Level of Service Analysis of University of Indonesia Outer Ring Road using HCM 2010

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Abstract—The University of Indonesia has 13 faculties with an area of 320 hectares. Activities are diverse cause high mobilization and impacted in increasing demand transportation. This research is done with primary data collection which consists of a survey of the volume of the vehicle, speed and also road inventory survey. While LOS analyzed using HCM 2010 provides an assessment of all modes of transport (Car, Pedestrian, Bicycle and buses) and LOS value interplay between transportation modes. Result of making data using instrument “person counter” and manuals obtained the difference calculation namely 86.24% on FT-FH segment and 66.73% on Pondok Cina-FT segment

Keywords: HCM 2010, Level of Service, University of Indonesia

I. INTRODUCTION

University of Indonesia is one of the biggest universities in Indonesia that has considerable number of academicians. Having 320 hectare of area, University of Indonesia is facilitated with 13 faculties and other supporting facilities for academician activities. Activities of individual or group in University of Indonesia are diverse and having different interest. Those diverse activities lead to great mobilization that resulting a higher transportation needs (Waskito Ady, 2004).

Spatial planning is needed to ensure the balance development of city and region ((GIZ), 2004). Besides driving behavior, the condition of road infrastructure also has to support the safety. Study shows that around 30% of incident on road is resulted by the condition of road infrastructure (Balsas, 2003). As the time being, the method to calculate Level of Service (LOS) has been improved. MKJI 1997 calculation method that refers to HCM 1985 was used for calculating road level of service. After HCM 1985 experienced some improvements and recasts to be HCM 2000, Indonesia had not changed MKJI 1997 until HCM 2000 was improved and generated HCM 2010. By that time, Indonesia did not give any changes for calculation method to determine LOS standard.

High Capacity Manual (HCM) 2010 is the newest revision from the previous invention. HCM 2010 combines the latest research about road capacity and road level of service quality. HCM 2010 aims to give methodology and application procedure that suitable to evaluate multi transportation performance in road and road facility in terms of operational and as the indicator for service quality. (High Capacity Manual 2010, 2010)

Due to those problems, research that analyzes facility service level in ring road of University of Indonesia, Depok is needed. Assessment for service level of road facility in University of Indonesia is conducted using HCM 2010 calculation method.

II. LITERATURE REVIEW

A. Service Level

Service level of road is one of the indicators used for describing the existing condition of facility and for assessing service quality from infrastructure and road equipment (Asadi-Shekari, 2012).

B. Highway Capacity Manual 2010

According to (Highway Capacity Manual 2010, 2010) the difference between HCM 2000 and HCM 2010 is explained below:

HCM 2000 gives systematic and consistent base to assess capacity and level of service for every element of transportation system and for system that involves in series or combination from some facilities.

HCM 2010 has supplemented new materials from various research projects since the publication of HCM 2000 and has been rearranged to make the content easier to be used or understood. That arrangement aims to encourage the analysis and various decisions to considering the road drivers and have expanded work scope when assessing transportation performance.
C. Person Counter with Arduino

Person counter is a device for calculating objects (in this case is person) that traversing. This device works by using an ultrasonic sensor as its main detection sensor. The result from the detection will be shown in LCD display.

Basically, this device works by using Arduino as the center of data/information processing that is received from ultrasonic sensor which is shown in installed LCD display. Ultrasonic sensor has 2 main components for the sensor activity which are trigger and receiver. Trigger component will constantly emit ultrasonic waves and when the waves hit an object (person traversing) then the ultrasonic waves will be reflected and received by receiver component. The reception in receiver will be the input value and will be processed in microcontroller (Arduino) that will generate corresponding value (distance from object to sensor in cm).

Abovementioned become the base of calculation and algorithm for person counter. As we know, the width distance from the road is approximately 2 meters. We can conclude that if the distance calculation from microcontroller (Arduino) and sensor generates a value that less than 2 meters (200 cm) it means there is a person traversing in front of the device. When that happens, Arduino will automatically count the number of people traversing and show the result in LCD display.

This device is also programmed to represent time calculation in LCD display. So, that the user can knows the elapsed time. LCD display is used to show the number of people that are traversing, counter time measurement and distance. Reset button and on-off button are also provided.

III. RESEARCH METHODOLOGY

This research was conducted in University of Indonesia roads by direct survey on the field. Inventory survey was conducted on Saturday and Sunday while traffic survey was conducted on weekdays, Monday until Thursday. Survey was conducted in the morning at 07.00-09.00 and in the afternoon at 16.00-18.00. Besides conducting manual survey, person counter was also used to count the people that traversing. Afterwards, in data analysis HCM 2010 method is used to determine the result of road service on University of Indonesia ring road and to compare the calculation result from the device and manual. LOS* is calculation analysis that is used in LOS calculation with HCM 2010 method in form of excel software.

IV. RESULT AND DISCUSSION

Existing data about road in University of Indonesia is obtained by survey result. The data consists of length and width of vehicle lane in every segments, length and width of bicycle track, length and width of pedestrian, median width of road and the condition of road stiffening. The traffic data in University of Indonesia road on the morning and afternoon is also obtained.

The result obtained from person counter is different compared to manual counting result. When conducting data retrieval in Faculty of Engineering - Faculty of Humanities segment, this device had result percentage of 86.24%. Meanwhile, for data retrieval in Pondok Cina – Faculty of Engineering had result percentage of 66.73%. This was due to the sensor sensitivity of object that had not stable yet which led to different result.

For the calculation of LOS using manual data, the obtained data is shown on Table XX.

While the calculation of LOS using the data from the person counters, the obtained data is shown on Table XX.

The greater the number of people traversing the segment, the smaller the accuracy. So, that, the difference of people traversing the segment affect LOS value.

The determination of LOS for people traversing the segment is not only affected by the number of people traversing yet other influencing factors are, the number of vehicle traversing, the width of pedestrian, and environmental condition that affects the pedestrian.

LOS assessment in urban road using HCM 2010 covers 4 transportation which are automobile, pedestrian, bus and bicycle. Those transportations, in terms of LOS assessment, interplay each other.

Based on the research “Service Level Analysis of University of Indonesia Outer Ring Road using HCM 2010”, which is conducted by field survey, some conclusions are obtained, such as:

1. Different results of the calculation of people traversing using person counter and manual which is 86.24% for Faculty of Engineering-Faculty of Humanities segment and 66.73% for Pondok Cina-Faculty of Engineering segment. Thus, the device cannot be used for data retrieval.
2. LOS value using manual data is ……
3. LOS value using person counter device is …
4. Person counter device can be used to calculate the number of people traversing the sensor but cannot differentiate the traversing direction of the people

Regarding to the result from the research, discussion and conclusion, the suggestion for further study is to modify person counter device to give a greater sensitivity for detecting object properly and can differentiate the direction of people who traversing that can lead for easier determination of road service level.

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