พฤติกรรมการเดินทางของผู้พักอาศัยในคอนโดมิเนียมใกล้สถานีรถไฟฟ้า:กรณีศึกษากรุงมะนิลา

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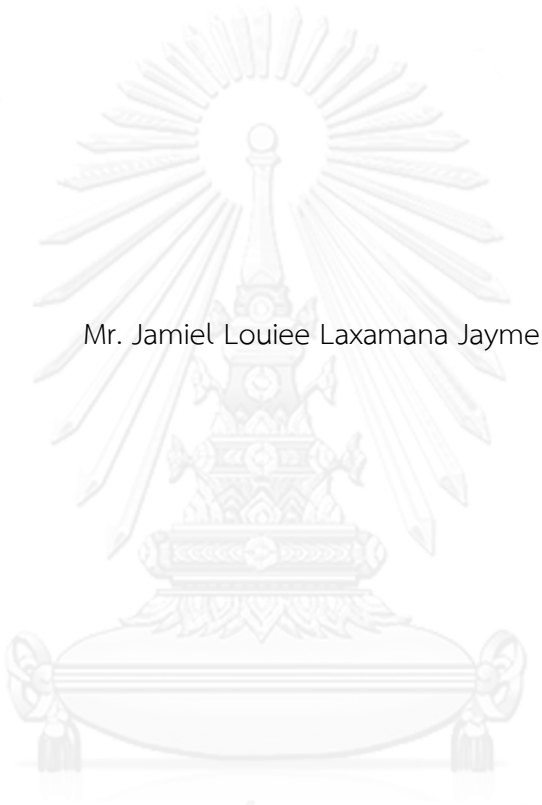
ปีการศึกษา 2556

TRAVEL BEHAVIOR OF CONDOMINIUM RESIDENTS NEAR URBAN RAIL TRANSIT STATIONS: CASE OF METRO MANILA

Mr. Jamiel Louiee Laxamana Jayme



A Thesis Submitted in Partial Fulfillment of the Requirements
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Thesis Title	TRAVEL BEHAVIOR OF CONDOMINIUM RESIDENTS NEAR URBAN RAIL TRANSIT STATIONS: CASE OF METRO MANILA
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Field of Study	Civil Engineering
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เจเมียล ลุย ลักซามานา เจมี่ : พฤติกรรมการเดินทางของผู้พักอาศัยในคอนโดมิเนียมใกล้สถานีรถไฟฟ้า:กรณีศึกษากรุงมะนิลา. (TRAVEL BEHAVIOR OF CONDOMINIUM RESIDENTS NEAR URBAN RAIL TRANSIT STATIONS: CASE OF METRO MANILA) อ.ที่ปรึกษาวิทยานิพนธ์หลัก: รศ. ดร. ศักดิ์สิทธิ์ เฉลิมพงศ์, 120 หน้า.

ปัญหาการจราจรติดขัด ณ เขตเมโทรมะนิลาเป็นสิ่งที่น่ากังวลอย่างยิ่ง สำหรับพฤติกรรมการเดินทางของผู้โดยสารเนื่องจากขาดความคล่องตัวในการเดินทาง และความยากลำบากในการเข้าถึงสถานี ซึ่งการเปลี่ยนรูปแบบการเดินทางจากการใช้รถยนต์มาใช้บริการระบบขนส่งมวลชนนั้นช่วยก่อให้เกิดประโยชน์ต่อความก้าวหน้าของการพัฒนาพื้นที่รอบสถานีขนส่งมวลชน ณ เขตเมโทรมะนิลา ให้ก้าวหน้ายิ่งขึ้น โดยการใช้แบบสอบถามและการวิเคราะห์ความถดถอยทางโลจิสติก ซึ่งผลจากลักษณะทางเศรษฐกิจ,สังคม และการใช้ประโยชน์ของที่ดินที่แตกต่างกันที่เกิดขึ้นระหว่างผู้โดยสารที่ใช้บริการขนส่งระบบรางในเมืองและรถยนต์ กับผู้ที่อยู่อาศัยโดยรอบสถานีขนส่งระบบราง จะเป็นตัวกำหนดพฤติกรรมการเดินทางของพวกเขา จากผลการวิจัยพบว่าผู้โดยสารผู้ที่พักอาศัยอยู่ใกล้สถานีขนส่งระบบรางมีแนวโน้มสูงที่เข้ามาใช้บริการสถานีดังกล่าว ในทางกลับกันเมื่อระยะห่างระหว่างที่พักอาศัยและสถานีขนส่งนั้นมีมากขึ้น จะมีความเป็นไปได้สูงที่จะเปลี่ยนไปใช้รถยนต์หรือระบบขนส่งมวลชนรูปแบบอื่นที่พวกเขาสามารถใช้เดินทางได้แทน แต่เนื่องจากปัจจัยบางอย่างที่เป็นประโยชน์และแนวความคิดของตัวผู้โดยสารเองบางคนที่มีลักษณะการใช้ประโยชน์ที่ดินเหมือนกันที่ยังคงใช้ระบบการขนส่งทางรางต่อไป

ภาควิชา วิศวกรรมโยธา ลายมือชื่อนิสิต .....

สาขาวิชา วิศวกรรมโยธา ลายมือชื่อ อ.ที่ปรึกษาวิทยานิพนธ์หลัก .....

ปีการศึกษา 2556

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KEYWORDS: TRAVEL BEHAVIOR / URBAN RAIL TRANSIT / CONDOMINIUM RESIDENTS / METRO MANILA

JAMIEL LOUIEE LAXAMANA JAYME: TRAVEL BEHAVIOR OF CONDOMINIUM RESIDENTS NEAR URBAN RAIL TRANSIT STATIONS: CASE OF METRO MANILA. ADVISOR: ASSOC. PROF. SAKSITH CHALERMPONG, Ph.D., 120 pp.

Metro Manila's traffic congestion problem had been a concern for the travel behavior of commuters due to the lack of mobility and difficulty in accessibility. A shift from automobile to transit use would be beneficial for the progress of a transit-oriented development in Metro Manila. Using questionnaire survey and logistic regression analysis, the effects of different socio-economic and land use characteristics among commuters using urban rail transit and automobile, and whose residences are along stations of the rail transit would determine the behavior of their travel. The research outcomes entails that commuters whose residents are very near the rail transit stations are more likely to utilize them. On the other hand, as the residence to transit station proximity increases, a higher likelihood of choosing automobiles or different public transit as their modes of transport was observed, but due to some beneficial factors and own perception, some commuters with the same land use characteristic, still use rail transit.

Department: Civil Engineering Student's Signature .....
Field of Study: Civil Engineering Advisor's Signature .....
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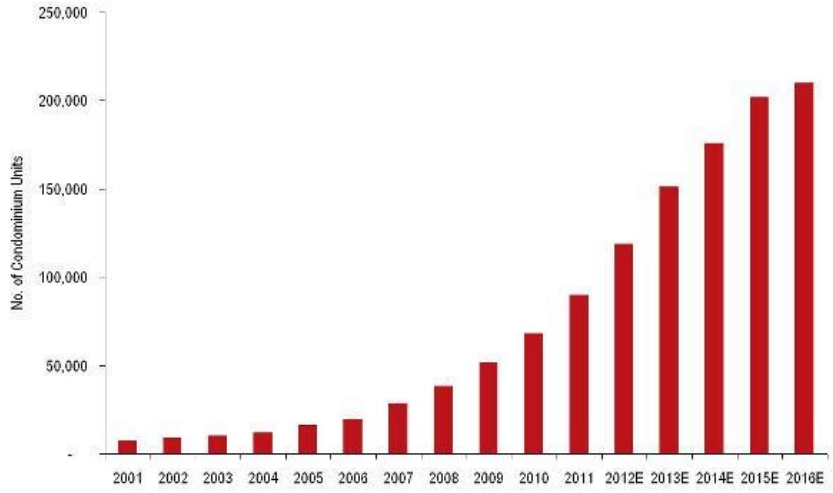
CHAPTER I
INTRODUCTION

1.1. Background of the Study

The developments of condominiums within the vicinity of rail transit stations in Metro Manila are beginning to increase. This supply increase of condominiums is relative to the demand that more Filipinos opt to live in a condominium unit in Metro Manila rather than to buy a house and lot outside of capital (Garcia 2013). According to Jones Lang LaSalle Leechiu Research & Consulting 2012 (Go 2012), the number of condominium units in Metro Manila alone reached 90,000 in 2011, and the average annual supply growth of condominiums is at least 30% as shown in Figure 1.1.



Source: Jones Lang LaSalle Leechiu Research & Consulting 2012

Figure 1.1: Cumulative Supply of Mid- to High-End Condominiums in Metro Manila

Note: Mid-end condominiums have selling prices ranging from PHP 1.5 million to PHP 10 million, while high-end condominiums typically have prices above PHP 10 million.

Meanwhile, Metro Manila's urban rail transit system have been accepted as one of the most active transit mode in the city, with its good accessibility, low-priced fare and traffic congestion-free service. These transit systems have been utilized by many commuters mainly to avoid a traffic congested travel. According to the Department of Transportation and Communications ((DOTC) 2010), the annual urban rail transit ridership is about 350 million in 2009, and the estimated growth rate is 5-10% per year. This certainly sets a trend on urban rail transit travel.

The current rail systems in Metro Manila have three operating lines. First, the Light Rail Transit Line 1 (LRT 1) or the Yellow Line is the oldest elevated heavy rail line in the country. Dating back from the 1980's, LRT 1 was the first operated urban rail transit in the Philippines. As of 2011, LRT 1 consists of a 20.7 km length network with 20 stations. Second, the Metro Rail Transit (MRT 3) or the Blue Line is also an elevated heavy rail system, which began operating in 1999. It has a total length network of 16.9 km with 13 stations. The MRT Line is located on the busiest road in Metro Manila, EDSA (Epifanio Delos Santos Avenue), with approximately 350,000 vehicle volume per day (MMDA, 2012). Third, the Light Rail Transit Line 2 (LRT 2) or the Purple Line is the East and West extension of the LRT, which began operating in 2003, and has a total length network of 13.8 km with 11 stations.

Table 1.1: Summary of Metro Manila's Rail Systems

Rail Transit Lines	Line Color	Year of Operation	Total Length (Km)	Total Number of Stations
LRT 1	Yellow	1980	20.7	20
LRT 2	Purple	2003	13.8	11
MRT 3	Blue	1999	16.9	13

Source: ((DOTC) 2012, (LRTA) 2012)

Table 1.2: Ridership of Transit Lines

Rail Transit Lines	Approximate Daily Traffic (in Passengers)	Annual Passenger Traffic (in Millions of Passengers)		
		2010	2011	Mid 2012
LRT 1	550,000	155.91	156.93	83.31
LRT 2	200,000	63.36	63.83	33.16
MRT 3	450,000	153.16	158.81	82.81

Source: ((DOTC) 2012, (LRTA) 2012)

The summary and location of these rail systems in Metro Manila are shown in Table 1.1 and Figure 1.2 respectively. These three systems mainly serve commuters in Metro Manila. The number of riderships for the three operating lines is shown in Table 1.2.

Source: (Johomaps 2010)

Figure 1.2: Metro Manila Rail Transit Systems

1.2 Statement of the Problem

Mobility dilemmas are highly experienced in Metro Manila. Being a developing city, there is a need for high mobility for land usage and transport, but the problem in traffic congestion confronts the capital of the Philippines with great intensity. The travel behavior of most of the commuters in Metro Manila involves the use of

automobiles mainly due to comfort. On the other hand, commuters without access to automobiles tend to use different public modes of transport such as jeepneys, buses, FX's and taxicabs, then again these public modes together with the great amount of car users tend to overload the capacity of major roads in Metro Manila; hence traffic congestion takes place. However, urban rail transit could be one of the best solutions to lessen the traffic congestion problem in the Metro. According to Fouracre, Dunkerley et al. (2003), there may be patent basis for the shift of commuters from private motor vehicles to mass rapid transit in some of Asia's densely populated cities.

In relation with the high number of riderships of the rail transit lines in Metro Manila, the rise of residential condominiums, mainly within the surrounding area of rail transit stations, provides more opportunity for the utilization of the urban rail transit lines; hence supportive of the transit-oriented development (TOD) in the capital.

Considering the potential of the urban rail transit systems and the increasing amount of residential condominiums proximate to rail transit stations, the travel behavior of residents in condominiums within the vicinity of the rail transit stations must be studied to determine the effectiveness of the transit-oriented development instruments on the reduction of automobile users as well as traffic congestion in Metro Manila.

1.3 Objectives

The general objective of the study is to determine the effects of the travel characteristics of residents in high-density condominiums near urban rail transit

stations in promoting a transit-oriented development to reduce traffic congestion in Metro Manila, Philippines.

The specific objectives of the study are:

1. To compare and analyze the relationship between condominiums' location characteristics and residents' socio-economic profile and their effects on the travel behavior of those residing in condominiums near urban rail transit stations, and
2. To determine the effect of residential movement to newly developed condominiums located near urban rail transit stations of both transit and automobile users.

1.4 Hypothesis

Majority of residents living in condominiums located in the vicinity of rail transit stations use the rail system for their daily commute. Moreover, their travel behavior is dependent on their socio-economic profile and characteristics, and their accessibility to the rail transit stations. The effectiveness of such premise for a progressive transit-oriented development is to encourage residential movements to newly developed condominiums proximate to urban rail transit stations leading to mode shift from automobiles to rail transit.

1.5 Scope and Limitations

The study is focused on the travel behavior of urban rail transit users in Metro Manila and is limited with the following conditions:

1. The survey data used were for residents of condominiums near urban rail

transit stations.

2. Data were gathered by online survey questionnaire and on-site survey.
3. A considered residential condominium to be surveyed is with the following given definition; a building that is comprised by a number of residential units in which each unit can be individually owned or have it rented.
4. Residential condominiums with an approximate radial distance of 1,000 meters or so from a transit station constructed after the urban rail transit was built were considered to assess the land-use characteristics.
5. Only trips from residence to work place or school were considered.
6. Residential movement is only within cities in Metropolitan Manila.

1.6 Significance of the Study

The purpose of this study is to stimulate a transit-oriented development in transit corridors and urbanized areas in the case the developing city capital of Metro Manila in the Philippines by an effective transportation planning policy improvements through the impact on how people travel. Transit-oriented development is the advancement of an area with more compact dwellings within easy walking to transit stations and accessible to different mix land usage. With this premise, commuters will develop a sense of urge to shift from the use of an automobile to using urban rail transit. Also, individuals may choose to relocate their residential place near a transit station for better transport and easier travel; this will then “create a sense of community and of place” (Reconnecting-America 2012).

CHAPTER II
LITERATURE REVIEW

2.1 Land-use and Transport

The interrelation of land-use and transport is shown in Figure 2.1. There are some variables which are affected by this relationship, accessibility, mobility and proximity. The changes made within the relationship of land-use and transport will influence both and may cause an increase in the demand of transport. In some studies, it is said that the interaction of these two variables is the one of the most dynamic fields in the transportation area. The connection of land-use and transportation is the focal point for formulating policies which are related to travel behavior, automobile usage, and vehicle travel (Senbil, Zhang et al. 2006).

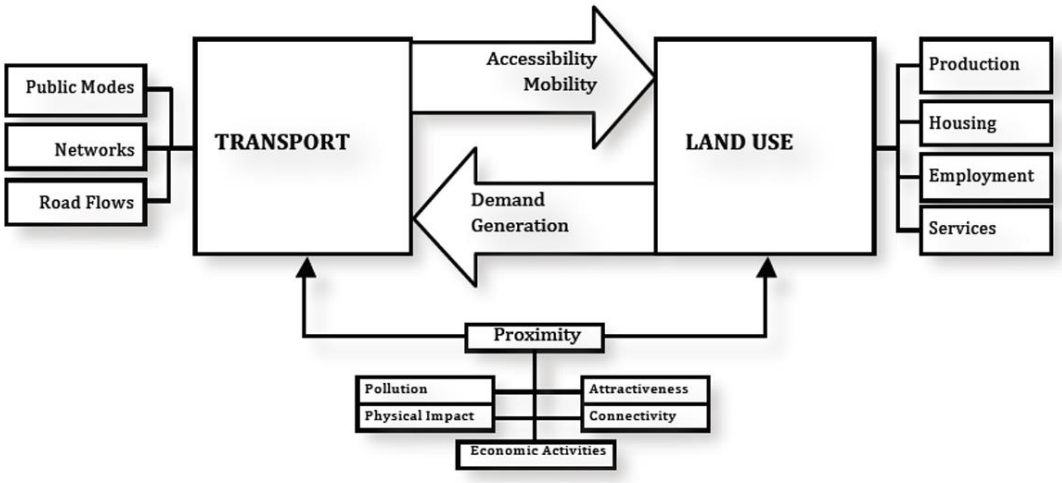


Figure 2.1: Transport and Land-use Interaction Diagram (Pacheco-Raguz 2010)

An illustration of one relationship of transport to land use was given by Stringham (1982), relating the accessibility of the rapid transit stations to the developments within the vicinity of the station. It is evident that the tendency of

people's mode access is quite dependent on the distance from where they will start or end their commute. Figure 2.2 shows an example of the relation of modes of access to the distance of the transit station. It is seen that walking is a popular mode of access until it reaches the distance where people would not like to walk anymore, which is beyond 1,000 meters. O'Sullivan and Morrall (1996) also confirmed the efficiency of walking to rail transit stations. The case of the light rail transits in San Francisco Bay and Edmonton, Canada, revealed that walking access to LRT stations acquires half of its users and has similar distance limitations as in Figure 2.2. Other access choice will arise where demand is needed or when the starting point of the commute is not very suitable for walking. In relation with Metro Manila's situation, Wibowo and Chalermpong (2010) established the same concept provided by Stringham (1982).

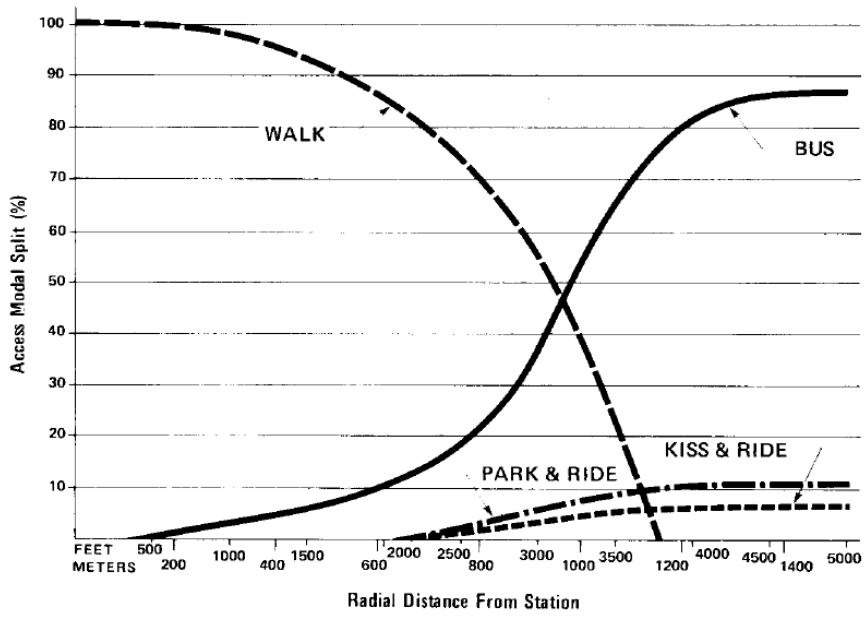


Figure 2.2: Access to Rapid Transit Station Relative to Distance from Station (Stringham 1982)

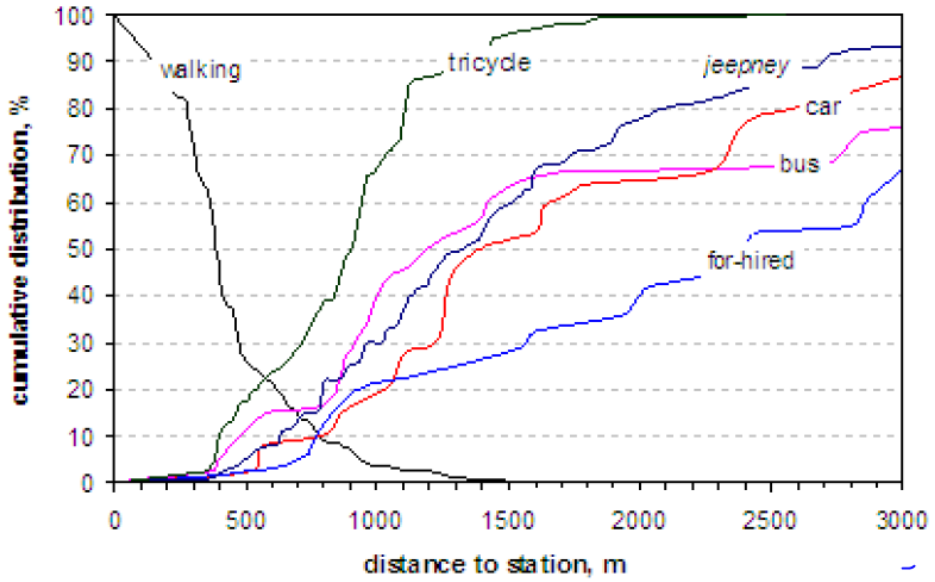


Figure 2.3: Metro Manila's Access Mode and Distance to Urban Rail Station Relationship (Wibowo and Chalermpong 2010)

In Figure 2.3, the mode of access in Metro Manila's urban rail transit stations gave out that generally, walking is suitable for people's travel with a distance not greater than 1,500 meters. On the other hand, other modes for access are commonly used with longer distances relative to the urban rail stations.

2.2 Accessibility and Mobility

Accessibility is defined as the ease of being useful and convenient, while mobility is defined as the ability of people or things to move spontaneously. In transportation, they are the level of convenience for a commuter towards transport to move without any obstructions. Accessibility is directly proportional to mobility. Accessibility increases, as well as mobility, in areas where different transportation modes provide service. In comparison with the areas that transportation modes do not provide service; their level of accessibility is quite low (Giuliano 1995). In general,

all activities related to transportation should shift towards a location where the use of land is dominant. However, Giuliano (1995) also stated that the overall transport network is affected if a single link is modified.

Figure 2.4 shows the relationship of different modes to their allowable access towards an area. Transportation modes have different speeds which affects their level of access. The increase of the speed of a certain mode of transport reflects a wider range of access of land.

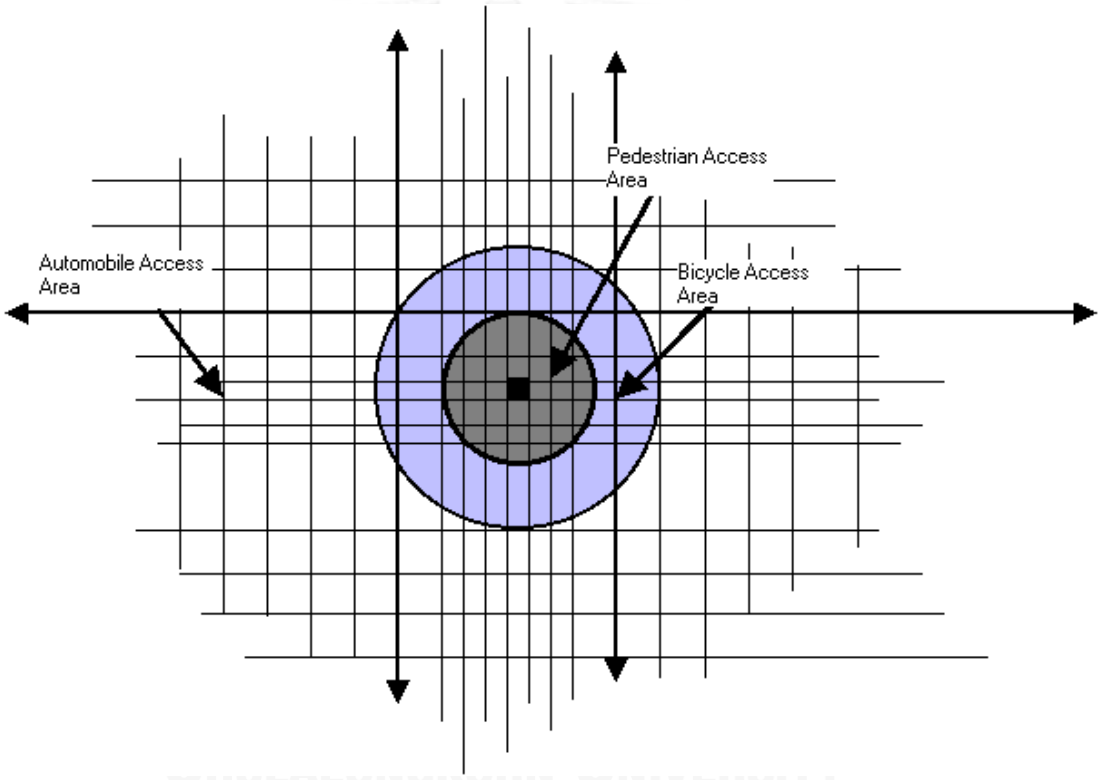
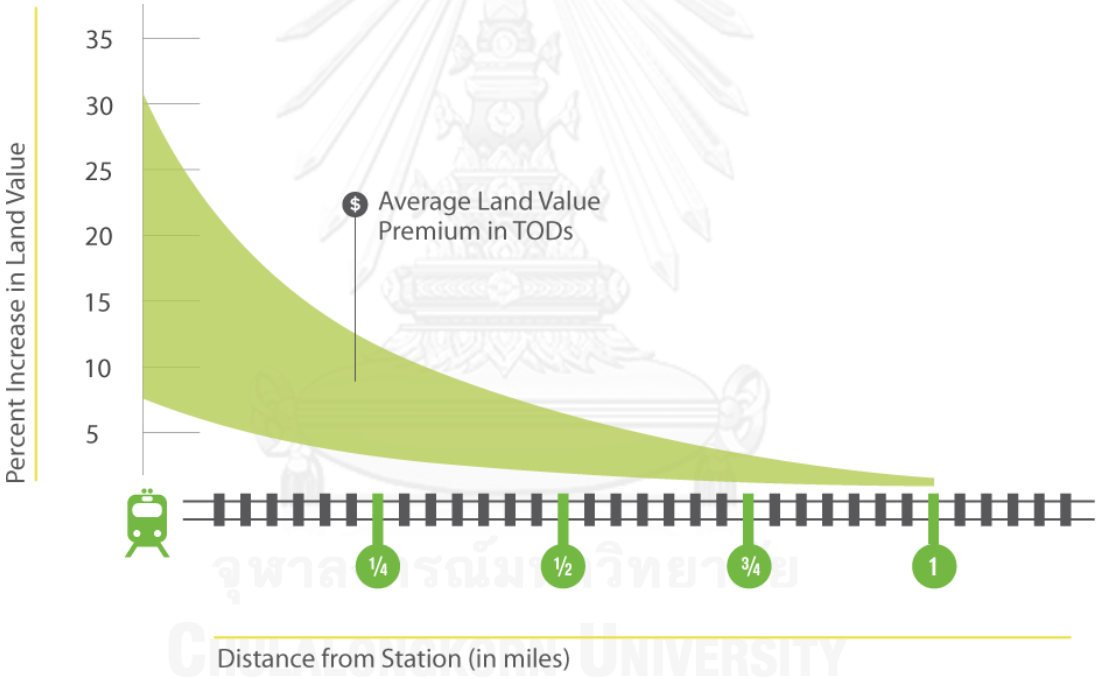


Figure 2.4: Accessibility of Different Modes (Krizek, El-Geneidy et al. 2007)

2.3 Proximity

Proximity is defined as the nearness in space, time or relationship. The relationship of proximity to transport and usage of land is also an important influence on urbanized cities. The distance of different land use areas to transport

corridors affect the travel behavior of commuters by the attracting them to produce more trips on dwelling areas. Some research states that the value of land properties in several cities of the United States increases their monetary value due to the proximity to transit stations. This potential of urban rail transit is considered as a medium to urban development (Gardner, Rutter et al. 1990). Studies have shown that land value in the United States increase with accessibility to rail stations. The proximity of a land use area produces 8 – 30% increase in land value, as shown in Figure 2.5.



Source: (Reconnecting-America 2012)

Figure 2.5: Land Value Percentages versus Proximity

The distance of a land use development to a transit station may be different for each commuter, but most of the transit users prefer to have a shorter distance from their origin to the nearest transit station. Some studies provide longer distances from 1,200 (Stringham 1982) to 2,000 meters (Halden 2000). In the study of Guerra,

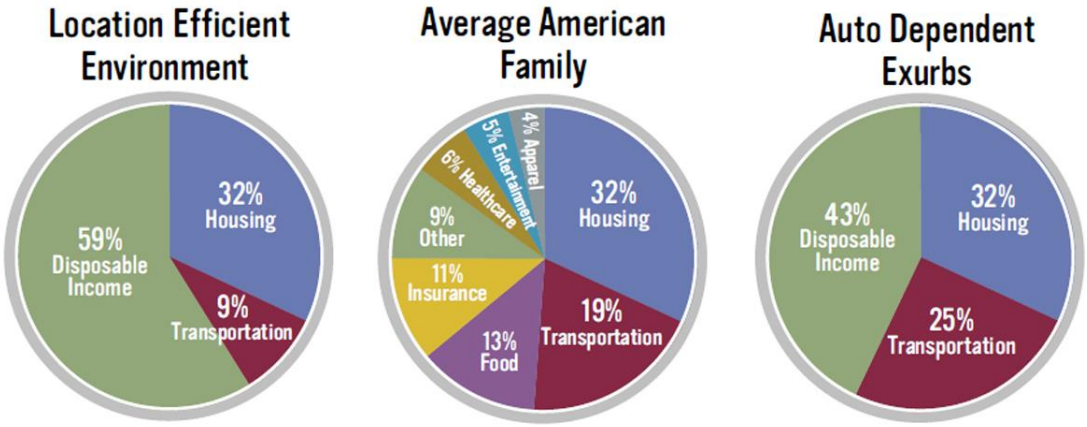
Cervero et al. (2011), the use of a quarter-mile and half-mile circle radius was utilized on the proximity of land usage to a transit station. It is found out that for quarter-mile catchment area functions best to predict ridership of workers, while the use of a half-mile catchment area functions best for predicting ridership of households. Therefore, the research found indications of workplace land usage and residences should be located within a quarter-mile and a half-mile radius from transit stations respectively.

2.4 Residential and Rail Transit Station Situation

2.4.1 Residential Selection

The choices of residential location for a household differs with each other but are based on some factors. Some of these factors are density, workplace (Alonso 1964, Clark 2000), usage of land area, proximity to transit stations, and the like. In other studies, accessibility plays a big part in considering residential location choices, such as accessibility to commercial areas, walkability to stores and services, ease of use of public transit, and proximity to recreational areas (Van De Vyvere, Oppewal et al. 1998, Bowes and Ihlanfeldt 2001, Colwell, Dehring et al. 2002, Bhat and Guo 2004). Selection of residential location is influenced by built environment and travel behavior (Cao, Mokhtarian et al. 2008), but most studies found that built environment and travel behavior have a separate influence to the selection of a residential location (Kitamura, Mokhtarian et al. 1997). Jun and Morrow-Jones (2011), found out that the decision of households to relocate their residential place is significant to their desire to enhance accessibility and lessen transportation costs.

The residential location is important, in relation to transportation, because transportation expenses are part of each household's budget (Reconnecting-America 2012). Figure 2.6 shows the percentage of expense of a typical average American family in comparison with the percentage of expense for an auto dependent exurb household location and an efficient environment (Transit-Oriented Location). The typical transportation expense for a household amounts to 19% of the total expenditure. Allocating a household to an exurb or suburban area, where they will be auto dependent, will cost them an increase in transportation expense of about 25% of their total expenditure. On the other hand, the selection of a transit-oriented location will decrease their expense for transportation to 9%. This explains the relation of a good residential location to transportation cost and benefits.



Source: (Center for TOD Housing + Transportation Affordability Index 2004)

Figure 2.6: Significance of Transportation on Household Expense

2.4.2 Location of Rail Transit Stations

The location of a rail transit station depends on several factors, which involves the travel demand of commuters, amount of predicted ridership, and different kinds of costs. Figure 2.7 shows the flowchart on selecting a feasible

location for a rail transit station. This model was developed by Samanta and Jha (2011) and can be used in a general overview of rail transit station alignments.

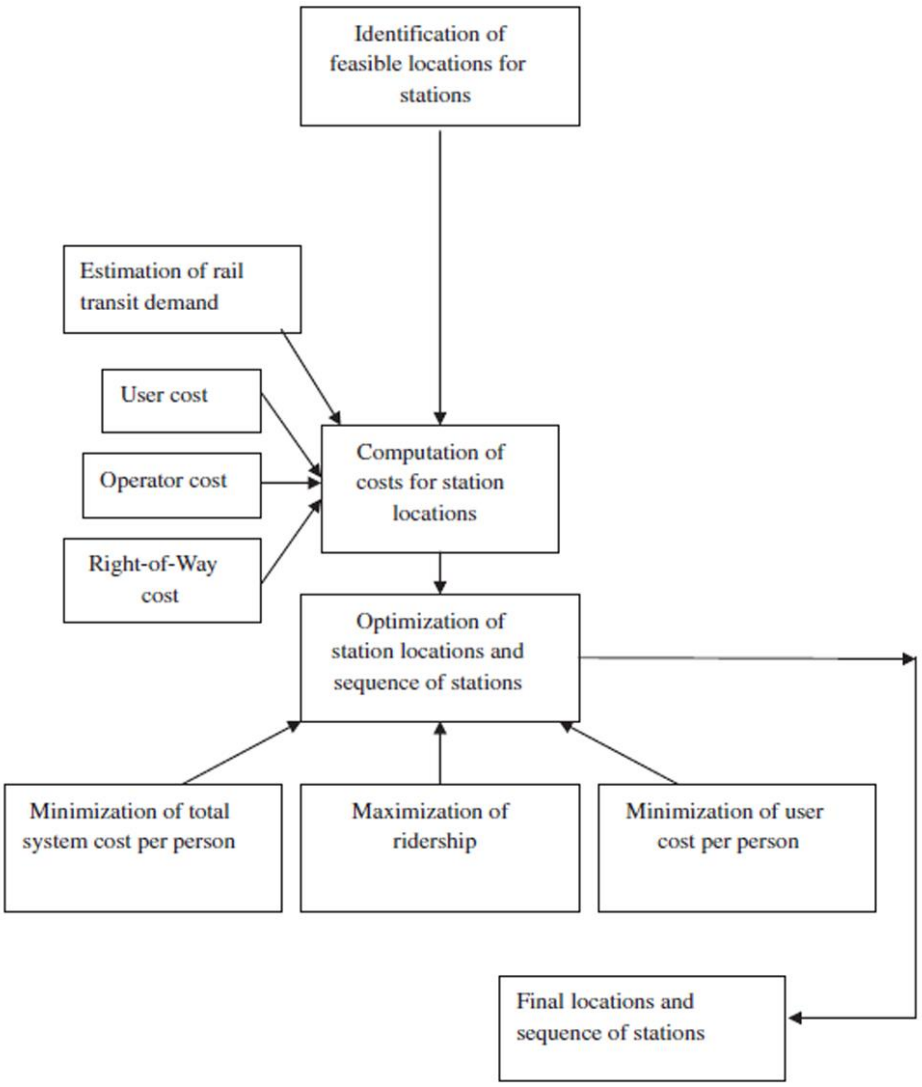
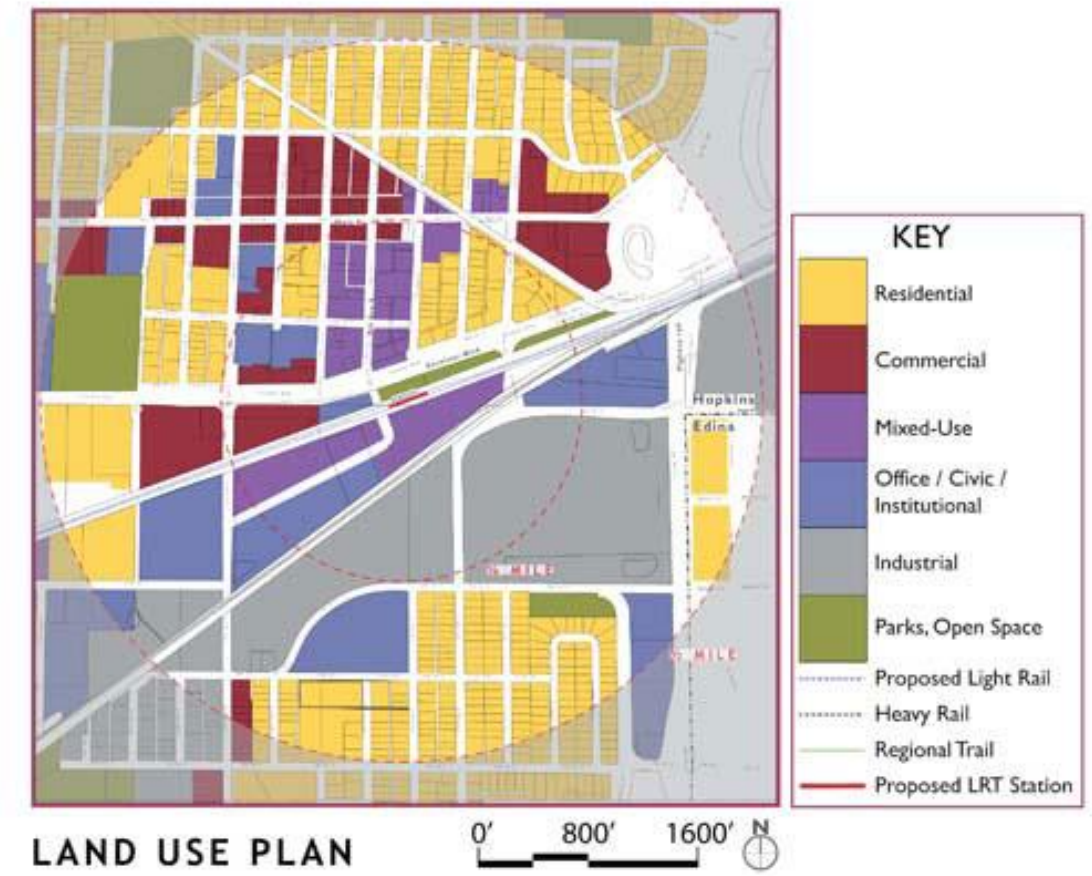


Figure 2.7: Flowchart of the Proposed Model for Rail Transit Alignment (Samanta and Jha 2011)

Using the formulated model and mathematical methods, considers the objective functions of cost and ridership, several optimal results were found out like the least user's cost and highest operating cost possible. The observations made by

Samanta and Jha (2011) can considerably provide knowledge to transport or urban planners in selecting the appropriate objective function with the optimal results for the location of rail transit stations for several types of situations depending on the nature of the area.



Source: (Downtown Hopkins 2009)

Figure 2.8: Transit Station Location – Case of Downtown Hopkins Station Area Plan

A study on planning the station area location for the case of Downtown Hopkins has several undertakings and analysis before the placement of the rail transit station. Also, the existing features of the land should be improved or the multi-modal movement within the area be enhanced. There is also a need for a traffic analysis of the area to be used. The following factors should be assessed to be able

to obtain optimal usage of the transit station: access to transit station site, road capacity, constraints, transportation improvements, and parking considerations.

2.4.3 Catchment Areas

The catchment area of a rail transit station, in relation with walking accessibility, has a great impact on the radial distance needed to capture land use developments where commuters dwell in order for them to use rail transit; this was discussed by Kitamura, Mokhtarian et al. (1997) and with all other factors affecting trip modes. An illustration of Metro Manila's urban rail transit station catchment area is shown in Figure 2.9. It indicates the average urban rail transit station catchment area with the access of walking. It was compared to a larger radial distance with an access mode for car was observed. It is seen that the there is a vast number of commuters who access the urban rail transit by walking, therefore these people have been dwelling within the vicinity of the rail transit station. As for commuters who use car as their access mode to the rail transit, their dwelling places were a farther to the station. It implements that most of the land use around a transit station were being utilized for the convenience of the urban rail commute (Cao, Mokhtarian et al. 2008).

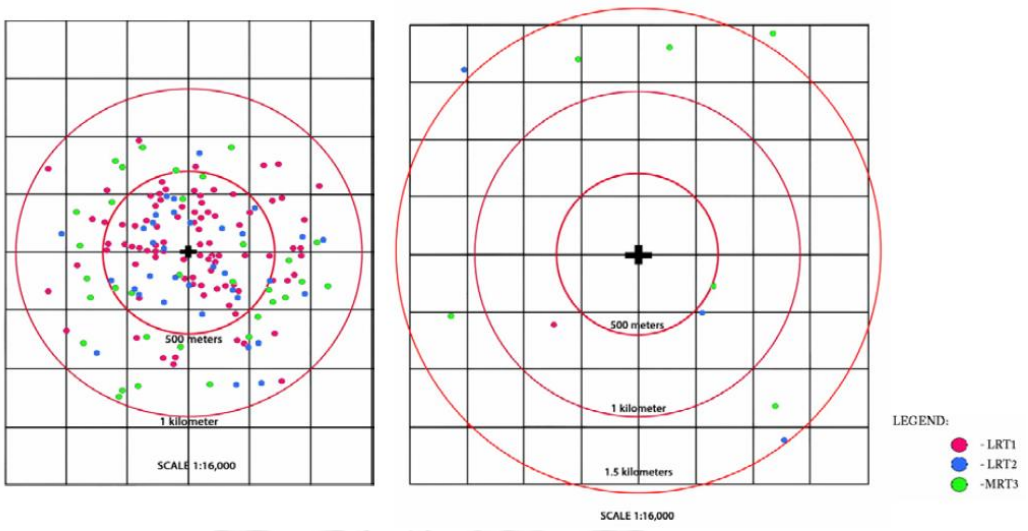


Figure 2.9: Catchment Areas for Modes of Walking (Left) and Car Use (Right) to Urban Rail Transit in Metro Manila (Fillone, Chalermpong et al. 2008)

Land developments around rail transit stations are increasing, mostly are residential and condominium types, due to this substantial theory. As for residents who live farther away from a transit station, they tend to use other modes to access the rail transit but only a few of them actually uses transit. Similarly, O'Sullivan and Morrall (1996) discussed the case of Brentwood station in Calgary, Canada, in relation with the catchment area used. The theoretical catchment area, as shown in Figure 2.10, of the Brentwood station is very diverse compared to the actual catchment area after the observations. The variation of the catchment area was mainly due to obstructions from the developments around the area, which made the observed area different for the actual pedestrian walking spaces.

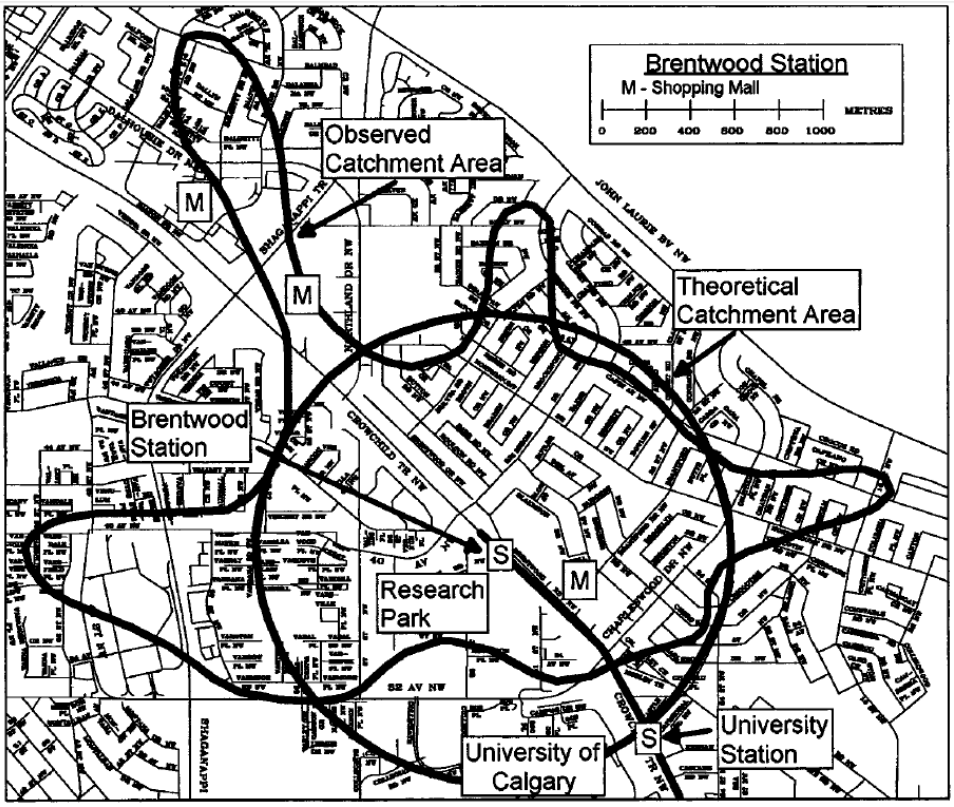


Figure 2.10: Catchment Area of Brentwood Station, Calgary, Canada (O'Sullivan and Morrall 1996)

2.5 Logistic Regression Model

Logistic regression models are statistical models which evaluates the relationship between: A dependent qualitative variable, and One or more independent explanatory variables, whether qualitative or quantitative (Dominguez-Almendros, Benitez-Parejo et al. 2011). In a regression model, two objectives represent the best fit model: Predictive, and Explanatory.

A predictive objective has an intention of establishing a model involving the smallest amount number of variables that best explain the dependent variable. On the other hand, an explanatory objective shows a causal relationship between a

cause and effect variable. The best fit model depends on what type of objective or strategy will be used, because the result and interpretation will lead to different cases.

The construction of the model starts from the univariate case where Y is a dichotomic dependent variable, with response 0 when the event does not occur and response 1 when the event is present, and X1 is an independent variable, qualitative or quantitative. We wish to relate the true proportion *p* of individuals presenting a certain characteristic to the value of a certain explanatory variable *X*1 as possible risk factor. If linear regression is performed, and in order to use the data to estimate the coefficients ˇ0ˇ1 of the equation (Dominguez-Almendros, Benitez-Parejo et al. 2011):

$$\mathbf{p} = \boldsymbol{\beta_0} + \boldsymbol{\beta_1}\mathbf{X_1} \quad \text{(Equation 1)}$$

This formulation will lead to illogical results due to the fact that the values of *p* will be between 0 and 1. It is assumed that the regression model has a normal distribution, thus values of - ∞ and +∞ should be produced.

A transformed model will be used to avoid such illogical results, thus a function of $f(p)$ will be defined and a normal distribution for the dependent variable is assumed. Equation 2 shows the transformed expression, where u are the residuals.

$$\mathbf{f(p)} = \boldsymbol{\beta_0} + \boldsymbol{\beta_1}\mathbf{X_1} + \mathbf{u} \quad \text{(Equation 2)}$$

For a statistical setting, the use of a logit transformation is likely to happen. Transforming the above equation using the logistic model will produce Equation 3.

$$\mathbf{y} = \mathbf{logit(p)} = \mathbf{ln}\,\frac{\mathbf{p}}{\mathbf{1-p}} = \boldsymbol{\beta_0} + \boldsymbol{\beta_1}\mathbf{X_1} + \mathbf{u} \quad \text{(Equation 3)}$$

For the disturbance term u, it should be additive in the transformed model to obtain the properties of a linearized model. Also, the regression model conditions should be satisfied and should have a normal distribution for the application of the

statistical tests. To achieve the assumed form of the disturbance term in the transformed model, it should have a multiplicative term e^u, also denoted as v, in the original logistic model shown in Equation 4.

$$\mathbf{y = \beta_1 X^{\beta_2} e^u = \beta_1 X^{\beta_2} v} \quad \text{(Equation 4)}$$

This means that when u is equal to zero, in the original logistic model the value of the disturbance term will be one. Also, positive values of u means that the values of v will be greater than one, with a positive effect on y and $\log y$. Similarly, negative values of u will have a negative effect on y and $\log y$, and will have v values between zero and one.

2.6 Logit and Probit Analysis

Using a linear model for the prediction of the probability of a certain incident may produce several problems. First, the linear regression graph may lead to illogical results, which are the probabilities outside the range of zero and one. Second, the same marginal effect is the same all throughout the data. Lastly, plotting the residuals show the heteroskedasticity of the data. The use of logit and probit models fit a non-linear function to the data.

2.6.1 Logit Model

Hypothesizing that the probability is a sigmoid shape model, where Z is a function of the independent variables used in the model. Shown in Figure 2.11 is the sigmoid shape graph (S-shaped) of a logistic distribution function, whereas Z reaches infinity, the value of e^{-Z} approaches zero and the probability approaches one. While as Z reaches negative infinity, e^{-Z} approaches infinity and the probability approaches

zero. This is a case where the sensitivity of the probability is highest when the value of Z is nearly zero.

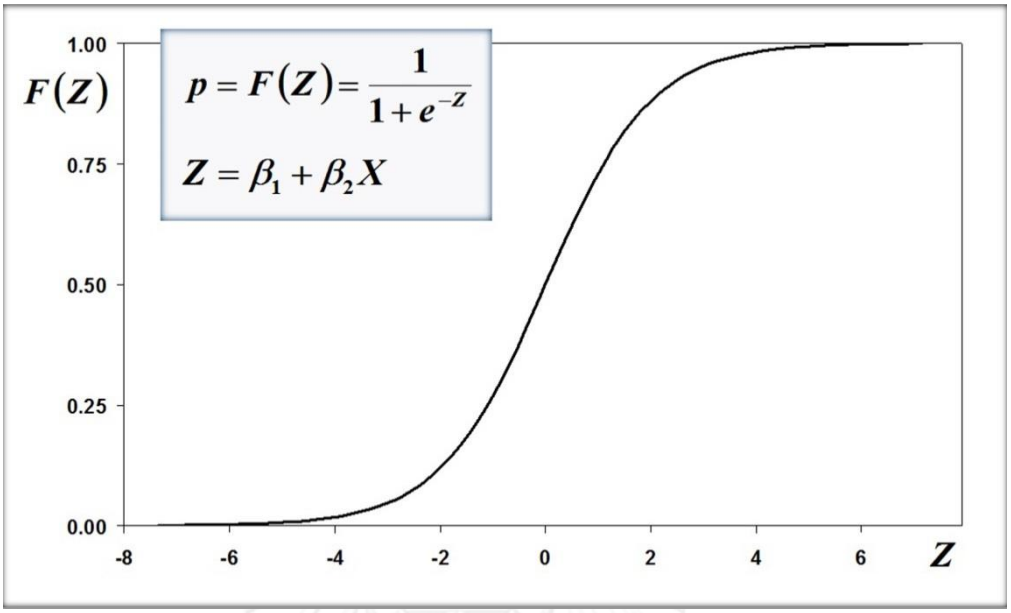


Figure 2.11: CDF of a Logistic Distribution (Dougherty 2012)

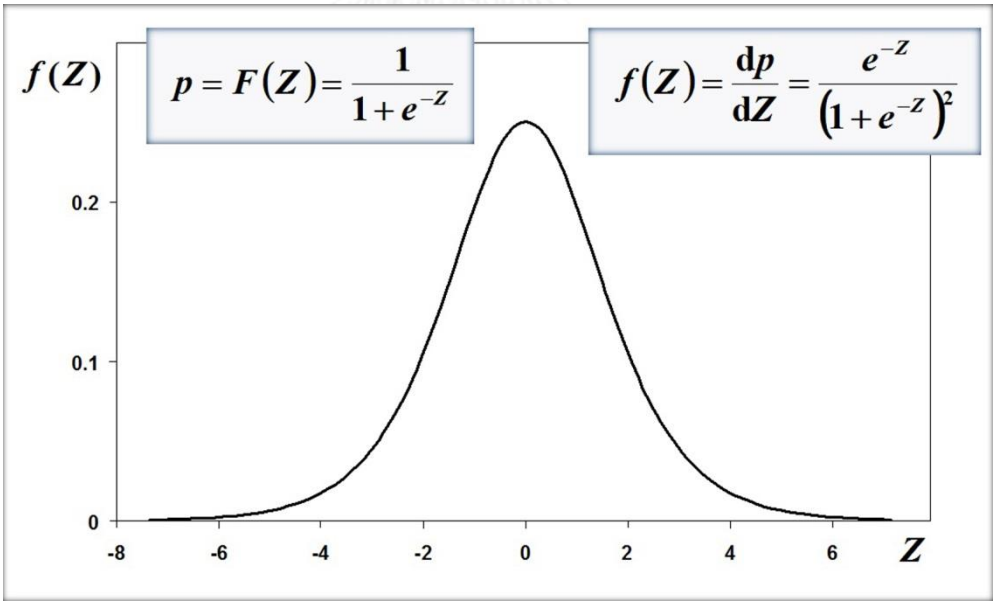


Figure 2.12: Marginal Effect of a Logistic Distribution (Dougherty 2012)

$$\mathbf{F(Z)} = \frac{\mathbf{1}}{\mathbf{1+ e^{-Z}}} \qquad \text{(Equation 5)}$$

$$\mathbf{f(Z) = \frac{e^{-Z}}{(1+ e^{-Z})^2}} \qquad \text{(Equation 6)}$$

The function in Equation 5 (Dougherty 2012) was differentiated with respect to Z to obtain the sensitivity or marginal function in Equation 6 (Dougherty 2012)which denotes the slope of the function as the sensitivity. Figure 2.12 shows the relationship of the marginal function to the values of Z. The highest sensitivity is when Z is equal to zero, also the marginal function f(Z) reaches a maximum value at this condition.

Also, the marginal effects of the independent variables can be derived using the function in Equation 5 (Dougherty 2012), where Z is the function of the independent variables. The marginal effect of X_i on p can be formulated as the marginal effect of Z on p multiplied to the marginal effect of X_i on Z, shown in Equation 6 (Dougherty 2012).

$$\mathbf{\frac{\partial p}{\partial X_i} = \frac{dp}{dZ}\frac{\partial Z}{\partial X_i}} \qquad \text{(Equation 7)}$$

Since the marginal effect of Z on $\mathbf{p}$ was already derived from the sensitivity function, the marginal effect of $\mathbf{X_i}$ on Z will be denoted by the coefficient $\mathbf{??}$. Thus, the marginal effect of $\mathbf{X_i}$ on $\mathbf{p}$ is obtained, shown in Equation 8 (Dougherty 2012). This marginal effect depends on the value of Z and the independent variables used.

$$\mathbf{\frac{\partial p}{\partial X_i} = F(Z)\beta_i = \frac{e^{-Z}}{(1+ e^{-Z})^2}\beta_i} \qquad \text{(Equation 8)}$$

2.6.2 Probit Model

The probit model used the cumulative standardized normal distribution to determine the probability of the function f(Z), while the marginal effect is the normal

distribution function itself. Shown in Figure 2.13 is the cumulative distribution function of a standardized normal distribution and marginal effects.

Similarly, marginal effects of probit models can be written using the same formula in Equation 7 (Dougherty 2012). Since the marginal effect of Z on $\mathbf{p}$ is given by the standardized normal distribution and the marginal effect of $\mathbf{X_i}$ on Z is taken by $\boldsymbol{\beta}$, the marginal effect of $\mathbf{X_i}$ on $\mathbf{p}$ is obtained and shown in Equation 9 (Dougherty 2012).

$$\frac{\partial \mathbf{p}}{\partial \mathbf{X_i}} = \mathbf{F(Z)}\boldsymbol{\beta}_\mathbf{i} = \left(\frac{\mathbf{1}}{\sqrt{\mathbf{2\pi}}} \boldsymbol{e}^{-\frac{\mathbf{1}}{\mathbf{2}}\mathbf{Z^2}}\right)\boldsymbol{\beta}_\mathbf{i} \qquad \text{(Equation 9)}$$

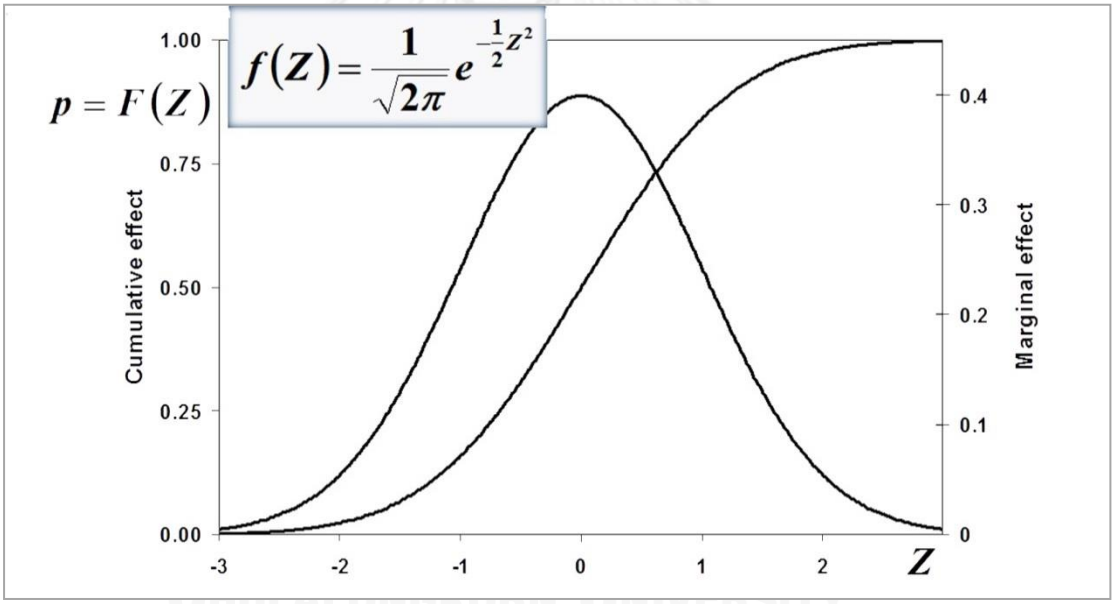


Figure 2.13: CDF of (S-shaped) Standardized Normal Distribution and (Bell-shaped) Marginal Effects (Dougherty 2012)

CHAPTER III
METHODOLOGY

3.1 Research Methods and Design Flow

In this study, in order to collect travel behavior data of urban rail transit users residing in condominiums near the rail transit stations in Metro Manila, online questionnaire survey and on-site survey were used. The focused group was residents of condominiums within 500 to 1,000 meters away from the rail transit stations or so.

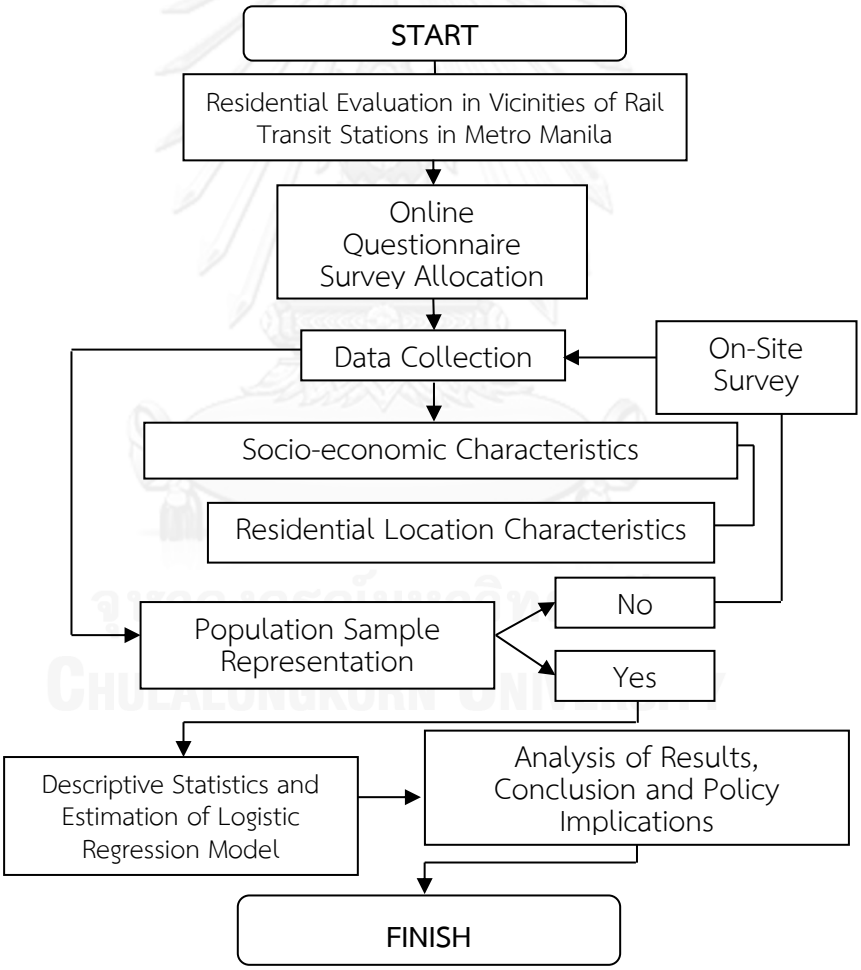


Figure 3.1: Research Design Flow Diagram

Data inputs include the following: mode choice, trips characteristics, socio-economic profile of users. After which, a logistic regression model was used to determine the effects of the travel behavior of each commuter and approximate the car use of commuters with different aspects as functions that affects their travel. The research design diagram below was developed to show the outline and flow of the entire research.

3.2 Online Questionnaire Survey

An online questionnaire survey in Google Docs developed by Chalermpong and Ratanawaraha (2013) was used to determine the preliminary travel behavior and socio-economic characteristics of commuters using urban rail transit in Metro Manila. The following variables were inputs in the questionnaire survey:

Household Information:

1. Age
2. Gender
3. Marital Status
4. Occupation
5. Number of Household Members
6. Monthly Income
7. Household Income
8. Motorized Vehicle Ownership (Automobile or Motorcycle)

Residence Information:

9. Name of Condominium
10. Condominium Street Address

11. Nearest Transit Station to Condominium
12. Distance of Transit Station to Condominium
13. Length of Residency in the Condominium

Workplace Information:

14. Name of Workplace or School
15. Workplace or School Street Address
16. Nearest Transit Station to Workplace or School
17. Distance of Transit Station to Workplace or School

Commute Trip:

18. Main Mode of Commute
19. Commute Time by Public Transportation
20. Commute Cost by Public Transportation
21. Access Trip from Condominium to Transit Station
22. Access Time
23. Access Cost
24. Egress Trip from Transit Station to Workplace
25. Egress Time
26. Egress Cost
27. Direction of Trip
28. Automobile Ridership
29. Commute Time by Motorized Vehicle
30. Fuel Cost of Motorized Vehicle
31. Toll Costs
32. Installment Payment

33. Parking Cost
34. Walking Time to Destination
35. Walking Distance to Destination
36. Alternative Mode of Commute
37. Commute Time by Alternative Mode
38. Commute Cost by Alternative Mode

Personal Information:

39. Full Name
40. Contact Number
41. Email Address

The actual preliminary questionnaire survey is found in Appendix A-1. On the other hand, from the previous questionnaire survey in Google Docs, the final questionnaire survey was patterned, revised, and developed to accommodate other variables and factors needed for an improved analysis of the data. The final questionnaire survey was upgraded to be user-friendly to the respondents especially to those who have no idea on what inputs should be written in some of the questions. Almost all of the previous variables were included and only some other variables were added for a more advanced filtering of the data. This improved the reliability of the data for the analysis. The following were the added variables to the final questionnaire survey, which is found in Appendix A-2:

1. Position of household members
2. Current commute trip per household
3. Head of the household
4. Decision maker about the current residence of the household

5. Condominium property type
6. Previous residence before moving to the current residence
7. Main mode at previous residence before moving into the current residence
8. Factors that affected the decision to move into the current residence
9. Other residence options
10. Factors of not using the urban rail transit
11. Stay time in workplace
12. Different workplace before moving into current residence
13. Number of transport modes a commuter use from origin to destination

Lastly, a more general form of the online questionnaire survey was revised to accommodate on-site survey and face-to-face survey interview. A 2-page questionnaire survey was developed in a sense that a similar analysis can be prepared out of the results collected from the survey. The revised general questionnaire survey is found in Appendix A-3.

3.3 Logistic Regression Model

Logistic regression was used to describe and test the hypothesis in which the relationship of a dependent variable to the independent variables is known. Discussed in Chapter 2.5, the logistic regression model's importance is that the analysis of several factors and/or variables is mutual, with regards to the effect of such aspect to the hypothesis of the study.

To be able to test the hypothesis of the study, a logistic regression model will be estimated from the travel behavior data using the equation shown (Chalermpong and Ratanawaraha 2013):

$$\ln\left(\frac{p}{1-p}\right) = X\beta + L\gamma + \varepsilon \qquad \text{(Equation 10)}$$

Where:

p = probability that the condominium resident commutes by private motorized modes

X = vector of the resident's socioeconomic characteristics variables

L = vector of the condominium location characteristics variables

ε = logistically distributed error

β, γ = vectors of model parameters.

The model consists of dependent and independent variables, model parameters, and residual. The dependent variable is the probability that the respondent uses car as their main mode of commute. Since this variable is dichotomous, the result can either be of the two: (1) a condominium resident use private vehicles for their commute, (2) a condominium resident use transit for their commute.

On the other hand, independent variables are predictors of the estimation of the parameters. There were two independent variables used. First, the socio-economic variables of commuters, which are the following: age, gender, marital status, occupation, number of household members, commuters' monthly income, and motorized vehicle ownership. These variables usually have a significant effect on the way commuters travel and also affect their choice of mode. For instance, commuters who are very young and very old most probably would not choose to take the train regardless of its benefits, and may just choose to ride a car for their travel. Most likely, male commuters would be taking the rail transit than female

commuters. There might be an issue of security for different gender groups. Individuals who are not married would be the ones who might take the rail often than married commuters. One factor to consider is that single commuters do not have that much responsibility yet compared to married commuters. The occupation of a commuter may also affect their travel patterns. Most probably, students and employees are the ones who travel most by public transportation, which includes urban rail transit. Business owners or individuals with a high position in a firm would most likely travel by car. Also, some household factors reflect a significant effect on how household members travel. The lesser the number of members of a household, the higher the probability of automobile use will occur, while households with a lot of members tend to use transit due to car ownership factors. The higher the number of car ownership of a household, the more likely members would drive, while transit use would be more significant to low car ownership households. Also, the longer the residency in a condominium near an urban rail transit station will lead to the utilization of the rail system. Lastly, the financial state of each commuter or household would be the most remarkable factor which would affect their travel behavior due to some dependency of the other socio-economic variables connected to monetary values. The higher the income of a commuter or household, the use of the automobile would be the most probable, while low income travellers tend to use public transportation or modes with low pay-out-of pocket cost.

Second, the land use variables also affect the way people travel. The location and proximity of land dwellings to public transit access is particularly the main factor of influence to the mode share of commuters. In this study, two land use variables are considered: housing or residential, and employment or office

workplace. In relation with transit use, these land use factors would influence the mobility, accessibility, and proximity. It is more likely for a commuter whose residence and workplace, which is accessible to several public transportation, to actually utilize those modes. Meanwhile, a commuter whose residence or workplace location has an impossible access to transit would likely to choose car to travel. Unlike the socio-economic variables, land use variables cannot be obtained by questionnaire survey alone. With the use of several condominium databases from different agencies, the location, characteristics, and specifications of condominium residences near rail transit stations can be achieved.

3.4 Condominium Profile

To know the different types and location of condominiums in Metro Manila, a condominium database was developed, shown in Appendix B-1. There are a lot of different real estate agencies, construction companies, and government organizations that have records of current and future condominiums within Metro Manila. The database of condominiums in Metro Manila was produced with different facts, figures, and information. The following categories were included in the condominium database:

1. Name of condominium
2. Location/Address
3. Floor levels
4. Number of residential units
5. Turnover year

The database was used to determine the number of condominiums located within 500 to 1,000 meters radially away from urban rail transit stations or so.

3.5 Socio-economic Profile Representation

The average socio-economic profile of the population sample in the study area, in this case Metro Manila, was obtained to be the basis of comparison for the empirical data findings. The different socio-economic variables involved were the following: household and individual monthly income, age, gender, marital status, occupation, number of household members, number of motorized vehicle owned by the household (car and motorcycle), and number of rental units in Metro Manila. These were acquired through different statistical records and reports of the country headed by the National Statistical Coordination Board ((NSCB) 2000, and 2010) of the Philippines in the years 2000 and 2010. As for the vehicular average count per household, the data were obtained from the Metro Manila Urban Transportation Integration Study ((MMUTIS) 1996) data.

Table 3.1 shows the obtained data for the socio-economic profile representation in Metro Manila. The average household income of a family in Metro Manila is around PHP 50,000 monthly or approximately PHP 500,000 annually (12,300 USD)[1], while the average income of a person in a household living in Metro Manila per month is around PHP 20,000 or PHP 240,000 annually (5,903 USD)[1]. The national average household individual income is PHP 206,000 annually (5,066 USD)[1]. The average age in Metro Manila is around 25.5, which is quite low, but higher than that of the national average age of 23.4. For the gender, marital status, and occupation

[1] (1 USD = PHP 40.66) As of August 2013

percentages in Metro Manila, there are 49.01% of males compared to 50.99% of females, 43.90% are singles compared to 56.10% of married couples or others, and only 34% are students. In an average household in Metro Manila, there are around 4.3 household members with an average of 1.33 and 0.09 numbers of cars and motorcycles respectively owned by the household. Also, 39% of households living in condominiums are renting their residence compared to 61% owning their residence.

The said socio-economic variables were the base variables to be analyzed for the model in this study; other socio-economic profile representation can be further analyzed.

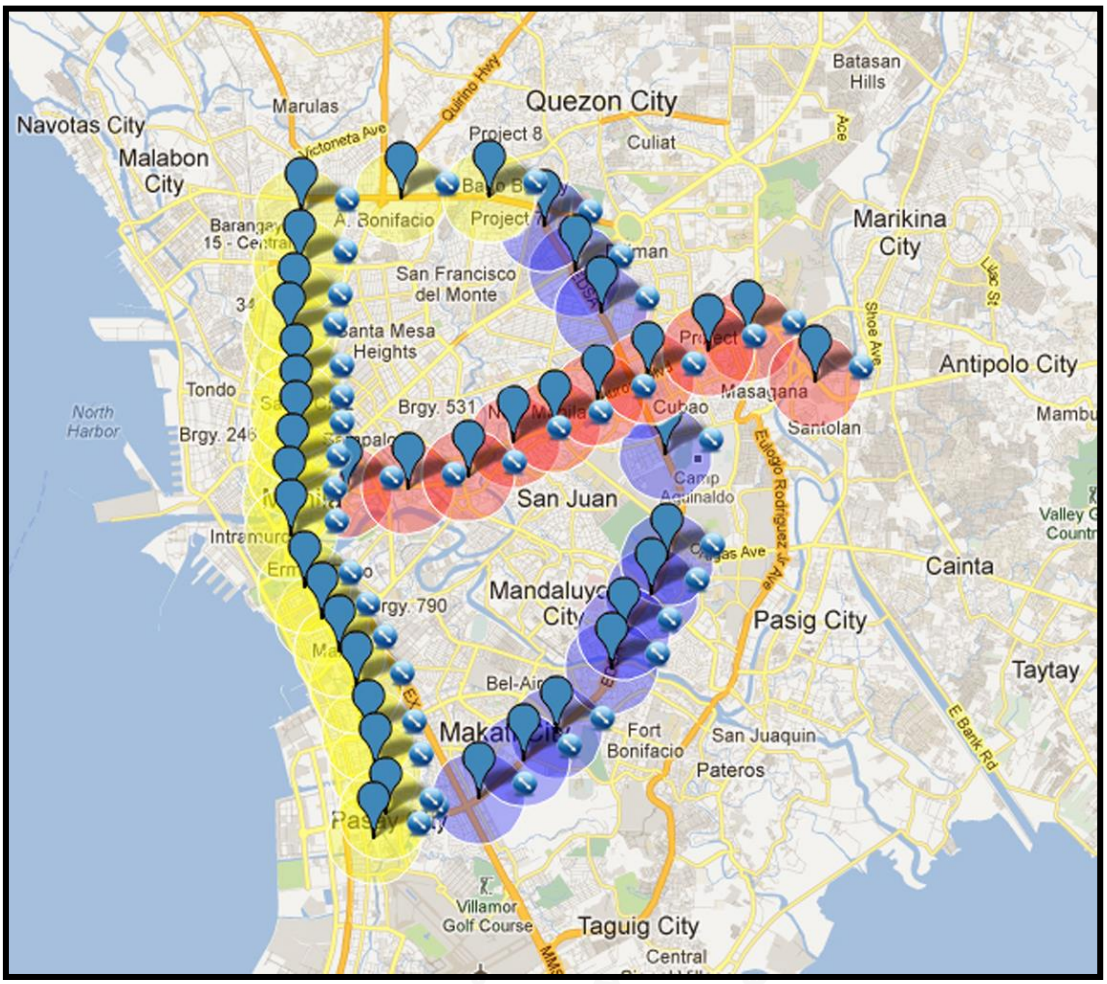
Table 3.1: Socio-Economic Profile Representation in Metro Manila

Socio-Economic Base Model Variables	Average Statistics	S.D.
Household Income (PHP per month)	50,000	47376.15
Individual Income (PHP per month)	20,000	28282.86
Age (Year)	25.50	34.65
No. of cars owned by household	1.33	0.47
No. of motorcycles owned by household	0.09	0.11
No. of household members	4.30	4.67
Male	49.01 %	0.55
Single	43.90 %	0.48
Student	34.00 %	0.34
Rent unit	39.00 %	0.41

3.6 Data Collection Process

The data collection process was divided into three parts in which the basis of having multiple data gathering procedures was the quantity and representativeness

of the base socio-economic variables in the gathered data to the population sample statistics. The amount of procedures may vary depending on the said intention.



Source: (freemaptools.com)

Figure 3.2: Metro Manila's Urban Rail Transit Station 1,000-Meter Catchment Areas

Also, the proximity of a residential condominium to a rail transit station catchment area was measured roughly to project a 1,000 meter radius from each station. This will provide location investigation of condominiums all throughout the surroundings of the urban rail transit lines. Theoretically, the catchment area of each station is represented by a circle, but significant condominium locations might be outside the said catchment area, therefore changes for the observed catchment

areas can be made, discussed in Chapter 2.4.3. In this study, the proximity analysis of a condominium was divided into three groups: less than 500 meters from the transit station, 500 to 1,000 meters from the transit station, and more than 1,000 meters away from the transit station.

3.6.1 Pilot Data Collection

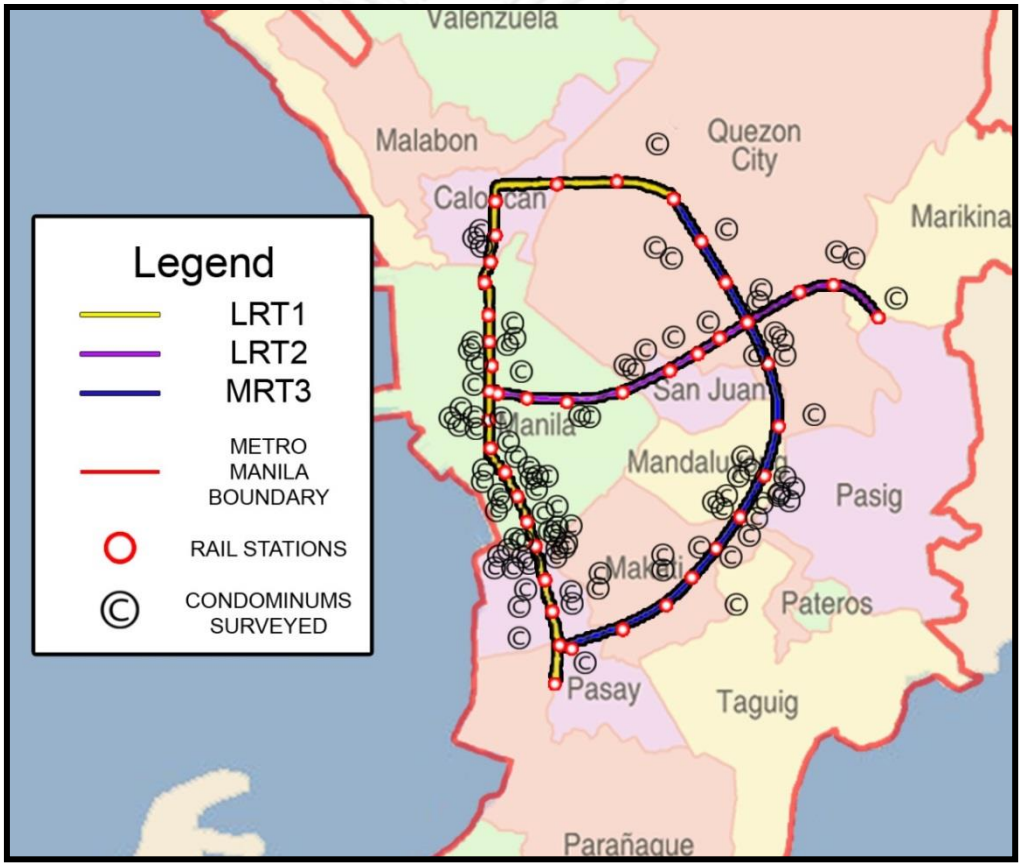


Figure 3.3: Plot Map of Condominiums Surveyed within Urban Rail Transit Stations under Pilot Data Collection

The questionnaire survey developed by Chalermpong and Ratanawaraha (2013), as stated in section 3.2, was used to test the compatibility of the research methodology and the established questionnaire survey. The pilot test was held by

several Civil Engineering students from De La Salle University-Manila (DLSU) and other surveyors. The objective of this pilot test was to assess if the design method conforms to the objectives of the research before conducting the final analysis. A rough plot of all the surveyed condominiums within the urban rail transit lines was shown in Figure 3.3.

3.6.2 Final Data Collection – Online Survey

Figure 3.4: Flyer Design

The online questionnaire survey was revised as mentioned in section 3.2, and was used to collect the final data which represents the research methodology plan. The following were the parts of the data gathering process:

1. Flyers were distributed to different condominiums near urban rail transit stations. The procedures on how to access the online questionnaire and incentive prizes for respondents were indicated on each flyer. In Figure 3.4, the sample flyer design was shown. Note that the flyers were distributed in condominium units by door-to-door manner or through mailbox.

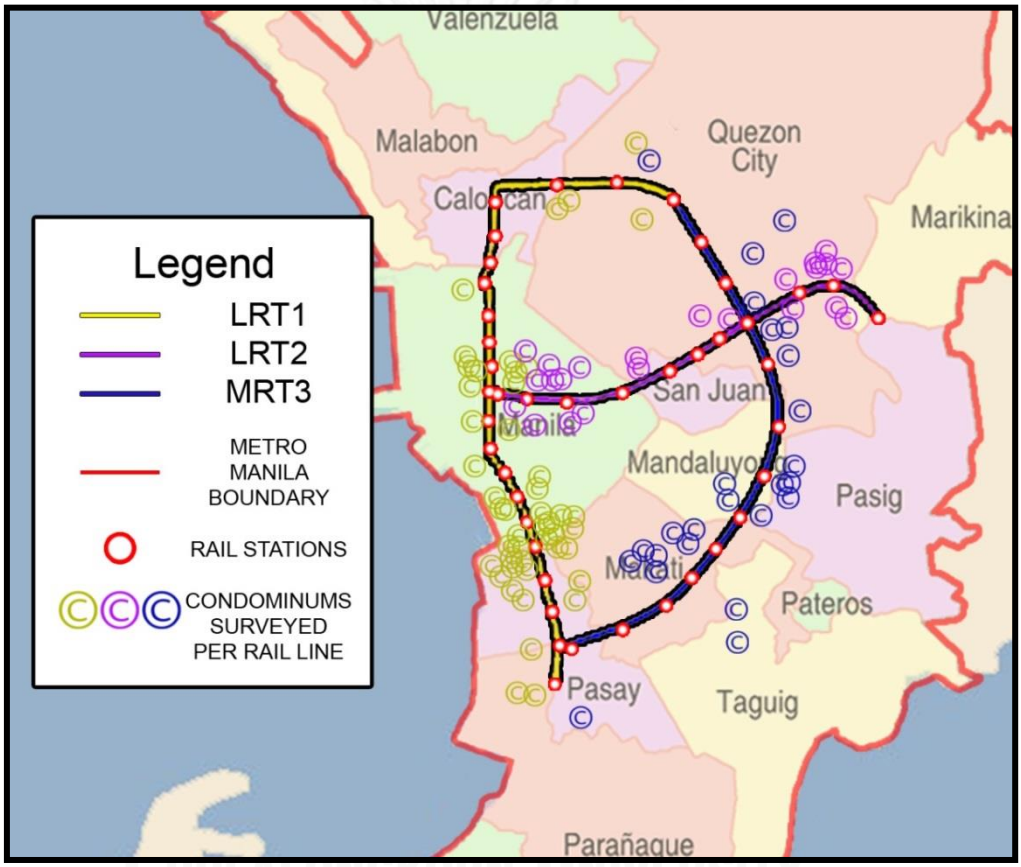


Figure 3.5: Plot Map of Condominiums Surveyed Per Urban Rail Transit Line Stations under the Online Survey for the Final Data Collection

2. Students and surveyors allocated the information of the online questionnaire survey and procedures to different respondents, similar to the pilot data collection.

In Figure 3.5, a rough plot of all the condominiums surveyed for the initial data in the final data collection was shown. The condominiums within each urban rail line were highlighted with the same color of each line to be well represented.

3.6.3 Final Data Collection – On-site Survey

The on-site survey was obtained to complete the final data collection. The generalized questionnaire survey, stated in section 3.2, designed for on-site survey was used to conduct face-to-face interviews to provide more significant data which complements the initial data collected. Condominiums near urban rail transit stations, as shown in Figure 3.6, were surveyed for commuters who mainly used urban rail transit and automobile.

For a more productive collection of data, the questionnaire was converted into a table wherein the variables needed for the analysis were in each heading of the columns, in this manner the interviewer did not have to take much time on each respondent. The data gathered from the on-site interviews were added to the initial data collected from the online survey and were analyzed collectively to have more significant results.

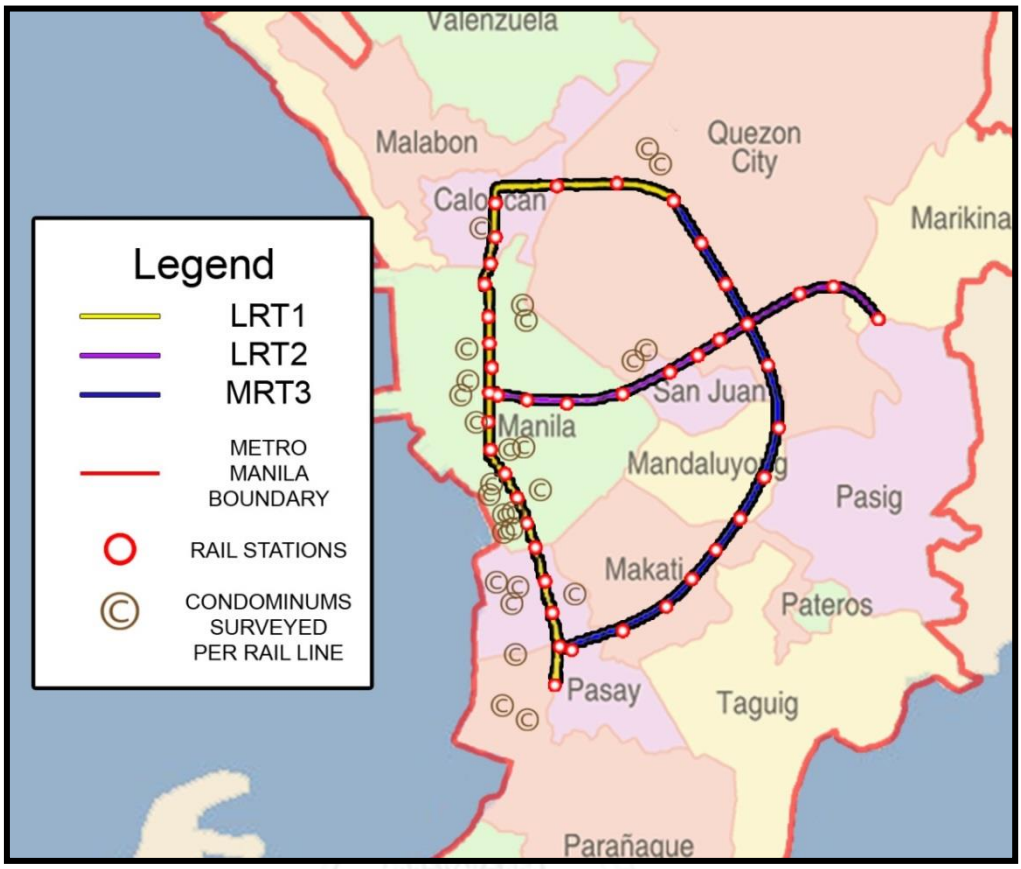


Figure 3.6: Plot Map of Condominiums Surveyed Per Urban Rail Transit Line Stations under the On-site Survey for the Final Data Collection

3.7 STATA (Statistics/Data Analysis)

Using the filtered data from the collection process, and the logit model, the parameters were estimated using the STATA software. STATA, a statistical software which is capable of managing data, analyzing statistical data, simulations, and programming. Using some statistical tests, built-in through the software, the significance of the model was analyzed. The use of t-test and z-test are practically the same, they test and compare between two means to suggest whether both samples come from the same population (Gaten, 2000). Also, the use of correlation,

and likelihood ratio test was utilized to estimate the relationship between the independent variables and also to test the best fit model. Maximum likelihood test leads to the highest amount of probability that the set of parameters produced. The distribution of the dependent variable was used to derive the maximum likelihood equation.

The effectiveness of the estimation of the model would be evaluated overall. Logistic models provide the best fit for the data if the model exhibits developments more than the null model or the intercept. Statistical t-test and z-test would measure the significance of each parameter for each predictor.

CHAPTER IV
DATA RESULTS AND ANALYSIS

4.1 Pilot Test Results

In order to test the research methodology, a pilot test was made to ensure the capability of the design flow, discussed in Chapter 3.6.1. At the end of the pilot test, a total of 266 respondents were obtained and used for the data analysis.

4.1.1 Statistical Data

The descriptive statistics of the preliminary survey data were obtained to evaluate each of the socio-economic characteristics of each household and their condition with respect to their proximity to rail transit stations, shown in Table 4.1. The average individual income of the respondents was approximately PHP 360,000 annually (8,854 USD)[2], which is quite high compared to the national average household income of PHP 206,000 annually (5,066 USD)[2] stated by the National Statistical Coordination Board ((NSCB) 2000, and 2010). The respondents' age average is at 23.31 years and the range is from 12 to 70 years.

Dummy variables were used to represent the different variables which would be used in the regression analysis. The mean values of these variables were the percentage of respondents that fits the cluster. The dummy variables used for the socio-economic and household characteristics in this sample were the gender, marital status, occupation, and type of condominium unit (rent or owned), that would have a value of 1 if the respondent is male, single, student, and rents a

[2] (1 USD = PHP 40.66) As of August 2013

condominium unit respectively, and 0 otherwise. The percentages of the respondents regarding these variables are as follows: 51.88% are males, 85.34% are single, 51.50% are students, and 91.35% of the respondents are renting a unit.

Also, location of the residence and workplace of each respondent were considered as dummy variables. Respondents whose residences were within 500 meters to the rail transit station are 51.13% of the sample, while only 20.30% have their residence within 500 to 1,000 meters to a rail station.

Table 4.1: Respondents' Socio-economic, Household and Location Characteristics

Variable	Mean	S.D.	Min.	Max.
Socio-Economic Characteristics				
Individual Income (PHP per month)	30000	18708.29	5000	55000
Age (Year)	23.31	3.44	12	70
Male*	0.5188	0.5208	0	1
Single*	0.8534	0.8566	0	1
Student*	0.5150	0.5170	0	1
No. of cars owned by household	0.5752	0.5774	0	3
No. of motorcycles owned by household	0.0414	0.0415	0	2
No. of household members	2.5	1.2910	1	4
No. of residency years	2.5	1.8708	1	5
Rent unit*	0.9135	0.9170	0	1
Location Characteristics				
Condo located within 500m*	0.5113	0.5132	0	1
Condo located within 500-1,000m*	0.2030	0.2038	0	1
Condo located near CBD station*	0.4060	0.4075	0	1
Office located near CBD station*	0.4511	0.4528	0	1

(*) Dummy variables

Lastly, condominium residence and workplace near rail transit stations located within the Central Business District (CBD) were considered as well to be dummy variables. In Metro Manila, there are four CBD areas, but only 3 CBD areas

have a close access to the urban rail transit stations, which are the following: Makati CBD, Manila CBD, and Ortigas CBD. In the sample, 40.60% lives near a CBD station while 45.11% works or studies near a CBD station.

4.1.2 Modal Share

The mode share of the respondents was summarized in Table 4.2. Also, the trip characteristics of individuals, which include travel time and cost were statistically measured by modes. It can be seen that the greatest mode used in the sample was rail followed by car and jeepney. Even though rail had the second longest time of travel, many commuters still used it as their main mode of transportation. Car users paid out the most between the modes, followed by taxi users, and it can be seen that there was a significant difference between the cost of using car and taxi compared to all other modes. The use of car had the second highest percentage, even though it had the highest amount of cost. Meanwhile, jeepney users experienced the lowest travel cost among the modes. With the jeepney's low cost, commuters managed to use them as their main mode of transportation; this was reflected by being third highest in the mode share percentage. Walking was not considered as the commuters' major mode of travel due to the fact that it resulted to the longest travel time even if no cost was utilized.

The mode share of the respondents was divided in terms of their proximity to the rail transit stations, being 0 to 500 meters, 500 to 1,000 meters, and over 1,000 meters. The premise was that the utilization of motorized vehicles will be higher with residence location farther to a transit station; on the other hand transit utilization will be higher with residence location near to a transit station. In the sample, rail users

were dominant when their residence were not more than 500 meters away from a transit station, as expected the commuters using rail decreased when the distance increased until 1,000 meters. Having the premise in place, surprisingly there were a lot of commuters using rail residing more than 1,000 meters. This may be due to the incapability of the other public modes to efficiently transport commuters to their destination. Whether the lines of public bus and jeepneys do not coincide with their workplace, an expensive taxi ride was too much for their commute, or the mere traffic congestion problem exists as factors to their mode choice.

Table 4.2: Overall Sample Mode Share with Trip Characteristics

Mode	Frequency	Percentage	Travel Time (Min.)		Travel Cost (PHP)	
			Average	S.D.	Average	S.D.
Bus	19	7.15	39.68	12.27	22.37	10.05
Jeepney	45	16.92	28.47	12.91	17.44	7.68
Rail	102	38.35	38.09	8.38	28.32	13.18
Taxi	12	4.52	36.08	15.18	100.83	49.88
FX	18	6.77	34	19.41	25.29	17.44
Walk	10	3.76	8	4.47	-	-
Car (Self-Driven)	49	18.43	32.12	12.96	97.92	43.14
Car (Share-A-Ride)	11	4.14	36.64	14.30	104.17	69.37
Car Total	60	22.57	34.38	13.63	101.04	56.26
Total	266	100				

Meanwhile, bus and taxi users increased between residences from 500 to 1,000 meters away from a rail transit station, but decreased as the residence location gets farther to the station. On the other hand, jeepney and FX users have an inverse

proportion relationship. Users of jeepneys increased as the commuters' residence location were farther away from the rail transit stations, while FX users decreased. The overall use of public transportation in all areas was interestingly similar.

The car users were quite the same for all the distances from residence to transit station, although car share are higher within a distance of 500 to 1,000 meters. The car share reveals that prominent car users were unlikely to use public transportation as their main mode of transport but more likely as an alternative.

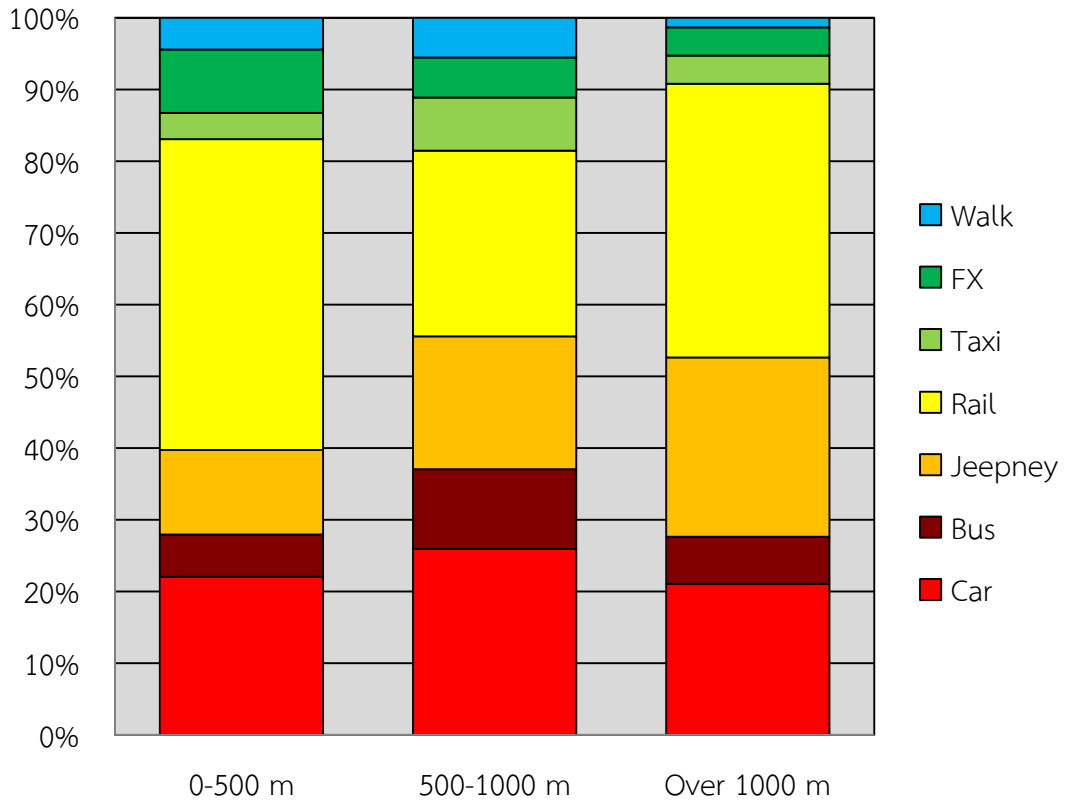


Figure 4.1: Mode Share of Individuals by Residence Proximity to Transit Stations

The descriptive statistics of the pilot data was found out to fit the objectives of the study and also the design methodology. This was used to determine and assess the final data results, which is shown in the next section.

4.2 Final Results

The final data collection was done in accordance with the research methodology and with some of the modifications from the pilot test results. Initially, a total of 470 respondents were collected through the online survey. The raw data was filtered and only substantial data of 193 respondents out of 470 were treated to be considerable for the initial data. Likewise, the final collection of data was completed through the on-site survey data collection in conformity of the research methodology, discussed in section 3.6.3. At the end of the on-site survey a total of 115 respondents were interviewed and only 82 respondents were analyzed and added to the initial data of 193 as a result of different variations in the representativeness of the overall sample to the population statistics in Metro Manila. Overall, 275 respondents were analyzed for the final data statistics and analysis of the logistic regression model.

4.2.1 Descriptive Analysis

The descriptive statistics of the final data is shown in Table 4.3. The average household income of the respondents was about PHP 700,000 per year (around 16,500 USD[3]). The obtained average individual income of the respondents was approximately PHP 270,000 annually, which is roughly 6,650 USD[3]. This estimated income value was higher than the national average income and the region's average income; if it was compared in a monthly basis, the average income from the data is proximate compared to the population average income in Metro Manila. A 28.19 average age of respondents was obtained and was quite higher than the previous

[3] (1 USD = PHP 40.66) As of August 2013

data as a result of more mature respondents. The respondents' age range was from 18 to 61 years. The respondents' age average displays the situation or status of respondents in the society.

Table 4.3: Respondent's Socio-economic, Household and Location Characteristics

Variable	Mean	S.D.	Min.	Max.
Socio-Economic Characteristics				
Household Income (PHP per month)	56054.55	33075.02	15000	100000
Individual income (PHP per month)	22523.64	20468.12	3000	70000
Age (Year)	28.19	11.24	18	61
Male*	0.5164	0.5006	0	1
Single*	0.5745	0.4953	0	1
Student*	0.4764	0.5004	0	1
No. of cars owned by household	1.0618	1.1301	0	3
No. of motorcycles owned by household	0.0655	0.2886	0	2
No. of household members	2.7122	1.1313	1	4
Years of residency	2.1909	1.3478	0.5	5
Rent unit*	0.5673	0.4964	0	1
Location Characteristics				
Distance from condominium to rail station	444	443.97	50	2000
Condo located near CBD station*	0.4327	0.4964	0	1
Office located near CBD station*	0.4145	0.4935	0	1
Office or school located within 1,000 meters from a rail transit station*	0.7491	0.4343	0	1

(*) Dummy variables

The dummy variables male, single, and student have an obtained average of 51.64%, 57.45%, and 47.64% respectively, while the percentage of the respondents who rents their condominium residence unit was 56.73% with a residency of about 2.1909 years. The average number of household members living in Metro Manila was 2.7 and was quite reasonable due to the way of living these days. The household

average of owning a car and a motorcycle were 1.06 and 0.07 respectively, representing that almost all of the households owns a car while there were very few households in Metro Manila owning a motorcycle. This trend of using a car over a motorcycle in the city is caused by different factors such as pollution, accidents, and comfort.

Table 4.4: Comparison of Socio-Economic Profiles of Surveyed Data and Population Average in Metro Manila

Variable	Mean		Percentage Error (%)	Assessment
	Survey Data	Population In Metro Manila		
Household Income (PHP per month)	56054.55	50000	12.11	Good
Income (PHP per Month)	22523.64	20000	12.62	Good
Age (Year)	28.19	25.50	10.55	Good
Male	0.52	0.49	6.12	Good
Single	0.58	0.44	31.82	Fair
Student	0.48	0.34	41.18	Fair
No. of cars owned by household	1.07	1.33	19.55	Good
No. of motorcycles owned by household	0.07	0.09	22.22	Fair
No. of household members	2.72	4.30	36.74	Fair
Rent unit	0.57	0.39	46.15	Fair

The average distance of respondents' condominium residence to an urban rail transit station was 444 meters. The percentages of respondents having their residence and office near a CBD station were almost similar with 43.27% and 41.45%

respectively. Lastly, it was shown that most of the respondents' office or school locations were near an urban rail transit station with 74.91%. This proved the mode share characteristics discussed in the next section.

Table 4.4 showed the comparison of the obtained socio-economic profile data from the questionnaire survey to the average profile in the population of Metro Manila. Practically all of the obtained data for each variable were satisfactory to the population sample with a margin of error more or less than 10 to 20%. Overall, the data gathered represents the actual population sample in Metro Manila.

4.2.2 Mode Share

Table 4.5 displays the overall sample mode share with trip characteristics of the final data collected and analyzed. It can be seen that the number of respondents using rail and car as their main mode of transport from residence to work was quite representative. This result was very reasonable due to the fact that the main focus of this study was the decision of commuters between those two modes of transport. Walking was also frequent from the respondents who transferred to their current residence near their workplace. The shortest travel time without considering the bicycle and walk mode, due to a number of respondents who have their work place near their residence, were the taxi and jeepney. Travel time comparison between car and rail transit users was quite proximate, for that reason respondents might want to choose car for their commute if they own one, compared to rail but relies on rail transit if a car is not available. On the other hand, rail transit had a very low cost of travel compared to using an automobile, and this may be one of the reasons commuters choose rail compared to cars without considering factors

of distance proximity; while the lowest travel cost was experienced by jeepney riders.

There were more rail transit, car users, and quite a number of users of other public modes of transport in the final data collected. The representativeness of the respondents' residence location and socio-economic characteristics displayed an overall mode share which depicted the respondents' travel patterns.

Table 4.5: Overall Sample Mode Share with Trip Characteristics

Mode	Frequency	Percentage	Travel Time (Min.)		Travel Cost (PHP)	
			Average	S.D.	Average	S.D.
Bus	5	1.82	50.5	38.04	31	11.40
Jeepney	19	6.91	21.95	14.66	9.21	5.07
Rail	97	35.27	28.98	15.51	16.60	8.65
Taxi	3	1.09	18	8.66	31.67	23.09
FX	6	2.18	71.67	42.97	37	17.89
Walk	69	25.09	4.34	4.10	0	0
Bicycle	1	0.36	8	-	0	-
Car (Self-Driven)	60	21.82	33.33	24.55	273.96	232.81
Car (Share-A-Ride)	15	5.45	28.67	17.07	188.64	160.87
Car Total	75	27.27	31	20.81	231.30	196.84
Total	275	100				

Figure 4.2 shows the mode share by the proximity of respondents' residence to urban rail transit stations. It is seen that as the proximity increased from 0 to 500 meters to over 1,000 meters to the station, the car users also increased, which depicted a concern of transit use if the residence of a commuter was far from a transit station; thus the use of a more convenient mode, automobile. Also, there

were a high number of people using rail transit living within 500 to 1,000 meters to the rail transit station compared to commuters living within 500 meters from the transit station. Lastly, an expected decrease of rail transit users living over 1,000 meters from the transit station was seen, thus an increase use of other public transit modes.

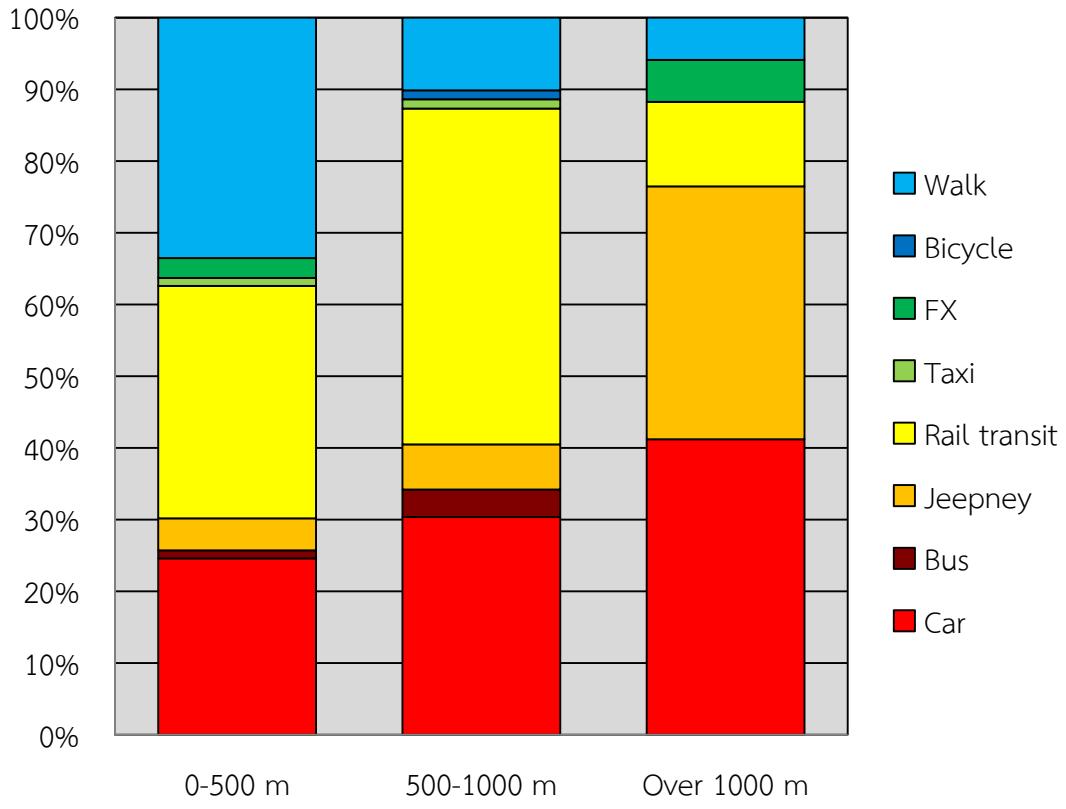


Figure 4.2: Mode Share of Individuals by Residence Proximity to Transit Stations

4.2.3 Correlation Analysis

The correlation analysis was done to determine if there were relationships between the socio-economic variables used in the model. Correlation within variables generally has a value from 0 to 1; a value of 0 defines no correlation while a value of 1 defines great correlation between variables. A positive sign convention

states a positive correlation while a negative sign convention states a negative correlation between variables.

Table 4.6: Correlation Analysis Result of Socio-Economic Variables

Socio Economic Variables	A	B	C	D	E	F	G	H	I	J
A	1									
B	-0.0322	1								
C	-0.0198	-0.1373*	1							
D	0.1749*	**-0.8072***	0.1680*	1						
E	0.1141*	**-0.7608***	0.2383*	**0.8060***	1					
F	0.1128*	-0.1471*	0.0853*	0.3145*	0.2575*	1				
G	0.0398	-0.1062*	-0.0074	0.1189*	0.1371*	0.1106*	1			
H	0.2949*	0.0686*	-0.1063*	0.0524*	0.1158*	0.1406*	0.0939*	1		
I	0.1940*	0.2603*	-0.1061*	-0.1157*	-0.2652*	0.0006	0.0757*	0.1566*	1	
J	-0.1397*	0.0147	0.0359	-0.1133*	-0.0193	-0.0432*	-0.0818*	-0.0655	-0.3289	1

(*) Significant correlation at 0.05 levels

(**Bold values**) High positive [+] or negative [-] correlation value

(Legend) A - Individual Income (PHP per month)
B - Age (Year)
C - Male
D - Single
E - Student
F - No. of cars owned by household
G - No. of motorcycles owned by household
H - No. of household members
I - Years of residency
J - Rent unit

In Table 4.6, the different correlation values for each variable relationship were shown. It can be denoted that there was a significant positive correlation between variable in column D (Single) and variable in row E (Student). It means that most, if not all, of the students were single or vice versa. Meanwhile, there was a

significant negative correlation between variable the variable in column B (Age) and variables in row D (Single) and E (Student). This explains that single and student respondents were within younger age groups.

4.2.4 Initial Logistic Regression Result

Presented in Table 4.7 is the initial logistic regression result from the final data. It is seen that even if most of the socio-economic variables have expected coefficient sign conventions, many of them were not significant at the 5% level. Significant variables with expected sign conventions were the following: age and the number of cars owned by a household. On the other hand, the single variable was found out to be significant but with an unexpected sign convention. The result implies that single commuters were more likely to use a motorized vehicle for their commute, which contradicts the premise of single commuters usually use public transport for their commute. The unexpected result may involve the prevailing trend in the society that people at the present time are willing to devote their money to an automobile for the simple pleasure of comfort to commute.

On the other hand, the only location characteristic variable that was found to be significant was the location of an office or school located within 1,000 meters from a rail transit station dummy variable. The reason may be due to the high number of respondents whose office or school location are near an urban rail transit station, as stated in the descriptive statistics in section 4.2.1.

Table 4.7: Initial Logistic Regression Model Result (ILRM)

Variable	Coefficient	S.E.	Z	P
Socio-Economic Characteristics				
Household Income (PHP per month)	0.000004	0.000006	0.65	0.52
Individual Income (PHP per month)	0.000006	0.000013	0.46	0.65
Age (Year)	0.11	0.05	2.27	0.02
Male*	0.74	0.51	1.46	0.15
Single*	3.11	1.20	2.58	0.01
Student*	-0.08	0.62	-0.13	0.90
No. of cars owned by household	2.74	1.35	2.03	0.04
No. of motorcycles owned by household	0.38	0.50	0.76	0.45
No. of household members	0.17	0.16	1.02	0.31
Years of residency	-0.24	0.18	-1.36	0.18
Rent unit*	-0.52	0.67	-0.78	0.44
Location Characteristics				
Distance from condo to rail station	0.0017	0.0012	1.50	0.14
Condo located near CBD station*	0.08	1.36	0.06	0.95
Office located near CBD station*	0.49	1.40	0.35	0.73
Office or school located within 1,000 meters from a rail transit station*	-1.02	0.54	-1.90	0.05
Interaction Variables				
[1] Individual Income x No. of cars owned by household	0.000009	0.000007	1.24	0.22
[2] Age x No. of cars owned by household	-0.04	0.03	-1.47	0.14
[3] Male* x No. of cars owned by household	-0.15	0.31	-0.46	0.64
[4] Single* x No. of cars owned by household	-1.56	0.81	-1.92	0.05
[5] Rent unit* x No. of cars owned by household	-0.27	0.32	-0.86	0.39
[6] No. of cars owned by household x Distance from condo to station	-0.0002	0.0004	-0.53	0.60
[7] Years of residency x Distance from condo to station	-0.0001	0.0002	-0.56	0.58
[8] Rent unit* x Distance from condo to station	-0.0015	0.0010	-1.47	0.14
[9] Office located near CBD station* x Distance from condo to station	-0.0007	0.0008	-0.83	0.41
[10] Office or school location near rail station* x Distance from condo to station	0.0003	0.0007	0.42	0.68
Constant	-6.74	2.22	-3.04	0.00
Number of observations	275			
LR chi2(25)	81.68			
Pseudo R2	0.2535			
Log Likelihood	-120.30			

(*) Dummy variables

Lastly, some interaction variables were made between variables which may affect the travel behavior of condominium residents near rail transit stations. The variables, number of cars owned by a household and the distance from a condominium residence to rail station were treated as the variables to be interacted to, or the multiplier. Other socio-economic and location characteristics variables were multiplied to the multiplier to create an interaction.

The premises for each interaction variables are as follows: for the first [1] interaction variable, individual income x number of cars owned by a household, high income people who owns an automobile are most likely to drive; for the second [2] interaction variable, age x number of cars owned by a household, older people who owns an automobile are most likely to drive; for the third [3] interaction variable, male x number of cars owned by a household, men who owns an automobile are less likely to drive; for the fourth [4] interaction variable, single x number of cars owned by a household, single commuters who owns a car are less likely to drive; for the fifth [5] interaction variable, rent unit x number of cars owned by a household, people who rents a condominium unit and owns an automobile are less likely to drive; for the sixth [6] interaction variable, number of cars owned by a household x distance from condominium to station, people who owns an automobile and have whose condominium residence distance is within 1,000 meters from a rail transit station or so are less likely to drive; for the seventh [7] interaction variable, years of residency x distance from condominium to station, commuters who are stays longer in a condominium residence within 1,000 meters from a rail transit station or so are less likely to drive; for the eighth [8] interaction variable, rent unit x distance from condominium to station, people who rents a unit in a condominium residence within

1,000 meters from a rail transit station or so are less likely to drive; for the ninth [9] interaction variable, office located near CBD station x distance from condominium to station, commuters whose office or school location is near a CBD station and lives in a condominium residence within 1,000 meters from a rail transit station or so are less likely to drive; and for the tenth [10] interaction variable, office or school location near rail station x distance from condominium to station, commuters whose office or school location is near a rail transit station and lives in a condominium residence within 1,000 meters from a rail transit station or so are less likely to drive.

4.2.5 Model Modification and Log-Likelihood Ratio Test

To obtain the best fit model from the initial logistic regression model, modifications were made with the use of the log-likelihood ratio test. The log-likelihood ratio test determines whether there an improvement of fit by a more restricted model is more significant.

Table 4.7 in section 4.2.4 showed the unrestricted model and the restricted model is shown in Table 4.9 section 4.2.6. The null hypothesis is that the restricted model is correct and the alternative hypothesis is that the unrestricted model is correct, shown in Table 4.8.

Table 4.8: Log-Likelihood Ratio Test between ILRM and FLRM

Null Hypothesis: FLRM is correct. Alternative Hypothesis: ILRM is correct.	Likelihood Ratio Statistic	=	17.48
	Critical Chi-square (17) 0.05	=	27.59

(ILRM) Initial Logistic Regression Model – Table 4.7

(FLRM) Final Logistic Regression Model - Table 4.9

Throughout the log-likelihood ratio tests, several variables were dropped from the initial logistic regression model (ILRM) to obtain the best fit model. There were 3 iterations made, in which insignificant variables were dropped every time until the final model was developed. In Table 4.8, the log-likelihood ratio test for the final iteration was shown. The likelihood ratio statistic, which is distributed Chi-Square with 17 degrees of freedom was 17.48. The value of this statistic was less than 27.59, the critical value at the 95% level. The result implied that the alternative hypothesis can be rejected, in favor of the null hypothesis. Since the null hypothesis was found to be significant, therefore the restricted model or the final model (FLRM) is the best fit model given this condition.

4.2.6 Final Logistic Regression Model

Based from the log likelihood ratio test, the best fit model was obtained, shown in Table 4.9, with almost all of the variables significant at the 5% level except for the interaction variable number [9], which was significant at the 10% level. For the socio-economic variables, the individual income and number of cars owned by a household have expected coefficient sign conventions leaning towards the probability of a commuter to drive a car, while the marital status (single dummy variable) had otherwise. Also, the location characteristic variables have expected coefficient sign conventions, which states that as the distance of a commuter's condominium residence becomes farther from a rail transit station, they were most likely to drive a car, on the other hand, if a commuter's work place or school was located near a rail transit station, they were less likely to drive.

Table 4.9: Final Logistic Regression Model Result (FLRM)

Variable	Coefficient	S.E.	Z	P
Socio-Economic Characteristics				
Individual Income (PHP per month)	0.000022	0.000008	2.87	0.00
Single*	1.40	0.51	2.75	0.01
No. of cars owned by household	1.08	0.32	3.41	0.00
Location Characteristics				
Distance from condo to rail station	0.0014	0.0005	3.15	0.00
Office or school located within 1,000 meters from a rail transit station*	-0.80	0.36	-2.24	0.03
Interaction Variables				
[4] Single* x No. of cars owned by household	-0.89	0.36	-2.49	0.01
[8] Rent unit* x Distance from condo to station	-0.0023	0.0006	-3.62	0.00
[9] Office located near CBD station* x Distance from condo to station	-0.0007	0.0004	-1.75	0.08
Constant	-2.42	0.55	-4.38	0.00
Number of observations	275			
LR chi2(8)	65.73			
Pseudo R2	0.2040			
Log Likelihood	-128.27			

(*) Dummy variables

Furthermore, the interaction terms determined the influence of the significant socio-economic and location characteristic variables with each other and to the dependent variable. For the interaction variable number [4], it was seen that the effect of owning a car for single commuters was -0.89 times the effect of owning a car for non-single commuters. The negative coefficient sign convention means that there was a negative effect of car ownership for single commuters towards the use of a motorized vehicle for their trips, or simply single commuters were less likely to drive. This was quite logical since car ownership was higher for non-single commuters

which make sense of having a higher influence towards the use of car. For the interaction variable number [8], the effect of renting a unit in a condominium residence, which is located within 1,000 meters from a rail transit station or so, for commuters, was -0.0023 times the effect of owning a unit in a condominium residence at the same location. Commuters with the characteristics stated in the interaction variable number [8] were found out to drive less. Lastly, for the interaction variable number [9], for commuters, the effect of having their work place or school located near CBD stations and having their condominium residence located within 1,000 meters from a rail transit station or so, was -0.0007 times the effect of having their work place or school location far from CBD stations but have their residence at the same location. Like the two other interaction variables, commuters with the characteristics stated in the interaction variable number [9] were less likely to drive.

Finally, the pseudo R-squared value decreased from 0.2535 from the initial logistic regression model, to 0.2040 for the final logistic regression model, but still within the acceptable range of 0.2 to 0.4. It can be denoted that the final logistic regression model was satisfactory.

4.2.7 Marginal Effects (Elasticity)

The estimated marginal effects for each variable of the final model are shown in Table 4.10. The marginal effects for each variable vary from a low percentage effect to a high percentage effect. For socio-economic variables, the individual income of a condominium resident was seen to have low percentage elasticity in choosing a motorized vehicle as the main mode of transport. 1% increase in the

household income would minimally increase the probability of choosing an automobile or a motorcycle as their mode of transport by 40%. However, the marital status (single dummy variable), and car ownership (number of cars owned by a household) of a condominium resident have higher percentage effects in choosing a motorized vehicle as the main mode for their commute. Single commuters have 63% probability increase to choose their main mode as a car. While, car owners have 89% probability increase to choose car as their main mode.

Table 4.10: Marginal Effects of the Final Logistic Regression Model

Variable	ey/ex	S.E.	Z	P
Socio-Economic Characteristics				
Individual Income (PHP per month)	0.40	0.14	2.82	0.01
Single*	0.63	0.23	2.67	0.01
No. of cars owned by household	0.89	0.27	3.31	0.00
Location Characteristics				
Distance from condo to rail station	0.49	0.16	3.09	0.00
Office or school location near rail station*~	-0.47	0.21	-2.20	0.03
Interaction Variables				
[4] Single x No. of cars owned by household~	-0.54	0.22	-2.45	0.01
[8] Rent unit x Distance from condo to station~	-0.40	0.12	-3.47	0.00
[9] Office located near CBD station x Distance from condo to station~	-0.09	0.05	-1.74	0.08

(*) ey/ex is for discrete change of dummy variable from 0 to 1
(~) ey/ex is for variables with negative effects

On the other hand, for the location characteristic variables, percentage effects below 50% were obtained. For instance, 1% increase in the distance of the condominium residence of a commuter to an urban rail transit station would increase the probability of driving a car by only 49%. This means condominium residences that are farther away from a rail transit station would increase the

probability of people choosing to drive. Also, the dummy variable for the office or school located within 1,000 meters or so from a rail transit station has a negative effect towards the use of a motorized vehicle. Implying that if commuter's office or school location is within 1,000 meters or so to the rail transit station, it would decrease their probability of using a motorized vehicle for their commute by 47%.

Also, the interaction variables produced a negative elasticity value. For the interaction variable number [4], a 1% increase in the effect of owning a car for single commuters would decrease the probability of choosing an automobile as their mode of travel by around 54%. For the interaction variable number [8], a 1% increase in the effect of renting a unit in a condominium, which is located within 1,000 meters from a rail transit station or so, would decrease the probability of choosing a car for their commute. Finally, for the interaction variable number [9], 1% increase in the effect of having a commuter's office or school location near CBD stations and have their residence within 1,000 meters from a rail transit station or so, would decrease their probability of driving.

CHAPTER V
CONCLUSION AND RECOMMENDATION

5.1 Conclusions

This study investigated the effects of the travel behavior of commuters, whose residence were newly developed and highly dense condominiums within the urban rail transit station corridors, to the advancement of a transit-oriented development and the reduction of traffic congestion on main roads in Metro Manila. In order to obtain this objective, two types of questionnaire survey, online and on-site surveys, were developed; meanwhile, the allocation of the questionnaires were accomplished by the following: (1) for the online questionnaire survey, flyers, indicating the web page of the online survey, were distributed to different condominiums within an approximate radial distance of 1,000 meters or so to a rail transit station; (2) while for the on-site questionnaire survey, a 2-page questionnaire was used to interview respondents from the similar residential location features as stated in the first method. These were done to acquire certain socio-economic and land use characteristics from commuters imposing the hypothesis that different behaviors on how people travel are based on their socio-economic profile and residential proximity to transit access. The socio-economic and location characteristic variables were then used to formulate the logistic regression model in relation to the tendency of commuters using a motorized vehicle. The descriptive statistics, modal share, correlation analysis, logistic regression results, log likelihood ratio test, and marginal effects, were presented and analyzed to identify how the results conform to the objectives and hypothesis of the study.

Based from the mode share characteristics of the respondents, it can be derived that the primary mode of transport of people living in condominiums along urban rail transit corridors was the urban rail transit itself, with a 35% share. Also, private vehicles' share was also significantly high with a share of 27%. Other modes of transport represent only a small share except for walking (25%), which was represented by respondents' residence location proximate to their office or school locations. The mode share signifies urban rail transit as the primary mode of transport to people living in condominiums near urban rail transit station and the average residency years of a household in their current condominium residence who use rail was around two years. Implicating that most of the movements of respondents' residential choice location to newly developed condominiums near urban rail transit stations within the past 5 years were based on the utilization of the urban rail transit for their commute. However, automobile users in condominiums within the proximity of a rail station were still prevailing, indicating that not all of the respondents moved to their current residence location for the purpose of using the urban rail transit.

Meanwhile, variables which significantly influence the travel patterns of commuters residing in condominiums near urban rail transit stations based from the logistic regression result at a 5% significant level were the following; for the socio-economic characteristic variables, individual income, marital status (single dummy variable), and the car ownership (number of cars owned by a household). It can be deduced that the travel behavior of a commuter was greatly affected by their income. Also, people travel with what was mostly appropriate for their marital status. Moreover, mode choice of commuters would be significantly affected if they own at

least one car, which leads to driving. On the other hand, location characteristic variables that were found to be significant were the condominium residence's distance to a rail transit station and the office or school located within 1,000 meter or less from a rail transit station dummy variable. Similar to the significant socio-economic variables, the location of the commuters' condominium residence greatly affects their choice of mode for travel. Commuter's residence located with easy access to transit were found out to utilize transit, while as the distance of the residence to transit station increases, utilization of transit decreases resulting in an increase of car users. Lastly, the location of people's work place or school was also found out to be significant to their mode choice. This would be a great issue to tackle and may provide prominent results.

According to the results of the study, it can be derived that different socio-economic characteristics of commuters, and whose residence locations were near an urban rail transit station, affect their travel behavior. Also, the utilization of urban rail transit, if not the main cause, was most likely one of the reasons for commuters selecting their residence within rail transit station corridors. Therefore, high density condominiums and TOD improvements would be able to reflect a significant effect in reducing traffic congestion in Metro Manila.

5.2 Discussions

5.2.1 Comparison of Results

The empirical results of this study are mostly similar with other parallel and related studies in different cities, especially on the developing cities. For instance, in the study of Chalermpong and Ratanawaraha (2013) on the travel behavior of

commuters living in residential condominiums near urban rail transit stations in the city of Bangkok, Thailand have almost similar outcomes on how people seem to travel, in relation with their socio-economic and land use characteristics. The study of Kawada, Okamoto et al. (2010) on the Tsukuba Express connecting two cities, Tsukuba and Akihabara in Tokyo, Japan also supports the premise and result of this research regarding the effects on the travel patterns of commuters with their residential proximity to the transit station. It was seen that people who live near the Tsukuba Express stations utilized the rail transit and shifted from their previous mode of transport (bus, car, Joban rail line; distant to most residents) to rail transit, implying the same results to Metro Manila's case. Another study that conforms with the results of this research regarding the land use is from Senbil, Zhang et al. (2006), which is about the effects of land use on travel behavior in the city of Jabotabek, Indonesia. It is discussed that land use characteristics in the metropolitan city of Jabotabek divert private vehicle users to public transit users for short term travel behavior or mode choices.

Although similarities were found in some parallel studies, the differences may take place into the types of socio-economic and land use characteristics that affected the travel behavior of commuters. Also, the analysis of the objectives may differ regarding on the methods to be used in determining the effects of the travel behavior of people in relation with transit-oriented development. Also, in some cases, transit-oriented development may not be a resolution to the traffic congestion problems in other cities.

5.2.2 Policy Implications

The empirical results and findings may involve certain policies in the city of Metro Manila regarding the use of land use and transport. In relation with the mode choice of people living in condominiums, one transport policy that should be embarked upon is the accessibility of transit stations. According to the results of this research, near access to transit stations affects people's choice of main mode for travel. If the accessibility of different transit stations are unavailable or maybe out of reach, commuters owning a car would prefer to drive, which are comfortable to them. Also, these transit station infrastructures should provide a good service to commuters who are willing to use transit as their mode of travel. Furthermore, since it was found out that the if the location of the work place or school of a commuter is near an urban rail transit station, it also affects their mode preference, imposing transit accessibility to these dwellings may also significantly promote a better TOD system which will lead to the reduction of traffic congestion in major roads of Metro Manila.

5.2.3 Weaknesses and Limitations

The results of the research imply significant improvements for transit-oriented developments in Metro Manila; however some limitations would need further investigation. For instance, a methodology limitation that may have caused difficulty in data collection was the allocation of the information about the online questionnaire survey, along with the assurance of responding to the survey once it was distributed to different residential condominiums. Also, the disapproval of the condominium administration and management regarding the allocation of survey

related materials can sometimes limit the condominiums available in a certain catchment area of the rail transit station and may affect the proximity parameters of the study. Also, the scope of the study only focuses on the travel behavior of residential condominiums and did not considered other residential housing types near urban rail transit stations.

Moreover, data analysis limitations involved the logistic regression model and the variables used. For instance, the travel behavior of condominium residents may also depend on other variables not only their socio-economic characteristics but also to some transport externalities, noise, air pollution, risk, congestion, and safety (Wee 2009), that probably affect their selection of modes, as well as residence choice. These factors may be further analyzed and may take into consideration.

5.3 Recommendations

Future enhancements to this study involve the improvement of the data gathering process. The use of other data gathering survey methods can be done for an effective response entry. Other survey methods that were not used in this research but can be an efficient method are the following (Richardson, Ampt et al. 1995): (1) direct and indirect observational surveys, which may use observational tools like video cameras, and (2) telephone surveys, which may personally interview a respondent regarding the topic with a more efficient time savings compared to personal interviews. Also, the distribution of survey materials can be quite challenging to dwellings that disapprove of such surveys, nevertheless, the use of the intercept survey method (Richardson, Ampt et al. 1995), wherein respondents are intercepted on-site for a short period of time, can be quite useful but inconvenient

to other people. Moreover, other residential dwelling types may be also considered to obtain the effect of land developments in each area of focus.

Furthermore, as for the different factors and transport externalities that may affect the travel behavior of commuters, further evaluation of influence premises would be beneficial prior to the involvement of such factors and externalities in the analysis of data. Also, considering the generalized cost of transportation modes and analyzing some model separations for different commuter class groups would also be a great addition to this study. Extending this research would produce more significant effects on transport and land use developments.

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APPENDIX

Appendix A-1: Preliminary Online Questionnaire Survey

Condominium Residents Travel Survey

De La Salle University and Chulalongkorn University with the support of JICA is conducting a comparative research on travel patterns of condominium residents in Manila and Bangkok. We request about five minutes of your time to fill out this on-line questionnaire.

The research team would like to assure you that your personal information will be kept confidential. The data will be used for academic purpose only and will be useful for improving transportation and land use planning in the future.

Thank you very much for your cooperation

* Required

General Information

Name of your condominium*
If no name, write “None”.

Street address of your condo*

Nearest transit station to your condo*
Please indicate the transit line and name of the station nearest to your condo. If no transit station is within 2 km of your condo, write “None”.

Distance from your condo to the nearest transit station*
- O 100 meter or less
- O 101 to 300 meter
- O 301 to 500 meter
- O 501 to 700 meter
- O 701 to 900 meter
- O 901 to 1,100 meter
- O 1,101 to 1500 meter
- O 1,501 to 2,000 meter
- O Over 2,000 meter

How long have you resided in this condo? *
- O Less than 1 year 1 to 3 years
- O 3 to 5 years
- O Over 5 years

Age (year)*
Your age. Write the number of years.

Gender*
- O Female
- O Male

Marital Status*
- O Single
- O Married
- O Other (widowed, divorced, etc.)

Occupation*
- O Student
- O Employee (private or public sector)
- O Business owner or family business
- O Independent profession (architect, musician, etc.)
- O Other:_____

Number of members of household*
Number of all members living in the same household
- O 1
- O 2
- O 3
- O 4 or more

Monthly income*
Your own income in pesos per month
- O Less than 5,000 pesos
- O 5,001 to 15,000 pesos
- O 15,001 to 25,000 pesos
- O 25,001 to 35,000 pesos
- O 35,001 to 45,000 pesos
- O 45,001 to 55,000 pesos
- O Over 55,000 pesos

Household income per month*
Total income in pesos per month of all household members
- O Less than 25,000 pesos
- O 25,001 to 45,000 pesos
- O 45,001 to 65,000 pesos
- O 65,001 to 85,000 pesos
- O 85,001 to 100,000 pesos
- O Over 100,000 pesos

Car ownership in household*
Number of cars owned by your household
- O None
- O 1 car
- O 2 cars
- O More than two cars

Motorcycle ownership in household*
Number of motorcycles owned by your household
- O None
- O 1 motorcycle
- O More than one motorcycle

Commute Trip Data

Please provide information about your commute trip that you make regularly

Name of work place or school*
E.g. Philippine Airlines, De La Salle University, etc.

Street address of your work place or school*

Nearest transit station to your work place or school*
Please indicate the transit line and name of the station nearest to your work place or school. If no transit station is within 2 km of your condo, write “None”.

Distance from the nearest transit station to your work place or school*
- O 100 meter or less
- O 101 to 300 meter
- O 301 to 500 meter
- O 501 to 700 meter
- O 701 to 900 meter
- O 901 to 1,100 meter
- O 1,101 to 1500 meter
- O 1,501 to 2,000 meter
- O Over 2,000 meter

Main mode of commute to work place or school*
Choose the main mode of commute that you use most regularly.
- O Rail transit
- O Air-conditioned Bus
- O Non-air-conditioned Bus
- O Jeepney
- O FX
- O Taxi
- O Car (self-driven)
- O Car (share-ride)
- O Motorcycle (self-driven)
- O Motorcycle (share-ride)
- O Walk
- O Other:

Public Transportation Users

Commute time by public transportation *
Total time from your condo to work place or school (one way)
- O 1 to 15 minutes
- O 1 to 30 minute
- O 31 to 45 minutes
- O 46 minutes to 1 hour
- O 1 hour 1 minute to 1 hour 30 minutes
- O 1 hour 31 minutes to 2 hour
- O Over 2 hours

Commute costs by public transportation*
Total commute costs from your condo to work place or school (one way)
- O 10 pesos or less
- O 11 to 20 pesos
- O 21 to 30 pesos
- O 31 to 40 pesos
- O 41 to 50 pesos
- O 51 to 60 pesos
- O 61 to 80 pesos
- O 81 to 100 pesos
- O Other:

Access trip from your condo to transit station or transit stop*
- O Walk
- O Bicycle
- O Motorcycle
- O Taxi/FX
- O Jeepney
- O Air-conditioned Bus
- O Non-air-conditioned Bus
- O Drop off by friends or family
- O Other:_____

Time for accessing transit station or transit stop *
Write the total amount of time (in minutes) you need to access transit station or stop from your condo. Write '0' if none.

Costs for accessing transit station or transit stop *
Write the total cost in pesos you spend on accessing transit station or stop from your condo. Write '0' if none.

Egress trip from transit station or transit stop to your work place or school *
- O Walk
- O Taxi/FX
- O Jeepney
- O Bus
- O Other:_____

Time for egressing from transit station to your work place or school *
Write the total amount of time (in minutes) you need to egress from transit station or stop to your work place. Write '0' if none.

Cost for egressing from transit station to your work place or school *
Write the total cost (in pesos) you spend on egressing from transit station or stop to your work place. Write '0' if none.

Are your trips making the same in both directions? *
E.g. you use the same modes of travel for both going to work or school and back.
- O Yes
- O No

Have you ever driven a car to your work place or school? *
- O Yes, I have driven to my work place.
- O No, I have not.

Car or Motorcycle Commuters

Commute time by car or motorcycle *
Total commute time (one way) on average
- O 1 to 15 minutes
- O 1 to 30 minute
- O 31 to 45 minutes
- O 46 minutes to 1 hour
- O 1 hour 1 minute to 1 hour 30 minutes
- O 1 hour 31 minutes to 2 hour
- O Over 2 hours

Fuel cost by car or motorcycle commuters *
Total fuel cost you spend per month
- O Not over 2,500 pesos per month
- O 2,501 to 5,000 pesos per month
- O 5,001 to 10,000 pesos per month
- O Over 10,000 pesos per month

Toll cost by car or motorcycle commuters *
Total toll cost you spend per month
- O None
- O 1 to 2,500 pesos per month
- O 2,501 to 5,000 pesos per month
- O Over 5,000 pesos per month

Installment payment by car or motorcycle commuters *
Installment payment you make for your vehicle per month
- O None
- O 1 to 10,000 pesos per month
- O 10,001 to 20,000 pesos per month
- O Over 20,000 pesos per month
- O

Parking costs by car or motorcycle commuters *
Parking costs in pesos per month
- O None
- O 1 to 1,000 pesos per month
- O 1,001 to 2,000 pesos per month
- O Over 2,000 pesos per month

Walkers

Walking time *
Total amount of walking time (in minutes) from your condo to work place or school

Walking distance *
Approximate walking distance (in meter) from your condo to work place or school

Alternative Commute Mode

Alternative commute mode *
If you don't commute by the main mode you normally use, which alternative mode will you use?

- O Rail transit
- O Air-conditioned bus
- O Non-air-conditioned bus
- O Jeepney
- O FX
- O Taxi
- O Car (self-driven)
- O Car (share-ride)
- O Motorcycle (self-driven)
- O Motorcycle (share-ride)
- O Cannot use alternative mode
- O Other:_____

Commute time by alternative mode *
Total time from your condo to work place or school (one way)

- O 1 to 15 minutes
- O 15 to 30 minutes
- O 30 to 45 minutes
- O 45 to 60 minutes
- O 1 hour 1 minute to 1 hour 30 minutes
- O 1 hour 31 minutes to 2 hours
- O Over 2 hours

Commute cost by alternative mode *
Total cost from your condo to work place or school (one way)

- O 20 pesos or less
- O 21 to 40 pesos
- O 41 to 60 pesos
- O 61 to 80 pesos
- O 81 to 100 pesos
- O Other:_____

Contact Information

Your name and cellular phone number will be useful for verifying the information that you have provided. We assure you that your personal information will be kept confidential and used for academic purpose only. Please answer 'Yes' to provide your contact information. However, if you choose not to do so, you can skip the next step by choosing 'No'.

Do you agree to provide your contact information? *

- ○ Yes
- ○ No

Cellular Phone Number *

Phone Carrier Company *

Given Name *

Family Name *

Middle Initial

Email address *

Thank you very much for your cooperation!
If you have any question, please contact Dr. Alexis M. Fillone at De La Salle University.

Appendix A-2: Final Online Questionnaire Survey

Condominium Residents Travel Survey

Good day!

De La Salle University-Manila, Philippines and Chulalongkorn University, Thailand, with the support of the ASEAN University Network/Southeast Asia Engineering Education Development Network (AUN/SEED-Net) under the Japan International Cooperation Agency (JICA) is conducting a comparative research on the travel behavior of condominium residents in Manila and Bangkok.

We request about ten (10) minutes of your time to fill out this on-line questionnaire. The research team would like to assure you that your response and personal information will be kept confidential and will be used for academic purpose only.

This survey will be useful for the improvement of transportation and land use planning in the future.

Thank you very much for your cooperation.

* Required

Household Information

Information about the socio-economic profile of the respondent and their household

1. Gender *
Mark only one oval.

- ○ Male
- ○ Female

2. Age *
Specify your age.

_____

3. Marital Status *
Mark only one oval.

- ○ Single
- ○ Married
- ○ Others (Widowed, divorced, etc.)

4. Occupation *
Mark only one oval.

- ○ Student
- ○ Employee (Private or Public Sector)
- ○ Business owner or self-employed
- ○ Independent professional (Doctor, lawyer, etc.)
- ○ Other: _____

5. Monthly income *
Your own income in Philippine pesos per month
Mark only one oval.

- ○ Less than 5,000 Php
- ○ 5,000 to 15,000 Php
- ○ 15,001 to 25,000 Php
- ○ 25,001 to 35,000 Php
- ○ 35,001 to 45,000 Php
- ○ 45,001 to 55,000 Php
- ○ Over 55,000 Php

6. Household members *
Number of all members living in the same house
Mark only one oval.

- ○ 1 Skip to question 7.
- ○ 2 Skip to question 10.
- ○ 3 Skip to question 15.
- ○ 4 or more Skip to question 20.

7. Household income per month *
Total income of all household members in Philippine pesos per month
Mark only one oval.

- ○ Less than 25,000 Php
- ○ 25,000 to 45,000 Php
- ○ 45,001 to 65,000 Php
- ○ 65,001 to 85,000 Php
- ○ 85,001 to 100,000 Php
- ○ Over 100,000 Php

8. Motorized vehicle ownership in the household *
Number of cars and motorcycles owned by your household
Mark only one oval per row.

	None	1	2	More than 2
Car	O	O	O	O
Motorcycle	O	O	O	O

9. Current commute trip of household *
What mode of transportation do you use currently?
Mark only one oval.

- O Private Transportation (Car or motorcycle)
- O Public Transportation (LRT, MRT, bus, etc.)

Skip to question 32.

10. Household income per month *
Total income of all household members in Philippine pesos per month
Mark only one oval.

- O Less than 25,000 Php
- O 25,000 to 45,000 Php
- O 45,001 to 65,000 Php
- O 65,001 to 85,000 Php
- O 85,001 to 100,000 Php
- O Over 100,000 Php

11. Motorized vehicle ownership in the household *
Number of cars and motorcycles owned by your household
Mark only one oval per row.

	None	1	2	More than 2
Car	O	O	O	O
Motorcycle	O	O	O	O

12. Position of household members *
PLEASE DO NOT REPEAT THE CHOICES
Mark only one oval per row.

	Father	Mother	Husband	Wife	Children	Sibling	Others (Grandparents, uncle, etc.)
Household Member 1 (Yourself)	O	O	O	O	O	O	O
Household Member 2	O	O	O	O	O	O	O

13. Current commute trip of household members *
Current mode of transportation used
Mark only one oval per row.

	Car (Driver)	Car (Share-a-ride)	Motorcycle	Rail Transit (LRT or MRT)	Bus	Others (Jeepney, FX, etc.)
Household Member 1 (Yourself)	O	O	O	O	O	O
Household Member 2	O	O	O	O	O	O

14. Are you the head of your household? *
Mark only one oval.

- O Yes Skip to question 27.
- O No Skip to question 29.

15. Household income per month *
Total income of all household members in Philippine pesos per month
Mark only one oval.

- O Less than 25,000 Php
- O 25,000 to 45,000 Php
- O 45,001 to 65,000 Php
- O 65,001 to 85,000 Php
- O 85,001 to 100,000 Php
- O Over 100,000 Php

16. Motorized vehicle ownership in the household *
Number of cars and motorcycles owned by your household
Mark only one oval per row.

	None	1	2	More than 2
Car	O	O	O	O
Motorcycle	O	O	O	O

17. Position of household members *
PLEASE DO NOT REPEAT THE CHOICES
Mark only one oval per row.

	Father	Mother	Husband	Wife	Children	Sibling	Others (Grandparents, uncle, etc.)
Household Member 1 (Yourself)	O	O	O	O	O	O	O
Household Member 2	O	O	O	O	O	O	O
Household Member 3	O	O	O	O	O	O	O

18. Current commute trip of household members *
Current mode of transportation used
Mark only one oval per row.

	Car (Driver)	Car (Share-a-ride)	Motorcycle	Rail Transit (LRT or MRT)	Bus	Others (Jeepney, FX, etc.)
Household Member 1 (Yourself)	O	O	O	O	O	O
Household Member 2	O	O	O	O	O	O
Household Member 3	O	O	O	O	O	O

19. Are you the head of your household? *
Mark only one oval.

O Yes Skip to question 27.
O No Skip to question 29.

20. Household income per month *
Total income of all household members in Philippine pesos per month
Mark only one oval.

- O Less than 25,000 Php
- O 25,000 to 45,000 Php
- O 45,001 to 65,000 Php
- O 65,001 to 85,000 Php
- O 85,001 to 100,000 Php
- O Over 100,000 Php

21. Motorized vehicle ownership in the household *
Number of cars and motorcycles owned by your household
Mark only one oval per row.

	None	1	2	More than 2
Car	O	O	O	O
Motorcycle	O	O	O	O

22. Position of household members *
PLEASE DO NOT REPEAT THE CHOICES
Mark only one oval per row.

	Father	Mother	Husband	Wife	Children	Sibling	Others (Grandparents, uncle, etc.)
Household Member 1 (Yourself)	O	O	O	O	O	O	O
Household Member 2	O	O	O	O	O	O	O
Household Member 3	O	O	O	O	O	O	O
Household Member 4	O	O	O	O	O	O	O

23. For more than 4 household members
Please write the position of other household members.
(E.g. Household 5 - Child, Household 6 - Others)

_____

24. Current commute trip of household members *
Current mode of transportation used
Mark only one oval per row.

	Car (Driver)	Car (Share-a-ride)	Motorcycle	Rail Transit (LRT or MRT)	Bus	Others (Jeepney, FX, etc.)
Household Member 1 (Yourself)	O	O	O	O	O	O
Household Member 2	O	O	O	O	O	O
Household Member 3	O	O	O	O	O	O
Household Member 4	O	O	O	O	O	O

25. For more than 4 household members
Please write the current commute trip of other household members.
(E.g. Household 5 - Private Transport, Household 6 - Public Transport)

_____

26. Are you the head of your household? *
Mark only one oval.

- O Yes Skip to question 27.
- O No Skip to question 29.

27. Are you involved in making decision about the current residence location? *
Mark only one oval.

- O Yes, I am the sole decision maker
- O Yes, I am partly involved in the decision making
- O No, other person(s) are involved in the decision making

28. If No or Partly Yes, choose the involved decision maker(s) in your household

Check all that is applicable
Check all that apply.

☐ Father
☐ Mother
☐ Husband
☐ Wife
☐ Child
☐ Sibling
☐ None
☐ Other: _____

Skip to question 32.

29. Who is the head of your household? *

Check all that is applicable
Check all that apply.

☐ Father
☐ Mother
☐ Husband
☐ Wife
☐ Child
☐ Sibling
☐ None
☐ Other: _____

30. Are you involved in making decision about the current residence location? *

Mark only one oval.

○ Yes, I am partly involved in the decision making
○ No, the head of the household is the sole decision maker
○ No, other person(s) are involved in the decision making

31. Choose the involved decision maker(s) in your household *
Check all that is applicable
Check all that apply.

☐ Father
☐ Mother
☐ Husband
☐ Wife
☐ Child
☐ Sibling
☐ None
☐ Other: _____

Residence Information

Information about the condominium choice of the household in relation with the urban rail transit

Skip to question 32.

32. Condominium name *
State the full name of your condominium

_____

33. Condominium address *

_____

_____

_____

34. Condominium property type *
Mark only one oval.

○ Owned
○ Rent

35. How long have you resided in your current residence? *
Mark only one oval.

○ Less than 1 year
○ 1 to 3 years
○ to 5 years
○ Over 5 years

36. Where did you live before moving into your current residence? *
Mark only one oval.

- ○ Within Metro Manila
- ○ Outside Metro Manila (After the last question in this section, stop filling out this form.)

37. What is your main mode of transport before moving into your current residence? *
Mark only one oval.

- ○ Rail Transit
- ○ Air-conditioned Bus
- ○ Non-air-conditioned Bus
- ○ Jeepney
- ○ FX
- ○ Taxi
- ○ Car (Self-driven)
- ○ Car (Share-a-ride)
- ○ Motorcycle (Self-driven)
- ○ Motorcycle (Share-a-ride)
- ○ Tricycle
- ○ Pedicab
- ○ Bicycle
- ○ Walk

38. Factors that affected the decision to move into your current residence *
Check all that is applicable.
Check all that apply.

- ☐ Convenience of commute by rail transit
- ☐ Convenience of commute by other public transportation
- ☐ Accessibility to work place or school
- ☐ Low-cost condominium
- ☐ Other: _____

39. Other residence options *
Did you consider other residence locations? If yes, check all that is applicable. If no, check "none".
Check all that apply.

- ☐ Within the central business district (CBD)
- ☐ Near rail transit station
- ☐ Near other public transportation station
- ☐ Near work place or school
- ☐ None
- ☐ Other: _____

40. Is your condominium near an urban rail transit station? *
Is it near LRT/MRT stations?
Mark only one oval.

- ○ Yes Skip to question 41.
- ○ No Skip to question 50.

Urban Rail Transit Information

41. Nearest urban rail transit to your condominium *
Mark only one oval.

- ○ LRT 1 Skip to question 42.
- ○ MRT 3 Skip to question 44.
- ○ LRT 2 Skip to question 46.

Urban Rail Transit Proximity to Residence Information

42. Nearest LRT 1 station to your condominium *
Mark only one oval.

- ○ 5th Avenue
- ○ Abad Santos
- ○ Baclaran
- ○ Balintawak
- ○ Bambang
- ○ Blumentrit
- ○ Carriedo
- ○ Central
- ○ Doroteo Jose
- ○ EDSA
- ○ Gil Puyat
- ○ Libertad
- ○ Monumento
- ○ Pedro Gil
- ○ Quirino
- ○ Roosevelt
- ○ R. Papa
- ○ Tayuman
- ○ United Nations
- ○ Vito Cruz

43. Distance from your condominium to the nearest urban rail transit station? *
Mark only one oval.

- ○ Less than 100 meters
- ○ 100 to 300 meters
- ○ 301 to 500 meters
- ○ 501 to 700 meters
- ○ 701 to 900 meters
- ○ 901 to 1,100 meters
- ○ 1,101 to 1,500 meters
- ○ 1,501 to 2,000 meters
- ○ Over 2,000 meters

Urban Rail Transit Proximity to Residence Information

Skip to question 48.

44. Nearest MRT 3 station to your condominium *
Mark only one oval.

- ○ Araneta Center Cubao
- ○ Ayala
- ○ Boni
- ○ Buendia
- ○ Guadalupe
- ○ Kamuning
- ○ Magallanes
- ○ North EDSA
- ○ Ortigas
- ○ Quezon Avenue
- ○ Santolan - Annapolis
- ○ Shaw Boulevard
- ○ Taft Avenue

45. Distance from your condominium to the nearest urban rail transit station? *
Mark only one oval.

- ○ Less than 100 meters
- ○ 100 to 300 meters
- ○ 301 to 500 meters
- ○ 501 to 700 meters
- ○ 701 to 900 meters
- ○ 901 to 1,100 meters
- ○ 1,101 to 1,500 meters
- ○ 1,501 to 2,000 meters
- ○ Over 2,000 meters

Urban Rail Transit Proximity to Residence Information

Skip to question 48.

46. Nearest LRT 2 station to your condominium *
Mark only one oval.

- ○ Anonas
- ○ Araneta Center Cubao
- ○ Betty Go Belmonte
- ○ Gilmore
- ○ J. Ruiz
- ○ Katipunan
- ○ Legarda
- ○ Pureza
- ○ Recto
- ○ Santolan
- ○ V. Mapa

47. Distance from your condominium to the nearest urban rail transit station? *
Mark only one oval.

- ○ Less than 100 meters
- ○ 100 to 300 meters
- ○ 301 to 500 meters
- ○ 501 to 700 meters
- ○ 701 to 900 meters
- ○ 901 to 1,100 meters
- ○ 1,101 to 1,500 meters
- ○ 1,501 to 2,000 meters
- ○ Over 2,000 meters

Urban Rail Transit Utilization

Skip to question 48.

48. Do you use urban rail transit for your commute? *
Using LRT/MRT for commute
Mark only one oval.

- ○ Yes Skip to question 50.
- ○ No Skip to question 49.

Factors Affecting the Misutilization of Urban Rail Transit

49. What are the factors of not using the urban rail transit? *
Check all that is applicable.
Check all that apply.

- ☐ Long access and egress distance
- ☐ Crowded rail transit system
- ☐ Long queue and waiting time
- ☐ Indirect route
- ☐ Security reasons
- ☐ Convenience of other modes
- ☐ Other: _____

Commute Trip Data

Information about your regular commute trip

Skip to question 50.

50. Work place or school name *
State the full name of your work place or school
(E.g. Unilever, De La Salle University, etc.)

_____

51. Work place or school address *

_____

_____

_____

52. How long have you worked or studied in your current work place or school? *
Mark only one oval.

- ○ Less than 1 year
- ○ 1 to 3 years
- ○ to 5 years
- ○ Over 5 years

53. Do you have a different work place or school before you transfer into your current residence? *
Mark only one oval.

- ○ Yes
- ○ No

54. Is your work place or school near an urban rail transit station? *
Is it near LRT/MRT stations?
Mark only one oval.

- ○ Yes Skip to question 55.
- ○ No Skip to question 62.

Urban Rail Transit Information

55. Nearest urban rail transit to your work place or school *
Mark only one oval.

- ○ LRT 1 Skip to question 56.
- ○ MRT 3 Skip to question 58.
- ○ LRT 2 Skip to question 60.

Urban Rail Transit Proximity to Work Place or School Information

56. Nearest LRT 1 station to your work place or school *
Mark only one oval.

- ○ 5th Avenue
- ○ Abad Santos
- ○ Baclaran
- ○ Balintawak
- ○ Bambang
- ○ Blumentrit
- ○ Carriedo
- ○ Central
- ○ Doroteo Jose
- ○ EDSA
- ○ Gil Puyat
- ○ Libertad
- ○ Monumento
- ○ Pedro Gil
- ○ Quirino
- ○ Roosevelt
- ○ R. Papa
- ○ Tayuman
- ○ United Nations
- ○ Vito Cruz

57. Distance from your work place or school to the nearest urban rail transit station? *
Mark only one oval.

- ○ Less than 100 meters
- ○ 100 to 300 meters
- ○ 301 to 500 meters
- ○ 501 to 700 meters
- ○ 701 to 900 meters
- ○ 901 to 1,100 meters
- ○ 1,101 to 1,500 meters
- ○ 1,501 to 2,000 meters
- ○ Over 2,000 meters

Urban Rail Transit Proximity to Work Place or School Information

Skip to question 62.

58. Nearest MRT 3 station to your work place or school *
Mark only one oval.

- ○ Araneta Center Cubao
- ○ Ayala
- ○ Boni
- ○ Buendia
- ○ Guadalupe
- ○ Kamuning
- ○ Magallanes
- ○ North EDSA
- ○ Ortigas
- ○ Quezon Avenue
- ○ Santolan – Annapolis
- ○ Shaw Boulevard
- ○ Taft Avenue

59. Distance from your work place or school to the nearest urban rail transit station? *
Mark only one oval.

- ○ Less than 100 meters
- ○ 100 to 300 meters
- ○ 301 to 500 meters
- ○ 501 to 700 meters
- ○ 701 to 900 meters
- ○ 901 to 1,100 meters
- ○ 1,101 to 1,500 meters
- ○ 1,501 to 2,000 meters
- ○ Over 2,000 meters

Urban Rail Transit Proximity to Work Place or School Information

Skip to question 62.

60. Nearest LRT 2 station to your work place or school *
Mark only one oval.

- ○ Anonas
- ○ Araneta Center Cubao
- ○ Betty Go Belmonte
- ○ Gilmore
- ○ J. Ruiz
- ○ Katipunan
- ○ Legarda
- ○ Pureza
- ○ Recto
- ○ Santolan
- ○ V. Mapa

61. Distance from your work place or school to the nearest urban rail transit station? *
Mark only one oval.

- ○ Less than 100 meters
- ○ 100 to 300 meters
- ○ 301 to 500 meters
- ○ 501 to 700 meters
- ○ 701 to 900 meters
- ○ 901 to 1,100 meters
- ○ 1,101 to 1,500 meters
- ○ 1,501 to 2,000 meters
- ○ Over 2,000 meters

Main Mode of Transportation

Definition: Main modes of transport are those vehicles used by a commuter for a long period of travel or from the origin to destination.

Skip to question 62.

62. Main mode of commute to work place or school in CURRENT residence location *
What mode of transport do you use after you move?
Mark only one oval.

- ○ Private Transport — Skip to question 64.
- ○ Public Transport — Skip to question 63.
- ○ Walkers and Bicycle Commuters — Skip to question 88.

Public Transportation Commuters

63. How many modes of transport do you use from your origin to your destination? *
Mark only one oval.

- ○ 1 — Skip to question 65.
- ○ 2 — Skip to question 69.
- ○ 3 — Skip to question 73.
- ○ 4 — Skip to question 77.
- ○ 5 or more — Skip to question 81.

Private Transportation Commuters

64. Main mode(s) of transport *
Check all that you use regularly
Check all that apply.

- ☐ Car (Self-driven)
- ☐ Car (Share-a-ride)
- ☐ Motorcycle (Self-driven)
- ☐ Motorcycle (Share-a-ride)

Public Transportation Commuters

Skip to question 96.

65. Main mode of transport *
Mark only one oval.

- ○ Rail Transit (LRT or MRT)
- ○ Air-conditioned Bus
- ○ Non-air-conditioned Bus
- ○ Jeepney
- ○ FX
- ○ Taxi

66. Commute time *
Total time from your condominium to work place or school (one way) on average
Mark only one oval.

- ○ Less than 15 minutes
- ○ 15 to 30 minutes
- ○ 31 to 45 minutes
- ○ 46 minutes to 1 hour
- ○ 1 hour 1 minute to 1 hour 30 minutes
- ○ 1 hour 31 minutes to 2 hours
- ○ Over 2 hours

67. Commute cost *
Total commute cost from your condominium to work place or school (one way)
Mark only one oval.

- ○ Less than 10 Php
- ○ 10 to 20 Php
- ○ 21 to 30 Php
- ○ 31 to 40 Php
- ○ 41 to 50 Php
- ○ 51 to 60 Php
- ○ 61 to 70 Php
- ○ 71 to 80 Php
- ○ 81 to 90 Php
- ○ 91 to 100 Php
- ○ Over 100 Php

68. Are your trips making the same in both directions? *
Using the same modes of transport for going to work or school and back home
Mark only one oval.

- ○ Yes
- ○ No

Public Transportation Commuters

Skip to question 89.

69. Main modes of transport *

Please do not repeat the choices
Mark only one oval per row.

	Rail Transit (LRT or MRT)	Air-conditioned Bus	Non-air-conditioned Bus	Jeepney	FX	Taxi
Mode 1	O	O	O	O	O	O
Mode 2	O	O	O	O	O	O

70. Commute time *

Total time from your condominium to work place or school (one way) on average
Mark only one oval per row.

	Less than 15 minutes	15 to 30 minutes	31 to 45 minutes	46 minutes to 1 hour	1 hour 1 minute to 1 hour 30 minutes	1 hour 31 minutes to 2 hours	Over 2 hours
Mode 1	O	O	O	O	O	O	O
Mode 2	O	O	O	O	O	O	O

71. Commute cost *

Total commute cost from your condominium to work place or school (one way)
Mark only one oval per row.

	Less than 10 Php	10 to 20 Php	21 to 30 Php	31 to 40 Php	41 to 50 Php	51 to 60 Php	71 to 80 Php	81 to 90 Php	91 to 100 Php	Over 100 Php
Mode 1	O	O	O	O	O	O	O	O	O	O
Mode 2	O	O	O	O	O	O	O	O	O	O

72. Are your trips making the same in both directions? *

Using the same modes of transport for going to work or school and back home
Mark only one oval.

- O Yes
- O No

Public Transportation Commuters

Skip to question 89.

73. Main modes of transport *

Please do not repeat the choices
Mark only one oval per row.

	Rail Transit (LRT or MRT)	Air-conditioned Bus	Non-air-conditioned Bus	Jeepney	FX	Taxi
Mode 1	O	O	O	O	O	O
Mode 2	O	O	O	O	O	O
Mode 3	O	O	O	O	O	O

74. Commute time *

Total time from your condominium to work place or school (one way) on average
Mark only one oval per row.

	Less than 15 minutes	15 to 30 minutes	31 to 45 minutes	46 minutes to 1 hour	1 hour 1 minute to 1 hour 30 minutes	1 hour 31 minutes to 2 hours	Over 2 hours
Mode 1	O	O	O	O	O	O	O
Mode 2	O	O	O	O	O	O	O
Mode 3	O	O	O	O	O	O	O

75. Commute cost *

Total commute cost from your condominium to work place or school (one way)
Mark only one oval per row.

	Less than 10 Php	10 to 20 Php	21 to 30 Php	31 to 40 Php	41 to 50 Php	51 to 60 Php	71 to 80 Php	81 to 90 Php	91 to 100 Php	Over 100 Php
Mode 1	O	O	O	O	O	O	O	O	O	O
Mode 2	O	O	O	O	O	O	O	O	O	O
Mode 3	O	O	O	O	O	O	O	O	O	O

76. Are your trips making the same in both directions? *

Using the same modes of transport for going to work or school and back home
Mark only one oval.

O Yes
O No

Public Transportation Commuters

Skip to question 89.

77. Main modes of transport *

Please do not repeat the choices
Mark only one oval per row.

	Rail Transit (LRT or MRT)	Air-conditioned Bus	Non-air-conditioned Bus	Jeepney	FX	Taxi
Mode 1	O	O	O	O	O	O
Mode 2	O	O	O	O	O	O
Mode 3	O	O	O	O	O	O
Mode 4	O	O	O	O	O	O

78. Commute time *

Total time from your condominium to work place or school (one way) on average
Mark only one oval per row.

	Less than 15 minutes	15 to 30 minutes	31 to 45 minutes	46 minutes to 1 hour	1 hour 1 minute to 1 hour 30 minutes	1 hour 31 minutes to 2 hours	Over 2 hours
Mode 1	O	O	O	O	O	O	O
Mode 2	O	O	O	O	O	O	O
Mode 3	O	O	O	O	O	O	O
Mode 4	O	O	O	O	O	O	O

79. Commute cost *

Total commute cost from your condominium to work place or school (one way)
Mark only one oval per row.

	Less than 10 Php	10 to 20 Php	21 to 30 Php	31 to 40 Php	41 to 50 Php	51 to 60 Php	71 to 80 Php	81 to 90 Php	91 to 100 Php	Over 100 Php
Mode 1	O	O	O	O	O	O	O	O	O	O
Mode 2	O	O	O	O	O	O	O	O	O	O
Mode 3	O	O	O	O	O	O	O	O	O	O
Mode 4	O	O	O	O	O	O	O	O	O	O

80. Are your trips making the same in both directions? *

Using the same modes of transport for going to work or school and back home
Mark only one oval.

- O Yes
- O No

Public Transportation Commuters

Skip to question 89.

81. Main modes of transport *

Please do not repeat the choices
Mark only one oval per row.

	Rail Transit (LRT or MRT)	Air-conditioned Bus	Non-air-conditioned Bus	Jeepney	FX	Taxi
Mode 1	O	O	O	O	O	O
Mode 2	O	O	O	O	O	O
Mode 3	O	O	O	O	O	O
Mode 4	O	O	O	O	O	O
Mode 5	O	O	O	O	O	O

82. For more than 5 main modes of transport

Please write the main modes of transport. (E.g. Mode 6 - Jeepney, Mode 7 - Taxi) _____

83. Commute time *

Total time from your condominium to work place or school (one way) on average
Mark only one oval per row.

	Less than 15 minutes	15 to 30 minutes	31 to 45 minutes	46 minutes to 1 hour	1 hour 1 minute to 1 hour 30 minutes	1 hour 31 minutes to 2 hours	Over 2 hours
Mode 1	O	O	O	O	O	O	O
Mode 2	O	O	O	O	O	O	O
Mode 3	O	O	O	O	O	O	O
Mode 4	O	O	O	O	O	O	O
Mode 5	O	O	O	O	O	O	O

84. For more than 5 main modes of transport

Please write the commute time of each mode. (E.g. Mode 6 - 15 to 30 minutes, Mode 7 - Over 2 hours) _____

85. Commute cost *

Total commute cost from your condominium to work place or school (one way)
Mark only one oval per row.

	Less than 10 Php	10 to 20 Php	21 to 30 Php	31 to 40 Php	41 to 50 Php	51 to 60 Php	71 to 80 Php	81 to 90 Php	91 to 100 Php	Over 100 Php
Mode 1	O	O	O	O	O	O	O	O	O	O
Mode 2	O	O	O	O	O	O	O	O	O	O
Mode 3	O	O	O	O	O	O	O	O	O	O
Mode 4	O	O	O	O	O	O	O	O	O	O
Mode 5	O	O	O	O	O	O	O	O	O	O

86. For more than 5 main modes of transport
Please write the commute cost of each mode. (E.g. Mode 6 - 10 to 20 Php, Mode 7 - Over 100 Php) _____

87. Are your trips making the same in both directions? *
Using the same modes of transport for going to work or school and back home
Mark only one oval.

- ○ Yes
- ○ No

Walkers and Bicycle Commuters

Skip to question 89.

88. Main mode(s) of transport *
Check all that you use regularly
Check all that apply.

- ☐ Bicycle
- ☐ Walk

Access and Egress Trip

Definition:
Access Trip is the trip you are making BEFORE your main mode of transport. Egress Trip is the trip you are making AFTER your main mode of transport.

Skip to question 101.

89. Access trip *
What mode do you use before your main mode of transport?
Mark only one oval.

- ○ Car (drop off by friends or family)
- ○ Tricycle
- ○ Motorcycle
- ○ Pedicab
- ○ Bicycle
- ○ Walk
- ○ Other: _____

90. Access time *
Mark only one oval.

- ○ None
- ○ Less than 1 minute
- ○ 1 to 5 minutes
- ○ 6 to 10 minutes
- ○ 11 to 15 minutes
- ○ 16 to 20 minutes
- ○ 21 to 25 minutes
- ○ 26 to 30 minutes
- ○ Over 30 minutes

91. Access cost *
Mark only one oval.

- ○ None
- ○ Less than 10 Php
- ○ 10 to 20 Php
- ○ 21 to 30 Php
- ○ 31 to 40 Php
- ○ 41 to 50 Php
- ○ 51 to 60 Php
- ○ 61 to 70 Php
- ○ 71 to 80 Php
- ○ 81 to 90 Php
- ○ 91 to 100 Php
- ○ Over 100 Php

92. Egress trip *
What mode do you use after your main mode of public transport?
Mark only one oval.

- ○ Car (pick up by friends or family)
- ○ Tricycle
- ○ Motorcycle
- ○ Pedicab
- ○ Bicycle
- ○ Walk
- ○ Other: _____

93. Egress time *
Mark only one oval.

- ○ None
- ○ Less than 1 minute
- ○ 1 to 5 minutes
- ○ 6 to 10 minutes
- ○ 11 to 15 minutes
- ○ 16 to 20 minutes
- ○ 21 to 25 minutes
- ○ 26 to 30 minutes
- ○ Over 30 minutes

94. Egress cost *
Mark only one oval.

- ○ None
- ○ Less than 10 Php
- ○ 10 to 20 Php
- ○ 21 to 30 Php
- ○ 31 to 40 Php
- ○ 41 to 50 Php
- ○ 51 to 60 Php
- ○ 61 to 70 Php
- ○ 71 to 80 Php
- ○ 81 to 90 Php
- ○ 91 to 100 Php
- ○ Over 100 Php

95. Have you ever driven a car or motorcycle to your work place or school? *
Mark only one oval.

- ○ Yes Skip to question 103.
- ○ No Skip to question 103.

Private Transportation Commuters

96. Commute time *
Total time from your condominium to work place or school (one way) on average
Mark only one oval.

- ○ Less than 15 minutes
- ○ 15 to 30 minutes
- ○ 31 to 45 minutes
- ○ 46 minutes to 1 hour
- ○ 1 hour 1 minute to 1 hour 30 minutes
- ○ 1 hour 31 minutes to 2 hours
- ○ Over 2 hours

97. Fuel cost *
Total fuel cost spent per month
Mark only one oval.

- ○ Less than 2,500 Php
- ○ 2,500 to 5,000 Php
- ○ 5,001 to 10,000 Php
- ○ Over 10,000 Php

98. Toll cost *
Total toll cost spent per month
Mark only one oval.

- ○ None
- ○ Less than 2,500 Php
- ○ 2,500 to 5,000 Php
- ○ Over 5,000 Php

99. Parking cost *
Total parking cost spent per month
Mark only one oval.

- ○ None
- ○ Less than 1,000 Php
- ○ 1,000 to 2,000 Php
- ○ Over 2,000 Php

100. Installment payment *
Installment payment you make for your vehicle per month
Mark only one oval.

- ○ None
- ○ Less than 10,000 Php
- ○ 10,000 to 20,000 Php
- ○ Over 20,000 Php

Walker and Bicycle Commuters

Skip to question 103.

101. Commute time *
Total time from your condominium to work place or school (one way) on average
Mark only one oval.

- ○ Less than 1 minute
- ○ 1 to 5 minutes
- ○ 6 to 10 minutes
- ○ 11 to 20 minutes
- ○ 21 to 25 minutes
- ○ 26 to 30 minutes
- ○ Over 30 minutes

102. Commute distance *
Approximate distance from your condominium to work place or school
Mark only one oval.

- ○ Less than 50 meters
- ○ 50 to 100 meters
- ○ 101 to 200 meters
- ○ 201 to 300 meters
- ○ 301 to 400 meters
- ○ 401 to 500 meters
- ○ Over 500 meters

Alternative Mode of Transportation

Definition: Alternative modes of transport are those vehicles used by a commuter if the main mode is not available.

Skip to question 103.

103. Alternative mode of commute to work place or school in current residence location *

PLEASE CHOOSE THE MODE THAT IS DIFFERENT FROM YOUR MAIN MODE OF TRANSPORT
Mark only one oval.

- ○ Rail Transit
- ○ Air-conditioned Bus
- ○ Non-air-conditioned Bus
- ○ Jeepney
- ○ FX
- ○ Taxi
- ○ Car (self-driven)
- ○ Car (share-a-ride)
- ○ Motorcycle (self-driven)
- ○ Motorcycle (share-a-ride)
- ○ Tricycle
- ○ Pedicab
- ○ Bicycle
- ○ Walk
- ○ None

104. Commute time *

Total time from your condominium to work place or school (one way) on average
Mark only one oval.

- ○ Less than 15 minutes
- ○ 15 to 30 minutes
- ○ 31 to 45 minutes
- ○ 46 minutes to 1 hour
- ○ 1 hour 1 minute to 1 hour 30 minutes
- ○ 1 hour 31 minutes to 2 hours
- ○ Over 2 hours

105. Commute cost *
Total commute cost from your condominium to work place or school (one way)
Mark only one oval.

- ○ Less than 10 Php
- ○ 10 to 20 Php
- ○ 21 to 30 Php
- ○ 31 to 40 Php
- ○ 41 to 50 Php
- ○ 51 to 60 Php
- ○ 61 to 70 Php
- ○ 71 to 80 Php
- ○ 81 to 90 Php
- ○ 91 to 100 Php
- ○ Over 100 Php

Contact Information

Your name and cellular phone number will be useful for verifying the information that you have provided. We assure you that your personal information will be kept confidential and used for academic purpose only. Please answer 'Yes' to provide your contact information. However, if you choose not to do so, you can skip the next step by choosing ‘No’.

Skip to question 106.

106. Do you agree to provide your contact information? *
Mark only one oval.

- ○ Yes Skip to question 107.
- ○ No Skip to "Thank you very much for your cooperation!."

Contact Information

107. Given name *

108. Family name *

109. Middle initial

110. Cellular phone number *

111. Email address *

Thank you very much for your cooperation!

If you have any questions, please contact the following:

Engr. Jamiel Jayme (jamieljayme@gmail.com)
Dr. Saksith Chalermpong (saksith.c@gmail.com)

For Dr. Alex Fillone's Students

Please provide the full name of the student who's responsible for your survey response

112. **Given Name**

113. **Family Name**

Appendix A-3: General Questionnaire Survey

Condominium Residents Travel Survey

Good day! This survey is about the travel behavior of condominium residents and will be useful for the improvement of transportation and land use planning in the future. Respondent's personal information will be kept confidential and will be used for academic purpose only.

Thank you very much for your cooperation.

Please put a check (√) on your answer

Household Information

1. Gender:
   ☐ Male ☐ Female
2. Age: _____ (Specify your age)
3. Marital Status:
   ☐ Single ☐ Married ☐ Others
4. Occupation:
   ☐ Student
   ☐ Employee
   ☐ Business Owner
   ☐ Independent Professional
   ☐ Others
5. Monthly Income: (Local Currency)
   ☐ Less than 5,000
   ☐ 5,000 to 15,000
   ☐ 15,001 to 25,000
   ☐ 25,001 to 35,000
   ☐ 35,001 to 45,000
   ☐ 45,001 to 55,000
   ☐ Over 55,000
6. Household Members: _____
   Number of all members living together
7. Household Income: (Local Currency)
   ☐ Less than 25,000
   ☐ 25,000 to 45,000
   ☐ 45,001 to 65,000
   ☐ 65,001 to 85,000
   ☐ 85,001 to 100,000
   ☐ Over 100,000
8. Number of Car Owned: _____
9. Number of Motorcycles Owned: _____
10. Are you the head of your household?
    ☐ Yes ☐ No
11. Are you involved in making decision about your current residence?
    ☐ Yes ☐ No

Residence Information

12. Condominium Name:

_____
State the full name of your condominium

13. Condominium Address:

_____
State the full address of your condominium

14. Condominium Property Type:
    ☐ Owned ☐ Rent
15. How long have you stayed in your current residence?
    ☐ Less than 1 year
    ☐ 1 to 3 years
    ☐ 3 to 5 years
    ☐ Over 5 years
16. Is your condominium near an urban rail transit station?
    ☐ Yes ☐ No

Workplace Information

17. Workplace/School Name

_____
State the full name of your workplace/school

18. Workplace/School Address:

_____
State the full address of your workplace/school

19. How long have you worked/studied in your workplace/school?
    ☐ Less than 1 year
    ☐ 1 to 3 years
    ☐ 3 to 5 years
    ☐ Over 5 years
20. Is your workplace/school near an urban rail transit station?
    ☐ Yes ☐ No

Urban Rail Transit Information

21. What is the nearest urban rail transit line/station to your condominium?

_____

22. Distance of the nearest urban rail transit line/station to your condominium:
    _____(In meters)
23. What is the nearest urban rail transit line/station to your workplace/school?

_____

24. Distance of the nearest urban rail transit line/station to your workplace/school:
    _____(In meters)

Commute Trip

Answer one type of transport only.

☐ **Main Mode by Public Transport**

25. What is your main mode of transport?
    ☐ Bus ☐ Rail Transit ☐ Taxi
    ☐ Bicycle ☐ Walk ☐ Others: _____
26. Commute Time:
    ☐ Less than 30 mins.
    ☐ 30 mins. to 1 hr.
    ☐ 1 hr. 1 min. to 1 hr. 30 mins.
    ☐1 hr. 31 mins. to 2 hrs
    ☐ Over 2 hrs.
    Specific time: _____

27. Commute Cost: (Local Currency)
    Specific amount: _____
28. What mode do you use to access your main mode? (Ex. Walk, Drop-off)
    Specify: _____
29. Access Trip Commute Time:
    ☐ Less than 1 min.
    ☐ 1 to 10 mins.
    ☐ 11 to 20 mins.
    ☐ 20 to 30 mins
    ☐ Over 30 mins.
    Specific time: _____
30. Access Trip Commute Cost: (Local Currency)
    Specific amount: _____
31. Are your trips the same in both directions?
    ☐ Yes ☐ No

☐ **Main Mode by Private Transport**

32. What is your main mode of transport?
    ☐ Car (Self-driven)
    ☐ Car (Share-a-ride) ☐ Motorcycle
33. Commute Time:
    ☐ Less than 30 mins.
    ☐ 30 mins. to 1 hr.
    ☐ 1 hr. 1 min. to 1 hr. 30 mins.
    ☐1 hr. 31 mins. to 2 hrs.
    ☐ Over 2 hrs.
    Specific time: ____
34. Fuel Cost Monthly: (Local Currency)
    ☐ Less than 2,500
    ☐ 2,500 to 5,000
    ☐ 5,001 to 10,000
    ☐ Over 10,000
35. Toll Cost Monthly: (Local Currency)
    ☐ None
    ☐ Less than 2,500
    ☐ 2,500 to 5,000
    ☐ Over 5,000
36. Parking Cost Monthly: (Local Currency)
    ☐ None
    ☐ Less than 1,000
    ☐ 1,000 to 2,000
    ☐ Over 2,000
37. Installment Payment: (Local Currency)
    ☐ None
    ☐ Less than 10,000
    ☐ 10,000 to 20,000
    ☐ Over 20,000

Alternative Mode of Transport

38. What is your alternative mode of transport?
    ☐ Car ☐ Bus ☐ Rail Transit ☐ Taxi
    ☐ Motorcycle ☐ Bicycle ☐ Walk
    ☐ Others: _____
39. Commute Time:
    ☐ Less than 30 mins.
    ☐ 31 mins. to 1 hr.
    ☐ 1 hr. 1 min. to 1 hr. 30 mins.
    ☐1 hr. 31 mins. to 2 hrs
    ☐ Over 2 hrs.
    Specific time: _____
40. Commute Cost: (Local Currency)
    Specific amount: _____

Contact Information

Name: _____
Contact Number: _____
Email:

Thank you for your cooperation!

For inquiries, please contact the following:
Engr. Jamiel Jayme (jamieljayme@gmail.com)
Dr. Saksith Chalermpong (saksith.c@gmail.com)

Appendix B-1: Condominium Database

Name	Location	Floor Levels	No. of Residential Units	Turnover Year
5th Avenue Place	Fort Bonifacio Global City, Taguig City	43	328	2008
8 Forbes Town Road Golf View Residences	McKinley Hill Fort Bonifacio	53	611	2013
Adriatico Grand Residences	Adriatico St. corner Sta. Monica and Romero Salas St. Malate Manila	30	-	2008
Adriatico Grand Residences	Adriatico St. corner Sta. Monica and Romero Salas St. Malate Manila	30	-	2008
Aqua Private Residences	Across Rockwell Center	46-50	560-630	2015
Avida Towers Makati West	San Antonio Village Makati	26	480	2011
Avida Towers New Manila	Quezon City	34	330	2008
Avida Towers San Lazaro	Tayuman, Manila	56	782	2008
Avida Towers San Lazaro	Becerra Manila	26	450	2008
Bali Oasis	Santolan, Pasig City	5	630	2009
Bay Gardens	Metropolitan Park, Roxas Blvd.	18&20	220	2011& 2013
Baywatch Tower	Malate Manila	29	-	-
Bell Mansion	62 Road 13 Quezon City	17	165	2012
Bellagio III	Burgos Circle, Taguig City, Metro Manila	38	324	2010
Belton Place	Pasong Tamo corner Maluggay and Yakal St.	40	630	2011
Berkeley Residences	Katipunan Avenue, Loyola Heights, Quezon City	35	1058	2010
Blue Residences	Katipunan Ave., Quezon City	41	1591	2013
Bonifacio Residences	612 Boni Ave. corner Sikap St. Mandaluyong	10	-	2008
Burgundy Transpacific Place	#2444A Taft Avenue Malate Manila	30	-	-
California Garden Square	California Garden Square D.M. Guevara St. (formerly Libertad St.) Mandaluyong Cit	22	-	2003
Celadon Park Towers	Felix Huertas St., Sta. Cruz, Manila	27	407	2011& 2014
City Residences	420 P. Martinez St. Bagong Silang, Mandaluyong City	10	322	-
Cityland Grand Emerald Tower	F. Ortigas corner Ruby and Garnet St., Ortigas Center, Pasig City	39	840	2006
Cityland Vito Cruz Towers	720 Pablo Ocampo St., Malate, Manila	32&34	-	2000& 2002
Cityplace Residence	Calle Felipe 2 Street cor. General La Chambre Street, Binondo, Manila	37&39	556	2013
Dakota Residences	555 Gen. Malvar Cor. Adriatico St. Malate, Manila	10	-	2005
EDSA Grand Residences	EDSA corner Corregidor St., Quezon City	30	300	2010
EGI Taft Tower	2339 Taft Avenue, Malate Manila	29	-	2004

Name	Location	Floor Levels	No. of Residential Units	Turnover Year
Espana Grand Residences	Sampaloc Manila	28	-	-
Eton Baypark	Roxas Boulevard Ermita Manila	25	240	2010
Eton Parkview Greenbelt	Gamboa St. Greenbelt Makati	34	236	2011
Eton Residences Greenbelt	Legaspi St. Legaspi Village Makati	39	302	2011
Eton Tower Makati	Corner of Dela Rosa and V.A. Rufino St.	40	600	2011
Gateway Garden Heights	EDSA corner Pioneer St. Mandaluyong	33	980	2009
Gateway Garden Ridge	EDSA corner Pioneer St. Mandaluyong	30	500	2009
Greenbelt Chancellor	116 Rada St. bordering Castro St. Legaspi Village Makati	35	407	2010
Ivy Hill	Dagohoy corner Taft Ave. Malate Manila	15	84	2010
Kingswood Square	Don Chino Roces St. Makati	32	400	2009
Kroma Tower Makati	Dela Rosa St. Legaspi Village Makati	46	821	2017
Lancaster Suites 2	Shaw Blvd. corner Samat St. Mandaluyong	-	-	2010
Lee Gardens	Lee St. corner Shaw Blvd. Mandaluyong	23&33	200&480	2006
Lee Gardens	Lee St. corner Shaw Blvd. Mandaluyong	23&33	200&480	2006
Makati Executive Tower 1	Dela Rosa St. corner Medina St. Makati	32	-	-
Makati Executive Tower 2	Dela Rosa St. corner Medina St. Makati	35	-	2007
Makati Executive Tower 3	Cityland Square Sen. Gil Puyat Ave. Brgy. Pio del Pilar	38	-	-
Makati Executive Tower 4	Cityland Square Sen. Gil Puyat Ave. corner P. Medina St. Brgy. Pio del Pilar	29	-	-
Malate Bayview Mansion	Malate Manila	38	660	2010
Malate Crown Plaza	Adriatico St. corner San Andres St. Malate Manila	17	221	2005
Mayfair Tower	Ermita Manila	33	171	2009
Milano Residences By Versace	Kalayaan Ave. corner Makati Ave. Makati	53	340	2015
One Archers Place	2311 Taft Ave. Ermita Manila	31	696	2010
One Central	Sen. Gil Puyat Ave. corner Geronimo and H.V. Dela Costa St.	50&42	708	2012
One Gateway Place	EDSA corner Pioneer St. Mandaluyong	28	-	2008
One Rockwell	Rockwell Center Rockwell Drive corner Estrella St. Makati	39	-	2010
One Shangri-La Place	Ortigas Center Mandaluyong	60	663	2015
Oriental Gardens ORCHID, LOTUS, and LILAC Towers	Don Chino Roces Ave. corner Export Bank Drive Makati	30,30&34	625	-
Pioneer Pointe	Pioneer St. Mandaluyong	29	175	2007
Rada Regency	Rada St. corner Dela Rosa St. Legaspi Village Makati	25	-	2008
Robinsons Place Residences	Padre Faura St. Ermita Manila	38	-	-
Robinsons Place Residences	Padre Faura St. Ermita Manila	38	-	-
Soho Central	Shaw Blvd. near EDSA Central Mall	41	-	2008

Name	Location	Floor Levels	No. of Residential Units	Turnover Year
Strata Gold Condominium	Ongpin St. Binondo Manila	28	252	2011
Sycamore Tower Dansalan Gardens	Corner of Boni Ave. and M. Vicente St. Bgy. Malamig Mandaluyong	31	336	2008
The Columns Ayala Avenue	Ayala Ave. corner Sen. Gil Puyat Ave. Makati	40	400	2008
The Columns Legaspi Village	Arnaiz Ave. corner Amorsolo St.Makati	40	400	2011
The Columns Legaspi Village	Arnaiz Ave. corner Amorsolo St.Makati	40	400	2011
The Gramercy	Kalayaan Ave. Makati	73	-	-
The Knightsbridge Residences	Kalayaan Ave. Makati	60	-	2012
The St. Francis Shangri-La Place	St. Francis Ave. corner Shangri-La Plaza Internal Road Mandaluyong	54	-	2009
Tivoli Gardens Residences	Mandaluyong	24-42	380-740	2010-2013
W.H. Taft Residences	Malate Manila	30	400	2010
Xanland Condominium	Katipunan, Quezon City	28	-	2006
Zen Towers	1111 Natividad Lopez St.	30	300	2008

VITA

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Philippine Civil Engineering Board Exam Passer, 2011.

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Publications

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