Engineering/Science/Technology Civil/GET/TE

A COMPREHENSIVE STUDY CONDUCTED ON URBAN BUS ROUTE'S

Mr. B.Brahmaiah, Mr.K.Srinivas
Asst.Prof. Vignan's IIT, Beside VSEZ

ARTICLE HISTORY
Received: 05 Apr 2017
Revised: 15 Apr 2017
Accepted: 25 Apr 2017
Available online: 10 Jun 2017

ABSTRACT

The rapid growth of India's urban population has put enormous strains on all transport systems. Providing and improving urban public transport service is becoming highly important to meet the demand of rapidly growing mass mobility due to high population growth. So that overcome the problem and to reduce the growing of private vehicles, proper planning and operation of urban bus route is required to be practiced in major cities in India.

The main objective of this study is analyzing factors affecting the total travel time of urban bus roads and regression model is developed for the travel time prediction. For present study, two urban bus routes are selected in Visakhapatnam one is Gajuwaka junction to Gurudwar 16.9Km stretch and another one is Gurudwar junction to old post office 5.57km stretch. Based on this multiple regression analysis, it was found that bus dwell time is dependent on alighting and boarding of passenger and total travel time is dependent on dwell time and signal time. Sensitivity analysis was also carried out to check the performance of generalized service time model.

***Keywords*— planning and operation, urban bus route, Dwell Time, travel time, Regression Model.**

 2455-2062 | http://dx.doi.org/xx.xxx/xxx.xxx.xxx |

I. INTRODUCTION

Traffic is growing at a rapid rate in urban areas, thus, increasingly congested roadways that slow down buses, increase bus operating costs, and further discourage public transport use. This indicates inefficiency of urban transit system and public transport is being stifled by this congestion. Efficient urban travel modes and transit system can play an essential role in reducing travel time, congestion, and energy consumption in this case needed a comprehensive study conducted to accurate measurement of the Level of Service (LOS) attributes, such as travel time, waiting time and transfer times and cost components at particular origin and destination. From conducted studies find out the problems and policy should be designed in such a way as to reduce the need to travel by personalized modes and boost the public transport system. The main objective of this study is to better understand the factors affecting bus travel time and Performance measurement of urban bus routes by travel time analysis between origin and destination and Analyzing the Effect of dwell time in bus stops.

II. LITERATURE REVIEW

Furth and Muller et al. (2007): discuss how planners often have to decide on running times without having adequate historical data, and base their decisions on a single day's observations or in reaction to complaints. One common rule of thumb, also discussed in TCQSM, is to set the running time between time points equal to the mean observed running time. Another common rule of thumb is to set the route running time at 85-percentile

uncontrolled running time. Recovery time at the end of a bus line is then commonly determined using a fixed percentage (often 15% or 20%) of the scheduled running time.

Chen et al. (2009): looked at the service reliability for several different bus routes in Beijing. They proposed three different performance parameters (a punctuality index based on routes, deviation index based on stops and an evenness index based on routes) to analyze the route performance. Their results showed that in general all three performance parameters decreased with the increase of route length. This indicates that the longer the bus route the lower the reliability. Moreover, they find that the decline in performance is most significant up to 30 km route length.

Chen et al. (2014) used an orthogonal design method to generate stated preference questionnaires. Then, the relationships between the cost, time variable and the choice probability of the public transport were analyzed. According to the results, we found that the workability of Multinomial Logit (MNL) Model was better than Nest Logit (NL) model. They proposed some measures to improve the performance such as built Bus Rapid Transit systems, reducing the access time to Metro and bus stop, limiting parking.

Amita Johar et al. (2014) this presented the methodology for planning and operation of urban bus route. For present study, the urban bus route of Delhi Transport Corporation (DTC) from Janakpuri D Block to Jai Mata Market has been considered. Based on the regression analysis, it was found that bus service time is dependent on alighting and boarding of passenger plus opening and closing of door. Sensitivity analysis was also carried out to check the performance of generalized service time model.

III. METHODOLOGY

The current study examine the, effect of dwell time and signals time to the total travel time, analyzing the effect passenger loading and unloading to the dwell time and also developed generalized Dwell time and Total travel time model.

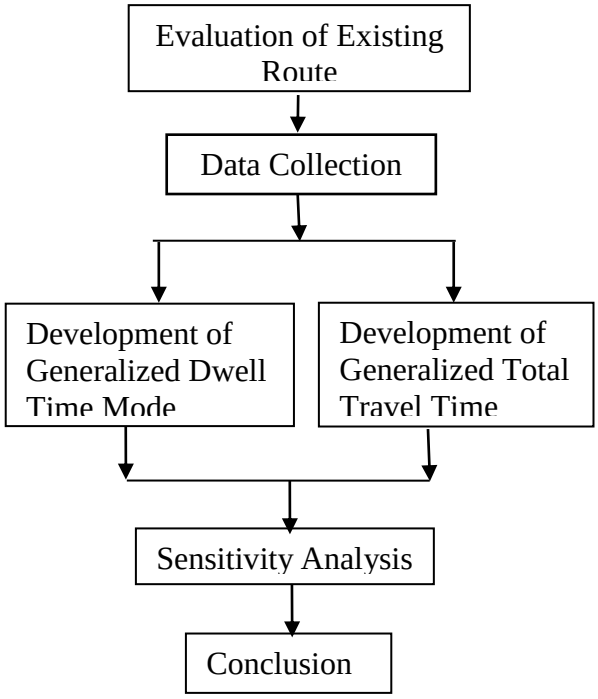

Fig.1 Methodology for Performance Analysis of Urban Bus Route

A. EVALUATION OF EXISTING ROUTE: For this study two existing bus routes are considered in Visakhapatnam, one is from Gajuwaka to Gurudwar about 16.9 km in length having17 number of bus stops and another one is from Gurudwara to old post office about 5.57 km in length having14 number of bus stops. For these routes data (Route, Passenger and Vehicle Related**)** is collected in weekdays (Monday to Friday) during morning peak from 8 to 11 am.

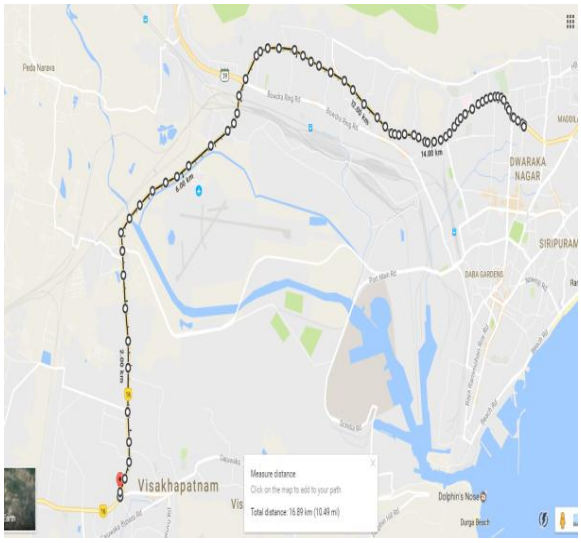

Fig 2: Shows Gajuwaka to Gurudwar Junction (Route 1)

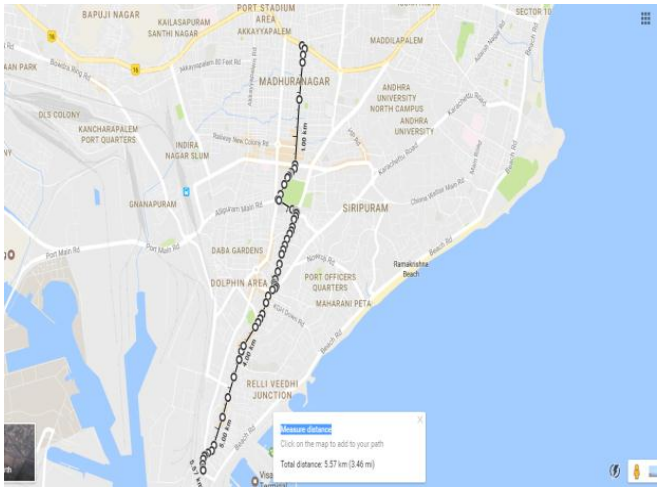

Fig 3 Shows Gurudwar Junction to Old Post Office (Route 2)

B. DEVELOPMENT OF GENERALIZED TRAVEL TIME AND DWELL TIME MODELS: The main objective model to develop generalized equation to estimate travel time and dwell time by using simple linear regression analyses. The **Regression** analysis is used to analyzing the performance of urban transit route and sensitivity analysis carried out on dwell time based on route LOS attributes and their interactions with a host of individual and socio-demographics. In this model, we evaluate the influence of two overall route characteristics: (a) Shortest travel time and low travel cost route and (b) effect of dwell time, signals time and reliability of transit mode (based on frequency analysis). All regression results and corresponding formulas are presented in Chapter-4.1. The attempts of introducing load in the dwell time model had marginal effects on the explanatory power (R2-values, t-stat and P-values) of the model.

$T.T=C+a_1D.T+a_2S.T$, Where

C=Constant,

a_1=Coefficient of Dwell Time,

D.T=Total Dwell Time Taken in A Particular Route,

a_2=Coefficient of Signal Time,

S.T=Total Signal Time Taken in A Particular Route,

T.T=Total Travel Time on Particular Route.

TT=1878.974+0.057D.T+0.908S.T (Route-1, Metro bus),

TT=1874.070+1.046D.T+0.958S.T (Route-1,Ordinary bus)

TT=1380.517-0.959D.T+0.503S.T (Route-2, Ordinary bus).

i.

i. TOTAL TRAVEL TIME ON PARTICULAR ROUTE: The model results demonstrates that Dwell time and Signals time travel time are playing a significant role in total travel time behavior of transit mode. We should evaluate quantifiably the effects of these variables on the travel time behavior so that the transportation policy can be better supported by the results. For the second route from Gurudwar to old post-office the dwell time coefficients clearly indicate the negative propensity towards travel time and first route from Gajuwaka to Gurudwar the passenger un-loading time coefficients clearly indicate the negative propensity towards dwell time

TABLE 1 SHOWS TRAVEL TIME COEFFICIENTS FROM REGRESSION ANALYSIS

Route	Parameters	Coefficients	Standard Error	P-Value	T-Stat
Route-1 Metro Bus	Constant	1878.974503	172.810	4.48E-09	10.873
	Dwell time	0.057976207	0.869	0.947632	0.066
	Signals time	0.908105482	0.306	0.008803	2.958
Route-1 Ordinary Bus	Constant	1874.07007	188.623	1.7E-08	9.935
	Dwell time	1.046202652	0.783	0.199398	1.335
	Signals time	0.958157825	0.306	0.006184	3.123
Route-2 Ordinary Bus	Constant	1380.517898	125.015	3.55E-09	11.042
	Dwell time	-0.95950996	0.868	0.284609	-1.104
	Signals time	0.503855662	0.499	0.327484	1.008

TABLE 2 SHOWS DWELL TIME COEFFICIENTS FROM REGRESSION ANALYSIS

Route	Parameters	Coefficients	Standard Error	P-Value	T-Stat
Route-1 Metro Bus	Constant	1.803315424	1.158	0.129736	1.556
	Passenger loading	3.598333613	0.596	1.13E-06	6.027
	Passenger un loading	2.527367859	0.556	7.98E-05	4.540
Route-1 Ordinary Bus	Constant	4.039896	1.268	0.00329	3.185
	Passenger loading	1.781048	0.280	4.47E-07	6.356
	Passenger un loading	0.51578	0.274	0.069857	1.877
Route-2 Ordinary Bus	Constant	1.904555334	1.716	0.277643	1.109
	Passenger loading	1.685410832	0.347	5.44E-05	4.853
	Passenger un loading	1.259075977	0.425283501	0.006637	2.960

ii. TOTAL DWELL TIME ON PARTICULAR ROUTE

$D.T=C+a_1P.L+a_2P.UL$, Where

C=Constant,

a_1=Coefficient of Dwell Time,

P.L=Total Passenger Loading in A Particular Route,

a_2=Coefficient of Signal Time,

P.UL=Total Passenger Un Loading in A Particular Route,
DT=1.803+3.598P.L-2.527P.UL (Route-1, Metro Bus).

DT=4.039+1.781P.L+0.515P.UL (Route-1, Ordinary Bus).

DT=1.904+1.685P.L+1.259P.UL (Route-2, Ordinary Bus).

TABLE 3 SHOWS OBSERVED AND PREDICTED TRAVEL TIME

Route	Dwell time	Signals time	Predicted Travel Time	Observed Travel Time
Route-1 Metro Bus	124	378.9	2230.083	2310.1
	128.2	366.2	2218.791	2139.1
Route-1 Ordinary Bus	186.8	374	2427.754	2527.6
	185.7	341.8	2395.756	2296.1
Route-2 Ordinary Bus	137.4	55	1221.085	1203.6
	120	70	1230.227	1363.5

C. VALIDATION OF MODELS DEVELOPED MODELS: The overall goodness-of-fit is reflected by the P-value and T-Value. The P-Values which is way less than the critical value (0.05). For the dwell time, travel time coefficients and also passenger's loading and un-loading coefficients. Further in order to check the goodness-of-fit of model a prediction success was prepared showing estimation and validation results. This is presented in Tables 4.5 and 4.6 It was seen that predicted total travel time is near to those of observed. The validation sample was 10 percent of the total sample

TABLE 4 SHOWS OBSERVED AND PREDICTED DWELL TIME

Route	Passenger Loading	Passenger un-Loading	Predicted Dwell Time	Observed Dwell Time
Route-1 Metro Bus	40.4	42	102.63	124
	39	13	109.271	128.2
Route-1 Ordinary Bus	86.7	70.2	193.412	187
	79.6	65.7	180.753	186
Route-2 Ordinary Bus	40.9	53.2	137.79	137.4
	46.3	28.2	115	133

IV. CONCLUSION

In the study conclude how the total trip time influenced by no of bus stops, signals are laid and types of modes are available in that particular route. Mode choice mainly depends on travel time, travel cost quality of service and personal characteristics of passengers.

1. Dwell time coefficient (-0.95950996) indicates the negative depicting total travel time of transit route increases. (Old Gajuwaka to Gurudwara)
2. Passengers unloading coefficient (-2.527367859) having negative impact which means due to passengers unloading dwell time increase at bus stops. (Gajuwaka to Gurudwara for metro bus)
3. As per simulated travel time metro bus takes very less time on Avg 38 minutes (from Gajuwaka to Gurudwara) compared to ordinary bus travel 44 min for same distance. Because bus has to face less bus stops compared to ordinary bus service.

4. Dwell time is mostly influenced by total trip time so that identify the unwanted bus stops and eliminate bus stops.
5. From Gurudwar to Old Post office within a short Distance highly travel time is consumed due to congestion and no of signals, so that it may required widening or introducing elevated model for Travel Time reducing.

REFERENCES

1. Abkowitz, M.D., Engelstein, I., 1983. Factors affecting running time on transit routes. Transportation Research Part A 17A (2), 107-113.

2. Chen, X., Yu, L., Zhang, Y., Guo, J., 2009. Analyzing the urban bus service reliability at the stop, route and network levels. Transportation Research Part A 43, 722-734.

3. Furth, P.G. and Muller, T.H.J. 2007. Service Reliability and Optimal Running Time Schedules. Transportation Research Record: Journal of the Transportation Research Board, No. 2034.

4. Tetrault, P.R., El-Geneidy, A.M. 2010. Estimating bus run times for new limited-stop service using archived AVL and APC data. Transportations Research Part A 44 (2010), 390-402.

5. West, J., 2011. Boarding and bunching. The impact of boarding procedure on bus regularity and performance. Kungliga Tekniska Högskolan, Stockholm.

6. Dueker K. J, Kimpel T. J, Strathman J.G, "Determinants of Bus Dwell Time," Journal of Public Transportation, vol.7(1), 2004,pp.21-40,.

7. El-Geneidy A.M and Vijayakumar N,"The Effects of Articulated Buses on Dwell and Running Times", Journal of Public Transportation, vol.14(3), 2011,pp.63-86.

8. Jaiswal S, Bunker J and Ferreira L, "Modeling the Relationships Between Passenger Demand and Bus Delays at Busway Stations," TRB Annual Meeting CD-Rom, 2009.

9. Amita Johar, S.S Jain, and P.K Garg "Planning and Operation of Urban Bus Route- A Case Study in West Zone of Delhi", ICETET- London (UK) 2014. http://dx.doi.org/10.15242/IIE.E0514516

10. Bertini R.L and El-Geneidy A.M, "Modeling Transit Trip Time Using Archived Bus Dispatch System Data," Journal of Transportation Engineering, vol. 130(1), 2004, pp.56-67.