iJRASET
International Journal For Research in Applied Science and Engineering Technology

INTERNATIONAL JOURNAL FOR RESEARCH

IN APPLIED SCIENCE & ENGINEERING TECHNOLOGY

Volume: 5 **Issue:** IV **Month of publication:** April 2017

DOI: http://doi.org/10.22214/ijraset.2017.4253

www.ijraset.com

Call: 08813907089 | E-mail ID: ijraset@gmail.com

International Journal for Research in Applied Science & Engineering Technology (IJRASET)

Generating Models of Mode Choice Analysis for an Industrial Zone (Gidc Makkarpura) in the City of Vadodara

Bharvi A. Shah[1], Dr. L. B. Zala[2]
[1]Professor & Head, [2]M.Tech. Student, Department of Civil Engineering
BVM Engineering College, V. V. Nagar, Anand, India.

Abstract: ***Various modes of transportation are available for road users. The choice for one particular mode greatly depends upon various factors such as socio-economic factors, trip characteristics, travel characteristics etc. In order to determine the overuse or ineffective use of a particular mode of transportation; it is necessary to analyse all the possible responsible factors. This study was conducted to determine the ruling factors of the mode choice in an industrial zone- GIDC Makkarpura in the city of Vadodara, where majority of the daily work trips are concentrated. The study was carried out by surveys in two parts, where the Revealed preference survey determines the major affecting factors of mode choice and the Stated preference survey comprises hypothetically framed 16 choice sets, giving choice between the private and public mode of transport for the varying conditions of the main factors determine from the RP survey (i.e travel time, travel cost, comfort and safety). Based on the responses of chosen sample, 8 models for the mode choice has been generated, and calibrated in the Biogeme software. The calibration gives the best suitable model to be implemented in order to shift maximum of private mode trips to the public mode. The choice of the best model is based on the utility value it gives for the use of public transport and the value of resulting probability. Mode shift results so generated helps in reducing the traffic congestion, as it encourages the use of public transport against the private.***
Keywords: Mode choice, Revealed and Stated Preferences (RP & SP), Logit model, Hypothetical choice sets, Mode Shift and Mode choice, Utility Maximization, Choice Attributes, Daily Work trips.

I. INTRODUCTION

Traffic congestion is one of the major rising problems in transportation these days. Due to door to door service and more convenience; the road users are more concentrated on the private mode of transportation, which is the major cause of the traffic congestion. In order to overcome the traffic congestion, that affects the LOS on various roads; one of the most commonly adopted solution is to shift the concentration of the road users to the public mode of transportation. In order to attract the users to public transport, various improvements need to be done. The factors such as travel time, travel cost, safety, comfort, reliability, accessibility etc. needs to be worked upon. The work trips with maximum frequency as compared to any other trips, took place between industrial zone GIDC Makkarpura & Vadodara city, leading to the selection of the respective zone. Utility maximization approach is used to choose the best possible model, which if implemented as a solution, would give the increased use of the public transport in the selected study area.

II. LITERATURE REVIEW

Several studies regarding the solution to the traffic congestion has been done in major and highly populated cities of India as well as other countries in the world. The use of modelling is the best approach to generate solutions for the same. Literature review is an important part of the study.

Few of the relevant studies are listed below:

Hu Hua, YANG Xiaoguang (2007), integrated multi-modal transit network with an approach of nested logit model (NL). The effects of integrated multi-modal transit information service (IMTIS) on the residents was studied. In order to determine why IMTIS was helpful in promoting modal shift a hyper-traffic network was designed. A bi-level NL model was designed to avoid the complicated decisions in the multi-modal network. A travel time reliability factor was designed to correct the values of the important variables of various modes.

Joachim Scheiner and Christian Holz-Rau (2012), studied mode choice with a focus on the car use especially in the car-deficient

families (i.e a household which has more drivers than cars), along with a consideration of the gender as well. Regression techniques were used to test few designed hypothesis in the study. It was concluded that gender as well as participation in unpaid work affects the mode choice more than participation in paid work.

Xuemei Zhou (2015), framed a Multi-Nomial model by considering both qualitative factors such as safety, comfort, convenience etc as well as quantitative factors such as travel time, travel cost etc. The effect on four different traffic modes bus, private car, moped and taxi was studied by designing a questionnaire and it was concluded that convenience factor has the highest impact on the mode choice than any other factor.

Dilum Dissanayake and Takayuki Morikawa (2002), made use of the Nested Logit (NL) model to study the mode choice in traffic problem facing countries, by considering vehicle ownership, mode choice, and various trip chaining aspects. RP and SP surveys were carried out and the model was divided into two levels. The upper level being vehicle ownership and lower being mode choice of two-traveller household.

Dawei Pan, Wei Deng (2011), studied the importance of travel time value (VTT) of the passengers in dealing with the traffic congestion problem. Using the theory of random utility maximization, the formula for travel time value was determined. It was concluded that the travel mode choice varies with service level and fares.

Yang Chen, Wang Wei (2009), stated that in order to determine the mode choice done by the user, factors such as household and travel characteristics are important. Discrete choice model was designed. Results showed that latent variables could express the mode choice better than unobservable factors.

Xuemei ZHOU , Xiaofei YU (2010), studied the characteristics of various traffic modes in comprehensive-transportation hub. Nested logit model was designed, using the utility function, the probability of the mode choice and model parameters were determined.

J.L. Bowman, M.E. Ben-Akiva (1999), studied activity-based disaggregated travel demand model system. Estimation was done based on available diary survey and transportation system level of service data. In result, time and mode specific trip matrices were generated and calibrated.

Al Ahmadi (2006), studied that the intercity mode choice pattern and the decision related to it was determined based on important factors such as in vehicle travel time, travel cost, travel distance, carpool members, monthly income, the nationality of rider, and cars owned.

Riza Atiq O.K.Rahmat, Abdullah Nurdden, and Amiruddin ismail (2007), compared the utility of private (car) and public mode of transport, and determined that reduction of travel time, travel cost and distance of public transport from house can encourage the choice of public transport over the private mode of travel. Out of all the factors studied, the travel time and travel cost were major factors which lead to the choice of car over public transit.

III. STUDY AREA PROFILE

GIDC Makkarpura: is an industrial estate developed under the Gujarat Industrial Development Act 1962 for industrial acceleration. It is located to the east of Vadodara city, and is divided into following sectors:

A1-A3,
B1-B7,
C1-C5,
D1-D3

Depending upon the type and size of the industries. GIDC Makkarpura has highest job potential in Vadodara & it attracts the highest number of work trips of the city. The layout map for the selected zone is as shown in fig.1 below

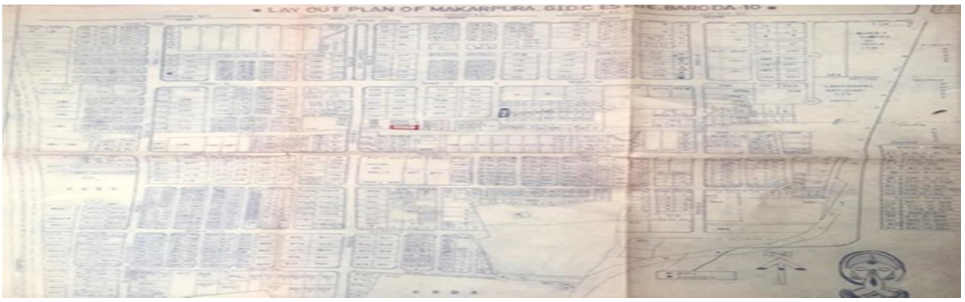


Fig 1: Layout of GIDC Makkarpura

IV. METHODOLOGY

To analyse the mode shift in the chosen zones. RP and SP survey forms have been designed, considering all the factors that are likely to affect the mode choice.

Part one of the RP survey questionnaire comprises of 12 different factors which include socio-economic characteristics such as income, family size, car ownership, age etc. Trip characteristics such as travel time, travel cost, fuel consumption etc. And the opinion details for the existing public transport facilities such as travel time, cost, safety, comfort, reliability, accessibility etc.

Part two is designed to carry out the stated preference (SP) survey. For this, 16 different choice sets between the private vehicle and public mode (VTCOS) have been designed. Each of the set has varying conditions of the travel time, travel cost, safety and comfort, from which the decision maker has to make a choice.

The sample size is decided based on the condition that N > 50 + 8m; where m is the number of characteristics. Here m being 11; the effective sample size is 138. The sample size chosen for the pilot survey is 40, with an objective to determine the completeness of the designed questionnaire.The various choice sets designed for the stated preference survey are as shown in table 1 and 2.

Based on the results obtained, 8 different models have been designed for the validation and calibration using the Biogeme software. The designed models are as shown below:

A. Base Model

$U_{(PV, VT)} = ASC_{(PV, VT)} + \beta_1^* (\text{Travel time}_{(PV, VT)}) + \beta_2^* (\text{Travel cost}_{(PV, VT)})$

B. Model 1

$U_{(PV, VT)} = ASC_{(PV, VT)} + \beta_1^* (\text{Travel time}_{(PV, VT)}) + \beta_2^* (\text{Travel cost}_{(PV, VT)}) + \beta_3^* (\text{Income}_{(PV, VT)})$

C. Model 2

$U_{(PV, VT)} = ASC_{(PV, VT)} + \beta_1^* (\text{Travel time}_{(PV, VT)}) + \beta_2^* (\text{Travel cost}_{(PV, VT)}) + \beta_{31}^* (\text{Income}_{(PV)}) + \beta_{32}^* (\text{Income}_{(VT)})$

D. Model 3

$U_{(PV, VT)} = ASC_{(PV, VT)} + \beta_1^* (\text{Travel time}_{(PV, VT)}) + \beta_2^* (\text{Travel cost}_{(PV, VT)}) + \beta_3^* (\text{Journey distance}_{(PV, VT)})$

E. Model 4

$U_{(PV, VT)} = ASC_{(PV, VT)} + \beta_1^* (\text{Travel time}_{(PV, VT)}) + \beta_2^* (\text{Travel cost}_{(PV, VT)}) + \beta_3^* (\text{Income}_{(PV,VT)}) + \beta_4^* (\text{Journey distance}_{(PV, VT)})$

F. Model 5

$U_{(PV, VT)} = ASC_{(PV, VT)} + \beta_1^* (\text{Travel time}_{(PV, VT)}) + \beta_2^* (\text{Travel cost}_{(PV, VT)}) + \beta_{31}^* (\text{Income}_{(PV)}) + \beta_{32}^* (\text{Income}_{(VT)}) + \beta_{41}^* (\text{Journey distance}_{(PV,)}) + \beta_{42}^* (\text{Journey distance}_{(VT)})$

G. Model 6

$U_{(PV, VT)} = ASC_{(PV, VT)} + \beta_1^* (\text{Travel time}_{(PV, VT)}) + \beta_2^* (\text{Travel cost}_{(PV, VT)}) + \beta_3^* (\text{Nearest bus stop}_{(PV, VT)})$

H. Model 7

$U_{(PV, VT)} = ASC_{(PV, VT)} + \beta_1^* (\text{Travel time}_{(PV, VT)}) + \beta_2^* (\text{Travel cost}_{(PV, VT)}) + \beta_3^* (\text{Income}_{(PV, VT)}) + \beta_4^* (\text{Journey distance}_{(PV,VT)}) + \beta_5^* (\text{Nearest bus stop}_{(PV,VT)}) + \beta_6^* (\text{Time taken to reach}_{(PV, VT)}) + \beta_7^* (\text{Waiting time}_{(PV, VT)})$

I. Model 8

$U_{(PV, VT)} = ASC_{(PV, VT)} + \beta_1^* (\text{Travel time}_{(PV, VT)}) + \beta_2^* (\text{Travel cost}_{(PV, VT)}) + \beta_3^* (\text{Nearest bus stop}_{(PV, VT)}) + \beta_4^* (\text{Time taken to reach}_{(PV, VT)}) + \beta_5^* (\text{Waiting time}_{(PV, VT)})$

About 1/10 (10%) of the data is to be selected for the model validation whereas the remaining 9/10 (90%) data is for the calibration of the model.

The results from the stated and revealed preference survey have been obtained using the designed questionnaire and the given choice sets for the number of respondents, number of observations and the number of parameters for the designed models of utility as shown in result tables 3, 4 and 5. The analysis of which has been done in the Biogeme software in order to arrive to the conclusion of the

pilot survey. Table 6 shows utility and probabilities of different modes.

The model calibration for determining the t-test results, log likelihood value, maximum log likelihood, goodness of fit index i.e. rho-square and the corrected goodness of fit index rho-bar square has been computed using the Biogeme software.

TABLE 1 CHOICE SET A

ATTRIBUTES	OPTION 1	OPTION 2
MODE FOR TRAVEL	PERSONAL VEHICLE	VTCOS
TRAVEL TIME	SAME	25% MORE
TRAVEL COST	SAME	15% MORE
COMFORT	YES	YES
SAFETY	YES	YES
CHOICE SET A1	[ ]	[ ]

ATTRIBUTES	OPTION 1	OPTION 2
MODE FOR TRAVEL	PERSONAL VEHICLE	VTCOS
TRAVEL TIME	SAME	25% LESS
TRAVEL COST	SAME	15% MORE
COMFORT	YES	YES
SAFETY	NO	YES
CHOICE SET A2	[ ]	[ ]

ATTRIBUTES	OPTION 1	OPTION 2
MODE FOR TRAVEL	PERSONAL VEHICLE	VTCOS
TRAVEL TIME	SAME	25% LESS
TRAVEL COST	SAME	30% MORE
COMFORT	NO	NO
SAFETY	YES	NO
CHOICE SET A3	[ ]	[ ]

ATTRIBUTES	OPTION 1	OPTION 2
MODE FOR TRAVEL	PERSONAL VEHICLE	VTCOS
TRAVEL TIME	SAME	25% MORE
TRAVEL COST	SAME	30% MORE
COMFORT	NO	YES
SAFETY	NO	YES
CHOICE SET A4	[ ]	[ ]

ATTRIBUTES	OPTION 1	OPTION 2
MODE FOR TRAVEL	PERSONAL VEHICLE	VTCOS
TRAVEL TIME	SAME	25% MORE
TRAVEL COST	SAME	30% LESS
COMFORT	NO	NO
SAFETY	YES	YES
CHOICE SET A5	[ ]	[ ]

ATTRIBUTES	OPTION 1	OPTION 2
MODE FOR TRAVEL	PERSONAL VEHICLE	VTCOS
TRAVEL TIME	SAME	25% LESS
TRAVEL COST	SAME	30% LESS
COMFORT	YES	NO
SAFETY	YES	NO
CHOICE SET A6	[ ]	[ ]

ATTRIBUTES	OPTION 1	OPTION 2
MODE FOR TRAVEL	PERSONAL VEHICLE	VTCOS
TRAVEL TIME	SAME	25% LESS
TRAVEL COST	SAME	15% LESS
COMFORT	NO	NO
SAFETY	NO	NO
CHOICE SET A7	[ ]	[ ]

ATTRIBUTES	OPTION 1	OPTION 2
MODE FOR TRAVEL	PERSONAL VEHICLE	VTCOS
TRAVEL TIME	SAME	25% MORE
TRAVEL COST	SAME	15% LESS
COMFORT	YES	YES
SAFETY	NO	YES
CHOICE SET A8	[ ]	[ ]

Volume 5 Issue IV, April 2017
ISSN: 2321-9653
International Journal for Research in Applied Science & Engineering Technology (IJRASET)

TABLE 2 CHOICE SET B

ATTRIBUTES	OPTION 1	OPTION 2
MODE FOR TRAVEL	PERSONAL VEHICLE	VTCOS
TRAVEL TIME	SAME	25% LESS
TRAVEL COST	SAME	15% MORE
COMFORT	YES	NO
SAFETY	YES	NO

CHOICE SET B1 [ ] [ ]

ATTRIBUTES	OPTION 1	OPTION 2
MODE FOR TRAVEL	PERSONAL VEHICLE	VTCOS
TRAVEL TIME	SAME	25% MORE
TRAVEL COST	SAME	15% MORE
COMFORT	NO	YES
SAFETY	NO	YES

CHOICE SET B2 [ ] [ ]

ATTRIBUTES	OPTION 1	OPTION 2
MODE FOR TRAVEL	PERSONAL VEHICLE	VTCOS
TRAVEL TIME	SAME	25% MORE
TRAVEL COST	SAME	15% LESS
COMFORT	NO	NO
SAFETY	YES	NO

CHOICE SET B3 [ ] [ ]

ATTRIBUTES	OPTION 1	OPTION 2
MODE FOR TRAVEL	PERSONAL VEHICLE	VTCOS
TRAVEL TIME	SAME	25% LESS
TRAVEL COST	SAME	15% LESS
COMFORT	YES	YES
SAFETY	YES	YES

CHOICE SET B4 [ ] [ ]

ATTRIBUTES	OPTION 1	OPTION 2
MODE FOR TRAVEL	PERSONAL VEHICLE	VTCOS
TRAVEL TIME	SAME	25% LESS
TRAVEL COST	SAME	30% MORE
COMFORT	NO	NO
SAFETY	YES	YES

CHOICE SET B5 [ ] [ ]

ATTRIBUTES	OPTION 1	OPTION 2
MODE FOR TRAVEL	PERSONAL VEHICLE	VTCOS
TRAVEL TIME	SAME	25% MORE
TRAVEL COST	SAME	30% MORE
COMFORT	YES	NO
SAFETY	YES	NO

CHOICE SET B6 [ ] [ ]

ATTRIBUTES	OPTION 1	OPTION 2
MODE FOR TRAVEL	PERSONAL VEHICLE	VTCOS
TRAVEL TIME	SAME	25% MORE
TRAVEL COST	SAME	30% LESS
COMFORT	NO	NO
SAFETY	NO	NO

CHOICE SET B7 [ ] [ ]

ATTRIBUTES	OPTION 1	OPTION 2
MODE FOR TRAVEL	PERSONAL VEHICLE	VTCOS
TRAVEL TIME	SAME	25% LESS
TRAVEL COST	SAME	30% LESS
COMFORT	YES	YES
SAFETY	NO	YES

CHOICE SET B8 [ ] [ ]

V. RESULTS

Few factors affecting mode choice, respondents ready to use public transport, if frequency is improved and the best and worst aspect of public transport is given in Fig 2 to Fig 5.

The travel time and travel cost, are major parameters affecting mode choice. The best aspect of public transport is to save money, and time; while worst aspects are no seats and discomfort to users. The respondents ready to use the improved public transport are 77% as shown in Fig 2.

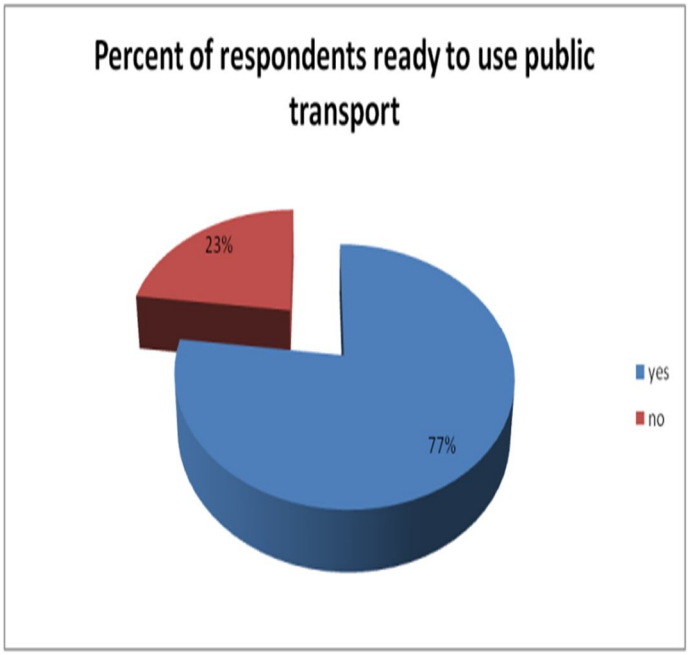


Fig 2: Respondents ready to use public transport, if the frequency is improved.

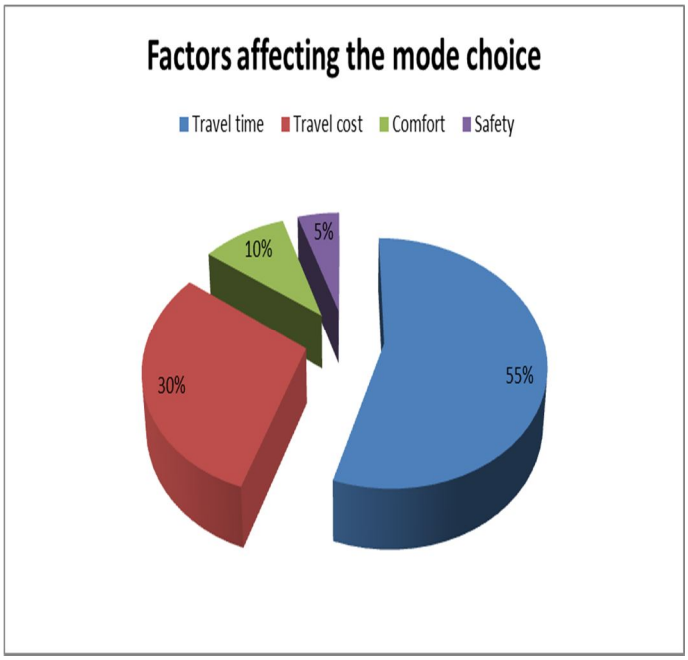


Fig 3: Factors affecting the mode choice

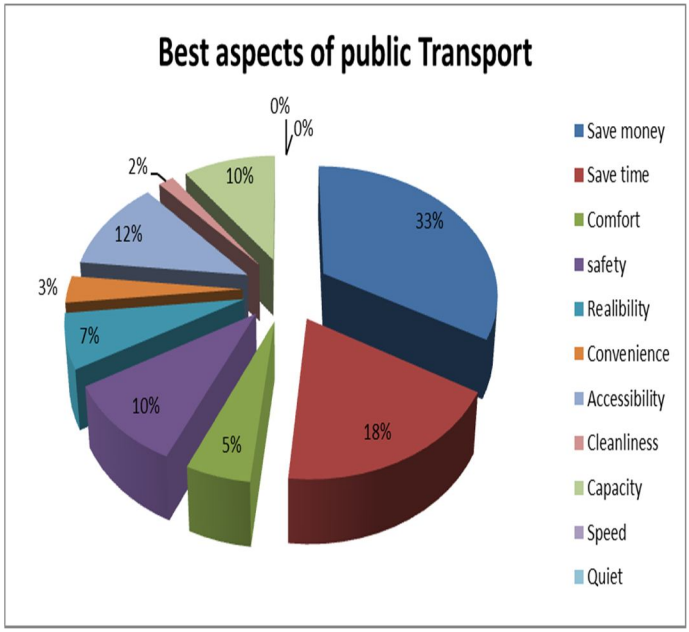


Fig 4: Best aspects of public transport

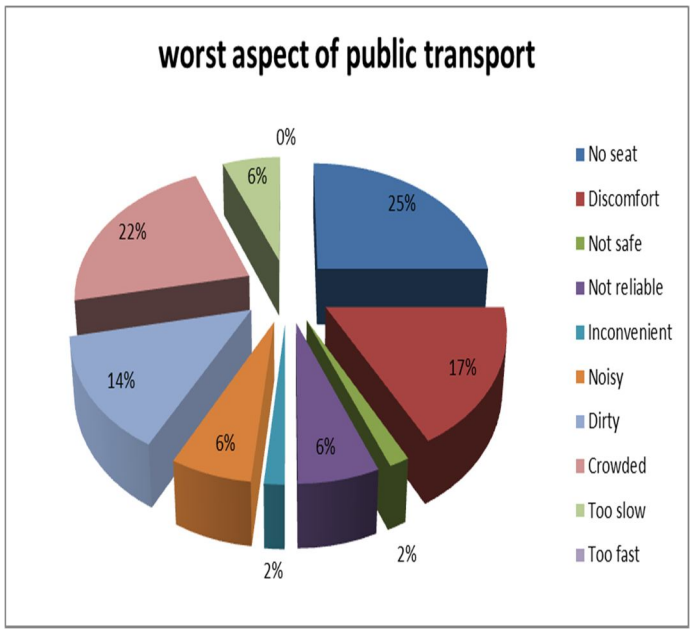


Fig 5: Worst aspects of public transport

TABLE 3 RESULT TABLE 1

Variables	Constant model		Base model		Model 1		Model 2	
No. of Respondents	40		40		40		40	
No. of Observations	320		320		320		320	
No. of Parameters	1		3		4		5	
	Estimated value	t-stat	Estimated value	t-stat	Estimated value	t-stat	Estimated value	t-stat
Travel Time			-0.981	-3.28	-0.267	-7.31	-0.267	-7.31
Travel Cost			-0.102	-2.18	-0.0187	-2.71	-0.0187	-2.71
Income11					2.88e-012	0.00	9.57e-013	0.00
Income12							3.08e-013	0.00
Journey distance								
Nearest bus stop								
Time taken to reach								
Waiting time								
Constants								
ASC(pv)	0		0		0		0	
ASC(VTCOS)	-0.242	-2.50	-1.18	0.05	-0.431	-3.01	-0.431	-3.01
Rho-square	0.010		0.529		0.226		0.226	
Adjusted rho-square	0.007		0.426		0.205		0.200	
Final log-likelihood	-296.302		-13.703		-150.235		-150.235	
Likelihood ratio test	6.274		30.818		87.692		87.692	

TABLE 4 RESULT TABLE 2

Variables	Model 3		Model 4		Model 5		Model 6	
No. of Respondents	40		40		40		40	
No. of Observations	320		320		320		320	
No. of Parameters	4		5		7		4	
	Estimated value	t-stat	Estimated value	t-stat	Estimated value	t-stat	Estimated value	t-stat
Travel Time	-0.267	-7.31	-0.267	-7.31	-0.267	-7.31	-0.267	-7.31
Travel Cost	-0.0187	-2.71	-0.0187	-2.71	-0.0187	-2.71	-0.0187	-2.71
Income11			-3.66e-012	-0.00	1.32e-013	0.00		
Income12					2.01e-013	0.00		
Journey distance11	-1.00e-015	-0.00	7.09e-017	0.00	2.65e-016	0.00		
Journey distance12					1.98e-016	0.00		
Nearest bus stop							-1.36e-016	-0.00
Time taken to reach								
Waiting time								
Constants								
ASC(pv)	0		0		0		0	
ASC(VTCOS)	-0.431	-3.01	-0.431	-3.01	-0.431	-3.01	-0.431	-3.01
Rho-square	0.226		0.226		0.226		0.226	
Adjusted rho-square	0.205		0.200		0.190		0.205	
Final log-likelihood	-150.235		-150.235		-150.235		-150.235	
Likelihood ratio test	87.692		87.692		87.692		87.692	

TABLE 5 RESULT TABLE 3

Variables	Model 7		Model 8	
No. of Respondents	40		40	
No. of Observations	320		320	
No. of Parameters	8		6	
	Estimated value	t-stat	Estimated value	t-stat
Travel Time	-0.267	-7.31	-0.267	-7.31
Travel Cost	-0.0187	-2.71	-0.0187	-2.71
Income	-3.90e-012	-0.00		
Journey distance	2.14e-016	0.00		
Nearest bus stop	-6.72e-017	-0.00	1.58e-017	0.00
Time taken to reach	-2.63e-016	-0.00	6.15e-016	0.00
Waiting time	-4.94e-016	-0.00	4.15e-016	0.00
Constants				
ASC(pv)	0		0	
ASC(VTCOS)	-0.431	-3.01	-0.431	-3.01
Rho-square	0.226		0.226	
Adjusted rho-square	0.185		0.195	
Final log-likelihood	-150.235		-150.235	
Likelihood ratio test	87.692		87.692	

TABLE 6
MODEL UTILITY AND PROBABILITY RESULTS

Models	Utility of private mode	Utility of public mode	Probability of private mode	Probability of public mode
Base model	-24.37242	-25.55242	0.0315	0.9685
Model 1	219.8480	219.4171	0.6061	0.3938
Model 2	303.6174	303.1864	0.5125	0.4875
Model 3	-106.1235	-106.5545	0.6061	0.3938
Model 4	-636.2778	-636.7088	0.4890	0.5109
Model 5	-308.4602	-308.8910	0.5309	0.4690
Model 6	-36.9459	-37.3769	0.6061	0.3938
Model 7	-13.5120	-13.5163	0.5011	0.4989
Model 8	-84.6019	-85.0329	0.6061	0.3938

VI. CONCLUSION

From the RP and SP survey carried out for the chosen sample, following conclusions are drawn:

A. The travel time and travel cost, are major parameters affecting mode choice.

B. The best aspect of public transport is to save money, and time; while worst aspects are no seats and discomfort to users.

C. The respondents ready to use the improved public transport are 77%.

D. From the calibration of the models by Biogeme software, the utility function calculated with the base model (travel time and travel cost), it is found that travel time and travel cost has negative sign which fulfil internal validity.

E. Moreover the income parameter, which is also considered in the subsequent model, also received the positive sign, which also fulfils the internal validity.

F. The impact of the other parameters in the pilot study, though fulfil the internal validity, the external validity that is rho-square value is not improved at the same pace.

G. The reason behind this is the small sample size of pilot study.

H. The main survey which is carried out whose analysis is to be done, may reflect the above requirements as the sample size is bigger as well as it also covers different factors and different segments of the selected industrial zone.

I. However, from the pilot survey it can be concluded that the completeness of the questionnaire is efficiently satisfied and the same designed questionnaire and choice sets can be used for the detail survey for larger sample.

J. Apart from the base model, the best model from the suggested ones which gives the maximum utility (0.5109) of public transport is model 4. i.e the model considering travel time, travel cost, income and distance parameters.

REFERENCES

A. Papers

[1] Hu Hua, YANG Xiaoguang (2007), study on travel mode choice behavior with integrated multi-modal transit information service‖, The Eighth International Conference of Chinese Logistics and Transportation Professionals logistics.

[2] Joachim Scheiner and Christian Holz-Rau (2012), Gendered travel mode choice: a focus on car deficient households‖,Journal of Transport Geography 24, S. 250-261.

[3] Xuemei Zhou (2015), Travel Mode Choice Based on Perceived Quality of Bus Service‖, CICTP 2015

[4] Dilum Dissanayake and Takayuki Morikawa (2002), A Combined RP/SP Nested Logit Model of Vehicle Ownership,Mode Choice and Trip Chaining in Developing Countries‖,Traffic and Transportation Studies (2002).

[5] Dawei PAN, Wei DENG (2011), Research on The Travel Choice Mode Based on The Analysis of Travel Time Value‖, ICCTP 2011 © ASCE 2011.

[6] YANG Chen, WANG Wei (2009), travel mode choice based on latent variable enriched discrete choice model‖**,** International Conference on Transportation Engineering 2009 (ICTE 2009)International Conference on Transportation Engineering 2009.

[7] Xuemei ZHOU , Xiaofei YU (2010), Traffic-mode Choice Predict Model of the Comprehensive Transportation Hub Based on Nest Logit Model‖, Traffic-mode Choice Predict Model of the Comprehensive Transportation Hub Based on Nest Logit Model.

[8] J.L. Bowman, M.E. Ben-Akiva (1999), Activity-based disaggregate travel demand model system with activity schedules‖, Transportation Research Part A35, pp 1-28.

[9] Al Ahmadi (2006), Development of Intercity Mode Choice Models For Saudi Arabia‖, Jkau: Engg.sci, Vol.17 No.1, pp 3-12.

[10] Abdullah Nurdden, Riza Atiq O.K.Rahmat and Amiruddin ismail (2007), Effects of ransportation Policies on Modal Shift From Private Car To public Transport In Malaysia‖, Journal Of Applied science 7(7).

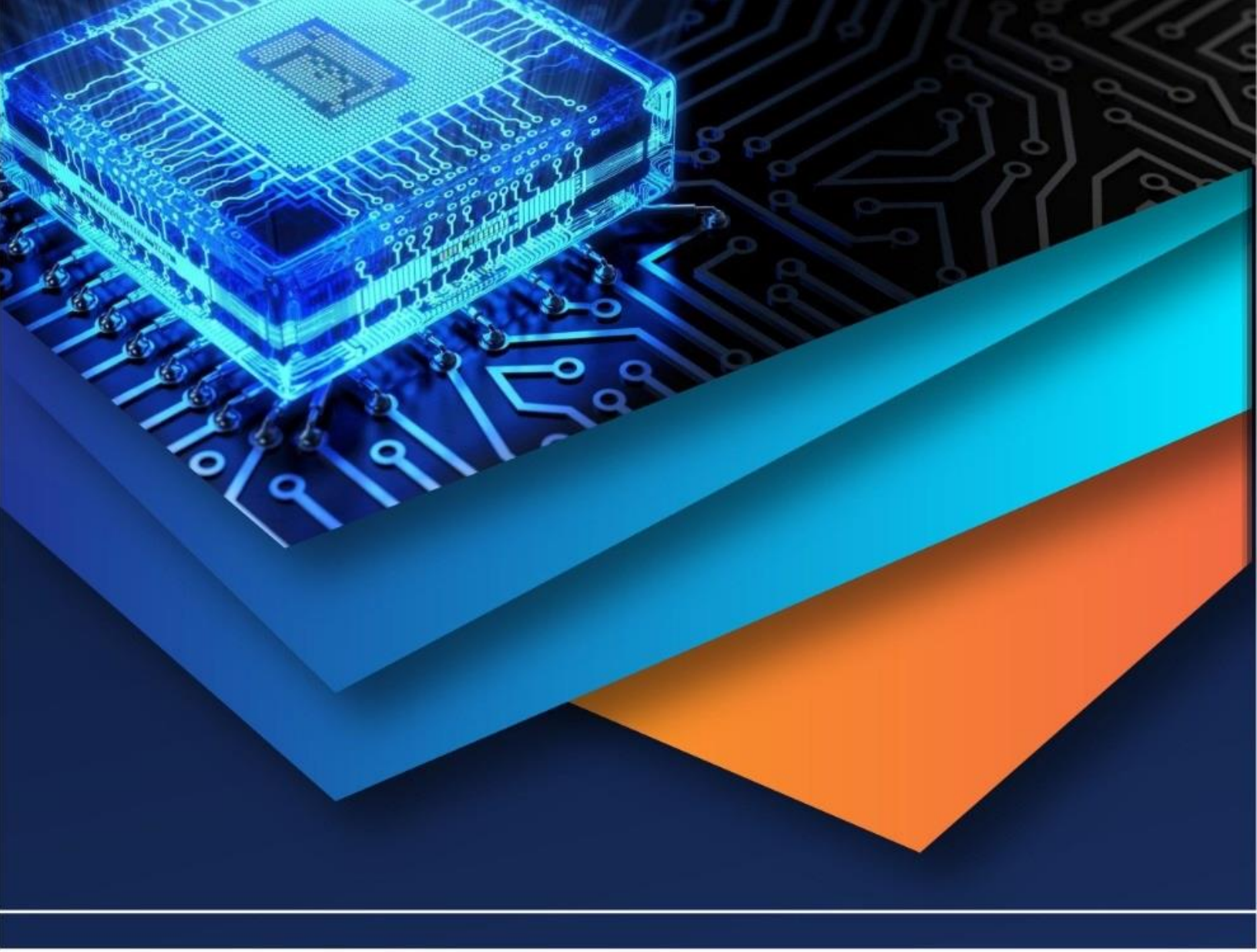
B. Books

[1] Ben-Akiva, M.E., And Lerman S.R. (1985), "Discrete Choice Analysis: Theory And Applications To Travel Demand", MIT Press, Cambridge, Massachusetts, USA.

[2] Green, S.B. (1991). How many subjects does it take to do a regression analys

[3] is? Multivariate Behaviour Research, 26, pp, 499-510.

[4] Hanson, S (1995), "The Geography Of Urban Transportation", 2nd Edition.Ortuzar J.De D. And Willumsen L.G, " Modelling Transport, 4th Edition", John Wiley And Sons Ltd, New York. 2011.



10.22214/IJRASET

45.98

IMPACT FACTOR: 7.129

IMPACT FACTOR: 7.429

INTERNATIONAL JOURNAL FOR RESEARCH

IN APPLIED SCIENCE & ENGINEERING TECHNOLOGY