



e-ISSN: 2319-8753 | p-ISSN: 2347-6710

# IJRSET

International Journal of Innovative Research in  
**SCIENCE | ENGINEERING | TECHNOLOGY**



# INTERNATIONAL JOURNAL OF INNOVATIVE RESEARCH

IN SCIENCE | ENGINEERING | TECHNOLOGY

Volume 10, Issue 8, August 2021

**ISSN** INTERNATIONAL  
STANDARD  
SERIAL  
NUMBER  
INDIA

**Impact Factor: 7.569**

9940 572 462

6381 907 438

[ijrset@gmail.com](mailto:ijrset@gmail.com)

[www.ijrset.com](http://www.ijrset.com)



# Mode Choice Behavior of Commuters in Amravati City

Priya S. Thakare<sup>1</sup>

P.G. Student, Department of Civil Engineering, G.H. Raisoni University, Amravati, India<sup>1</sup>

## ABSTRACT: MODE CHOICE BEHAVIOR OF COMMUTERS IN AMRAVATI CITY

The commuter's mode selection behaviour contributes significantly to transportation planning decisions. The commuter may choose a mode from a variety of available modes for a variety of reasons. Numerous variables contribute to a mode selection decision. Proper study of the chosen mode of transport may assist in resolving problems such as predicting demand for new modes of transport, reducing traffic congestion, allocating resources, and evaluating the overall efficiency of travel, among others. Mode choice analysis is the process of determining which mode of transport the public will choose in a given set of conditions. The purpose of this study is to investigate commuter mode choice behaviour in Amravati. It seeks to identify the many variables that affect commuters' choice of mode in Amravati, as well as the factors that encourage and discourage them from using public transit. Additionally, an online and offline pilot survey was performed. Mode of evaluating the questionnaire's effectiveness.

**KEYWORDS:** Logistics; Urban area; Commute; Travel pattern

## I. INTRODUCTION

Mode choice behavior of commuter plays an important role in transportation planning decision. The commuter may choose a mode out of many available modes for specific reasons. Many factors are responsible for a mode choice decision. A proper analysis of the mode choice decision can help in addressing issues such as forecasting demand for new mode of transport, mitigating traffic congestion, allocating resource, examining the general efficiency of travel, and will provide insight into the traveler behavior characteristic mode choice analysis is the third step of the classical four-step transport planning process coming after trip generation, which explain the level of trip making, and trip distribution, which explain the relative frequency of trip lengths. Mode choice analysis is the process of arriving at a decision about the mode availed of by the public in a particular set of circumstances. Based on the totality of these weights, a commuter decides that mode which has the least disutility. Mode choice models in analyzing the travel demand of a study area.

## DESCRIPTION OF THE STUDY CITY

Amravati also known as umravati is a city in state of Maharashtra, India. It is the second largest city in Vidarbha region of Maharashtra after Nagpur and is administrative head quarter of the Amravati region. The city had a population of approximately 646,001 as on call with a population density of 31819/km. The city has many central and state government offices, Organization Private sector. There are some government God Private owned medium and large scale industrial. Q Bait in Amravati city Bus Service limited is a Private incorporated on 07 April 2015. It is classified as state. Government company and is registered at Register of companies Mumbai (cabs and auto rickshaws Motorized three wheelers) are the other means of public transportation within the city. Cars and motorized two wheelers are the commonly used personal mode. Cyclists are very rare in the city and due to poor pedestrian facilities such as footpath, pedestrian subway and traffic signals with pedestrian phase, is not a good pre-dominant walking mode. Studies have shown that the bus service in the city has not come up to expectation of public.

## II. LITERATURE REVIEW

2.1 Arasan, V. T., Rengaraju, V. R., and Krishna Rao, K. V. (1994). "Characteristics of trips by foot and bicycle modes in Indian city." *J. Transp. Eng.*, 120(2), 283–294.

Walking and bicycling are the two types of transportation most often used in developed countries' metropolitan cities, and the features of these modes affect the position of transportation related facilities in urban areas. The promotion of nonmotorized modes of transportation would also contribute significantly to energy efficiency and environmental sustainability. The homebased walking and bicycling trips of Tiruchirappalli, India, are examined in this paper in terms of trip duration and influential variables such as age, gender, profession, trip intention, and period of day of travel.



Major differences in trip lengths by walk and bicycle were discovered among trip makers of various categories. Since walking and bicycling cannot be used for longer journeys, the appropriate trip distances for the two types must be determined. Fitting polynomials to trip length distributions yielded the appropriate trip duration for these modes. In certain instances, the use of likelihood distributions to determine suitable trip duration has also been shown.

2.2 Badoe, D. A., and Wadhawan, B. (2002). "Jointly estimated cross-sectional mode choice models: Specification and forecast performance." *J. Transp. Eng.*, 128(3), 259–269.

This paper looks at a variety of concerns related to jointly estimating disaggregate logit mode option models for two cycles utilising data obtained at two points in time in separate cross-sectional travel surveys in a given metropolitan environment. These include: (1) the influence of travellers' socioeconomic characteristics on the predictive and forecast output of jointly calculated models; and (2) the effect of enabling the volatility of random services in various time periods to vary, as well as the impact transfer-bias scale parameters could have on joint model predictive performance. The findings indicate that well-specified jointly estimated models based on data from two time intervals provide disaggregate and aggregate predictions that are comparable to those produced from traditional forecasting models based on data from a single cross-sectional sample. Socioeconomic variables and transfer-bias scale parameters have been discovered to increase model fit to estimation data as well as prediction accuracy. The shorter the time passed between the compilations of the two cross-sectional data sets used in joint estimation, the easier the jointly calculated models predict travel choices in each of the survey years.

2.3 Buehler, R. (2011). "Determinants of transport mode choice: A comparison of Germany and the USA." *J. Transp. Geogr.*, 19(4), 644–657.

Germany and the United States have among the fastest rates of motorization in the country. Despite this, Germans make four times as many journeys on foot, bike, and public transportation as Americans, while driving accounts for a quarter of their trips. Using two comparable national travel studies, this paper explores the determinants of transportation mode preference in Germany and the United States. Higher population density, a more diverse land use composition, household access to public transportation, and fewer vehicles per household are all correlated with a lower share of vehicle trips in both nations. However, major variations remain: Americans in general are more car-dependent than Germans. And when differences in socioeconomic conditions and land usage are taken into account, Germans are more inclined to bike, ride, and take public transportation. Furthermore, Americans who live in compact, mixed-use neighbourhoods near public transportation are more inclined to drive than Germans who live in lower density areas with a more limited mix of land-uses and further from public transportation. Differences in transportation policies that render car travel slower, more costly, and less convenient in Germany, as well as alternatives to the automobile more appealing could help account for the remaining differences.

#### AIM

To identifying the various factor that contribute to the selection of a particular mode in the city of Amravati and the factors. Which influence the commuters to use Public transport and those factor that stand in their way in using transport.

#### RESEARCH OBJECTIVE

The foregoing are the study's key objectives:

- Recognizing people's actions in choosing a form of transportation.
- To define the variables shaping mode selection The trip-makers' actions.
- To go into the trip mode choice survey results.
- To prepare the MNL model for various types of transportation.

### III. METHODOLOGY

#### 3.1 DATA COLLECTION FOR ESTABLISHED PUBLIC TRANSPORTATION ROUTES IN AMRAVATI

Data was obtained for a total of five pathways identified for analysis. Five routes have been chosen to link the city's different important areas with Foreskin. Surveys were undertaken at peak hours to gather data. Data can be obtained when considering waiting time, boarding and disembarking times, and the amount of passengers at and beyond each bus stop, rather than the number of curves and spaced breakers. Data on safety, comfort, service level, and convenience are obtained by offering proforma to citizens who use public transit, and conductors gather statistics on how many trips per day and travel expenditures.



The aim of this research is to examine commuter mode preference conduct in the city of Amravati. It aims to recognize the numerous factors that lead to the selection of a specific mode in the city of Amravati, as well as the factors that influence commuters to use public transportation and those that prohibit them from doing so. The research is confined to work trips only. In the analysis, the disclosed preference survey, a method used to study the travel trend in an actual scenario, was used to assess the travel patterns of all accessible modes in the region. Initially, a stated choice questionnaire was developed, which included entries to collect data on commuters' socioeconomic and travel characteristics. The questions were written with the chosen section of the book in mind. The survey region covered the planned Metro stations. The questionnaire was distributed prepared in digital form as well to draw web visitors responses to the questionnaire. As a result, the vocabulary and the technical aspects were explicitly listed to help in self-understanding of the Age, gender, and income are examples of socioeconomic parameters. Vehicle possession was used to estimate the probability of switching to the metro, as well as transit criteria. The purpose of the journey, the mode of transportation, the discomfort encountered, and Reasons to move to metro, etc., were also needed. Examine the commuter's proclivity to utilize public transit. A pilot survey was also conducted both online and offline. Mode to test the efficacy of the designed questionnaire.

MNL modeling was included in the analysis because of its potential to estimate mode shares when a rider has more than two modes of transportation options. The questionnaire questioned regarding commuters' socioeconomic status and trip details.

Respondents given the following information:

1. The options made available to each user.
2. Per individual's socioeconomic characteristics (age, gender, occupation, vehicle ownership, and monthly income).
3. Transportation mode, waiting period, and walking time are trip-related variables.
4. Basic trip-related characteristics of the transportation system, such as travel time (min) and travel expense. Data for the study were gathered via direct interviews with employees from different government and private departments, colleges, and educational institutions in Amravati. Surveyors offered guidance and descriptions to respondents as required.

#### DESIGN OF QUESTIONNAIRE

A pilot questionnaire survey was first conducted. The questions pertained to the socioeconomic condition and travel characteristics of the trip maker. The socioeconomic characteristics were assessed by considering factors such as age, gender, nature of job, monthly income, and vehicle ownership. Travel characteristics included distance from home to office, mode of conveyance, reasons for choosing the mode, waiting time, in-vehicle travel time, cost of travel, etc. Commuters' satisfactory levels with respect to present mode, their willingness to switch over to another mode, and reasons for it were also arrived through the questionnaire survey. It also contained questions that enabled ranking of mode attributes in general and ranking of performance of the existing KSRTC service in the city. Efficiency level of existing KSRTC service were ranked based on factors such as comfort, time of travel, cost of travel, safety, ease of boarding, frequency/availability, travel in peak hours, reliability, travel in difficult weather. A pilot survey was conducted and 90 samples were obtained. Based on the response, preferences, and the suggestions of the commuters, the variables were shortlisted and the questionnaire was further refined. A large scale survey was conducted among the commuters using this refined questionnaire.

#### SOME QUESTIONNAIRE:

1. which mode of transport that you use?
  - o Bus
  - o Car
  - o Two-wheelers
  - o By cycle
2. why you choose private mode of transport?
  - o Comfort
  - o Safety
  - o Duration
  - o All of the above
3. Do you satisfied with your present mode of transport?



- Yes
  - No
4. which mode of transport is cheaper?
- Public transport
  - Private transport
  - None of the above
  - All of the above

5. Do you waiting for more time on the stop for bus?

- Yes
- No

**CALCULATION**

Table 1. Case processing summary along with coding pattern

Factors considered	categories	Coding pattern	N	Marginal%
Mode of conveyance	Bus	1	72	39.34
	Two Wheeler	2	63	34.42
	Car	3	48	26.22
Age group	21-30	1	52	28.41
	31-40	2	43	23.49
	41-50	3	50	27.32
	51-60	4	38	20.76
Gender	Male	1	88	48.08
	Female	2	95	51.91
Monthly income	Less than 10000	1	48	26.22
	10000-15000	2	44	24.04
	15000-20000	3	34	18.57
	20000-25000	4	19	10.38
	Above 25000	5	38	20.76
Vehicle ownership	Does not own a vehicle	1	52	28.41



	Owns car only	2	33	18.03
	Owns twowheelers	3	74	40.43
	Owns both car And two wheelers	4	24	13.11
Distance(km)	0-5	1	73	39.89
	6-10	2	48	26.22

### Analysis Using MNL Regression

When using MNL regression the dependent variable is chosen as the reference category. All parameters in the model are interpreted with reference to it. It is the standard/reference category to which others (response category) would naturally be compared. The coefficients are estimated through an iterative maximum likelihood method. Odds ratios are determined for all independent variables for each category of the dependent variable except the reference category. Odds ratio represents the change in the odds of being in the dependent variable category versus the reference category associated with a one unit change in the independent variable. MNL regression was done to identify the influence of various factors on the switching behavior of commuters from bus to car and two-wheeler. Such an analysis will help policymakers to improve the government-owned buses and attract more commuters from personalized modes such as cars and two-wheelers. Therefore, for the, the mode of conveyance is chosen as dependent variable, as the problem is concerned with choice of mode. In order to get the preference of bus relative to other modes, bus is chosen as the reference category. Bus was compared with car and two-wheeler separately to understand the factors and their degree of influence in shifting commuters from bus (public transport) to personalized modes (car and two-wheeler). The independent variables chosen are age group, gender, monthly income, vehicle ownership, distance from home to office, time per distance, and cost per distance. The independent variables are classified into various categories. The output of analysis is shown in Table 1, in which N represents the number of observations under each case. The marginal percentage lists the proportion of valid observations found in each of the outcome variable's groups. Valid indicates the number of observations in the data in which the output variable and all predictor variables are nonmissing. The likelihood ratio tests that show the contribution of each variable to the model are shown in Table 2. From Table 2, it can be seen that all variables have significance less than 0.05. Therefore, it can be concluded that all the variables used in the model have significant contribution toward predicting the mode choice behaviour of commuters. Of these, age, vehicle ownership, distance to travel, and cost of travel are found to be the most significant ones. Table 3 shows a statistical comparison of intercept-only model and final model. Intercept only describes a model that does not include any predictor variables and simply fits an intercept to predict the output variable. Final describes a model that includes the specified predictor variables and has been arrived at through an iterative process that maximizes the log likelihood of the outcomes seen in the output variable (Table 3). By including the predictor variables and maximizing the log likelihood of the outcomes seen in the data, the final model is an improvement on the intercept-only model. The likelihood ratio test shows the contribution of each variable to the model.

This fact is revealed by the statistical tests on the two models as given in Table 3. The chi-square statistic is the difference between the  $-2$  log-likelihoods of the null/intercept-only and final models. Because the significance level of the test is less than 0.05, it can be concluded that the final model is outperforming the null model. The pseudo R2 value of the final model according to Cox and Shell, Nagelkerke, and McFadden tests were 0.694, 0.789, 0.560, respectively. Pseudo R2 value indicates the proportion of variance of the response variable explained by the predictors and its maximum value is 1. Larger pseudo R2 statistics indicate that larger percentage of variation can be explained by the model. Thus, based on the pseudo R2 values it can be concluded that the model developed in the present study explains approximately 56–79% variation. Therefore, the model can be considered statistically significant.



**Table1.Model-Fitting Information**

Parameter	Model-fitting Criteria Likelihood ratiotest		
	-2LogLikelihood	Chi-square	DegreeofFreedom
			Significance
Intercept Only	774.833	0.000	0 -
Age group	328.821	36.656	6 0.000
Gender	353.163	12.372	2 0.002
Income	342.121	23.415	8 0.003
Ownership	354.252	577.377	6 0.000
Distance	354.252	32.472	6 0.000

**Table2.Values of Likelihood Ration Test**

Model	Model-fitting Criteria Likelihoodratiotest		
	-2LogLikelihood	Chi-square	DegreeofFreedom
			Significance
InterceptOnly	774.833	0.000	0 -
Final	352.821	422.012	28 0.000

**Table4.Parameter of Choice between Bus and Two–Wheeler**

Response Category	Predictor Variables and their categories	B	Exp(B)
Two– Wheeler	Intercept	1.248	-
	Agegroup=1.00	1.363	1.256
	Agegroup=2.00	-0.661	0.516
	Age group=3.00	-1.549	0.213
	Gender =1.00	1.105	3.019
	Income=1.00	-0.445	0.560
	Income=2.00	-0.216	0.242



Income=3.00	0.138 1.871
Income=4.00	0.523 1.687
Vehicalownership=0.00	-7.045 0.001
VehicleOwnership =1.00	-4.694 0.009
VehicleOwnership=2.00	-0.765 0.465
Distance=1.00	2.243 9.423
Distance=2.00	1.980 7.240

### III. RESULT

Analysis of MNL Regression Model of Two-Wheeler in Relation to Bus The MNL model estimates for a unit increase in each variable affecting commuters' choice of two-wheeler relative to bus, when the other variables in the model are held constant, are discussed in the following sections (as given in Table 6).

- Age group. MNL regression analysis of those who choose two-wheelers relative to bus observed that compared with commuters of age group (51–60), commuters of age group (21–30) have 1.26 times as much chance of choosing two-wheeler rather than bus. Therefore, it can be concluded that the preference of two-wheeler relative to bus is higher for lower age groups and lower for higher age groups.
- Gender. Regarding the influence of gender over choice between two-wheeler and bus, compared with females, males have almost 3.02 times more chance of switching to two-wheeler from bus. The reason may be because females are not comfortable in using two-wheeler as it is an unsafe mode, and therefore they prefer bus to two-wheeler. • Monthly income. The preference of two-wheeler relative to bus is lower for low-income groups (monthly income less than Rs. 10,000–15,000) and higher for high-income groups (monthly income Rs. 15,000 to greater than 25,000). The trend is similar to the observation regarding choice between car and bus given in the previous section. Therefore, the same argument holds good for this case as well.
- Vehicle ownership. The preference of two-wheeler relative to bus is lower for those who own only car and higher for those who own both two-wheeler and car. The reason for this might be because those who own only car, preference of two-wheeler to bus does not make any sense. Only teenagers might prefer such a shift if they get an opportunity to own a two-wheeler. However, those who own both two-wheeler and car have shown a greater trend to switch to two-wheeler from bus compared with those who own only two-wheeler. The better manoeuvrability of two-wheelers and their ability to travel faster than car under congested conditions could be the reason for this trend. Moreover, considering the total cost, two-wheelers are more economical. The MNL model has correctly predicted captive riders as their odds ratio is near to zero.
- Distance (km). Multinomial analysis reveals that as travel distance increases, the chances of switching to two-wheeler from bus decreases. The chance of switching to two-wheeler from bus is almost 9.42 times for short distance commuters (0–5 km), whereas it is only 7.24 for commuters having travel distance in the 6–10 km range. The preference of two-wheeler relative to bus is higher for short-distance commuters. It decreases with increase in travel distance.

### IV. CONCLUSION

A comparison between two-wheeler users and car users with reference to their preference to bus revealed that two-wheeler owners showed a greater preference to bus compared with car users. This may be because users of two-wheelers generally fall under low middle income category, and therefore their next natural choice will be bus. The commuters, who own both two-wheeler and car, gave least preference to bus and higher preference to car. This is because in a developing country like India, given the poor state of public transport, those owning car as well as two-wheelers prefer car owing to its safety and flexibility. The study also revealed that the bus





commuters who own both car and two-wheeler preferred two-wheeler when faced with a situation that demands switching from bus. This shifting from bus is mainly due to the inefficient and nonreliability of bus transport. This also points to the fact that in the. For personal use only; all rights reserved. cities of developing countries like India where there is a predominant share of two-wheeler traffic, improving public transport will likely attract more commuters to bus. This will likely lead to significant reduction in traffic volume on urban roads.

The MNL modeling which has been made use of in this study will be of much help to the policymakers to introduce various schemes to improve government-owned bus system, so that it can be made more attractive. This will ensure that more commuters shift from personalized mode to public transport system. Such a shift is highly recommended for a developing country like India, as it will ensure substantial reduction in traffic volume along already choked urban corridors, and will reduce vehicular emission, delay, and fuel consumption.

#### REFERENCES

- 1) Arasan, V. T., Rengaraju, V. R., and Krishna Rao, K. V. (1994). "Charactersitics of trips by foot and bicycle modes in Indian city." J. Transp. Eng., 120(2), 283–294. Journal of Engineering Research and studies. vol.10,1994
- 2) Badoe, D. A., and Wadhawan, B. (2002). "Jointly estimated crosssectional mode choice models: Specification and forecast performance." J. Transp. Eng., 128(3), 259–269. Journal of sustainable Development, vol 12,2002
- 3) Buehler, R. (2011). "Determinants of transport mode choice: A comparison of Germany and the USA." J. Transp. Geogr., 19(4), 644–657. Vol 14,2011
- 4) Census of India. (2001). Series 10 Kerala, Government of India. Census of India. vol 13,2001
- 5) Ghareib, A. H. (1996). "Evaluation of log it and probit models in mode choice situation." J. Transp. Eng., 122(4), 282–290. Institute of Town planners vol 7,1996



**Impact Factor:  
7.569**



# INTERNATIONAL JOURNAL OF INNOVATIVE RESEARCH

IN SCIENCE | ENGINEERING | TECHNOLOGY

 9940 572 462  6381 907 438  [ijirset@gmail.com](mailto:ijirset@gmail.com)



[www.ijirset.com](http://www.ijirset.com)

Scan to save the contact details