people perceive that they are safe, it results in higher LOS.

3. *Roadway width*: Increase in width of the road makes it difficult for the bicyclist to cross the road from one end to another thus decreasing the BLOS.

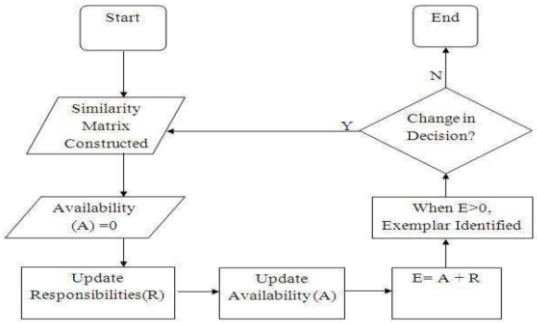
4. *Speed limits*: The speed limit for the road surveyed was 40 km/hr. With increase in speed there is a drastic decrease in the bicycle level of service. It is due to the fact that at higher speeds the bicyclists perceive higher threat levels to their life hence resulting in a decrease in BLOS.

Methods of Cluster Analysis

The methods to be discussed can be categorized as follows K-mean method, is characterized by a centrally located object called the representative object and each time an object changes clusters the centroids of both its old and new cluster are recalculated.

- Fuzzy C-Means Clustering (FCM), method, where objects are not assigned to a particular cluster but possess a membership function indicating the strength of membership to each cluster.
- Hierarchical Agglomerative Clustering (HAC), starts with all points belonging to their own cluster and then iterates merging the two closest clusters until it gets only one cluster.
- Affinity Propagation (AP), an clustering algorithm that identifies exemplars among data points and forms clusters of data points around these exemplars.
- GA-fuzzy, algorithms are search algorithms that are based on concepts of natural selection and natural genetics.
- Self-organizing map (SOM) is a type of artificial neural network that use unsupervised learning to produce a lower-dimensional (usually 2D) representation of the input space of the training data set samples.

The above mentioned six methods of solving the clustering problem are discusses in the following subsections.



Flowchart of AP Clustering

Conclusions

Qualitative Analysis of BLOS is different from Quantitative Analysis in terms of its surveyed data. While qualitative analysis takes into account real time human perceptions for calculating BCI, quantitative analysis uses mathematically calculated data from on-site observation to calculate BCI. However if both types of analysis are carried out on the same road segment, the results would not vary to a much extent.

From the survey and analysis it can be concluded that based on human perceptions the surveyed region was "very compatible" for bicyclists lying in Level of Service-B range. The Bicycle Compatibility Index using qualitative analysis was found out to be 5.66. Further the LOS can be improved to LOS-A i.e. extremely high compatibility by implementing the following changes:

- Introducing specific bicycle lane in and around the region to achieve higher levels of satisfaction during utilitarian cycling.
- Introducing traffic lights at the intersection to achieve higher levels of satisfaction with respective to safety.
- Introducing street lights or some other source of light in the bus-stop region to achieve higher levels of satisfaction with respect to visibility at night.

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