Survey Method Creation of Stated Preference Method to Model Modal Shift to MRT Line 7

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Abstract: The examination of passenger choice is critical in evaluating modal shift. One of the best method of predicting mode choice is the stated preference method (SPM). This study centers on the creation of a SPM survey that will predict passenger choice upon adding MRT Line 7 mode alternative in Metro Manila. Among the alternatives that have been studied along the MRT Line 7 are the private car, bus, jeepney, van, motorcycle, taxi, and ride-hailing transport service (e.g. Grab) with cost and time as their main attributes with the addition of comfort or security for some of the modes. The final design result of the study was a fractional factorial orthogonally designed survey that could be used predict mode choice.

Keywords: MRT, Stated Preference Method, Mode Choice, Modal Shift, Prediction Model

1. INTRODUCTION

The traffic situation in the Philippines had reached its limit capacity particularly the National Capital Region and other highly urbanized areas. The main reason for the traffic is the constant increase in private car ownership. According to a Japan International Cooperation (JICA) study in 2012, there had been an accumulated increase of 41% of private car trips in Metro Manila from 1996, with an average annual average of 2.2% increase. In consonance, another reason the study observed was a drop in jeepney occupancy from 15.1 to 10, in bus occupancy from 46.5 to 35.3, and in private vehicles occupancy from 2.5 to 1.7 (JICA and NEDA, 2014). The Philippine government had been trying different efforts to solve this traffic problem such as implementation of new traffic schemes and policy for a short-term solution and construction of new BRT and MRT infrastructures for a long-term solution. In 2016, the Philippine government reported that it will use a budget of 1 trillion pesos to be used for 14 train projects all over the country as an answer for the on-going crisis (Vera and Camus, 2016). For this traffic solution to be effective, a modal shift of both private and public transportation passengers to the new transit modes must be stimulated or all this investment will have gone to waste.

This study focused on the mode choice of MRT Line 7 (an ongoing rail project by the Philippine government that started to be constructed in 2017). The study created survey forms using the SPM that will properly assess passenger behavior and choice. Previous studies using the SPM in the Philippines only tackled at the maximum of three mode choices. This study will show how to apply the SPM that deals with a wide range of public mode choices common in the Philippines. The results and methods of this study may be used as a basis for developing and improving both new and old public modes of transport such as BRT and MRT.

The research problem is "How will the new MRT Line 7 affect passenger mode choice?" The objectives of the study are to provide a standard SPM survey procedure that manages wide variety modes choices and to determine the relevant factors for each mode to stimulate a modal shift to MRT Line 7. Figure 1 shows the study area MRT Line 7, an on-going-construction rail project located within Metro Manila.

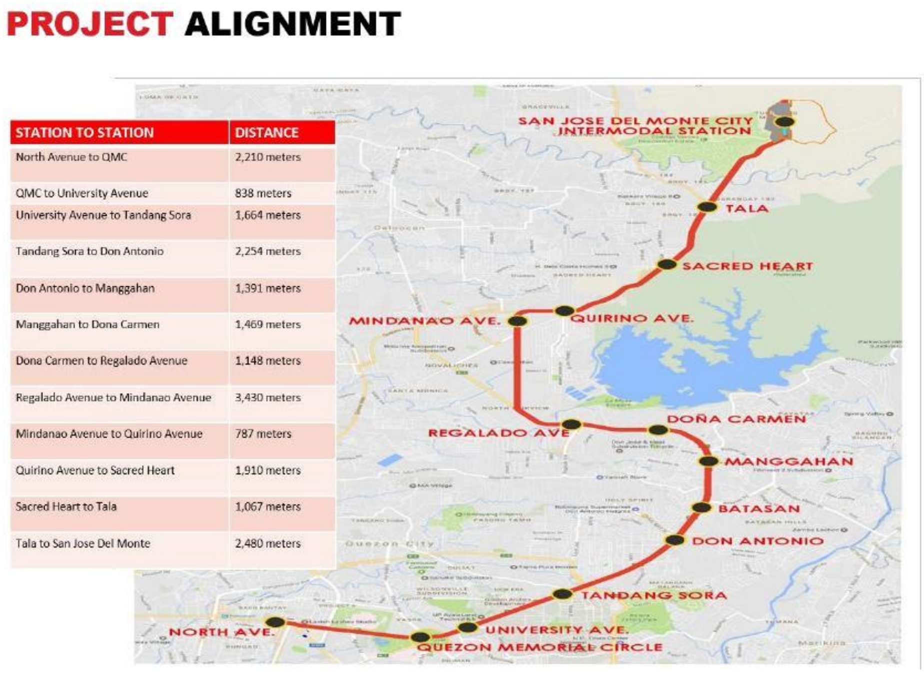

Figure 1. Location of the Study Area
Source:DoTR

2. REVIEW OF RELATED LITERATURE

2.1 Factors of Mode Choice

A study on mode choice by Nurdden *et al.* (2007) found that age, gender, car ownership, travel time, travel cost household size and income are the important factors that affect travel mode choice in Malaysia. Moreover, reduction in travel time and fare and more accessibility are the main motivation to drive a modal change from private to public transportation.

Another study by Kamba et al. (2007) found that factors that may encourage car use are efficiency, comfort, safety, and accessibility in Malaysia. The factors that discouraged a shift to public transport are risk, congestion, cost, and parking maneuver. The factors the encouraged a shift to public transport are efficiency, low-cost, not crowded, clean, and accessibility.

The study by Derek Halden Consultancy (2003) suggested that mode choice factors can be classified into three branches which are the hard, soft, and complementary factors. The hard factors are the most significant attribute of the direct travel. The hard factors include time, cost, availability, and reliability. The soft factors are the attributes of the travel experience. The soft factors include comfort, convenience, safety, control, effort, privacy, and so forth. Lastly, the complementary factors are the attributes of the travel context. The complementary factors include social, weather, carrying loads, children, internet connection, health or disability, and so forth.

2.2 Preference Methods

There are two preference methods namely the revealed and stated preference method. The revealed preference method is used for representing the current market equilibrium and comparing existing alternatives; it yields one observation per respondent. The stated preference method is used for representing hypothetical scenarios and comparing both existing and proposed alternatives; it yields multiple observations per respondent.

2.3 Stated Preference Method

The SPM is a technique of evaluating a set of different factors that constitute a function. It uses a customized survey that will examine three or more factors in a question. The result of this survey method may be in the form of a linear or higher-termed function that will represent the interrelationship of the different factors of each mode (Kroes and Sheldon, 1988).

The four types of choice modeling design are the discrete choice, contingent ranking, contingent rating, and paired comparisons (Accent, 2010).

In discrete choice design, the respondent is to choose the preferred alternative among two or more alternatives with different levels of attributes. This design may include a base line alternative scenario or an option not to select an alternative. The data collected from the discrete choice is only about the selected alternative and does not consider alternatives that are not chosen, consequently it is weakly ordered. Additionally, the discrete choice design is in line with the theory of rational, probabilistic choice.

In the contingent ranking design, the respondent is to rank all the alternatives from most to least preferred. This design may include an option not to rank an alternative after the top choice. The data collected from contingent ranking is strongly ordered due to the ranking of most of the alternatives

In the contingent rating design, the respondent is to rate an alternative with the given attributes one at a time. This design may use a numeric scale of one to ten or a semantic scale. The data collected from contingent rating is completely indifferent between alternatives due to not comparing alternatives directly.

Lastly the pairwise comparison design, the respondent is to choose the degree of preference for compared alternative. This design is a combination of discrete choice and rating and is limited to comparing two alternatives.

Among these choice modeling designs, the best and least complex for the respondent is the discrete choice. This is the only method that replicates the real life where a person is to choose one alternative among the given alternative.

2.3.1 Methods of Analysis of the Stated Preference Method

The analytical methods the maybe used for SPM design are the graphical method, non-metric scaling, regression, and logit and probit. The tested to be the best of the methods is logit and probit (Sanko, 2001).

2.3.2 Methods of Lowering the Scenarios

Methods of lower the number of scenarios from the full factorial design of SPM are fractional factorial design, removing trivial games, contextual constraint, block design, common attribute, base alternative, showing design differently, and random selection (Sanko, 2001).

Factional factorial design is selecting some scenarios from the full factorial design. Removing trivial games is removing scenarios that are assumed dominant then inserting the removed scenarios during data processing. Contextual constraint is removing scenarios that are deemed unrealistic or improbable in a realistic situation. Block design is dividing the scenarios into group which results to different sets of scenarios for data collecting. Common attribute is making an attribute constant and assuming it is a common attribute, therefor reducing the design size. Base alternative is having a baseline alternative which all the other alternatives will be reference from. Showing design differently is applying the foldover sequential choice set method randomly. Random selection is randomly choosing the scenarios.

3. STUDY FLOW

There will be four main stages for this study as shown in Figure 2. Stage 1 is the supplementary data collection which has four parts namely, travel time and delay survey, MRT Line 7 specifications data, MMUTIS Update and Enhancement Project (MUCEP) urban database, and revealed preference survey. Stage 2 is the Survey creation that unifies all the data from Stage 1. Stage 3 is the survey conduction. Stage 4 is the model creation.

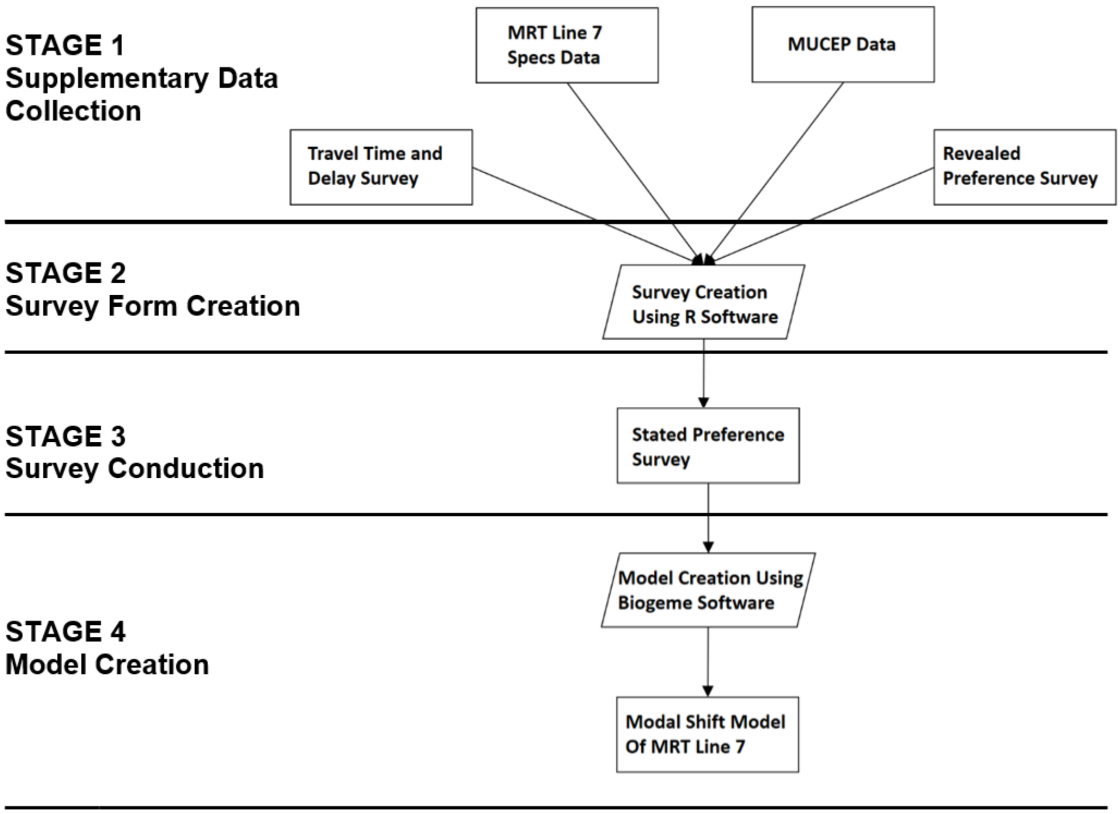

Figure 2. Study Flow

4. METHODOLOGY

4.1 Stated Preference Survey

The SPM is a technique of evaluating a set of different attributes(factors) that constitute a function of an alternative(mode). It uses a customized survey that will examine three or more attributes for each alternative in a question with a realistic scenario. Table 1 shows an example of a question with cost of travel, time of travel, and comfort level as variables.

Table 1. Sample Survey Question

	Car	Bus	Jeep	MRT
Cost of Travel	Low	Medium	High	Medium
Time of Travel	High	Medium	High	Low
Comfort Level	Medium	Low	Low	High

4.2 Utility and Prediction Model

Utility is used to describe user satisfaction. Utils is the numerical representation that represents utility. Utils by itself can not represent user satisfaction, it can only be used upon comparison of other alternative utils. The stated preference data will be used to get the utility functions of the different alternatives. The deterministic utility function V_i which excludes the unobservable variables of utility used for this study is given by (Hensher, 2005):

$$V_i = \beta_i + \beta_{1i} \cdot X_{1i} + \beta_{2i} \cdot X_{2i} + \cdots + \beta_{Ki} \cdot X_{Ki} \quad (1)$$

where,

V_i : marginal utility of the i alternative,
β_i : the alternative specific constant- all unobserved sources of utility of the i alternative,
X_{Ki} : an attribute of the i alternative that was observed in the experiment, and
β_{Ki} : weight of attribute X_{Ki} of the i alternative.

With probability function of these utility is given by:

$$P_i = \frac{e^{V_i}}{e^{V_i} + e^{V_j} + \cdots + e^{V_{N-1}} + e^{V_N}} \quad (2)$$

where,

P_i : probability of people choosing the i alternative,
V_i : marginal utility of the i alternative, and
N : the number of alternatives.

These deterministic utility functions are used for multinomial logit modeling (MNL). A more complex form of MNL is the nested logit modeling to be used as a solution to the IID condition (independently and identically distributed) of MNL models (Hensher *et al.*, 2005). New variables such as branch utility, scale factor, scale parameter, and index of expected maximum utility are introduced. For this particular study, the nested logit models will be limited to two levels. Figure 3 below shows model 1 as an example of a 2-level model. In this example, there are two branches namely private and public mode. Under the private mode are car and motorcycle alternatives and under the public mode are bus, jeepney, MRT, and van transport (e.g. UV Express).

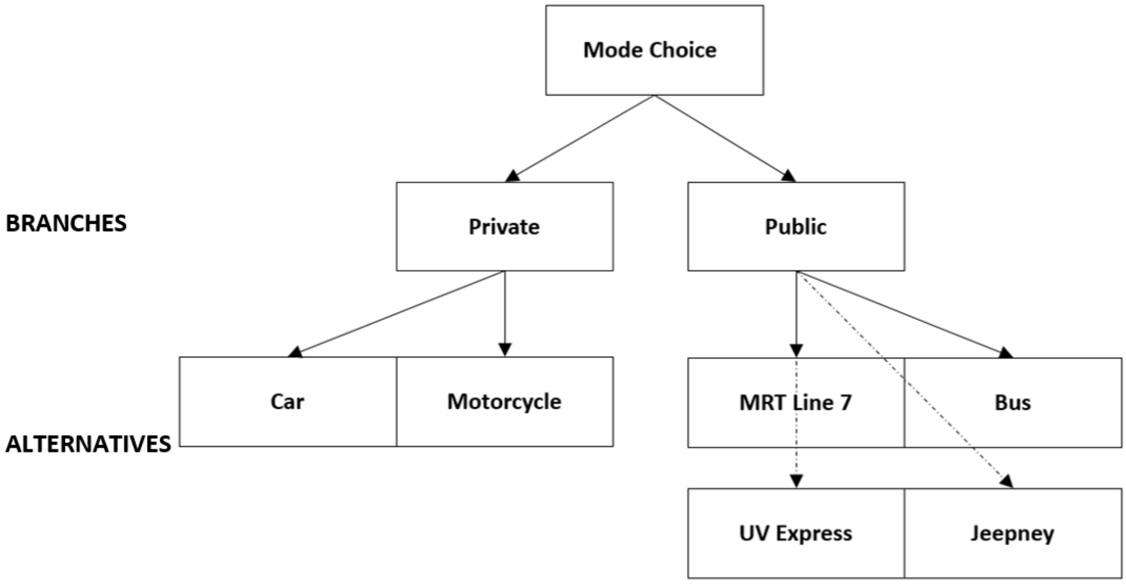

Figure 3. Example of a Nested Logit Model

According to Hensher *et al.* (2005), the branch utilities for nested logit model (NL) is given by:

$$V_J = \frac{\lambda_J \cdot IV_J}{\mu_J} \tag{3}$$

where,

V_i : marginal utility of the J branch,
λ_J : scale factor of the J branch,
IV_J : index of expected maximum utility of the j branch,
μ_J : scale parameter of the J branch which is normalized to 1.0.

The index of expected maximum utility is computed by:

$$IV_J = \ln(e^{\mu_J \cdot v_i} + e^{\mu_J \cdot v_j} + \cdots + e^{\mu_J \cdot v_{n-1}} + e^{\mu_J \cdot v_n}) \tag{4}$$

where,

IV_J : index of expected maximum utility of the J branch,
v_i : marginal utility of the i alternative,
μ_J : scale parameter of the J branch which is normalized to 1.0.

For probability function, the nested logit model has 3 types of probability: the branch probability, the conditional probability, and the alternative probability. The branch probability is the probability of choosing a branch. The conditional probability is the probability of choosing an alternative after already choosing a branch. The alternative probability is the probability of choosing an alternative. Below are the equations to calculate these probabilities. For the branch probability:

$$P_J = \frac{e^{V_J}}{e^{V_J}+e^{V_K}+ \cdots +e^{V_{N-1}}+e^{V_N}} \quad (5)$$

where,

V_i : marginal utility of the i alternative,
P_J : probability of choosing the J branch,
V_J : marginal utility of the J branch,
N : the number of branches.

For the conditional probability of an alternative:

$$P_{(i|J)} = \frac{e^{v_i}}{e^{v_i}+e^{v_j}+ \cdots +e^{v_{n-1}}+e^{v_n}} \quad (6)$$

where,

$P_{(i|J)}$: probability of people choosing the i alternative given J branch was chosen,
v_i : marginal utility of the i alternative,
n : the number of alternatives.

For the probability of an alternative:

$$P_i = P_{(i|J)} \cdot P_J \quad (7)$$

where,

P_i : probability of people choosing the i alternative,
$P_{(i|J)}$: probability of people choosing the i alternative given J branch was chosen,
P_J : probability of choosing the J branch.

4.3 Design Process of Choice Survey Creation

The design process of SPM is discussed in studies by Louviere *et al.* (2000), Sanko (2001), Hensher *et al.* (2005), Accent (2010), among others. Among these, the comprehensive survey design process suggested by Hensher *et al.* (2005) will be followed in this study to creating the most efficient design given budget and time constraints.

4.3.1 Problem Refinement

The first step of SPM survey creation is the problem refinement. This step involves breaking down the main research problem into more specific questions that will help eliminate any ambiguity to the study goal. For this study, the problem refinement resulted to the three questions namely:

1) What are the relevant attributes of MRT line 7 that will affect the user's mode choice?
2) What are the relevant attributes of each mode within the MRT Line 7 route and their weights that affects the mode choice of the user?
3) How to create a model that could predict future transport modal shift given the introduction of a new mode or the manipulation of a relevant attribute of a mode?

4.3.2 Stimuli Refinement

After problem refinement, the next step of SPM is the stimuli refinement. This step involves properly selecting the scenario, alternatives, attributes, and level of attribute parameters which are the "stimuli" of the survey. Because it is impossible to completely represent or model all the parameters observed in the real world, parameters are selected within the limit of budget, time, and reality. Additionally, the selected parameters should still sufficiently model the target choice analysis.

The scenario includes the length of the trip and the number of mode transfers. The length of the trip will be average of how long the passenger uses the section in kilometers, while the number of mode transfers is the typical number of transfers from origin to destination.

Alternatives are the different passenger modes available in the route. When there many available modes, the alternatives chosen should be reduced if possible.

Attributes are factors that make people choose an alternative. Cost and time attributes are typical for all modes. Additional attributes such as comfort, safety, environment friendly, accessibility, etc. may be added if deemed necessary. A way to determine additional attributes are through secondary data or, in this case, a survey to assess other relevant attributes.

Level of attribute is chosen within the goals of the study while considering time and budget. Logically, the higher the levels are, the more detailed the results are along with higher cost of implementation. The levels could vary between attributes, but, in this case, the level is made constant for all the parameters due to making an orthogonally designed survey (see 4.3.4 Experiment Design Consideration).

For this study, the hypothetical mode introduced is the MRT Line 7. The current possible transportation alternatives selected are:

1) Private Car
2) Bus
3) Jeepney
4) UV Express
5) Motorcycle
6) Taxi
7) TVNS

The possible attribute selected are:

1) Cost
2) Time
3) Comfort
4) Security
5) Safety
6) Environment-friendliness
7) Cleanliness

The attribute level selected are:

1) Low
2) Medium
3) High

Supplementary data will be used to identify the actual figures for each attribute and attribute level. Supplementary surveys will be necessary if the data needed not available. Among the data and supplementary surveys needed for this study are:

1) MUCEP Data
2) Travel Time and Delay Survey
2) Revealed Preference Survey
4) MRT Line 7 Specifications

4.3.2.1 MUCEP Data

From the MUCEP data, the primary usage of the route is accessed and typical modes is derived. MUCEP data will be used to analyze passenger behavior along the MRT Line 7 route. More importantly, it will be used to assess the origin and destination and typical length of travel for users of that route.

4.3.2.2 Revealed Preference Survey

The revealed preference survey was conducted on the month of February to March 2019 in situ along the stretch of the MRT Line 7. Among the 719 responses, 440 of the responses were deemed complete and usable upon examination after the survey. The descriptive statistics from the revealed preference survey conducted are shown in Table 2.

Table 2. Descriptive Statistics

Gender		
	N	Percentage
Male	236	53.6%
Female	204	46.4%
Monthly Income/Allowance		
	N	Percentage
₱20,832 and below	92	20.9%
₱20,833 to ₱33,332	238	54.1%
₱33,333 to ₱66,666	78	17.7%
₱66,667 to ₱166,666	28	6.4%
₱166,667 to ₱666,666	4	0.9%
₱666,667 and above	0	0.0%
Occupation		
	N	Percentage
Executive	2	0.5%
Professional/ Office	58	13.2%
Laborer	32	7.3%
Government Employee	17	3.9%
Housewife	48	10.9%
Clerical	8	1.8%
Sales and Service	136	30.9%
Farmer/ Fisherman	0	0.0%
Student	109	24.8%
Jobless	24	5.5%

Retired	6	1.4%
Car Owner		
Yes	84	19.1%
No	356	80.9%
Driver's License		
Yes	104	23.6%
No	336	76.4%
Trip purpose		
Work-Home Trips	184	41.8%
School-Home Trips	93	21.1%
Social-Home Trips	78	17.7%
Others	85	19.3%
Trips per Week		
1	94	21.4%
2	55	12.5%
3	24	5.5%
4	25	5.7%
5	164	37.3%
6	63	14.3%
7	14	3.2%
Trips Transfers		
0	41	9.3%
1	79	18.0%
2	195	44.3%
3	79	18.0%
4	39	8.9%
5	5	1.1%
6	2	0.5%

The age distribution and household size distribution are shown in Figures 1 and 2 respectively.

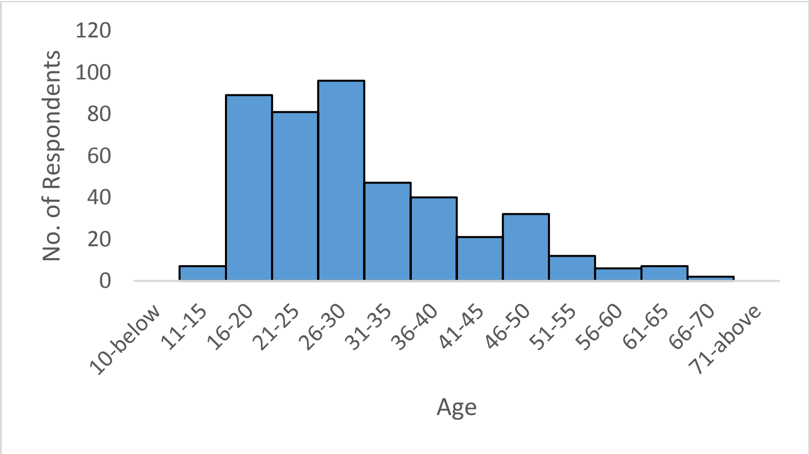

Figure 1. Age Distribution of the Respondents

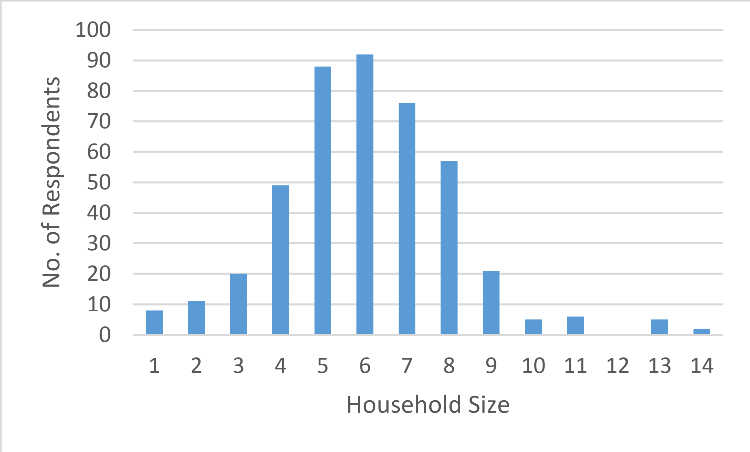

Figure 2. Household Size Distribution of the Respondents

The respondents were asked for their mode choice for four scenarios. The four scenarios in the survey were their first choice of transport along the route, their mode choice if the first choice was unavailable, their mode choice if they were in a rush, and their mode choice if the weather was rainy. Figures 3 to 6 show respondent mode choice for the four scenarios.

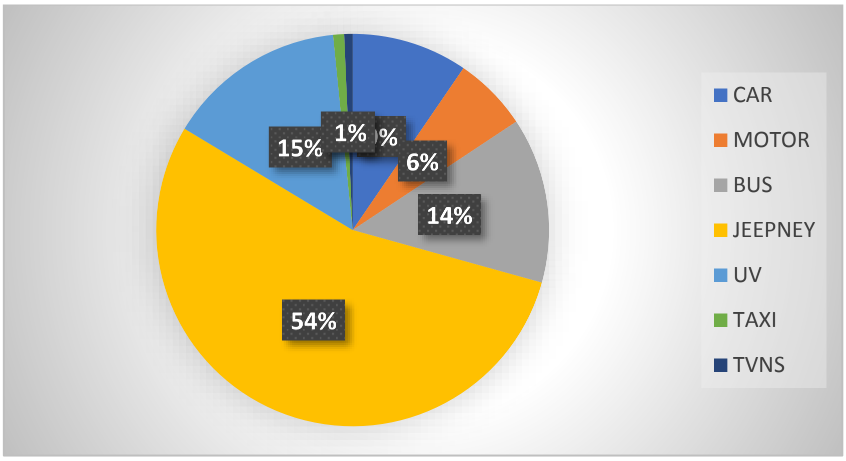

Figure 3. First Choice

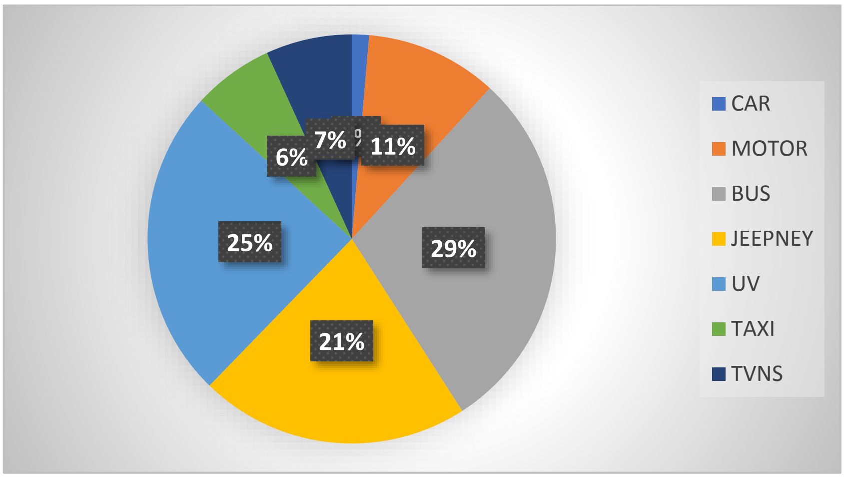

Figure 4. Second Choice

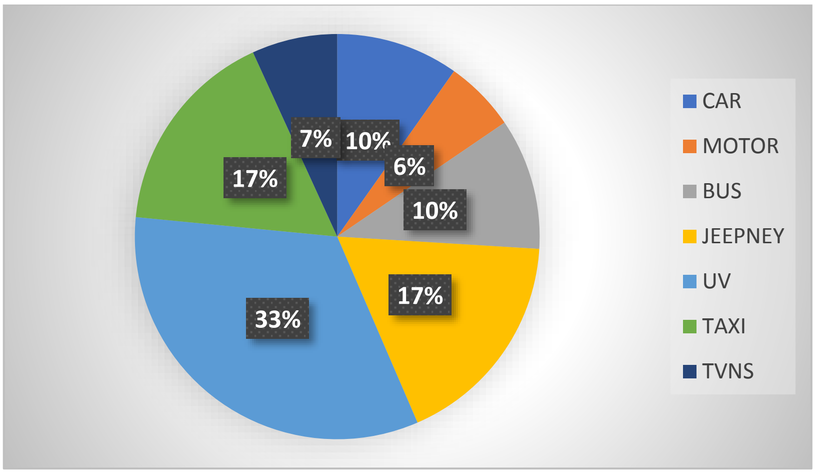

Figure 5. In-a-rush Choice

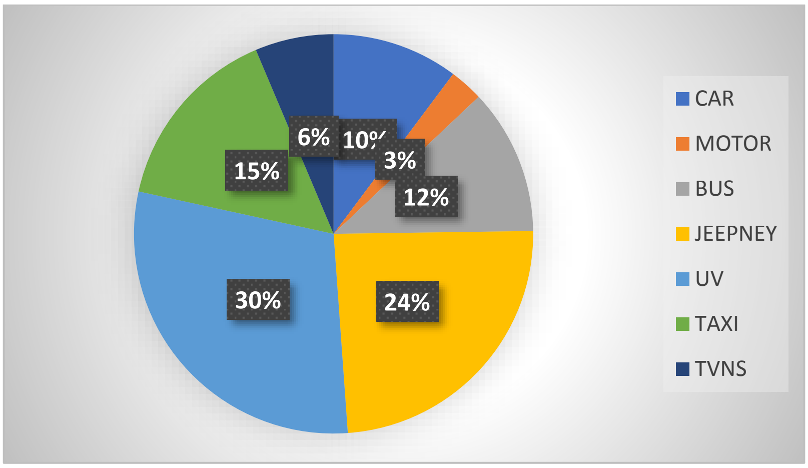

Figure 6. Rainy Weather Choice

The dominant mode choice for first-choice scenario is jeepneys, while for the second-choice scenario is bus. For both in-a-rush and rainy-weather scenario, the dominant mode is utility vans. It was observed that for the car choice most of the respondents that choose car for the first-choice will also chose car for the third and fourth scenario.

The study modeled mode choice using MNL, but it did not yield significant results. This is due to generally the low sample size and the insufficiency of respondents choosing a specific mode of transport. Additionally, the number of parameters modeled was very large.

The study also modeled mode choice using multinomial logistic regression and found four significant models for each scenario. The models were achieved after removing two of least chosen alternatives (accounts for less than 10% of the respondents for most of the scenarios). The results of the multinomial logistic regression are shown in the Appendices.

For the first-choice scenario, car ownership was significant for all the modes. There was a negative correlation number of trip transfers to car mode and UV against other modes, while positive for the bus mode. There was negative correlation for trips per week to the motorcycle mode. At ninety-percent significance, there is a positive correlation of driver's license for the car mode there is negative correlation of the female sex for motorcycle against all the other modes.

For the second-choice scenario, car-ownership, sex, number of trip transfers, and trips per week are significant in most of the modes. For the last two choices, less number of significant factors can be found. Uniquely though, the minutes of travel are significant for the UV and bus mode.

From this revealed preference survey, the study have observed that that the average trip transfer was 2.04. Neglecting similar origin to destination points, the average distance traversed along the MRT Line 7 was 5.997 kilometers. The average unique choice for the four scenarios was 2.41. All these data will be useful for the creation of a SPM survey.

4.3.2.3 Travel Time and Delay Survey

Travel time and delay survey was done to know the average speed and cost of travel using an existing mode. The travel time and delay survey is accomplished manually by the surveyor using the form in the appendix. At the start of the survey, the surveyor shall ride the mode as designated. He/she should sit at the front seat of the vehicle or a seat with a clear vantage of the traffic delay. As the survey begins, the surveyor starts the first stopwatch to record the total trips time. Important stops and intersections are recorded by the surveyor on the map. The second stop watch is used to record delay times for intersections or midblocks. The type of delays such as loading and unloading, stoplight, congestion, etc. are to be indicated and marked on the map by the surveyor. At the end stop of the survey, the last trip time is recorded as the total travel time of the survey.

The items that will be needed for this survey are survey forms, map of route, clipboard, pencil, eraser, and 2 stop watches.

For this study, a maximum of 6 of the prominent existing modes was surveyed. For each mode, the survey was done 3 times, morning peak- 6 to 8 am, evening peak- 5 to 7 pm, and noon- 11 am to 1pm. Each survey will be done twice, one for north to south direction and another for south to north direction.

Table 3 is the result of the travel time and delay survey. The medium value is the average travel time and cost for the respective modes in a situation where the travel distance is 10 kilometers. High and low are plus and minus thirty percent of the medium value respectively.

Table 3. Levels of Time and Cost

Car		
	TIME	COST
LOW	20.67	₱30.51
MID	29.53	₱43.58
HIGH	38.39	₱56.66

UV		
	TIME	COST
LOW	20.02	₱19.14
MID	28.59	₱27.34
HIGH	37.17	₱35.55

Motorcycle		
	TIME	COST
LOW	15.22	₱7.99
MID	21.74	₱11.42
HIGH	28.26	₱14.85

Taxi/ Grab		
	TIME	COST
LOW	16.48	₱93.08
MID	23.55	₱132.97
HIGH	30.61	₱172.87

Bus		
	TIME	COST
LOW	20.88	₱14.29
MID	29.83	₱20.41

MRT Line 7		
	TIME	COST
LOW	10.50	₱16.76
MID	15.00	₱23.94

HIGH	38.77	₱26.54	HIGH	19.50	₱31.12

Jeepney		
	TIME	COST
LOW	21.35	₱10.33
MID	30.50	₱14.76
HIGH	39.65	₱19.18

4.3.2.4 MRT Line 7 Specifications

The MRT Line 7 specifications was done to know the average speed and cost of travel of the future mode. The government inquiry resulted to a fare matrix given by the Department of Transportation. The design speed of the train was 90 kph and max operating speed at 80 kph. Average speed for this train is similar to the previous transits in the Metro Manila which ranges from 60 to 40 kph. These average speed and fare were incorporated in the design of the levels of cost and time as seen in Table 3. Final station locations were also given in Figure 1.

4.3.4 Experiment Design Consideration

Using a design of 7 alternatives with 18 attributes and 3 level of attribute from the refinement model, a full factorial design would require 387,420,489 treatment combinations (choice questions) for each respondent. This full factorial design will be impossible to do and to further reiterate, good survey is one that have the minimum possible question given limited time and resources without compromising the target goal. Three typical methods that can be used to reduce the treatment combinations are:

1) Unlabeled Experiment Design
2) Fractional Factorial Design
3) Block Design

4.3.4.1 Unlabeled Experiment Design

Unlabeled experiment design is a design that does not reveal the specific alternative name. It is normally for "willingness to pay" models. Though the unlabeled experiment design will reduce greatly reduce the treatment combinations, for this study, label experiment design was used because the main objective is more on prediction and forecasting.

4.3.4.2 Fractional Factorial Orthogonal Design (FFOD)

Fractional factorial design is a design that uses only a part of the treatment combinations. It is used to lower the scenarios needed without significantly compromising the statistical viability of the results. Orthogonal design is an example of fractional factorial design. Fractional factorial designs are used to lower the scenarios needed without significantly compromising the statistical viability of the results. An orthogonal design has all levels of each attributes appearing at equal frequency. This design results in a zero correlation with the attributes analyzed. This effect may affect higher order statistical analysis but this bias will only affect the variance by as much as 10% (Accent, 2010). FFODs are typically done using computer programs. For this study, the freeware R software was used to design the minimum fractional factorial design that is still orthogonal. After using this method, the required treatment combinations for the study to be answered by the respondent was reduced to 54.

4.3.4.3 Block Design

Block design is a design to further reduce the fractional factorial orthogonal design. Essentially, the block design distributes the fractional factorial systematically to more than one respondent. The result is the experiment will have different sets with the number depending on the design. After using this method, the required treatment combinations for the design to be answered by the respondent was further reduced to 9 questions with 6 sets of questionnaires. After the block design, the SPM survey is finalized.

4.3.5 Administration of the Survey Instrument

The following steps outline typical survey administration:

a) the survey may be conducted by using survey forms or online survey;
b) each respondent will be given sequentially one of the sets of survey form;
c) the respondent will be shown explanatory pictures (the location of the stations) that will aid him/her in properly answering the questions;
d) the surveyor will entertain any questions or clarifications the respondents ask

4.3.5.1 Length of the Survey Forms

A typical choice experiment can be answered in 20 minutes. Longer questionnaires may be done for household interview, while for situ interview, in the case of this study, roadside survey, shorter questionnaires that take not more than 10 minutes is advised (Accent, 2010).

4.3.5.2 Data Points Needed

Taking into account the cost without sacrificing the experiment's precision, a discrete choice experiment will require a minimum of 400 survey respondents. The requirement of each alternative to have at least 75 choice answers (Accent, 2010).

5. RESULTS

The designed set of the SPM forms are in the appendix. Part 1 of the survey for is for the socio-economic characteristics of the respondent. Among these are gender, age, income, ownership of car, and income. Part 2 of the survey form is the SPM questionnaire. The sample incorporates the supplementary data into the situation and the final level (low, mid, and high) values.

The BIOGEME is a recommended free program used for data processing of the SPM survey. It will be useful for the creation and analysis of the MNL achieved from the data of the survey.

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APPENDICES

FIRST CHOICE				SECOND CHOICE			
Samples	433			Samples	406		
Excluded Options	TAXI and TVNS			Excluded Options	CAR and TAXI		
Model	-2 Log Likelihood	Chi-Square	Sig.	Model	-2 Log Likelihood	Chi-Square	Sig.
Intercept Only	1113.578			Intercept Only	1213.252		
Final	815.631	297.947	0.000	Final	1072.219	141.033	0.000
PARAMETER ESTIMATES				**PARAMETER ESTIMATES**			
BASELINE	UV			BASELINE	TVNS		
	Factors	beta	Significance		Factors	beta	Significance
CAR	Intercept	0.606	0.740	MOTOR	Intercept	1.887	0.286
	nhm	-0.102	0.529		nhm	-0.187	0.173
	l	0.132	0.120		l	0.139	0.126
	mi	-0.006	0.813		mi	-0.002	0.930
	tw	0.296	0.131		tw	-0.441	0.020
	a	0.032	0.229		a	-0.019	0.460
	m	-0.003	0.732		m	-0.019	0.065
	tt	-1.349	0.000		tt	0.547	0.075
	[pco=.00]	-2.380	0.002		[pco=.00]	3.688	0.000
	[dl=.00]	-1.369	0.090		[dl=.00]	-0.086	0.921
	[s=.00]	0.332	0.631		[s=.00]	-2.035	0.003
MOTOR	Intercept	-3.497	0.020	BUS	Intercept	3.017	0.052
	nhm	0.112	0.323		nhm	-0.205	0.083
	l	0.066	0.275		l	0.110	0.174
	mi	0.007	0.632		mi	-0.015	0.401
	tw	-0.253	0.043		tw	-0.426	0.016
	a	0.011	0.614		a	-0.023	0.318
	m	0.007	0.187		m	-0.007	0.386
	tt	0.168	0.502		tt	0.616	0.026
	[pco=.00]	1.897	0.021		[pco=.00]	2.632	0.000
	[dl=.00]	0.166	0.803		[dl=.00]	0.611	0.452
	[s=.00]	-0.911	0.086		[s=.00]	-1.545	0.012
BUS	Intercept	-3.194	0.006	JEEPNEY	Intercept	2.890	0.066
	nhm	0.133	0.134		nhm	-0.186	0.119
	l	0.010	0.845		l	0.093	0.256
	mi	-0.016	0.320		mi	-0.027	0.143
	tw	-0.163	0.106		tw	-0.485	0.007
	a	0.027	0.114		a	-0.023	0.310
	m	0.007	0.121		m	0.001	0.869
	tt	0.445	0.024		tt	0.811	0.004
	[pco=.00]	1.508	0.004		[pco=.00]	2.218	0.001
	[dl=.00]	-0.469	0.362		[dl=.00]	0.163	0.841
	[s=.00]	0.134	0.742		[s=.00]	-1.451	0.021
JEEPNEY	Intercept	-0.631	0.513	UV	Intercept	2.219	0.155
	nhm	0.061	0.414		nhm	-0.220	0.064
	l	0.006	0.882		l	0.164	0.042
	mi	0.000	0.964		mi	-0.010	0.582
	tw	-0.106	0.199		tw	-0.388	0.029
	a	0.015	0.298		a	-0.026	0.257
	m	-0.016	0.000		m	0.001	0.944
	tt	0.172	0.293		tt	0.603	0.029
	[pco=.00]	2.255	0.000		[pco=.00]	2.607	0.000
	[dl=.00]	0.048	0.912		[dl=.00]	0.242	0.765
	[s=.00]	0.143	0.657		[s=.00]	-1.137	0.066

*monthly income and length of travel scaled by 1000

TIME CONSTRAINED				RAINING			
Samples	384			Samples	400		
Excluded Options	MOTOR and TVNS			Excluded Options	MOTOR and TVNS		
Model	-2 Log Likelihood	Chi-Square	Sig.	Model	-2 Log Likelihood	Chi-Square	Sig.
Intercept Only	1155.789			Intercept Only	1222.006		
Final	884.952	270.837	0.000	Final	897.845	324.161	0.000
PARAMETER ESTIMATES				**PARAMETER ESTIMATES**			
BASELINE	TAXI			BASELINE	TAXI		
	Factors	beta	Significance		Factors	beta	Significance
CAR	Intercept	1.249	0.454	CAR	Intercept	-1.950	0.368
	nhm	-0.124	0.442		nhm	0.123	0.519
	l	0.020	0.829		l	-0.076	0.506
	mi	0.015	0.377		mi	0.014	0.587
	tw	0.229	0.219		tw	0.671	0.006
	a	0.022	0.384		a	0.069	0.027
	m	0.005	0.543		m	0.014	0.214
	tt	-0.867	0.006		tt	-1.447	0.002
	[pco=.00]	-3.854	0.000		[pco=.00]	-4.916	0.000
	[dl=.00]	-0.758	0.353		[dl=.00]	-2.317	0.044
	[s=.00]	0.320	0.649		[s=.00]	1.845	0.114
BUS	Intercept	-3.796	0.005	BUS	Intercept	-1.545	0.235
	nhm	0.037	0.686		nhm	-0.175	0.072
	l	0.043	0.478		l	-0.033	0.591
	mi	-0.036	0.069		mi	-0.024	0.186
	tw	0.145	0.179		tw	0.146	0.169
	a	0.027	0.117		a	-0.004	0.817
	m	0.013	0.026		m	0.024	0.000
	tt	0.170	0.400		tt	0.051	0.810
	[pco=.00]	1.218	0.146		[pco=.00]	0.885	0.237
	[dl=.00]	0.131	0.814		[dl=.00]	0.609	0.331
	[s=.00]	-0.468	0.265		[s=.00]	-0.668	0.106
JEEPNEY	Intercept	-1.330	0.253	JEEPNEY	Intercept	-1.304	0.242
	nhm	-0.044	0.604		nhm	-0.023	0.778
	l	-0.103	0.084		l	-0.046	0.403
	mi	-0.023	0.151		mi	-0.024	0.096
	tw	0.333	0.001		tw	0.266	0.004
	a	0.003	0.854		a	0.004	0.810
	m	0.002	0.754		m	-0.002	0.814
	tt	-0.073	0.695		tt	0.204	0.258
	[pco=.00]	0.731	0.259		[pco=.00]	1.048	0.087
	[dl=.00]	0.830	0.137		[dl=.00]	0.283	0.579
	[s=.00]	-0.547	0.128		[s=.00]	-0.488	0.162
UV	Intercept	-1.525	0.120	UV	Intercept	-0.850	0.413
	nhm	0.013	0.865		nhm	-0.128	0.113
	l	0.132	0.006		l	0.089	0.081
	mi	-0.012	0.303		mi	-0.007	0.540
	tw	0.144	0.089		tw	0.158	0.075
	a	0.001	0.956		a	-0.004	0.798
	m	0.011	0.027		m	0.020	0.001
	tt	-0.031	0.852		tt	0.089	0.620
	[pco=.00]	0.505	0.316		[pco=.00]	0.380	0.465
	[dl=.00]	0.419	0.358		[dl=.00]	-0.011	0.982
	[s=.00]	-0.488	0.130		[s=.00]	-0.340	0.329

*monthly income and length of travel scaled by 1000

Scenario 1						SET	A
Trip Description	MRT	JEEPNEY	CAR	BUS	UV	TVNS	MOTOR
Travel Time and Waiting Time (min)	10	20	40	40	40	30	30
Fuel or Fare Cost	₱15.00	₱10.00	₱55.00	₱25.00	₱35.00	₱175.00	₱15.00
Seat Availability	LOW	HIGH	-	HIGH	HIGH	-	-
If I had to I would choose	A	B	C	D	E	F	G

Scenario 2							
Trip Description	MRT	JEEPNEY	CAR	BUS	UV	TVNS	MOTOR
Travel Time and Waiting Time (min)	15	30	40	40	20	15	20
Fuel or Fare Cost	₱25.00	₱15.00	₱55.00	₱25.00	₱20.00	₱130.00	₱10.00
Seat Availability	MID	HIGH	-	LOW	LOW	-	-
If I had to I would choose	A	B	C	D	E	F	G

Scenario 3							
Trip Description	MRT	JEEPNEY	CAR	BUS	UV	TVNS	MOTOR
Travel Time and Waiting Time (min)	15	30	30	30	40	30	15
Fuel or Fare Cost	₱25.00	₱15.00	₱45.00	₱20.00	₱35.00	₱95.00	₱5.00
Seat Availability	MID	MID	-	HIGH	HIGH	-	-
If I had to I would choose	A	B	C	D	E	F	G

Scenario 4							
Trip Description	MRT	JEEPNEY	CAR	BUS	UV	TVNS	MOTOR
Travel Time and Waiting Time (min)	20	40	20	20	40	30	20
Fuel or Fare Cost	₱30.00	₱20.00	₱30.00	₱15.00	₱35.00	₱130.00	₱10.00
Seat Availability	HIGH	LOW	-	HIGH	HIGH	-	-
If I had to I would choose	A	B	C	D	E	F	G

Scenario 5							
Trip Description	MRT	JEEPNEY	CAR	BUS	UV	TVNS	MOTOR
Travel Time and Waiting Time (min)	10	20	30	30	30	25	20
Fuel or Fare Cost	₱15.00	₱10.00	₱45.00	₱20.00	₱30.00	₱130.00	₱10.00
Seat Availability	LOW	MID	-	MID	MID	-	-
If I had to I would choose	A	B	C	D	E	F	G

Scenario 6

Trip Description	MRT	JEEPNEY	CAR	BUS	UV	TVNS	MOTOR
Travel Time and Waiting Time (min)	20	40	30	30	20	15	30
Fuel or Fare Cost	₱30.00	₱20.00	₱45.00	₱20.00	₱20.00	₱175.00	₱15.00
Seat Availability	HIGH	MID	-	LOW	LOW	-	-
If I had to I would choose	A	B	C	D	E	F	G

Scenario 7

Trip Description	MRT	JEEPNEY	CAR	BUS	UV	TVNS	MOTOR
Travel Time and Waiting Time (min)	10	20	20	20	20	15	15
Fuel or Fare Cost	₱15.00	₱10.00	₱30.00	₱15.00	₱20.00	₱95.00	₱5.00
Seat Availability	LOW	LOW	-	LOW	LOW	-	-
If I had to I would choose	A	B	C	D	E	F	G

Scenario 8

Trip Description	MRT	JEEPNEY	CAR	BUS	UV	TVNS	MOTOR
Travel Time and Waiting Time (min)	20	40	40	40	30	25	15
Fuel or Fare Cost	₱30.00	₱20.00	₱55.00	₱25.00	₱30.00	₱95.00	₱5.00
Seat Availability	HIGH	HIGH	-	MID	MID	-	-
If I had to I would choose	A	B	C	D	E	F	G

Scenario 9

Trip Description	MRT	JEEPNEY	CAR	BUS	UV	TVNS	MOTOR
Travel Time and Waiting Time (min)	15	30	20	20	30	25	30
Fuel or Fare Cost	₱25.00	₱15.00	₱30.00	₱15.00	₱30.00	₱175.00	₱15.00
Seat Availability	MID	LOW	-	MID	MID	-	-
If I had to I would choose	A	B	C	D	E	F	G

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