IJE TRANSACTIONS B: Applications Vol. 34, No. 05, (May 2021) 184-191

International Journal of Engineering

Journal Homepage: www.ije.ir

Calibrating and Validation Microscopic Traffic Simulation Models VISSIM for Enhanced Highway Capacity Planning

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PAPER INFO

Paper history:
Received 10 November 2020
Received in revised form 23 December 2020
Accepted 04 January 2021

Keywords:
Traffic Flow;
Driver Behavior;
Model Calibration;
Model Validation;
Simulation Analysis.

ABSTRACT

This research aims to calibrate and validate the VISSIM simulation model tool by comparing field data with simulation data. The ultimate goal is to evaluate traffic performance by comparing simulation results with direct observations in the field. This study uses modeling to determine a road segment's maximum flow volume. This study was conducted in Makassar, South Sulawesi, Indonesia, on Jalan Veteran Selatan. The method uses two main inputs: urban road primary capacity data from the Indonesian Highway Capacity Manual (IHCM 1997) and roadside activity data from PTV VISSIM. The GEH and MAPE have commonly used metrics for measuring the accuracy of simulation models and calibration measurements using driving behavior parameters. The research results obtained for validation measurements have met the requirements. Namely, the obtained MEPE value (7.38%) is 10% smaller than the obtained GEH value (2.032 and 3.961), which is still more than 5.00. The calibration measurements obtained the suitability of the vehicle location and intervehicle spacing in the simulation model (VISSIM) with the actual field conditions. The results obtained from using VISSIM can be reliable and helpful in designing and optimizing urban transportation systems in the future. It the essential to remember that traffic simulation with VISSIM is only a transportation decision-making and planning tool and must be combined with field observations and accurate data for adequate and efficient transportation solutions.

doi: *10.5829/ije.2021.34.05b.01*

1. INTRODUCTION[1]

Urban development and transportation planning are closely intertwined, and transport planning is crucial to creating sustainable, efficient, and livable cities [1, 2]. It involves evaluating the current transportation system, including road networks and public transportation, and developing new systems that meet the needs of urban residents. The ultimate goal of transport planning is to ensure the smooth flow of people and goods while reducing congestion, which can have many benefits, such as more efficient use of resources and less air pollution [3–5]. One of the biggest challenges in transport planning is the increasing traffic volume in cities worldwide. This leads to problems such as traffic congestion, longer travel times, and increased air pollution [6, 7]. While many efforts have been made to address this issue, such as improving road infrastructure and public transportation, these solutions are often insufficient to reduce traffic congestion effectively. Therefore, innovative and sustainable solutions are needed to tackle this challenge, including using intelligent transportation systems, encouraging alternative modes of transportation, and implementing policies that promote sustainable urban development [8, 9].

High congestion and traffic density levels often cause delays, accidents, and air pollution. Therefore, it is necessary to have the right strategy in traffic management to reduce the negative impacts. One of the practical tools in traffic management is the Microscopic Traffic Simulation Model. Simulation analysis heavily relies on software as the primary tool for facilitating the

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calculation process [10]. Salgado et al. and Hadi et al. analyzed the features of three different simulation programs: AIMSUN [11], TransModeler [12], CORSIM [13], and VISSIM [14, 15]. Although each software package has advantages, the study ultimately chose VISSIM due to its superior vehicle routing capabilities, total output, stability, and extensive supporting documents accompanied by animations. Traffic flow simulation can be conducted at macro and micro levels. However, Habtemichael and de Picado Santos focused on transportation management and found that simulation at the micro level yields more satisfactory results compared to macro simulations. At the micro level, the simulation can better capture the impact of heterogeneous traffic and produce more comprehensive and precise results [16]. This level of detail is crucial for evaluating traffic flow scenarios, predicting traffic patterns, and making informed traffic management and planning decisions.

Using microscopic traffic simulation models such as VISSIM has revolutionized transportation planning by providing planners with a powerful tool to evaluate various scenarios and predict the impact of infrastructure changes on traffic flow. These models use advanced algorithms to simulate the behavior of individual vehicles, considering factors such as driver behavior, traffic signals, and lane changes [17]. By analyzing the simulation results, transportation planners can identify potential issues and test different solutions before making any changes to the transportation infrastructure [18].

The level of detail provided by these models allows for a comprehensive evaluation of traffic flow in urban areas. Transportation planners can use these models to optimize the timing of traffic signals, adjust road layouts, and improve public transportation systems to reduce congestion and improve accessibility. Using microscopic traffic simulation models, transportation planners can make more informed decisions that lead to a more efficient flow of people and goods, improved safety, and reduced environmental impact [19]. VISSIM, in particular, has become a widely used and well-regarded microscopic traffic simulation software program due to its ability to accurately predict traffic flow and congestion. The software includes various customizable parameters, including vehicle types, traffic signals, and lane changes, allowing for detailed traffic flow analysis at the individual vehicle level [20]. The program also allows the simulation of various scenarios, such as changes in traffic patterns, lane configurations, or signal timings, to estimate the effect of different infrastructure changes on travel movement.

VISSIM and other traffic simulation models' accuracy depends on the calibration and validation process. This process involves adjusting the model's parameters to match real-life traffic flow data and validating the calibrated model against independent traffic data to verify the model's accuracy [21]. Calibration and validation ensure that the model accurately represents actual traffic conditions, accounting for changes in traffic volume, time of day, and weather conditions. It is important to note that calibration and validation are not one-and-done tasks; instead, they're ongoing procedures that must be regularly updated and maintained to ensure accuracy and reliability [22].

Calibrating a microstimulator involves two sets of parameters: driving behavior parameters and travel behavior parameters. Some examples of the former are models of acceleration, lane switching, and intersections; examples of the latter are models of origin-destination flows and route selection. However, scant information is available on calibrating traffic simulation models, with most studies focusing on one aspect—typically driving behavior—and assuming that the rest of the limits are already known. For example, studies such as Zhe et al. [23], Jha et al. [24], Daigle et al. [25], and Ratrout et al. [26] only calibrate driving behavior parameters. On the other hand, route choice in the calibration process, but they still assume that origin-destination flows are already known. The assignment matrices that capture the effect of route selection and flow propagation are assumed to be known by the estimation routines for origin-destination flows [11]. Jiménez et al. take a different tack by extending the origin-destination estimation process to incorporate a route choice model, but they do so assuming that the model parameters are immutable [12].

The model's parameters are fine-tuned during calibration by comparing the simulated and observed traffic flows. This requires making small, incremental changes to the parameters to get simulation results as close as possible to the actual data. The calibration process is not complete until validation has been performed, as this verifies the accuracy of the model and its applicability for foreseeing the results of any future changes to the infrastructure. Predictions from the calibrated model are checked against data on traffic flows that were not used during calibration. The calibration and validation process is essential to the success of traffic simulation models like VISSIM [20, 27]. Adjusting the model's parameters to correspond with observed traffic volumes is known as calibration, and checking the model's accuracy by comparing predictions to external traffic measurements is known as validation. Calibration and validation check the accuracy of traffic simulation models so that transportation infrastructure decisions can be made confidently [28].

Based on the description, the research aims to calibrate and validate using the VISSIM simulation model tool by comparing field data with simulation data. The ultimate goal of the research is to evaluate traffic performance by comparing simulation results with direct observations in the field. By evaluating these results, the research can provide recommendations to improve traffic performance in the future. VISSIM model's vehicle behavior in urban transportation systems to better understand traffic performance and predict infrastructure changes' effect on traffic movement. Therefore, by calibrating and validating, the results obtained from using VISSIM can be reliable and helpful in designing and optimizing urban transportation systems in the future.

2. MATERIALS AND METHODS

2. 1. Research Approach The research approach in this study involves a modeling method to determine the determined movement volume a highway segment can handle. The method uses two main inputs, namely the primary capacity data from the Indonesian Highway Capacity Manual (IHCM 1997) [29] for urban roads and the number of roadside activities from the PTV VISSIM assistance program [30]. The study requires several data types to model, including road geometry, side barriers, and free-flow speed data. The side barrier data used in this study include roadside parking activities, vehicle activities entering and leaving the road segment, and slow vehicles. The study did not consider the influence of pedestrians in the modeling process.

This study employed a quantitative methodology based on the analysis and modeling of collected data. The study relies on existing data sources and software programs to perform the modeling process. The study results are presented in numerical values that indicate the maximum flow volume the road segment can handle.

2. 2. Location of Study This research was conducted at Jalan Veteran Selatan, Makassar, in front of Maricaya Market. The choice of this location allows researchers to analyze the effect of activities around the market on road volume and travel congestion.

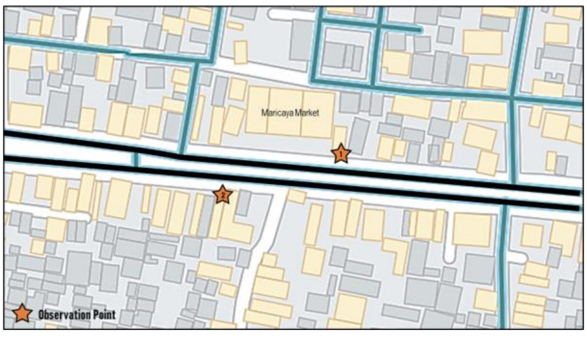

Figure 1. Test Site: Veteran Selatan Road, Makassar, South Sulawesi, Indonesia

This research was conducted for one week, including weekdays and holidays, with observations at peak hours, namely 4 (four) hours in the morning and 2 (two) hours in the afternoon. This study aims to collect traffic flow data consisting of four types of vehicles, namely light vehicles, heavy vehicles, motorbikes, and non-motorized vehicles, which are obtained directly from observations and measurements in the field. The road section has 2/4D divided lanes. Observations were made on this road section because it is a busy and vital area for land transportation in Makassar City.

2. 3. Data Geometric Primary data was obtained directly from surveys of geometric road conditions. This data includes road width, number of lanes, lane width, road shoulder width, and road type. Where the observed location is at the point of the road, namely Jalan Veteran Selatan. The following is a description of the geometric conditions of the road (Table 1).

TABLE 1. Road Geometric Characteristics

Road Characteristics	Observation (Existing)
Road Type	Four-lane Split or One-way Street
Type of Road Pavement	Asphalt Coating
Road Lane Width	9 meters
Road Lane Width	3 meters
Road Shoulder Width	1 meter

Data obtained from field observations will later be processed and analyzed to produce useful information on road capacity, traffic density, and congestion around Maricaya Market. The data from this research can assist decision-makers in traffic management in Makassar City, particularly in increasing road capacity and reducing traffic jams in busy and densely populated areas.

2. 4. Data Analysis

2. 4. 1. Traffic Volume The definition of traffic volume refers to the count of vehicles passing a particular point or line on a road cross-section. The calculation of vehicle volume is determined using an equation:

$$Q = {}^{n}/_{t} \quad (1)$$

where: Q = Volume of vehicles (vehicles/hour); n = Number of vehicles (vehicles); t = Observation time (hours).

2. 4. 2. Road Capacity Capacity refers to the maximum traffic volume sustained under specific conditions, including geometry, distribution of traffic directions and composition, and environmental factors, with units of PCU/hour [29]. The basic equation for determining capacity is as follows:

$$C = C_O \times FC_W \times FC_{SP} \times FC_{SF} \times FC_{CS} \quad (2)$$

where: C = Capacity (PCU/hour); Co = Basic capacity for ideal conditions (PCU/hour); FCw = Traffic Lane width adjustment factor; FCsp = Directional separation adjustment factor; FCsf = Side resistance adjustment factor; FCcs = City size adjustment factor.

2. 4. 3. Degree of Saturation The degree of saturation is the traffic flow ratio (PCU/hour) to capacity (PCU/hour) and is used as a critical factor in assessing and determining the performance level of a road segment.

$$DS = {}^{Q}/_{C} \quad (3)$$

where: DS = Degree of saturation; Q = Traffic flow (PCU/hour); C = Capacity (PCU/hour)

2. 2. Calibration Model The purpose of the calibration of driving behavior parameters is to ensure that the simulation model used can accurately reproduce driver behavior in the field. This is very important in transportation analysis and highway planning because an accurate simulation model can provide more accurate predictions about how changes in road conditions or traffic policies may affect driver behavior and traffic flow.

Calibration in VISSIM is a process of forming appropriate parameter values so that the model can replicate traffic to conditions that are as similar as possible. The method used is trial and error, which is done by comparing field observation conditions with conditions in the simulation. This simulation is accurate if the error rate between the simulation results and the observed data is relatively low. The calibration uses optimization techniques to minimize the deviation between the observed data and the simulation measurements made to match.

This calibration process is carried out by comparing empirical or field data with the simulation results of the developed mathematical model. In this case, the difference between the empirical data and the simulation results will be used to adjust the required parameter values in the model. The simulation model must first be calibrated using field data to produce accurate predictions. This can be done by collecting data from direct observations, such as measurements of speed, acceleration, head distance, and other variables related to driver and vehicle behavior on the road.

2. 2. Validation Model In VISSIM, the validation process involves comparing the results of simulations with observations to verify the accuracy of the calibration. The validation examines the traffic flow volume and the queue length. The GEH (Geoffrey E. Havers) test is a statistical method used to evaluate the accuracy of simulation models. It measures the difference between the observed and simulated values and compares it to the expected range of differences. In the following GEH [31–34], the formula has specific provisions for the resulting error values as follows:

$$GEH = \frac{\sqrt{(q\_simulated - q\_observed)^2}}{0.5 \times (q\_simulated + q\_observed)} \quad (4)$$

where: q_simulated = Average traffic flow volume in Simulation (vehicles/hour); q_observation = Traffic flow volume in the field (vehicles/hour).

The GEH test is a valuable tool for evaluating the accuracy of simulation models and can help ensure that the models are reliable and accurate for use in transportation planning and decision-making. To explain from the GEH results can be seen in Table 2.

TABLE 2. Description of GEH Result

GEH Range	Description
GEH < 5.00	Accepted
5.00 ≤ GEH ≤ 10.00	Caution: model error or insufficient data
GEH > 10.00	Denied

a GEH value less than 5.00 is generally considered acceptable, indicating that the simulated values are accurate and can be used for further analysis and planning. However, a GEH value between 5.00 and 10.00 indicates a possible error or harmful data, and further investigation may be necessary. A GEH value greater than 10.00 indicates that the simulated values are significantly different from the observed values, and the model should not be used for further analysis or planning.

The Mean Absolute Percentage Error (MAPE) is a commonly used metric for measuring the accuracy of a forecast or prediction. It is calculated by taking the absolute difference between the actual and predicted values, dividing that by the actual value, and multiplying by 100 to get a percentage. The MAPE is then calculated as the average of these percentage errors.

$$MAPE = \frac{1}{n}\sum_{t=1}^{n}\left|\frac{At - Ft}{At}\right| \times 100\% \quad (5)$$

where: n = Total data; At = Observation data; Ft = Simulation model data.

MAPE is a valuable metric because it provides a simple way to evaluate the accuracy of a forecast or prediction, regardless of the scale of the data or the units of measurement.

TABLE 3. Description of MAPE Result

MAPE Range	Description
≤ 10%	Simulation results are very accurate

MAPE Range	Description
10% – 20%	Good Simulation results
20% – 50%	Simulation results are feasible (good enough)
> 50%	Inaccurate simulation results

MAPE is a method of measuring the error or accuracy of a prediction or simulation model by comparing the difference between the actual value and the normalized predicted value in the form of a percentage. Based on Lewis [35], the range of MAPE values can be interpreted into 4 categories (Table 3).

3. RESULTS AND DISCUSSIONS

3. 1. Calibration Model Driving Behavior must be adapted to conditions in the field so that the simulation results can represent conditions in the field. The parameter used for modeling validation with field conditions is the model traffic volume equal to the field traffic volume. If the results do not represent the conditions in the field, then a reset or calibration is required to suit the field. By calibrating the Driving Behavior parameters, the simulation model will be able to represent driver behavior and traffic volume following the conditions in the field so that the simulation results can be used to predict realistic traffic conditions. The Driving Behavior Parameters used in this study can be seen in the following table:

TABEL 4. Driving Behavior Parameters

Parameter	Calibration Value
Average Standstill Distance	0.2 meter
Add. Part of Desired Safety Distance	0.5 meter
Add. Part of Desired Safety Distance	1 meter
No. of Observed Vehicle	2.00
Lane Change Rule	Free Lane Selection
Desired Lateral Position	Any
Lateral Distance Driving	0.15 meter
Lateral Distance Standing	0.45 meter
Safety Distance Reduction Factor	0.45 meter
Minimum Headway	0.5 second

The driving behavior Table shows that several parameters have constant values in each simulation period, such as the Free Flow Speed, Mean Jam Density, and Maximum Deceleration parameters. While other parameters, such as Lateral Distance Driving, Average Standstill Distance, and Lateral Distance Standing, have different values in each simulation period. This shows that driver behavior can vary in traffic conditions, such as rush hour and off-peak. Therefore, to obtain accurate simulation results, it is necessary to calibrate these parameters based on traffic conditions according to the situation in the field (Figures 2 and 3).

Figure 2. VISSIM Test: Before Calibration

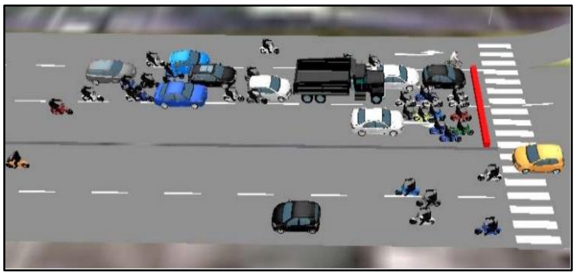

Figure 3. VISSIM Test: After Calibration

The calibration figure 3 and 4 show the difference in traffic flow behavior before and after calibration on the VISSIM software. The traffic in the simulation is observed to move steadily in a lane-by-lane manner with sufficient gaps between the vehicles before undergoing calibration. However, the traffic becomes more erratic after calibration, with frequent overtaking and closing gaps between vehicles.

This change indicates that the driving behavior in the VISSIM simulation model better represents real-world traffic conditions, where overtaking and chaos on the road are common occurrences. In a heterogeneous traffic context, where various vehicles with different speeds are on the same road, the calibration results show that the simulation model is acceptable and provides more accurate results. This way, the VISSIM simulation results can be used to plan and develop a more effective and efficient traffic system.

3. 2. Validation Model Table 5 shows the validation results of the simulation models used in transportation analysis and planning. The table calculates two GEH values for two days, namely Monday and Saturday (peak hours).

TABLE 5. GEH Test Validation Results (vehicle/hour)

Time	VISSIM	IHCM 1997	GEH
Monday	1707	1792	2.032
Saturday	1340	1489	3.961

The validation results with a value of 2.032 for Monday and 3.961 for Saturday. In this context, the Geoffrey E. Havers test (GEH) is used to evaluate the accuracy of the simulation model, where a value smaller than 5 is considered eligible for an acceptable simulation model (Table 3). In this case, the GEH values for both days (Monday and Saturday) are below 5, meaning the simulation model meets the desired accuracy criteria. Therefore, the simulation model is acceptable for more advanced transport planning and analysis.

TABLE 6. MAPE Test Validation Results (vehicle/hour)

Time	VISSIM	IHCM 1997	MAPE
Monday	1707	1792	2.37%
Saturday	1340	1489	5.00%
		Average MAPE	7.38%

The range of MAPE values (Table 6) obtained in the calibration results given is (7.38%) where these results are ≤10. This shows that the forecasting/simulation results are accurate and follow the actual field conditions. The smaller the MAPE value, the better the forecasting or simulation model's ability to predict the actual value. In this context, the MAPE values obtained indicate that the simulation model used in this study can predict actual values and is reliable for further analysis and transportation planning.

Apart from using performance evaluation metrics such as Mean Absolute Percentage Error (MAPE), validating the simulation results can also be done by comparing field conditions with simulation results. From Figures 4 and 5, it can be seen that the simulation results are quite similar to the actual field conditions. This shows that the simulation model used is quite good and can represent traffic conditions in the field.

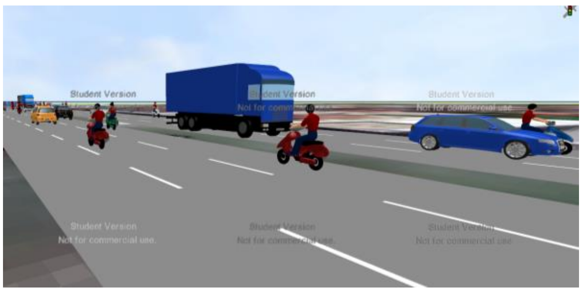

Figure 4. VISSIM Test Condition Site

Figure 5. Existing Conditions Site.

Simulation model validation is a process to check the reliability and accuracy of the model in predicting traffic behavior in the field. By doing good validation, the simulation model can be well-calibrated to be trusted in predicting traffic behavior in the field. In this case, the visualization images in Figures 4 and 5 show the suitability of the vehicle position and the distance between the vehicles in the simulation model with the actual field conditions. This proves that the simulation model has passed the validation process correctly.

By using a well-calibrated simulation model, traffic infrastructure development decisions can be taken more effectively and efficiently because the model can accurately predict traffic behavior in the field. Therefore, validation of the simulation model is essential to ensure the reliability and accuracy of the model so that decisions made based on the model can be more accurate and reduce the risk of errors in the development of traffic infrastructure.

3. 3. Comparison of Observation (IHCM 1997) and Simulation (VISSIM)

Traffic volume is one of the parameters used in validating using the Geoffrey E. Havers (GEH) formula. This aims to compare whether the simulation model is appropriate or describes the traffic conditions at the observation location. Due to the limitations of the VISSIM Software in displaying simulation results, namely for 600 seconds of simulation, the volume of vehicles compared is the volume of vehicles per hour.

The Figure 6 compares simulated and observed traffic volumes on Monday and Saturday afternoons. The simulated traffic volume is calculated using the VISSIM software, while the observed traffic volume is measured directly in the field. The figure shows that the traffic volume on Monday afternoon was higher than Saturday afternoon for both simulation and observation. However, there is a difference between the simulated and observed values on the two days. On Monday afternoon, the simulation value was 1707 vehicles/hour, while the observed value was 1792 vehicles/hour. On Saturday afternoon, the simulation value was 1340 vehicles/hour, while the observed value was 1489 vehicles/hour.

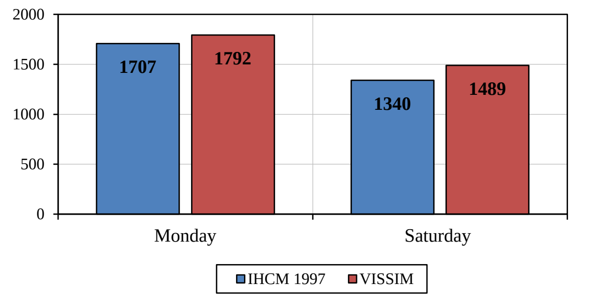

Figure 6. Comparison of Observation (IHCM 1997) and Simulation (VISSIM)

This shows that even though the simulated and observed values have the same trend (i.e., the traffic volume is higher on Monday afternoon), there is a numerical difference between the two. Several factors, such as inaccuracies in observational measurements or the calibration of simulation models, can cause this difference. Therefore, it is necessary to adjust or calibrate the simulation model so that the results are more accurate and can better represent field conditions.

The VISSIM process involves using pre-set parameters, such as the maximum vehicle speed, distance between vehicles, and traffic lights' red and green time. The simulation results obtained from the VISSIM process show the traffic service level on a road or intersection. This data can be used to evaluate the performance of existing traffic and identify areas that need improvement or improvement. The simulation results from VISSIM can also be used to compare the performance of various scenarios that have been tested. By comparing the performance of one scenario with another, the best and most effective scenario can be selected for increasing traffic performance. The initial stage calibration and validation process must be carried out carefully to obtain accurate and reliable simulation results. After that, the running process on VISSIM can be carried out regarding the parameters set to produce accurate and reliable service level simulation results.

Level of Service is a rating system used to measure road performance and traffic congestion. This scoring system usually includes five levels measured based on average speed, travel time, number of vehicles in one unit of time, road capacity, traffic density, and congestion level. The level of road service obtained is as follows:

TABLE 7. Table of comparison of service of levels resulting from IHCM 1997 and VISSIM

Time	IHCM 1997	VISSIM
Monday	D	B
Saturday	C	B

At the Level of Service, each level is denoted by a letter from A to F, with A being the best level and F being the worst level [29, 36]. At level B, traffic flow is stable with moderate vehicle volume and limited speed. The driver has sufficient freedom in choosing the speed of the vehicle. At level C, traffic flow remains stable, but the speed and movement of vehicles are controlled by traffic volume. The driver has limitations in choosing the speed of the vehicle. At level D, the traffic flow is nearly unstable, with high traffic volumes and speeds that can be tolerated but are highly influenced by flow conditions. The traffic flow is close to unstable, and almost all drivers have limited freedom in driving the vehicle.

Based on the simulation results using the VISSIM software, the level of service on Monday is D, while on Saturday, it is B. However, there are differences in results when using the 1997 Indonesian Highway Capacity Manual (IHCM) method, which uses the degree of saturation value in categorizing service levels. Based on this calculation, the level of service on Monday afternoon is categorized as C, and on Saturday afternoon is categorized as B. This shows differences in the results of measuring the traffic service level depending on the methods and techniques used. Therefore, traffic and transportation experts need to choose the correct methods and techniques for analyzing and measuring the level of traffic services. In addition, the results of these measurements can be used to identify traffic problems and design effective solutions to improve road service levels and performance.

In addition, several studies in Indonesia have also used VISSIM as a microscopic simulation application to evaluate the performance of a road segment. This study used VISSIM to model vehicle traffic on a road segment and evaluate traffic performance [37–44]. To compare the results of the analysis from VISSIM, the study also used the Indonesian Highway Capacity Manual (IHCM) 1997 as a comparison. The research results in several countries show that VISSIM can accurately evaluate traffic performance on a road segment. Thus, using VISSIM in traffic simulations can assist decision-makers in making more informed decisions regarding developing a better transportation system [45–49].

In the Indonesian context, which has challenges in overcoming traffic congestion, using VISSIM can assist in designing more effective and efficient transportation solutions. Using VISSIM, decision-makers can evaluate various traffic development schemes and select the most appropriate solution to address traffic problems in an area. This can help improve the transportation system's performance in Indonesia and reduce traffic congestion, a significant problem in several big cities in Indonesia. In addition, the calibration carried out for drivers in Indonesia in this study cannot be immediately generalized to drivers in other countries. Driver behavior in each country can also vary, such as the level of discipline in following traffic rules, preparedness in dealing with emergencies, and awareness in driving. This difference may affect the driver's ability to follow the calibration model simulation results in other countries. Observations conducted in Chinese and Dutch [50], and China [51] cities showed that drivers there had lower acceleration and desired speed profiles than observations in the Netherlands. Drivers in Indonesia may have experience driving on potholes or damaged roads, while drivers in other countries may not.

4. CONCLUSION

There are differences in measuring the traffic service level based on the simulation results using VISSIM and the Indonesian Highway Capacity Manual (IHCM) 1997 method. This demonstrates the significance of selecting the appropriate method and technique for analyzing and measuring traffic service levels. Using VISSIM as a microscopic simulation application can help decision-makers design more effective and efficient transportation solutions to alleviate congestion. Traffic simulation with VISSIM is only a transportation decision-making and planning tool. The simulation results must be analyzed using data and field observations to reach more accurate and relevant conclusions about the field situation. VISSIM should always be combined with field observations and accurate data for adequate and efficient transportation solutions. Overall, VISSIM is an effective software tool for researchers and transportation planners to evaluate road network performance, develop scenarios, and make better decisions to improve road network safety and performance.

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Persian Abstract

چكيده

يهدف هذا البحث إلى معايرة أداة نموذج المحاكاة VISSIM والتحقق من صحتها من خلال مقارنة البيانات الميدانية مع بيانات المحاكاة .الهدف النهائي هو تقييم أداء حركة المرور من خلال مقارنة نتائج المحاكاة مع الملاحظات المباشرة في الميدان .تستخدم هذه الدراسة النمذجة لتحديد حجم التدفق الأقصى لجزء من الطريق .أجريت هذه الدراسة في ماكاسار ، جنوب سولاويزي إندونيسيا ، في جالان المخضرم سيلاتان .تستخدم الطريقة مدخلين رئيسيين :بيانات السعة الأولية للطرق الحضرية من دليل قدرة الطرق السريعة الإندونيسية (IHCM 1997) وبيانات النشاط على جانب الطريق من PTV VISSIM. استخدمت GEH و MAPE مقاييس شائعة لقياس دقة نماذج المحاكاة وقياسات المعايرة باستخدام معلمات سلوك القيادة .استوفت نتائج البحث التي تم الحصول عليها لقياسات التحقق المتطلبات .أي أن قيمة MEPE التي تم الحصول عليها)7.38٪ (أقل بنسبة 10٪ من قيمة GEH التي تم الحصول عليها)2.032 و 3.961(مع الظروف الميدانية الفعلية .يمكن أن تكون (VISSIM) والتي لا تزال أكثر من 5.00 .حصلت قياسات المعايرة على ملاءمة موقع السيارة والتباعد بين المركبات في نموذج المحاكاة ، النتائج التي تم الحصول عليها من استخدام VISSIM موثوقة ومفيدة في تصميم وتحسين أنظمة النقل الحضري في المستقبل .من الضروري أن تتذكر أن محاكاة حركة المرور باستخدام VISSIM ليست سوى أداة لاتخاذ قرارات النقل والتخطيط ويجب دمجها مع الملاحظات الميدانية والبيانات الدقيقة للحصول على حلول نقل مناسبة وفعالة.