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A Review on Road Level of Service for Heterogenous Traffic Condition

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ABSTRACT

The Highway Capacity Manual (HCM) (1965) was the first to offer the notion of LOS and certain accompanying performance measurements that accurately reflect a roadway's operational characteristics. Highway Capacity Manual proposed the term "Level-of-Service" to represent the standard of quality that may be obtained from a location under various operating parameters and traffic volume. The Highway Capacity Manual's six recommended levels of service, which run from A to F and are separated by threshold values of distinctive indicators of effectiveness, such as traffic density, volumeto-capacity v/c ratio, and average speed, are common measurements used in traffic planning and highway engineering. The extent to which these six categories of service correspond to driver perceptions has, however, been thoroughly discussed in the literature. In developing countries like India, mixed traffic situations make it impossible to apply the Level of Service (LOS) requirements outlined in the HCM of developed countries. Due to differences in traffic characteristics and driving culture, the suggested LOS criteria in HCM of developed nations may not be applicable in the context of India or other developing countries. The literatures in the study shows the various approaches to deal with level of service of highways under heterogenous traffic condition.

Key Words:Traffic, Level of service, Heterogenous Traffic, highway, Highway capacity Manual

1.INTRODUCTION

A traffic facility's level-of-service (LOS) is a term created to correlate the quality of traffic services to a certain flow rate.The Highway Capacity Manual (HCM) (1965) was the first to offer the notion of LOS and certain accompanying performance measurements that accurately reflect a roadway's operational characteristics. Highway Capacity Manual proposed the term "Level-of-Service" to represent the standard of quality that may be obtained from a location under various operating parameters and traffic volume.The Highway Capacity Manual's six recommended levels of service, which run from A to F and are separated by threshold values of distinctive indicators of effectiveness, such as traffic density, volumeto-capacity v/c ratio, and average speed, are common measurements used in traffic planning and highway engineering.The extent to which these six categories of service correspond to driver perceptions has, however, been thoroughly discussed in the literature.In developing countries like India, mixed traffic situations make it impossible to apply the Level of Service (LOS) requirements outlined in theHCM of developed countries.Due to differences in traffic characteristics and driving culture, the suggested LOS criteria in HCM of developed nations may not be applicable in the context of India or other developing countries. Furthermore, ribbon development, encroachment, and a variety of other factors have an impact on the degree of service given to users.Six LOS were proposed in the most current edition of HCM (2010), along with threshold values of percent free-flow speed, which was established as the principal performance metric for LOS evaluation of urban streets for the automotive mode.

2.LITERATURE REVIEW

Following are the literatures related to Road level of service:

(Eleonora Papadimitriou 2010),The findings imply a piecewise linear relation between perceived level of service and traffic circumstances, with considerable variances in slopes. As a result, perceived service levels are not always equal, nor are the respective criteria. The HCM-2000, on the other hand, suggests a continuous linear connection, with six virtually equal v/c intervals defining the six service levels. As a result, it could be worthwhile to revisit how service levels and thresholds are set, taking into consideration probable variances in slopes.The number of service levels now in use does not appear to correspond to drivers' perceptions.According to the findings of this study, drivers only perceive two or three types of traffic circumstances. Only low-tolerance drivers appear to differentiate level of service A from B, and only high-tolerance drivers appear to differentiate level of service D from E, according to the HCM-2000 definitions. On the contrary, a significant decline in perceived level of service happens within a certain v/c period, which corresponds to a single HCM level of service, namely level of service C, in all cases.The impacts of driver and vehicle attributes on the perceived quality of service were not detected in this sample of drivers. It should be emphasised, however, that such effects might be

included as extra explanatory variables in piecewise linear regression models if necessary. In such instance, it would be interesting to investigate the variance in slopes and breakpoints caused by the drivers' unique traits.

(Yuanyuan Chai 2009),Computational intelligence methods have made significant contributions in a wide range of application disciplines. Hybrid algorithms research has become a prominent topic in computational intelligence. they highlight the existing and found patterns of hybrid algorithm research using the SMB classification, which gives an innovative path for developing new hybrid algorithms. All branches are divided into three groups under the SMB classification: Organic mechanism simulation class, Inorganic mechanism simulation class, and Artificial mechanism simulation class. According to particular criteria, all existing hybrid algorithms are created by combining distinct approaches among internal or inter-category methods. They discovered that there are two well-known types of hybrid algorithms: fuzzy-neural networks and fuzzy evolutionary computing, after conducting a review of the existing hybrid algorithms. The most common one in FNN is ANFIS, which was introduced by R. Jang.In the process of fuzzy inference, ANFIS uses a linear equation as a result, which cannot accurately represent human judgement. As a result, they present the Mamdani model-based adaptive fuzzy inference system (M-ANFIS), which is superior in the following portion and intuitive in fuzzy reasoning. Because of its unlimited approximation capabilities through training, M-ANFIS is a universal approximator.M-ANFIS is used to evaluate traffic LOS. The findings reveal that the M-ANFIS model outperforms the ANFIS model in terms of adjusted parameters, training data size, consumption time, and testing error. As a novel hybrid algorithm in computational intelligence, M-ANFIS provides a lot of non-linear modelling and forecasting capabilities. The work presented in this paper introduces a novel hybrid algorithm known as the MANFIS model, as well as a practical and efficient method for studying hybrid algorithms in CI.

(Justin GEISTEFELDT 2014), The use of simulation tools for freeway quality of service evaluation was presented in the study using the example of a diverging stretch with two-lane off-ramp. The simulation tools VISSIM, Aimsun, Paramics, and BABSIM are adequate to recreate the design capacities supplied in the German Highway Capacity Manual HBS, according to the derivation of standard parameter sets. Only SUMO, a simulation programme primarily used for traffic study in cities, produced findings that differed significantly from the HBS design parameters. Other types of freeway portions produced similar outcomes.Overall, the research shows that microscopic traffic flow modelling is a viable tool for estimating service quality, particularly on complicated highway infrastructures where analytical procedures are ineffective. Simulation results corresponding with the assessment techniques presented in the German Highway Capacity Manual HBS may be produced using the suggested methodology.

(S. Marisamynathan 2017),The LOS technique has been used to assess the effectiveness of pedestrian infrastructure for numerous years. The study found that existing approaches for estimating the PLOS score do not reliably anticipate the PLOS at signalised junctions. In light of this discovery, the scientists created a two-stage PLOS model. Various pedestrian crossing behaviours were researched in the first stage, and the delay model was designed keeping crossing behaviour differences in mind. In the second step, the elements that impact PLOS were discovered, and the PLOS model for signalised crossings was constructed. The models were created and threshold values were determined based on a videographic and pedestrian perception survey done at eight signalised crossings in Mumbai, India.The pattern of pedestrian arrival and crossing speed were investigated, and distribution models were created. Following that, the binary logit model was developed to study pedestrian compliance behaviour and interaction. The pedestrian delay model was suggested and validated with field data based on the pedestrian crossing behaviour research, attesting to the high accuracy level of predictions offered by the created delay model. At signalised crossings, the PLOS model was developed using CLR and FLR approaches.The FLR approach was used to construct the PLOS model for the first time, and it is more suited to ordered data and produces more accurate findings than the CLR technique. This is also the first effort to use clustering approaches to calculate the threshold values for each PLOS rating; the FCM method was shown to be the best match for mixed-traffic circumstances in India. Overall, the findings of this research can assist traffic planners and engineers in better understanding the current state of pedestrian facilities in terms of safety, convenience, and comfort. The findings can also help planners and engineers construct or improve pedestrian amenities at signalised junctions by providing suitable safety measures.

(B.R. MARWAH 2018), This article sought to classify the degree of service for urban traffic conditions that are varied. The level of service (LOS) is a composite of numerous operating parameters intended to assess the quality of service as experienced by the user at various flow levels. Journey speeds of vehicles and motorised two-wheelers are taken into account while determining the LOS, as well as concentration and road occupancy. The four levels of service are characterised based on the simulation results of the benchmark road (Road – I) and traffic composition (Level I) (LOS I, II, III, and IV).The LOS categorization developed in this study will be useful in identifying shortcomings in an urban road system and planning alternative improvement approaches to achieve the desired level of service. The capacity of the model to replicate urban diverse traffic flow conditions is clearly demonstrated by the examination of simulation data.

(MATTI PuRSULA 2019),The conclusions of the research are consistent with data from the United States and other countries about the flatness and linearity of speedflow curves, as well as the size of the capacity of two-lane rural roads. In the HCM, the reduction in speed as flow increases appears to be quicker than in real-world traffic on Finnish highways.The platoon length and headway distributions were considered to be simple in the study, and may be represented by geometric and negative exponential distributions. Closer examination of the luuk al lhe headway distributions, as well as statistical studies on platoon length distributions, revealed that the assumptions are not universally valid. Nonetheless, the simple theory gave simple connections that proved useful in examining the fundamental linkages between platoon percentage, mean platoon length, and flow rate.The percentage of cars with headways shorter than 5 seconds was used as an approximation for the PTD in the level of service study. This technique follows the HCM, although the variations between the Finnish traffic and the HCM might be due to variances in genuine PTD values and the approximation utilised. This study was unable to examine this disparity, hence the findings reached are predicated on the premise that the approximation is not severely skewed.The flow volumes corresponding to a specific PTD value are frequently much greater than those in the HCM under Finnish road and traffic circumstances. On good roads, the difference is negligible. In contrast to the Finnish study, the Dutch investigation indicates that the Dutch findings and the 1985

HCM are quite comparable. The differing conclusions might be due to the varying road conditions.The closeness of results in excellent road conditions suggests that disparities in other situations might be due to the HCM computations' adjustment parameters. In Finland, the correct values of the adjustment variables are likely to differ from those in the HCM. Changing the adjustment factors is one method of aligning measured service flow rates with PTD values. Altering the critical vie ratios, which are strongly connected to the steepness of the speed-flow curve, is another option. There have been no modifications to any HCM data so yet. To correctly adapt the technique for Finnish circumstances, more material is required.

(Subhadip Biswas 2016), A methodology for evaluating the LOS of urban arterials was presented in this study. To that purpose, LOS criteria were established based on field data acquired from a six-lane split urban arterial in Kolkata, using the same technique. Apart from this contribution, some of the study's significant findings are detailed here.The free f low speeds of several vehicle categories were calculated, and it was discovered that FFS varies significantly according on the vehicle type. Smaller vehicles (with the exception of two-wheelers) have a higher free-flow low speed than bigger vehicles. When compared to other types of vehicles, the results showed that LCVs and trucks behaved more consistently during low traffic conditions.For LOS assessment on urban arterials, the percentage speed reduction (PSR) from FFS was chosen as a performance indicator. A rise in the PSR indicates a drop in the road's service quality. In addition, it was discovered that PSR rises as the v/c ratio rises, and a link was established.The silhouette approach discovered six groups produced using the K-mean clustering methodology, which are "reasonable structures" that are compatible with PSR data. When the percentage speed reduction looks to be larger than 50%, the operating state falls into the worst level, LOS F, according to PSR-based LOS criteria.The technique proposed in this study might be beneficial for analysing LOS standards for urban arterials in a variety of various locations and conditions.

3.CONCLUSION:-

Following are the conclusions drawn from the literatures:

- The impacts of driver and vehicle attributes on the perceived quality of service were not detected in this sample of drivers. It should be emphasised, however, that such effects might be included as extra explanatory variables in piecewise linear regression models if necessary.
- M-ANFIS model outperforms the ANFIS model in terms of adjusted parameters, training data size, consumption time, and testing error. As a novel hybrid algorithm in computational intelligence, M-ANFIS provides a lot of non-linear modelling and forecasting capabilities.
- microscopic traffic flow modelling is a viable tool for estimating service quality, particularly on complicated highway infrastructures where analytical procedures are ineffective. Simulation results corresponding with the assessment techniques presented in the German Highway Capacity Manual HBS may be produce good results.
- the FCM method was shown to be the best match for mixed-traffic circumstances in India.

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