Gharyan University Journal of Engineering Science (GUJES)
Website: http://gujes.gu.edu.ly
email: gujes@gu.edu.ly

Modelling Switch-Behaviour of Own Car vs. Public Transport (PT) Modes for Shopping Trips Case Study: Tripoli - Libya

Adel Ettaieb Elmloshi[1]
Civil Eng. Department - Faculty of Engineering - University of Gharian
adelelmloshi@gmail.com

Abstract

This research deals with estimating the likely switch of car ownership drivers and private transport vehicles modes users to public transportation system (PT) modes in the main cities as Tripoli Capital city of Libya due to reduced shopping travel time of all trips influenced by age, household size. Car ownership and shopping distance through the introducing the public transport modes such as public buses. The data on other factors (variables) that could potentially reason a model switch of from car ownership drivers and private transport vehicles modes users to public transport were collected through a survey (questionnaire) with a specified predilection method. Mode-switch models to describe the switch of conduct of own car operators to PT system are developed. A binary logistic regression model was used to assessment the transport displacement model for shopping trips. Probability curves have been developed to change the position so that it is a user-friendly tool for analysing the potential transformation Model of a variety of variables. One way to achieve this objective is by establishing reserved public transportation lanes on main urban Tripoli city roads. The providing of private road lanes will increase of service road level and reduce the level of road traffic congestion and this may effect in a switch of all or some private transport mode users to public transport modes.

Key words: Own car, Public transport modes, logit model, shopping Travel time, shopping distance, age, car ownership and switch probabilities, likelihood..

1. Introduction

The own car ownership are an important means of transportation and are of great significance for the household activities of the majority of families in Libyan society. And considered one of the significant modes of private transport vehicles in all Libyan cities and especially in Tripoli, as it is more reliable than the available private transport modes options such as (private taxi and micro coach) [1]. In addition, they provide a great opportunity to offer comfort and convenience for users to go to and return from their various daily trips without affecting other users. In fact, in Tripoli city there are to many areas that do not have private transportation modes and poor public transportation services such as stage-bases [2]. This research describes and presents the outcomes from the data collected analysis of data on own car and private transport vehicles such as private taxi, microbuses and coaches users, Providing a thorough description of the statistical tests that were employed in this study to determine the model's overall goodness-of-fit and the suitability of its parameters. These outcomes are displayed, with the aim of comparing the usefulness of the two and figuring out why owners of cars on the main Tripoli city highways are hesitant to use taxi and microbuses, a binary logistic model is provide for own car versus public transportation as alternate modes of transportation for everyday trips. Based on scenarios of lowering the public transportation modes age, shopping distance and travel time, the probability of car owners moving to public transportation was also investigated.

2. Problem Statement and Study Area

Own cars and private transportation vehicles are becoming more and more common among urban commuters in Libyan capital city, Tripoli. Commuters in Tripoli used private transport namely microbuses, private taxies and own cars to their works, study and shopping activities. Private transport can be own and operated by individuals or private company [3]. Which the own cars are considered one of the most accessible means of transportation modes in Libyan cities, which commuters can rely on to meet their daily travelling needs. There are many reasons that lead residents of Tripoli city to prefer using their own cars for all their trips, whether for shopping trips, and why these cars are more popular than other private transportation modes options available in Tripoli. In summary, because the own cars are readily available, reliable, comfortable, convenient and safe, they symbolize power, status and prestige and provide a convenient means of travel for all daily shopping trip and purposes [4]. The increase in a number of cars ownership on the Tripoli city net roads and streets has led to a significant rise in road traffic congestion, which results in longer travel times for all shopping trips, air and noise pollution and traffic accidents. While the main city has struggled with traffic congestion, becomes the surrounding districts are now also affected. Schrank and Lomax have described and recognised traffic congestion as the major problem in urban areas, with significant effects to the economy, travel behaviour, and land use in major cities [5].

3. Methodology

The survey was done using questionnaires to get relevant data. The questionnaires were distributed to the private vehicle users who do not use other modes of transportation [3]. The revealed preference and stated preference methods approach has been used to model mode choice when data on actual choice of mode by travellers are available. Besides the modes choice attributes, shopping travel time, shopping distance and social demographic information of each respondent [6]. The survey was conducted through questionnaires on selected roads in Tripoli city, where the movement of available private vehicles, such as (own cars, taxi, and private coaches) is higher the available public transport vehicles modes and who don't utilize other forms of transportation. A questionnaire was used in the survey to collect crucial data and information. Users of private vehicles and own cars who travel throughout the shopping trip area and use their own cars for everyday shopping excursions are the research's target respondents. The questionnaire's questions were designed to make it simple and quick for the respondent to complete. Short questionnaires with both open-ended and closed-ended questions were created to make sure consumers understood them. The respondents that were chosen were based on private transportation vehicle types and car owners who utilize their

Gharyan University Journal of Engineering Science (GUJES)
Website: http://gujes.gu.edu.ly
email: gujes@gu.edu.ly

private vehicles to go to their shopping trips destinations. Road users and respondents in Tripoli streets were chosen at random. A binary logistic model for public transport alternatives was created, and the Statistical Package for Social Science software (SPSS) and Microsoft Excel 2007 software were used to analyze this questionnaire and get the best outcomes that emphasize the problem.

4. Mode Switch Model, Own car vs. Public Transport

The purpose of the binary logistic model was to predict the likelihood of switching from own car to public transport modes as an outcome of shorter shopping travel times, as well as to investigate the factors influencing the use of own car versus PT (public transport) modes for daily trips to shopping area. In order to ascertain their impact on the selection of the most suitable mode of transportation, the models examined the attributes of both own car and PT, including socio-economic variables, personal information, and shopping travel time. The dependent variables in the models were “0” for the use of own car and “1” for the use of public transportation. Age, household size, shopping distance, shopping travel time and car ownership were among the descriptive characteristics for shopping trips. The own car was used as the foundation case for case estimation. Thus, a variable in the choice of own car that has a positive coefficient denotes a fall in the use of PT, and a higher negative rate of coefficient denotes a decrease in the use of PT modes.

4.1 Mode Switch Model: Private Car vs. Public Transport for Shopping Trip

The estimation sample and holdout sample (for model validation) were separated from the data. 150 samples were used for model validation and 750 samples were selected for model estimation. With 0 denoting a car and 1 denoting PT, mode switch was thought to be the dependent variable. An examination of shopping trip models outcomes were conducted and Table 1 displays the best model outcome.

Table 1 Binary logistic model estimation for public transport switch under shopping trip (n = 750 samples)

Variable	coefficient	S.E.	df	Sig.	Exp(β)	95% C.I.for EXP(β) Lower	Upper
Age	-0.867	0.18	1	0.000	0.42	0.295	0.598
Household size	1.796	0.308	1	0.000	6.023	3.293	11.017
Shopping travel time	-1.067	0.215	1	0.000	0.344	0.226	0.524
Shopping distance	-2.177	0.271	1	0.000	0.113	0.067	0.193
Car ownership	-1.625	0.327	1	0.000	0.197	0.104	0.374
Constant	6.929	1.173	1	0.000	1021.06		
Summary of statistics							
-2 Log likelihood	205.514a						
Chi square	579.754		5	0.000			
Cox & Snell R^2	0.538						
Nagelkerke R^2	0.830						
Number of observation	750						

Dependent variable: 1 = Public transport, 0 = Car

Table 1 displays the significant characteristics of shopping travel time, shopping distance, age, household size and car ownership with significant levels reaching 0.0000.
According to Abuhamoud [7], Bajracharya [8], Dayton [9] and Essia [10], in the binary logistic probability model where only two options are present, the model is written as in Equation 1.

$$P_a = \frac{1}{1 + e^u} \qquad (1)$$

Where

P_a = probability of own car users' switch to PT modes.
u = utility function for bus mode.
e = the base of natural logarithms (approximately 2.718).

The study utility function for PT was shows as in Equation 2.

$$U_b = \beta_0 + \beta_1 X_{Age} + \beta_2 X_{Hd} + \beta_3 X_{ST} + \beta_4 X_{Sd} + \beta_5 X_{no} \qquad (2)$$

Where

U_b = utility function for bus modes
β_0 = the model specific constant
$\beta_1, \beta_2, .., \beta_5$ = coefficients associated with explanatory (significant variables
$X_1, X_2, .., X_5$ = individual explanatory variables
Age = age
Hd = household size
ST = shopping travel time
Sd = Shopping distance
no = number of own car per household.

As demonstrated in Table 2, the The omnibus tests for the model coefficients revealed a significance of $p < .001$ with a chi-squared value of 579.754 and df = 5. This is a test of the null hypothesis, which holds that the ability to predict the study participants' decisions is not substantially improved by the addition of independent variables to the model. The current model's coefficient are therefore determined to be statistically significant.

Table 2 Omnibus Tests of Model Coefficients

		Chi-square	df	Sig.
Step 1	Step	579.754	5	.000
	Block	579.754	5	.000
	Model	579.754	5	.000

Table 1 shows, -2LL with a value of 205.514a, with a chi-square value of 579.754 ($p < 0.001$) indicating that the model with 5 variables is significant. Additionally, Cox & Sell and

Nagelkerke R square values of 0.538 and 0.830 also show that the model fits well with R square values close to 1.

The "odds ratio”, exp(β), which shows how the independent variables affects the odds ratio, is a way to explain the logistic coefficient that typically offers more information (particularly for the dummy independent variables). Stated differently, the odds ratio is calculated by dividing the likelihood of an event happening by likelihood that it won't. for instance, a change of one unit in X would double the likelihood of the event occurring (0.598/0.295) since the 95% C.I. for exp(β) 2 = (from 0.598/0.295, that is, a probability of 0.598 for the event occurring and 0.295 for the event not occurring).

All of the study's variables were significant at the 0.05 level, as Table 1 shows. It was discovered that age had a considerable influence on the switch to modes of transport, with is found to significantly transport switch with coefficient -0.867 and likelihoods ratio of 0.42 (95% CI: 0.295-0.598). Likelihoods smaller than 1 indicate that the larger the age of respondents, the more likely they will switch to car. With a reduction in an age group, the chance of switching to public transport modes will increase by 2.38%.The size of Household had significant effect on transport switch with coefficient of 1.796 and likelihoods ratio of 6.023 (95% CI: 3.293-11.017).

A positive coefficient means that the probability of respondents using PT will increase by a factor of 6.023 for every unit increase in household size group. With a coefficient of -1.067 and likelihoods ratio 0.344 (95% CI: 0.226-0.524), the outcomes indicate that shopping travel time is a significant factor for transportation switching. An increase in the group's unit shopping travel time will lower the likelihood of switching to PT by 65.6%. Similarly, a negative coefficient 0f -2.177 and a likelihood ratio of ratio 0.113 (95% CI: 0.067-0.193) are identified for shopping distance. Thus, a person is less likely to switch to PT if the shopping distance is longer.

More specifically, the probability of selecting PT will increase by a factor of 8.85 for every unit reduction in the shopping travel distance group.

Lastly, it was discovered that the number of people who own a car has a major influence on the decision to switch modes of transportation. According to the prior odds ratio of 0.197 (95% CI: 0.104-0.374) and the coefficient of -1.625, respondents who own cars are less likely than those who do not use PT. it is easy to see that the likelihood of taking PT will decrease by 80.3% for every unit increase in the number of people who possess their own cars.

In order to determine the goodness-of-fit, Hosmer-Lemshow, statistic creates 10 ordered groups of individuals and compares the number in each group (observed) to the number predicted by the logistic regression model (expected), as shown in Table 3. With a desirable outcome of non-significance, the test statistic is a chi-square statistic, indicating that there is no significant difference between the observation and the model assumption.

The ratio of the likelihood function's maximum value for the whole model to its maximum value for the simplest model is uses in the probability-ratio test. The model statistics from Hosmer and Lemeshow's goodness-of-fit test, were computed and assembled for improved support as indicated in Table 3.

The test shows that the observed and anticipated value were insignificantly different (chi square = 3.365, df = 8, p = 0.909) suggesting that the model fit is excellent. Figures 1 and 2 display the model fit's graphical distribution. If the observed points are dispersed about the projected fitting line, this indicates that the model fits. The scattering of the points around the fitting line leads the researcher to the conclusion that the model fits the data adequately. How well the model fit the Hosmer and Lemeshow's test's Goodness-of-Fit test statistic was determined by assessing the quality of data modelling.

As indicated in Table 3, a chi-square test was performed between the observed values which the researcher empirically collected through direct observation and expected frequencies. The expected values were created based on certain hypotheses. For both transport modes, there was a slight discrepancy between the expected and observed values as the chi-square value was not statistically significant.

Table 3 Hosmer and Lemeshow's test for shopping trip (n = 750 samples)

	Car		Public	Transport	
No.	**Observed**	**Expected**	**Observed**	**Expected**	**Total**
1	75	75	0	0	75
2	75	74.995	0	0.005	75
3	76	75.977	0	0.023	76
4	75	74.913	0	0.087	75
5	74	74.712	1	0.288	75
6	75	73.923	0	1.077	75
7	72	71.662	4	4.338	76
8	51	52.768	24	22.232	75
9	13	11.858	60	61.142	73
10	1	1.192	74	73.808	75
Chi-square	Df	Sig.			
3.365	8	0.909			

Gharyan University Journal of Engineering Science (GUJES)
Website: http://gujes.gu.edu.ly
email: gujes@gu.edu.ly

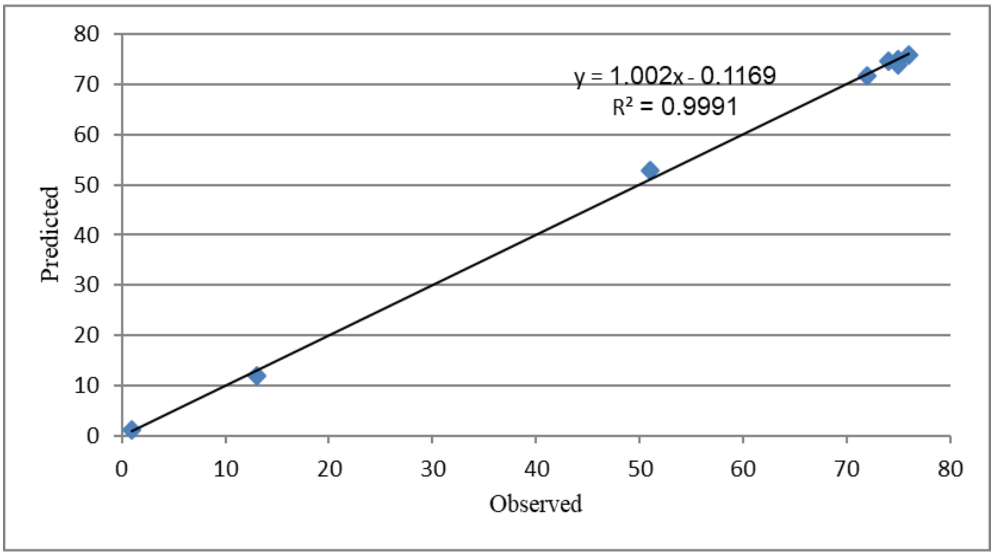

Figure 1: Observed vs. predicted by car

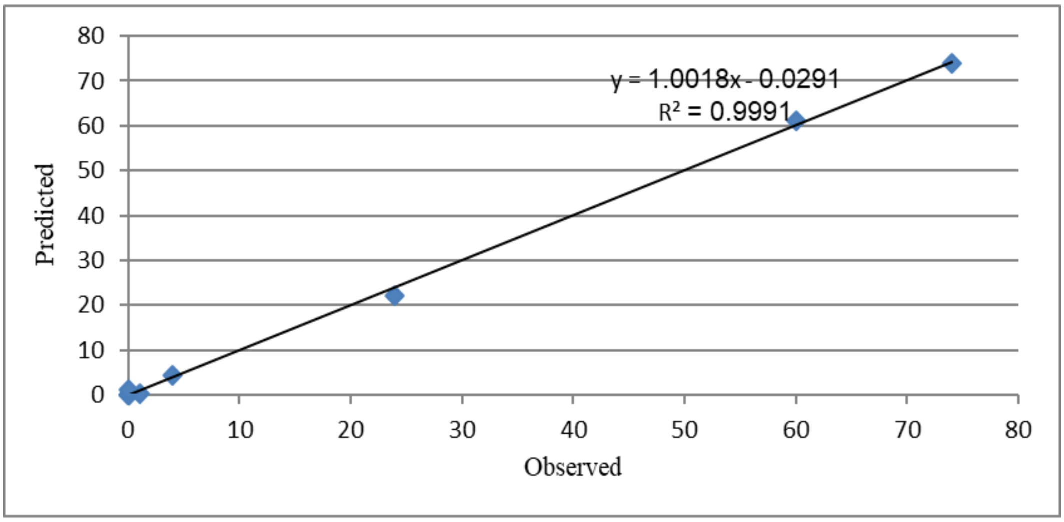

Figure 2: Observed vs. predicted by public transport

Figure 1 and 2 shows the model's good-fit as the observed and predicted values were extremely near to one another. As seen in Table 4, classification matrices were also computed to evaluated how well the model fit the data. According to these measurements, the model accurately identified 0.0% of the bus cases and 100% of the own car cases. The accuracy of the likelihood was 78.3%. these probabilities are divided from the model when the constant is the lone input.

Table 4 Observed by all trips models for (car vs. Public transport) under shopping trip (n = 750 samples)

	Observed	Predicted		
		Car	Public transport	% Correct
	Car	587	0	100.0
Step 0	**Public transport**	163	0	.0
	Overall Percentage			78.3

The cut value is 0.50

The calculated logistic model for shopping trips expected and observed frequencies are presents in Table 5. According to the chance criteria of 82.5%, the overall success rate of 94.5% was higher than the proportionate accuracy of 25% indicating that the logistic model has good discriminatory capabilities. The findings indicate that 97.4% of people how drive their own cars had access, but 84.0% of people who utilize PT were appropriately categorized. The model's overall accuracy of 94.5% shows that it fits the data well, and its average expectations' were accurate at 94.5%.

Table 5 Classification table for binary logistic model under shopping trip (n = 750 samples)

		Predicted		
		Car	**Public transport**	**% Correct**
Observed	**Car**	572	15	97.4
Step 1	**Public transport**	26	137	84.0
	Overall Percentage			94.5

proportional accuracy by chance 25% criteria = 82.5

5. Probability Prediction

This section generated the probability of transport switch in holdout sample (for model validation) sample (150) using a probability function of 750 samples. The group was also, classified using a Cut-off value of 0.5. If the probability is less than or equal to 0.5, the sample will be assigned to the own car group, if the probability is more than 0.5, the sample will be assigned to the PT group. Then, using the classification table shown in Table 6 below, the probability function's prediction power for the holdout samples was assessed, the probability function properly predicted 83.7% of car users, but only 70.4% of public transport users, according to the table. The overall success rate was 81.3%, which is still significantly higher than the random proportional accuracy of 25%, which comes out to 88.1%. This suggests that the probability function has a good capacity for shown, by Equation 3 and Table 6.

$$P = \frac{1}{1 + e^{(6.929 - 0.867*Age + 1.796*Hd - 1.067*ST - 2.177*Sd - 1.625*no}} \quad (3)$$

Table 6 Classification table for shopping trip probability function

		Predicted		
		Car	Public transport	% Correct
Observed	Car	103	20	83.7
	Public transport	8	19	70.4
	Overall Percentage			81.3

proportional accuracy by chance 25% criteria = 88.1

Table 6 shows that the estimated logistic model has an overall success rate of 81.3%, which is higher than the random criteria's 25% relative accuracy of 88.1%. This suggests that the estimated logistic model does a very good job of showing between the two groups. 83.7% of respondents who used their own cars were correctly classifies compared to 70.4% of respondents who used PT modes. Consequently, the 81.3% total accuracy provides information on how the model fits.

6. Validation

Table 7 summarizes the outcomes of the binary logistic model validation of the user of a shopping trip with five factors. In order to acquire the validation model, 150 test cases were introduced and subsequently chosen; the independent variables with p-values less than 0.05 served as the basis for the criteria for significant levels. With p-values less than 0.05, it seems that every factor was significant according to the p-values in this table. The likelihood that we will make a type I error, or reject the null hypothesis when it is true, is known as the significance level. Therefore, there is a 5% risk of committing a type I error if we select a significance threshold of 0.05 (strong evidence).

Table 7 Binary logistic model validation for public transport shift under shopping trip (n =150 samples)

						95% C.I.for EXP(B)	
Variable	B	S.E.	Df	Sig.	Exp(B)	Lower	Upper
Age	-1.601	0.691	1	0.020	0.202	0.052	0.781
Household size	4.759	1.555	1	0.002	116.686	5.535	2459.763
shopping travel time	-1.696	0.843	1	0.044	0.183	0.035	0.957
shopping distance	-3.166	1.043	1	0.002	0.042	0.005	0.326
Car ownership	-4.91	1.657	1	0.003	0.007	0.00	0.19
Constant	8.857	3.943	1	0.025	7024.85		
Summary of statistics							
-2 Log likelihood	24.607a						
Chi square	116.811		5	0.000			
Cox & Snell R Square	0.541						
Nagelkerke R Square	0.886						
Number of observation	150						

Dependent variable: 1 = Public transport, 0 = Car

The table illustrations the significant characteristics that indicate age, household size, shopping travel time, shopping distance and car ownership with significant level 0.0000. The binomial logit model that only has two possibilities is write as in Equation 4.

$$P_a = \frac{1}{1+e^u} \tag{4}$$

Where

P_a = probability of own car users' switch to public transport modes
u = utility function for bus mode
e = the base of natural logarithms (approximately 2.718).

The study utility function for public transport is shows as in Equation 5.

$$U_b = \beta_0 + \beta_1 X_{Age} + \beta_2 X_{Hd} + \beta_3 X_{ST} + \beta_4 X_{Sd} + \beta_5 X_{no} \tag{5}$$

On the other hand, the model is

$$U_b = 8.857 - 1.601 * Age + 4.759 * Hd - 1.696 * ST - 3.166 * Sd - 4.91 * no \tag{6}$$

Where

U_b = utility function for bus modes
β_0 = the model specific constant
$\beta_1,\beta_2,..,\beta_5$ = coefficients associated with explanatory (significant variables
$X_1, X_2,..,X_5$ = individual explanatory variables
Age = age
Hd = household size
ST = shopping travel time
Sd = shopping distance
no = number of own car per household.

The model's summary statistics reveal a significant correlation, indicating a perfectly fitted model, with the Nagelkerke R^2 at 0.886 (close to 1), the Cox & Snell R^2 value at 0.541 and the -2 Log likelihood (-2LL) anchored at 24.607a. According to Table 7, every variable seemed to be significant at the 0.05 level of significance. The transport switch model is still significantly impacts by age, as seen by the coefficient of -1.601 and an odds ratio of 0.202 (95% CI: 0.052-0.781). The likelihood that respondents will move to own car increase with their age, according to odds less than 1. Switching to PT is more likely when the age group decrease by one unit. A significant determinant in this switch is household size, as seen by the coefficient of 4.759 and odds ratio of 116.686 (95% CI: 5.535-2459.763). According to the positive coefficient, respondents are more likely to switch to PT for every unit increase in the household size group. With a coefficient of 1.696 and likelihoods ratio 0.183 (95% CI: 0.035-0.957), the outcomes

Gharyan University Journal of Engineering Science (GUJES)
Website: http://gujes.gu.edu.ly
email: gujes@gu.edu.ly

indicate that shopping travel time is significant factor for transport switching. Therefore, the likelihood to PT modes will decrease with an increase of own car in the shopping travel time group. Similarly, a negative coefficient of -3.166 with odds ratio 0.042 (95% CI: 0.005-0.326) are identified for the shopping distance. Therefore, people are less inclined to switch to PT the farther they have to go shopping. In particular, decreasing the shopping travel distance group by one unit will increase the probability of selecting PT modes. In the end, the number of people who own cars has a big influence on transportation switching. According to a likelihood ratio of 0.007 (95% CI: 0-0.19) and a Coefficient of -4.91, respondents who own car are less likely than those who do not to use PT. it is easy to see that the likelihood of using PT option reduces with every unit increase in the number of own car users. The outcomes of the binary logistic regression with (750) data points are consistent with the evaluation of the coefficient, which clearly shows that independent variables like age, shopping travel time, shopping distance, and own car ownership are significant and have negative value. However, the independent variable, such as household size is shown to be significant, which is in line with the outcome of the current data. A positive coefficient indicates that the likelihood of switching to PT modes increases with household size. As demonstrated in table 8, the classification table also assesses the model's validation. The estimated logistic model's overall success rate of 96% was higher than the proportional accuracy of 25% and the criteria of 88.1% by chance, indicating that the estimated logistic model effectively distinguishes between the two groups. 88.9% of respondents who used PT were properly predicted compared to 97.6% of respondents who used their own cars. As an outcome, the 96% overall accuracy indicates that the model fits the data well.

Table 8 Classification table for model validation under shopping trip (n=150 samples)

		Predicted		
		Car	**Public transport**	**% Correct**
Observed	**Car**	120	3	97.6
	Public transport	3	24	88.9
	Overall Percentage			96.0

proportional accuracy by chance 25% criteria = 88.1

7. Conclusion

This research examines the behaviour of transport users in Tripoli roads between two current transport modes available, namely private transport vehicles as (own car, taxi, minibuses) and public transportation vehicles, and it determines the switch to that travellers make when choosing their transport mode. As the mode switch model between using PT and driving own car. To investigate the factors influencing PT users and predict the likelihood of a change in PT users with regard to different shopping travel times and distances, a binary logistic model for shopping trip was created for two options; own car and PT modes. In order to ascertain the relative influence of demographic and socio-economic and mode attributes on the mode switch

Gharyan University Journal of Engineering Science (GUJES)
Website: http://gujes.gu.edu.ly
email: gujes@gu.edu.ly

behaviour, the model looks at the features of both owning a car and using PT, including shopping travel time, shopping travel distance and characteristics to determine the relative influence of demographic, socio-economic characteristics. In actuality, every variable was significant at 0.05 level. A wide range of respondent's viewpoints and their likelihood of selecting the best travel services are indicated by the probability prediction of policy switch. Nurdden et al. have identified the factors that prevent private car users from using public transport so that rational policies could be express to encourage greater use of public transport [11]. Mackett have identifies different policy actions to reduce own car use for different types of trips as shopping trip and the actions that are required to meet the travel needs that the car currently fulfils [12]. Reduced shopping travel time and the availability of dedicated lanes for PT modes were the two most significant factors that were determined to be likely to encourage the usage of PT. **Finally**, it has been concluded that the factors playing a significant role in the switch own cars ownership to public transportation modes include reducing shopping travel time. By improving this factor through the introduction of public transport services into the road network of Tripoli, a large proportion of respondents from residential area in Tripoli will switch to the public transport, which will also contribute to enhancing environmental protection and ecological balance. Accordingly. In order to optimize travel time for all types of city trips, this study suggests a few measures to promote the use of the public transportation system with divided lanes on Tripoli's network roadways.

References:

[1] Amiruddin, ISMAI & Adel Elmloshi 2011, Travel Time is the Main Factor for Switching Travel Mode in Tripoli Street: Proceedings of the Eastern Asia Society for Transportation Studies, Vol.8, 2011

[2] Regional workshop on urban transport in the Mediterranean Region, Blaikie 2003, Janury 22&23,2008 – Skhirat- Morocco.

[3] Adel Elmloshi. 2019. Probability of policy shift to public transport. Case study: Tripoli – Libya. International Conference on Technical Sciences (ICST2019) March 2019 04 – 06

[4] Alrabotti, F. B.2007. *Traffic Lights, part two – (Tripoli),*General people's committee of general secretariat (ministry) of Libya justice and directorate general of traffic and licensing.

[5] Schrank, D. L. & Lomax T. J. 1997. Traffic congestion; transportation; urban transportation policy; traffic flow; planning; United States, Texas Transportation Institute, Texas A & M University System (College Station, Tex. and Springfield, Va.), 100-385-610 (*Last edited on* 27 Feb US/Mountain).

[6] Amiruddin Ismail, Adel Elmloshi 2011. Introducing Public Transport System to Improve Travel Time and Road Safety in Tripoli, Libya. Australian Journal of Basic and Applied Sciences, 5(6): 563-569, 2011ISSN 1991-8178

[7] Abuhamoud M. A. 2012. Modelling modal shift and parking management in Tripoli City centre - (libya). Thesis Submitted In Fulfilment For The Degree of Doctor of Phlosophy. Faculty of Engineering and Built Enveronment, Universiti Kebangsaan Malaysia, Bangi.

[8] Bajracharya A. R., 2008. The impact of modal shift on the transport ecological foot print, A case study of the proposed Bus Rapid Transit System in Ahmedabad, India, thesis submitted to the International Institute for Geo-information Science and Earth Observation in partial fulfilment of the requirement for the degree of Master of Science in Geo-information Science and Earth Observation, Specialisation: Urban Planning Management. Enscheda, the Netherlands.

[9] Dayton, C. M. 1992. Logistic regression analysis, department of measurement, statistics & evaluation, room 1230d benjamin building, University of Maryland.

http://bus.utk.edu/stat/datamining/Logistic%20Regression%20Analysis%20(Dayton).pdf [28 Oct 2013].
[10] Essia Taleb Essia Ali 2009. Why do post graduate students use private cars, dissertation submitted in Partial Fulfilment of the Requirements for the Degree of Master of Engineering. Faculty of Engineering and Built Environment. Universiti Kebangsaan Malaysia, Bangi.
[11] Nurdden Abdullah, Riza Atiq O.K. Rahmat, & Amirudden Ismail. 2007. Effect of Transportation Policies on Model Shift from Private Car to Public Transport in Malaysia. *Journal of Applied Sciences* 7 (7): 1013-1018.
[12] Mackett, R.L. 2003. Why do people use their cars for short trips? *Transportation Journal* 30: 329-349.