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Tangible Service Level Assessment of Urban Streets using Point System to Support Improvement Issues for Private Mode of Transport

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ABSTRACT
This study proposes automobile users' response pattern to assess service quality provided by transportation infrastructure under mixed traffic flow condition. To determine the tangible Level of service (LOS) scores for urban streets, this study has explicitly considered some point indicators (*PI*) which reflect the automobile driver's requirement on various road facilities. Specific weight coefficients (C_i) were determined for each *PI* based on their degree of importance on the comfort level of drivers. Lastly, the %*LOS* score was calculated for street segments and classified into six different LOS categories (A-F) with the help of GA Fuzzy clustering technique.

Keywords: Point indicators, Level of service, Automobile drivers, GA Fuzzy clustering technique

1. Introduction

Transportation is a prominent amenity delivered to the public for which billion rupees of investment resolutions are prepared each year on the basis of decision taken by the apex authorities at center and state level. In fact, in the present scenario investment resolutions are not taken based upon the quantitative service levels offered by existing infrastructures or motorist's perception of determining each attribute of transportation services. Rather they are categorized from a blend of capacity based outcomes. For that reason, numerous aspects of the transport infrastructure in developing countries are quiet perforated with difficulties irrespective of current improvements. On the other hand, relatively low GDP per capita in developing countries like India indicates that the access to transportation facilities has not been uniform. So the transportation authorities should think through what physiognomies of the transportation scheme are essential for the automobile riders and how each of the features affecting their comfort level. According to Highway Capacity Manual (HCM) 2010, Level of Service (LOS) designates a variation of operating conditions and road user's opinion about those conditions. Related to this, numerous LOS studies on motorized vehicles based upon speed, density and capacity measuring parameters have been carried out in different parts of the world.

The objective of this study is to develop a model to assess the service levels provided by the transportation infrastructures under heterogeneous traffic flow condition from automobile users' perspective. To achieve the objective of this study, the study methodology is divided into three parts. The first step is to identify the important factors which influence the comfort level of automobile users under mixed traffic condition. The second stage is to measure the importance level of identified QOS factors and to propose a logical point system for the determination of LOS. The last part is to estimate % LOS scores of urban streets using the proposed model to support the planners and engineers to design streets considering the actual needs of road users.

In order to assist the present purpose, this study has explicitly considered some point indicators (*PI*) which reflect the automobile user's requirement for various road facilities. Specific coefficients (C_i) were determined for each PI based on their degree of importance on the comfort level of automobile drivers. So that the weight of each indicator in defining LOS can be judged from its coefficient value. To outline *PI*s for a logical point system, variations of level of satisfaction on the existing transportation facilities have been exposed to a lot of research and discussion. So that the point indices associated with each occurrence can be reasonably well defined. An innovative survey questionnaire was designed which includes different aspects of riding comfort of automobile users on various transportation facilities. Participants are requested to rate the importance level of each point indicator from 1 (not important) to 3 (very important). Factors related to road geometric design elements, speed, road surface quality, etc.

are considered in this study to create a convenient LOS model. The model outputs are classified into six different LOS categories (A-F) with the help of GA Fuzzy clustering technique to get an optimal clustering result.

2. Review of literature

The review of literature focuses on issues related to the identification of factors affecting user's perceptions of quality of service provided by urban streets and developed methods for service level estimation addressed in the previous studies. The operating conditions in a traffic stream and the level of satisfaction of drivers and passengers about the road infrastructures are characterized as Level of Service (LOS) in HCM (2000). The HCM defines six categories A to F of LOS according to the type of provided road infrastructure. LOS "A" represents the best operating conditions and LOS "F" is the worst. Each LOS category corresponds to a particular range of operation condition as defined by HCM (2010). These conditions are more appropriate for homogenous traffic flow condition of developed countries. There are some background studies to estimate LOS in a more relevant way for mixed traffic flow condition in India. Maitra et al. (1999) divided LOS into nine groups "A" to "I" taking congestion as the measure of effectiveness for heterogeneous traffic condition in India. Similarly, Marwah and Singh (2000) have investigated the behavior of mixed traffic stream speed and flow rate on an access controlled urban arterials and classified LOS into four groups (I-IV) based on the volume to capacity ratio.

Flannery et al. (2005) recommended that LOS does not completely represent drivers' assessment on performance of urban streets. The author addressed for incorporation of qualitative measures in estimating LOS. Zhang et al. (2007) developed an ordered probit model for user perceptions difficulty with protected left-turn signals using web-based questionnaire survey. The authors concluded that driver perception of difficulty to make turns without protected left-turn signals also increases with the increase in the intersection size. The model also specified that several demographic variables also affect the probabilities of driver perceptions of difficulty and preference. Dowling et al. (2008) presented a model to evaluate quality of service in an urban street considering four modes of travel, i.e. auto, transit, bicycle and pedestrian. Four level-of-service (LOS) models were developed one for each mode with the help of video laboratory survey. The models were classified with letter grade (A–F) based on the street cross section, intersection controls, and traffic volumes on the street. Clark and Miht (2008) specified the range of LOS "F" to be very broad. He recommended a new LOS criterion for LOS F as F+ or G. These findings were particularly based on the traffic conditions prevailing in New Zealand. Fang and Pecheux (2009) investigated the LOS perceived by the road users at signalized intersection applying fuzzy data mining technique and concluded that the drivers are able to differentiate among the six service levels (A-F), in which LOS A and B of existing HCM were perceived as one level and the existing LOS F was divided into two. Chen et al. (2009) implemented video laboratory survey to calculate signalized intersection LOS based on turning movement of vehicle using fuzzy neural networks.

Shao and Sun (2010) characterized LOS into two parts: Level of traffic facility provided and Level of traffic operation. Travel speed to free flow speed ratio was considered as appraisal index of traffic operation. Bhuyan and Rao (2010) prepared a worthy way to describe ranges of free-flow speed for urban street classes as well as the respective ranges of LOS classes using fuzzy c-means (FCM) clustering. Vacio et al. (2012) applied different algorithm with SOM to categorize partial discharge. The study reveals that hard competitive learning algorithm articulates superior performance with less error and training time. Yang et al. (2010) applied hard, soft and fuzzy learning schemes for segmenting the ophthalmological MRI data to reduce medical image noise effects with a learning mechanism. The consequences indicate that fuzzy learning offers superior performance than hard and soft learning patterns. Wei et al. (2010) concluded that FCM clustering has intrinsic problem of being more time taking and having poor clustering result. The authors burdened the search capability of GA by improving the global search process. GA is used in traffic engineering field by various researchers to solve traffic engineering problems. Lingras (2004) applied Genetic Algorithm to evaluate the missing traffic count. The authors used a genetically designed regression model having very high precision.

The method of assessing LOS proposed by developed countries for homogeneous traffic flow conditions shows several limitations as they are deficient in representing behavioral diversity among individual in mixed traffic flow condition. So they can't be applied directly to assess urban street performance in developing countries like India due to the heterogeneity of traffic flow conditions. Some researchers have also developed principles to estimate LOS taking speed and travel time as measures of effectiveness. But less attention was paid till now to what public believe about the service levels offered by the infrastructures. There are also no appropriate score classifications to observe importance level of each parameter to define LOS of intermediate conditions, which will be easier for designers to follow when assessing streets.

3. Study area and Data collection

To establish a comprehensive method for the evaluation of LOS offered by urban road infrastructures, both quantitative as well as qualitative data were collected from 41 road segments of three Indian cities as shown in the Figure 1. These cities include Rourkela and Bhubaneswar in Odisha State and Vishakhapatnam in Andhra Pradesh State, which covers varying geometric features and traffic conditions with high volumes of privately owned vehicles. Therefore, this study has included every circle of transportation and people belonging to all classes has been taken in to account.

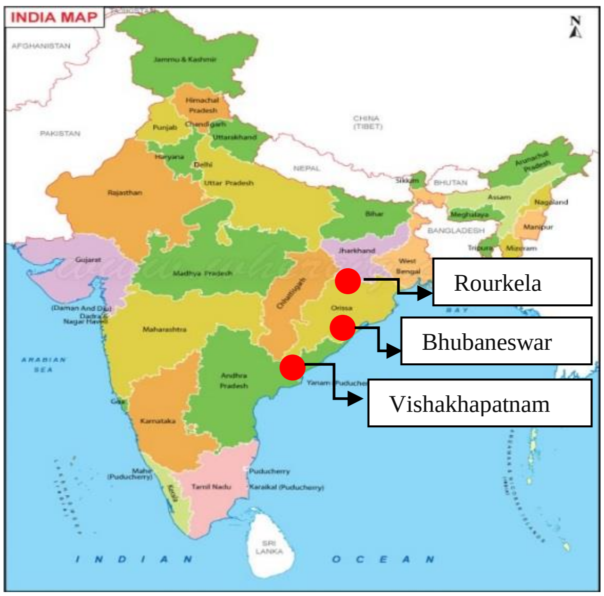

Figure 1 Selected cities for data collection across India

To define specific indices of logical point system, variations of level of satisfaction with respect to the existing transportation facilities have been exposed to a lot of research and discussion. In order to assist the present purpose, the different aspects of riding comfort were separately accounted for. So that, the point indices associated with each occurrence can be reasonably well defined. Factors related to road geometric design elements, traffic facilities, pavement condition etc. are considered in this study to create a novel LOS model.

3.1 Selection of quantitative variables

The impacts of different levels of traffic management on motorists' driving behavior and sense of comfort were studied in initial phase. Various QOS factors are derived from different standards of road maintenance and traffic management for typical estimation of LOS of urban streets. To explore these matters, both pilot stated preference and in-depth interviews have been carried out in the field. Based on the discussions with some experienced drivers and stakeholders, the prominent factors have been selected affecting comfort level of automobile drivers while driving on the road.

- Average Speed
- Number of lanes in one direction
- Road width
- Volume of traffic per lane
- Number of stops per Km
- Presence of median
- Average control delay at intersection

- Road surface quality
- Lane marking
- Heavy vehicle volume
- Width of sidewalk
- Separation between sidewalk and travel way
- Amount of landscaping
- Presence of shoulder
- Commercial density on sides of the road
- Street lighting
- Volume of encounters
- Percentage of signalized intersection
- On-street parking turnover
- Land use pattern
- Interruption by public transit/non-motorized vehicles/pedestrians
- Median openings per km

The above field data were collected from 41 urban road links during peak hours with the help of video camera, radar gun, measuring tape. This study includes roadway features considerably varying from place to place. The average travel speed of vehicles is measured by Radar gun during data collection, which varies from 17 Kmph with congested roads to 52 Kmph. The number of lanes in one direction of flow of traffic varies from 1 to 4 in two-way traffic flow. In some cases, traffic movements are restricted to one way only. The total volume of traffic varies from 296 PCU/hour to 5033 PCU/hour per one direction of flow, which is found out from video laboratory survey. Different sites include different pattern of land use, On-street parking turnover, divided or undivided roadways, quality of road markings etc., which have been visually inspected and their effects are tabulated accordingly. E.g. the effect of on-street parked vehicle percentage on a particular road segment was noted down by classifying the On-street parking turnover into three categories (high=1, medium=2 and low=3). The road link having high on-street parking density have been assigned with a value of 1 for the same link. Similarly, all such variables have been collected and entered in to the excel sheet along with the overall satisfaction score for Pearson correlation analysis. The overall satisfaction of road users for a particular road link was found out from perception survey.

3.2 Perception survey

In this research opinions of automobile drivers regardless of age, gender, and economic class have been extracted using travelers intercept survey. In this survey road users are either orally interviewed about the trip quality on the spot, or fill the survey form given to them on the basis of their stated preference for a particular road link. This is a cost effective method to represent a wider driving population, and to collect relatively large sample size. For this purpose, an innovative questionnaire was designed which includes prominent factors influencing the satisfaction level of automobile drivers on various transportation facilities. The target group for the survey was motorists. The resulting evaluations are therefore valid for private mode of traffic stream. Overall road user's satisfaction of each participant have been collected in a five-point rating scale varying from 1= highly dissatisfied to 5= highly satisfied. The participants were also requested to rate all the variables according to the importance level of each point indicator from 1 (not important) to 3 (very important). Demographic information like gender, age, driving experience, etc. are also included in this survey. More than six hundred participants were interviewed in which almost 36% of the total participants were females and 64% were male. 38%, 36%, and 26% of the respondents are of young (18-25 years), middle (26-40 years), and old age (>40years) respectively. For better understanding of respondents, influencing factors are explained in regional languages. Consideration of wide variation in demographic variables from different locations shows that collected data sets have a strong potential in model development for heterogeneous traffic flow condition.

4. Study methodology

4.1 Model development using Point system

Pearson correlation analysis was carried out for all the geometric and traffic flow variables listed above with respect to the Overall satisfaction of automobile users, and relevant variables (with $p < 0.001$) were identified. Out of total 22 attributes, 10 QOS attributes are identified affecting satisfaction levels of users with significance (p)< 0.001. This study has explicitly considered those QOS attributes as ten point indicators (*PI*s). These *PI*s are the quality of service (QOS) attributes, which reflect the automobile user's requirement on urban streets.

- PI_1=Average Speed
- PI_2=Number of lanes in one direction
- PI_3=Volume of traffic
- PI_4=Presence of median
- PI_5=Average delay
- PI_6=Road surface quality
- PI_7=Lane marking
- PI_8=On-street parking turnover
- PI_9=Land use
- PI_{10}=Interruption by public transit/non-motorized vehicles/pedestrians.

Each *PI* has some degree of priority for defining LOS. Specific coefficients (C_i) were determined for each PI based on their degree of impact on comfort level of drivers. So that the weight of each indicator contributes in defining LOS is judged from its coefficient.

Table 1 PI_i values for each point indicator

PI_i	**QOS Factors**	**Category**	**PI values**
PI_1	Average Speed in Kmph	<15	0
		15-25	0.25
		26-35	0.5
		36-45	0.75
		>45	1
PI_2	Number of lanes in one direction	1	0
		2	0.33
		3	0.67
		4	1
PI_3	Volume of traffic in pcu/h/lane	High (>1200)	0
		Medium (500-1200)	0.5
		Low (<500)	1
PI_4	Presence of median	Absent	0
		Present	1
PI_5	Average controlled delay at each intersection in second	>170	0
		120-170	0.2
		80-120	0.4
		50-80	0.6
		20-50	0.8
		<20	1
PI_6	Road surface quality	Poor	0
		Fair	0.5
		Good	1
PI_7	Lane marking	No marking	0
		Poor marking	0.5
		Proper marking	1
PI_8	On-street parking turnover	High	0
		Medium	0.5
		Low	1
PI_9	Land use	Commercial	0
		Mixed (commercial + office + Residential)	0.33
		Residential	0.67
		Rural fields	1
PI_{10}	Interruption by non-motorized vehicles / pedestrians / public transit	High	0
		Medium	0.5
		Low (Barrier free)	1

Mathematically, LOS score is defined as:

$$LOS = \sum_{i=1}^{10} C_i PI_i \tag{1}$$

Where, PI_i is the Point index representing i^{th} QOS attribute. C_i is the Coefficient of each Point indicator.

The value of C_i was defined in an appropriate way to have more reliable result as it signifies the strength and importance level of each PI.
C_i is calculated as follows:

$$C_i = \sum_{j=1}^{3} L_j N_{ij} \tag{2}$$

Where, L_j is the j^{th} importance level of PIs.
N_{ij} is the percentage of total participant indicated i^{th} point indicator with j^{th} importance level.
L_j shows different importance level of each *PI* perceived by individual user. i.e.
L_j =1 (If PI is not important), L_j =2 (If PI is somewhat important), L_j =3 (If PI is very important).

For instance, if the quality of road surface is perceived as very important factor which affects the satisfaction level of user R_1. Then the *PI* will be assigned with a higher value of L_j =3.

Accordingly, user R_2 perceived the same attribute as somewhat important and user R_3 perceived the same attribute as not important factor affecting his satisfaction level. Hence, *PI* will be assigned with a value of L_j =2 and L_j =1 respectively.

PI_i is an index value between 0 and 1. From perception study it was found that, if the average value of a point indicator leads to the highly satisfied users, then the corresponding PI_i is assigned with a value of 1. Likewise, PI_i =0 indicates least satisfied users. Intermediate PI_i values are calculated by interpolation as shown in Table 1.

The LOS of each urban street segment was estimated using equation (1). Finally, the percentage of LOS for each urban street segment was calculated by the following equation:

$$\%LOS = \frac{\sum_{i=1}^{10} C_i PI_i}{\sum_{i=1}^{10} C_i} \times 100 \tag{3}$$

4.2 Classification of model output using GA-Fuzzy Clustering

To get a close optimal solution in this research a hybrid algorithm based on fuzzy c-means (FCM) in association with genetic algorithm (GA) is used. This hybrid algorithm has global search of GA and local search capability of FCM. So it can solve the clustering problem in a more efficient way.
The quality of cluster result is determined by the sum of distances from objects to the centers of clusters with the corresponding membership values:

$$J = \sum_{k=1}^{m} \sum_{i=1}^{c} (\mu_{ki})^m d(v_k, x_i) \tag{4}$$

Where $d(v_i, x_j)$ is the Euclidean distances between the object $x_j = (x_{j1}, x_{j2}, ..., x_{jn})\frac{\pi}{3}$ and the center of cluster $v_i = (v_{k1}, v_{k2}, ..., v_{kn}), m \in (1, \infty)$ is the exponential weight determining the fuzziness of clusters.

Due to large volume of calculation realizing the search of global minimum of function *J* is difficult. GA which uses the survival of fittest gives good results for optimization problem. GA doesn't guarantee if the global solution will be ever found but they are efficient in finding a "Sufficiently good" solution within a "sufficient short" time.

5. Result and Analysis

The degree of importance for each point indicator was determined from automobile user's perception survey and tabulated below in the N_{ij} chart. Table 2 shows the percentage of automobile users indicated PI_i with importance level *j*.

Table 2 N_{ij} chart: Percentage of participant marked point indicator '*i*' with importance level '*j*'

j	%PI_1	%PI_2	%PI_3	%PI_4	%PI_5	%PI_6	%PI_7	%PI_8	%PI_9	%PI_{10}
1	0	7.14	7.14	7.14	0	0	21.43	14.29	35.71	0
2	14.29	57.14	28.57	64.29	71.43	28.57	57.14	78.57	64.29	50
3	85.71	35.72	64.29	28.57	28.57	71.43	21.43	7.14	0	50

Where *j*=1: not important, *j*=2: somewhat important, *j* =3: very important

Now the specific coefficients of each point indicators (C_is) were calculated using equation (2) and N_{ij} values shown in Table 2.

C_1=1*0 + 2*14.29 + 3*85.71=285.71
C_2=1*7.14 + 2*57.14+ 3*35.72=228.58
C_3=1*7.14 + 2*28.57 + 3*64.29=257.15
C_4=1*7.14 + 2*64.29+ 3*28.57=221.43
C_5=1*0 + 2*71.43 + 3*28.57=228.57
C_6=1*0 + 2*28.57+ 3*71.43=271.43
C_7=1*21.43 + 2*57.14+ 3*21.43=200
C_8=1*14.29 + 2*78.57+ 3*7.14=192.85
C_9=1*35.71 + 2*64.29+ 3*0=164.29
C_{10}=1*0 + 2*50+ 3*50=250

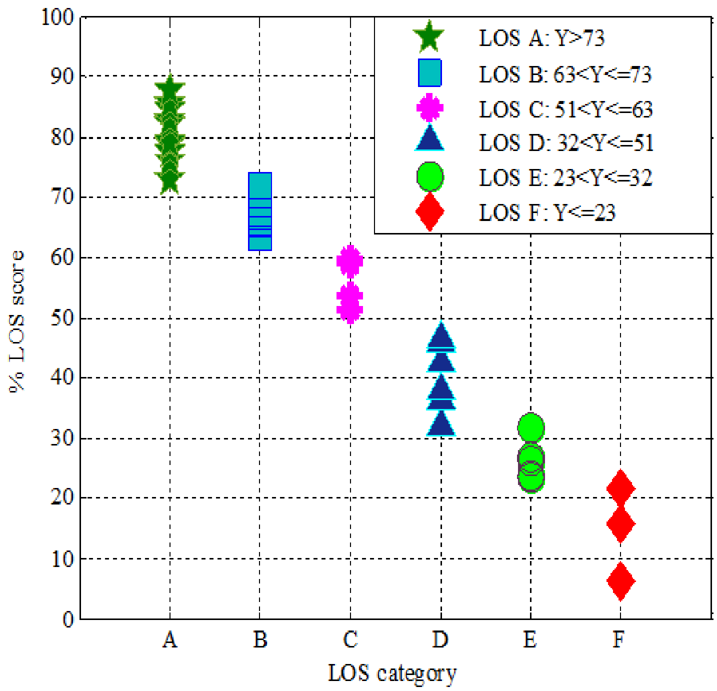

Figure 2 Classifying the percentage LOS of street segments using GA Fuzzy clustering technique

Further, LOS score for each street segment was calculated using equation (1). The total LOS score obtained for each street segment was divided by the total C_is to get the percentage of LOS score (with the help of Equation 3). The percentage LOS calculated for urban street segments are classified into six different categories (A-F) with the help of GA Fuzzy clustering technique to get ranges of LOS categories. The threshold percentages of six LOS categories A-F) were defined and shown in the legend of Figure 2.

Finally, LOS scores and the Service category offered by the urban street segments are also presented in in Table 3.

Table 3 Percentage LOS score and corresponding service category of urban street segments

Site ID	PI_1	PI_2	PI_3	PI_4	PI_5	PI_6	PI_7	PI_8	PI_9	PI_{10}	LOS score	%LOS score	LOS category
1	0.75	0.67	0	1	0.4	1	0.5	0.5	0	0.5	1230.29	53.49	C
2	1	0.67	0.5	1	1	1	1	1	0.67	1	2013.50	87.54	A
3	0.5	0.33	0	1	0	0	0.5	0	0	0	539.72	23.47	E
4	1	0.67	0.5	1	0.8	1	1	0.5	0	0.5	1621.72	70.51	B
5	0.75	0.33	0	0	0.2	0.5	0.5	0.5	0.67	0	835.07	36.31	D
6	0.75	0.33	0	0	0.4	0.5	1	0.5	0.33	0.5	977.93	42.52	D
7	1	0.67	0.5	1	0.8	1	1	1	0.67	1	1967.79	85.56	A
8	1	1	0	1	0.8	1	1	1	0.33	0.5	1747.50	75.98	A
9	0.75	0.67	0	1	0.2	1	0.5	0.5	0	0.5	1184.58	51.50	C
10	1	0.67	0	1	1	1	1	1	1	0.5	1885.28	81.97	A
11	0.75	1	0.5	1	0.4	1	1	0	0	0	1355.73	58.94	C
12	0.75	1	0.5	1	0.4	1	1	0.5	0	0.5	1534.30	66.71	B
13	0.75	0.33	0.5	0	0.2	1	1	1	0.67	1	1460.07	63.48	B
14	0.75	0.33	0	1	0.2	0.5	0.5	1	0.33	0	1067.92	46.43	D
15	0.75	0.33	0.5	1	0.4	1	1	0.5	0.33	1	1545.79	67.21	B
16	0.75	0.67	0	1	0	1	0.5	0.5	0	0	1056.72	45.94	D
17	0.75	0.33	1	1	0.6	1	0	1	0.33	1	1616.51	70.28	B
18	0.5	0	1	0	0.4	0.5	0.5	0	0	0	727.15	31.62	E
19	0.75	0.33	0	1	0.2	0.5	0.5	0	0	0.5	874.72	38.03	D
20	27.5	0	0	1	0	0	0	0	0	0	364.29	15.84	F
21	0.75	0.33	0.5	1	0.2	0.5	0.5	0.5	0.33	0.5	1182.22	51.40	C
22	0.75	0.33	0	0	0.4	0.5	0.5	0	0	0	616.86	26.82	E
23	0.75	0.33	0.5	1	0.8	1	1	1	1	0.5	1819.00	79.09	A
24	1	1	0.5	0	1	1	1	1	0.33	1	1782.51	77.50	A
25	0.75	0.33	0.5	1	0.4	0.5	1	1	0.67	0.5	1509.36	65.62	B
26	0.25	0.33	0.5	1	0	0	0	0	0	0	496.86	21.60	F
27	0.5	0	0	1	0	0.5	0.5	0	0	0	600.00	26.09	E
28	0.75	0.33	0.5	1	1	0.5	1	1	1	1	1811.14	78.75	A
29	0.75	0.67	0.5	1	0.6	1	1	0.5	0.33	0.5	1587.08	69.00	B
30	0.75	0.33	0.5	1	0.4	0.5	0.5	0.5	0.33	0.5	1227.93	53.39	C
31	0.75	0.33	0.5	1	0.8	1	1	1	1	1	1901.14	82.66	A
32	0.75	0.33	0.5	1	1	0.5	1	1	1	1	1811.14	78.75	A
33	0.75	0.33	0.5	1	0.4	0.5	1	1	1	1	1674.00	72.78	B
34	0.5	0	0	0	0	0	0	0	0	0	142.86	6.21	F
35	0.75	0	0.5	0	0.4	0.5	0	0	0.33	0.5	734.65	31.94	E
36	0.75	0.33	0.5	1	1	1	1	1	1	1	1946.86	84.65	A
37	0.75	0.33	0.5	1	0.6	0.5	1	0.5	0.33	0.5	1373.65	59.72	C
38	0.75	0.67	0.5	1	0	1	0	1	1	0.5	1513.86	65.82	B
39	0.75	0.33	1	1	0.4	1	0	1	1	0.5	1656.15	72.01	B
40	0.5	0.33	1	1	0.2	1	0	1	0.33	0.5	1371.51	59.63	C
41	0.5	0	0.5	0	0	0	0	1	0	0.5	546.43	23.76	E

6. Conclusion

Researchers have been established several methods to estimate LOS of urban street segments based upon measurable parameters such as speed, density and volume to capacity ratio. Research deduced that so far limited attention was paid to establish a suitable methodology to assess service quality offered by private mode of transportation based on what public believe. Although a comprehensively updated manual in the form of HCM is being followed in many countries including a developing country like India without acknowledging the effect of heterogeneous traffic on the perceived LOS assumed as a part of total service estimation method. An endeavor has been made in this regard for the evaluation of roadway service using Point system to represent variability and complexity of human perception about road conditions of developing countries. This methodology offers new insights into perception based Levels of service analysis and may thus overcome the limitations of conventional methods.

The inimitability of the proposed model is that it examines the importance level and contribution of each attribute through specific weight co-efficient (C_i) while estimating LOS. The priorities for each point indicators (*PI*) was arranged from highest to lowest effective coefficients, based on which the improvement decisions can be taken effortlessly by the transportation administration considering the actual needs of road users. This study has included diversity in driver's perception and high volumes of privately owned vehicles. Consideration of wide variation in demographic variables shows that collected data sets have a strong potential in model development for heterogeneous traffic flow condition. Also, the applied hybrid clustering algorithm has global search of GA and local search capability of FCM suitably matched the requirement of classifying percentage LOS score into a number of classes (A-F).

The result indicates that many of the road segments were designated as LOS category D, E and F. The basic conclusion drawn from this study shows that the important variables which mostly affect the comfort level of automobile drivers are speed, volume of traffic and road surface quality. Along with that vital issues related to interruptions by public transit/non-motorized vehicles/pedestrian and on-street parking turnover requires improvement to obtain a higher LOS score. These assessments will support to develop the implements for planning and decision making in the field of transportation administration. This model is more intuitive in practice; even non-modelers can easily understand the proposed methodology. Any additional variables can also easily be included in the model in future depending on revisions those may occur over time period.

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