

Review on Private Vehicle Ownership by Residents in Urban Area

¹Hetal R. Khasiya, ²Amandeep Singh B. Bhalla, ³Rena N. Shukla

¹ PG student, U.V Patel College of Engineering

² Assistant Professor, Department of Civil Engineering, U.V Patel College of Engineering, Ganpat University, Kherva

³ Associate Professor, Department of Civil Engineering, L. D. College of Engineering, Ahmedabad, Gujarat, India,

Abstract: The rapid growth in private-vehicle ownership has led to increased congestion problems in Indian cities. The growth of vehicles has been faster than that of the population of India. It has been observed that investment on expanding road network capacities may not solve the congestion problem but could induce more traffic. This analysis will show how life cycle changes in a household can influence the existing fleet for vehicle ownership decisions. To control the traffic congestion, find out the affecting factors which are led to people to buy private vehicle. This paper reviews the literature to derive the household parameters affecting as roots of growth of vehicle ownership. It is required to develop vehicle ownership model to predict future scenario to plan the policy for traffic management in urban area. It also helps to derive parking demand in future at residential locations and at public places. This paper reviews published papers till today to work in desired direction of problem solving.

Keywords: Congestion, Household parameters, Parking demand, Private vehicle, Vehicle ownership, Urban area.

1. Introduction

- The increasing rate of vehicle ownership affects as Traffic congestion. Traffic congestion impacts life quality & productivity of economic activities in urbanized areas. It is a transport condition that is defined by slower speed, longer travelling time & increased vehicular queuing. This wasted fuel increasing air pollution in environment. Dominant source of air pollution is the vehicle emissions. More traffic congestion with longer time period has the capacity to heighten the emissions of pollutant & air quality degradation which is affecting human life. The life span of road is also decrease. To control all of these factors we have to analysis about the vehicle ownership, which elements highly impacting on it and correlate with the vehicle ownership.
- Number of persons or family size, income, age, Number of school /college going children and number of persons working in family/household are major affecting parameters for vehicle ownership. Lack of efficient and insufficient public transportation also leads to more vehicle ownership. Distance of work place from home and atmospheric condition is a leading factor to have own vehicle if income permits. The type of business is encouraging personal vehicle ownership for more trips to contact, take order and to deliver, to enhance income and business. Increase in vehicle ownership affects health, as person make small trips also by vehicle instead of walk trip. This also impact environment and more consumption of petroleum products. There are also other factors which are impacting on vehicle ownership like distance from home if house is far away from CBD area where public transport frequency is less, then public choose private own vehicle.
- As per the current situation in India, most of the time land-use planning stays unchanged compared to the growth of the middle-class. So the profound regulation of intermediate public transportation (IPT) such as transit supply options, rickshaws, vehicle use & ownership will likely to increase. It will pressurize city administration to provide urban infrastructure. If infrastructure is not provided instantly, sufficient and efficiently then it leads to private vehicle ownership in urban area.

- In the present condition, India is growing economically; still a large population lives in poor situations in urban as well as rural context. Many people come to cities from rural areas to urban areas, in search of a better life conditions. Initially they are on walk, sharing vehicle and using public transport but with the time they turn to purchase own vehicle. To survive better way in large urban areas they have need of vehicle before need of shelter. Also, to purchase resident is out of scope for them till their economy by earning uplift. For education & employment needs migration from surrounding is much more in urban areas. Vehicle ownership is equal or more than increase in population in urban areas. Many household personal activities like marriage, event of new born; influencing requirements of the new vehicle for the residence.

2. Literature Review

Leong Lee Vien and Ahmad Farhan Mohd Sadullah (2005) ^[1] have worked to develop the motorcycle ownership model for Malaysia. It was concluded in the study that, there are approximately 5.8 million motorcycles on roads and rate of accidents occurs of motorcycles found almost half of the total road fatality rate recorded by them. However, the relating accident rate of motorcycles is found high; ownership of motorcycle in Malaysia had been enlarged from 0.13 motorcycles per person in year 1990 to 0.24 motorcycles per person in year 2002. So, the increase in the quantity for ownership of motor cycle in Malaysia had become a very crucial issue with regards to management & safety system for transportation planning in Malaysia. A general survey was addressed to define the significant fact for the ownership of motorcycles. By means of identifying the factors, a disaggregate choice model of motorcycle ownership will be derived by statistical analysis. In Malaysia, it was seen that there are many motorcycles (around 5.8 million) on the roads in comparison to the number of passenger cars (5 million). Based on the conclusion of the study, motorcycles will emerge to be one of a major mode of transportation in the nearer future for the low and middle income group people. By studying the statistics, a better perception to the future planning and development of traffic system could be carried out.

Kumar and Krishna Rao (2006) ^[2] had investigated and discovered necessary study and formed a multinomial legit (MNL); ownership model of cars (0 to 2 cars as considered alternatives) for Mumbai Metropolitan Region of Maharashtra. The SP (standard preference) study results indicate a very prominent disinclination of Indians to provide their family incomes and residential addresses. It was the main reason for the moderately low response rate. It was observed that the ownership of car increases with the rise of household income and fall of the car prices. It is also affected by the family size and ownership of home. Households of samples found the inclination for owning a car purpose for personal, shopping and shopping trips and not for the work trips. With proper analysis and study, it has been concluded that the defined methodologies are more effective in the modeling of vehicle ownership decision for the Indian households.

P. Sillaparcharn (2007) ^[3] has analyzed various vehicle ownership models (including motorcycle, car, bus & coach models and truck & heavy goods vehicle). These were projected commonly through a trip generation model. For motor vehicle ownership models and trip generation model; limited collection of data with series of time & cross sectional has been disaggregated spatially by domain through non log linear weighted least squares regression. The planned vehicle ownership models found to be advantageous in estimating the provincial & national level vehicle ownership which is essential for building road infrastructure, management of traffic. It is also considered for decision making process of transport. Apart from that other policy level problems and predications for energy use & emissions; it can be helpful. Indirectly it also influence the decision making process for frequency and distribution of trips with the help of choosing the route.

L.S. Putranto et al. (2007) ^[4] had studied and developed motorcycle and car ownership rate models at municipality and regency levels for the study area in Indonesia. The research was commenced using yearly aggregate data (1990-2000) from 28 regencies and 21 municipalities throughout the study area i.e. Indonesia. Furthermore, 106 households from 3 regencies and 4 municipalities were interviewed. The motorcycle and car

ownership rate model obtained was the quasi-logistic function and standards of the saturation level were carefully chosen based on previous research and the function boundary condition. Both in the cross-sectional and longitudinal aggregate models, the wealth level were the peak significant factor in demonstrating the vehicle ownership rates variation. In household level a substitute of wealth level (household monthly expenditure) was positively associated with the number owned cars. As the wealth level increased, motorcycle ownership in a household found decreased.

Chamon et al. (2008) ^[5] had used expenditure data of India for 29,631 numbers of households in 2004, from the urban & rural areas. It seems that, for income they have used substitution of expenditure. However any further details has not been addressed and assumed a binary probit model with two options: owning not a single car vs. owning a single car. Therefore, they concluded that 11 to 34% of households in India will own single car in 2030 to 2050.

Jaruwit Prabnasak and Michael A P Taylor (2009) ^[6] have studied and derived the primary analytical study of vehicle ownership and the nature of transport choice mode in urban cities of Asia. It was identified that factors hypothetically influencing the nature are determined using multinomial logit choice model (MNL) models established on the database of KKDTS07. Size of the household has been observed to be a critical aspect governing quantity of vehicles. On the other side, income is the aspect predominating the vehicle types in different houses. The quantity of vehicles, specifically the motorcycle, would be greater if the household increases.

Nobuhiro SANKO et al. (2009) ^[7] has analyzed and generated BOP (Bivariate ordered probit) models. The sole purpose of this analytical study is to determine and predict the behaviors of household car and motorcycle ownership, in Nagoya metropolitan area of Japan. Main focus has been given on following parameters: A) Ease of transportation with vehicle ownership in residential areas; B) Ownership behaviors of inter-temporal relationship and C) Inter-relationships between ownership of car & motorcycle. As motorization proceeds furthermore; parameter assessment for the ownership of car propensity function concludes that age & gender deviation of the ownership are commonly becoming less significant. Parameter relationship of the ownership of motorcycle propensity utility indicates that ownership of motorcycle increases much higher in males compared to females. Traffic convenience in residential areas also affects both motorcycle and car ownership as per the BOP models.

D. M. Priyantha Wedagama (2009) ^[8] has analyzed household variables that affect ownership of car & two wheelers in Deenpasar city in Bali through Poisson regression model. Analysis has derived that the rise in quantity of students & working persons in a house may influence the rate of two wheeler ownership increases. Also increase in distance of travel may influence person's preference to own a four wheeler. Capacity of four wheeler or car may influence the household to own a car. In this analysis, quantity of students & workers tend to increase the rate of motorcycle ownerships and travel distance tends to increase car ownership rate.

K. I. Wong et al. (2011) ^[9] has investigated and studied the household ownership of car and motorcycle in study area Macao. The study has used the household interview survey method to collect the disaggregated data. With the assessment results obtained using cross-sectional data in this study, the administrators can determine, obtain and understand the significance of various variables that a household would own a car or motorcycle. A raise in the household income would also increase the private vehicle ownership rates.

Shirgaokar et al. (2012) ^[10] have derived different factors (Ex. socio-economic variables, characteristics of the trip, locations of work & home) that manipulate the middle-class people's purchasing of motorcycle & cars through MNL models. Researchers used data of travel survey of household, composed by the Mumbai Metropolitan Regional Development Agency (MMRDA). The conclusion has derived that transit services of improved version could decrease the vehicle ownership need which can be comfort. It has been observed that ownership of vehicles decreases when trip distance is very larger and ownership of vehicles increases when the

people of the household are married. A need for a car is stronger in the family having children; per-capita income is higher, bigger house ownership, larger household size, etc. When prime earner is male and job has more frequent trips than inclination towards the two-wheelers is higher. Inclination towards the two-wheeler is higher in younger people and inclination towards the car is higher in the older people. Preference to own a car for the people residing in the peri-urban edge of the city has decreased because of high job density and the same thing has influenced to own a motorcycle.

Dash et al. (2013) ^[11] has used India's Consumer Expenditure Survey data (the data has been collected by Nation Survey Sample Office (NSSO) in the time period of July 2009 to June 2010). With the help of the collected data, model has been generated about a disaggregate model for ownership of private vehicle. The research has considered expenditures of household as proxy for household income. They worked for a nationwide model for vehicle ownership. In this research, the four vehicle choices for the household has been considered such as; 1) motorcycle, 2) motorized private vehicle, 3) both motorcycle & car and 4) only car. It had been observed that the presence of children & household size and per-capita expenditures has positive relationship with motorcycle & car ownership. Rural population has more inclination towards owning a car than the urban population. Logically, the presence of young adults between the age group of 19 to 35 years has more possibility of households owning motorcycles. Better perception can be obtained by including the data of young adults with variables like Distance of travel, make & model of vehicle, average travel time, etc.

Prateek Bansal et al. (2016) ^[12] developed a Multinomial Logit vehicle ownership model for the major cities of Bangalore, Calcutta and Delhi. They used parameters like household size, family income, workers and children in household, other in house facilities like cell phones, LPG stove, air conditioners, televisions, computers, bicycles, refrigerators, and internet connections. It has been suggested that the rise of four-wheeler vehicle ownership is parallel with the increment of incomes and size of residence.

Ravi Choudhary (2016) ^[13] studied the variables highlighting ownership of vehicle for rural as well as urban population in India. In the study, to quantify and comprehend the effects of different variables affecting the ownership of private vehicles for rural as well as urban population; disaggregate multinomial logit model has been established. Different models for rural and urban households have been generated individually. The analytical study defines that rural population are more inclined to own the private vehicles compared to the urban population. If the size of the household increases than rural as well as urban population are also inclined to own the private vehicles. Household having the salaried person generates the positive impact in assessment of relationship with private vehicle ownership, preferably two wheelers. The study results are found reliable with choice of transport mode. Apart from that one of the main factor for assessment of owning a private vehicle is also affected by the economic level. Family structure and size of household plays a key role in choice of transport mode. Analytical study shows that existence of children increases the inclination towards the vehicle ownership for both urban & rural population. Households and aged persons are more inclined to own a car and many of them are the owner of their first four wheeler vehicle. Contrary to that the younger generation between the age group of 19 to 35 years is involved towards owning motorcycles.

3. Conclusion

- By study and review of various literatures for vehicle ownership some conclusion is derived as here. Housing location and jobs in an urban geography affects the travelling time by private modes of vehicles. Development density to transit influence the utility derived from vehicle use and ownership. Public & private mode travel is influenced by work location. Family size, Number of employed person and family income are affecting parameters. Age is affecting parameter but people specifically young generation preferred two-wheeler for any travelling purpose. The congestion and parking space issues also lead to preferable mode as 2w. The need of vehicles increases with the age of family members. Children and senior citizen holding family prefer

to buy car. It is observed that car is also preferred only for family trips during weekend, social and hospital visits in urban area.

- The review paper is written with objectives of analyzing factors responsible for vehicle ownership and the model proposed to predict the vehicle ownership. The Ordered Probit Model and the Multi Linear Regression model is proposed in order to predict the vehicle ownership.

4. References

- [1] L. L. E. E. Vien (2005) "Modelling Motorcycle Ownership in Malaysia," *Transportation (Amst)*., vol. 2000, 2005.
- [2] M. Kumar and K. V. Krishna Rao (2006) "A stated preference study for a car ownership model in the context of developing countries," *Transp. Plan. Technol.*, vol. 29, no. 5, pp. 409–425, 2006, doi: 10.1080/03081060600917793.
- [3] P. SILLAPARCHARN (2007) "Vehicle Ownership and Trip Generation Modelling," *IATSS Res.*, vol. 31, no. 2, pp. 17–26, 2007, doi: 10.1016/s0386-1112(14)60218-1.
- [4] L. S. Putranto, S. Grant-muller, and F. Montgomery (2007) "Characteristics of Private Car and Motorcycle Ownership in Indonesia," *Proceeding East. Asia Soc. Transp. Stud.*, vol. 6, 2007.
- [5] Marcos Chamon et al (2008) "Mass car ownership in the emerging market giants" *Economic policy April 2008* pp 243-296
- [6] J. Prabnasak and M. A. P. Taylor, (2009) "An exploration of vehicle ownership and mode choice behaviour in a mid-sized Asian city: A case study in Khon Kaen City, Thailand," *32nd Australas. Transp. Res. Forum, ATRF 2009*, 2009.
- [7] N. Sanko, D. Dissanayake, S. Kurauchi, H. Maesoba, T. Yamamoto, and T. Morikawa, (2009) "Inter-temporal analysis of household car and motorcycle ownership behaviors," *IATSS Res.*, vol. 33, no. 2, pp. 39–53, 2009, doi: 10.1016/S0386-1112(14)60243-0.
- [8] D. M. Priyantha Wedagama (2009) "The Analysis of Household Car and Motorcycle Ownerships Using Poisson Regression (Case Study: Denpasar-Bali)," *Jurnal Teoretis dan Terapan Bidang Rekayasa Sipil*, Vol. 16 No. 2 Agustus 2009, pp.103-111.
- [9] K. I. WONG and H.-L. LIN (2011) "Modeling Household Car and Motorcycle Ownership: A Case of Macao," *Proc. East. Asia Soc. Transp. Stud.*, vol. 2011, p. 81, 2011, doi: 10.11175/eastpro.2011.0.81.0.
- [10] M. Shirgaokar, (2012) "UC Berkeley Dissertations Title The Rapid Rise of Middle-Class Vehicle Ownership in Mumbai," 2012, [Online]. Available: <https://escholarship.org/uc/item/936337w5>.
- [11] S. Dash, V. Vasudevan, and S. Singh (2013) "Disaggregate model for vehicle ownership behavior of Indian households," *Transp. Res. Rec.*, no. 2394, pp. 55–62, 2013, doi: 10.3141/2394-07.
- [12] W. Schievelbein, K. Kockelman, P. Bansal, and S. Schauer-West, (2005) "Indian Vehicle Ownership and Travel Behavior S: A Case Study of Bangalore, Delhi and Kolkata," *Res. Transp. Econ.*, pp. 1–17, 2016.
- [13] R. Choudhary and V. Vasudevan. (2017) "Study of vehicle ownership for urban and rural households in India," *J. Transp. Geogr.*, vol. 58, pp. 52–58, 2017, doi: 10.1016/j.jtrangeo.2016.11.006.