Determining the Impacts of Pedestrian Facility Improvements on Mode Choice of Car Users: A Case Study of the Ortigas Center

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Abstract: The promotion of non-motorized transportation like walking is often overlooked as a solution for traffic congestion in Central Business Districts (CBDs). This research aims to determine how improvements on pedestrian facilities would affect the mode choice of car users in Ortigas Center in Metro Manila. Through Binary Logistic Regression, it was determined that the presence of sidewalk railings increases the likelihood of mode shift for trips going in and out of Ortigas Center while the presence of covered sidewalks and walkways increases the likelihood of mode shift for trips within Ortigas Center. The results of the study can be used as a guide in determining which pedestrian facilities should be prioritized in CBDs as well as in future land developments.

Keywords: CBD, Pedestrian Facility, Mode Choice, Binary Logistic Regression

1. INTRODUCTION

The Central Business District (CBD) is the focal point of a city as it serves as the financial, social and cultural center, as well as the epicenter for transportation. Hence, a major problem that most CBDs face is traffic congestion. Several solutions usually implemented to mitigate the impacts of congestion are road construction and road widening. However, one possible solution that is regularly overlooked is the promotion of non-motorized transportation (NMT) like walking.

An ADB study in 2011 stated that nearly 35% of destinations in Metro Manila are within a 15-minute walk or bicycle trip but a majority of the short trips are made by jeepneys, tricycles and even cars (Leather et al., 2011). It shows that people have grown more dependent on motorization while the political attitude towards pedestrians is neglectful whereby roads are widened at the expense of pedestrian paths and sidewalks.

The subject of this study is the Ortigas Center which is a central business district located within the boundaries of Mandaluyong City, Pasig City, and Quezon City. This 100-hectare estate is bounded by the streets of EDSA to the west, Ortigas Avenue to the north, Meralco Avenue to the east, and Shaw Boulevard to the south (Figure 1).

It can be observed that the Ortigas Center is compact, with the distance of the western boundary (EDSA) to the eastern boundary (Meralco Avenue) at around 870 meters (through Julia Vargas Avenue) while the southern boundary (Shaw Boulevard) to the northern boundary (Ortigas Center) measures 1,500 meters (through San Miguel Avenue and ADB Avenue). This means that one can walk from the center and reach the boundary within 10 minutes or the whole Ortigas Center from one end to another within 20 minutes.

Although Ortigas Center is very compact, it was observed that traffic volume is still very high and congestion is experienced every day. There is a demand for public utility

vehicles but jeepneys are only available during the morning peak period while the city-operated buses were re-routed due to low ridership caused by the long travel route. For the existing pedestrian facilities, it was observed that it was not consistent for the whole area. Some sections have sidewalks that have inconsistent widths with varying slopes with lot of obstructions while other sections have wide and consistent sidewalks. Except for the grade-separated crossings, there are no covered walkways which exposes the pedestrians to weather and pollution. Given these conditions, this study aims to understand how a person's likelihood to choose public transport or walking instead of using private cars will be affected given the introduction of pedestrian facility improvements for trips going in and out of Ortigas Center; and trips within Ortigas Center.

Based on a traffic survey conducted by WSP Philippines, Inc. in 2016, private cars take up a majority of the traffic composition within the Ortigas Center and are mostly concentrated along Julia Vargas, San Miguel, and ADB Avenues.

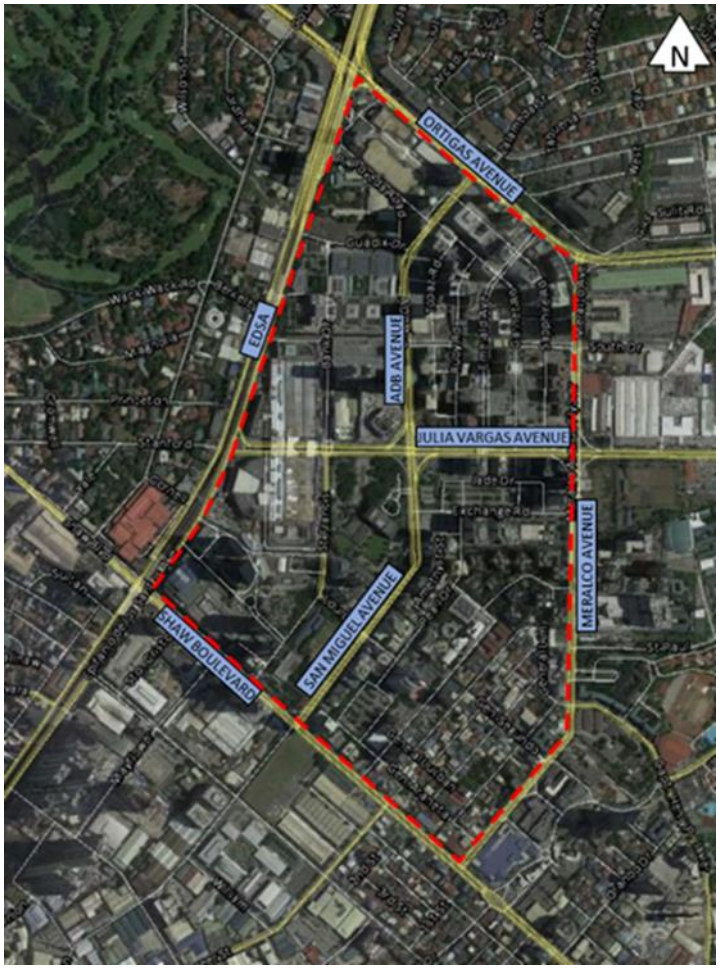

Figure 1. Ortigas Center CBD

Based on the ITDP 2016 report on Metro Manila Greenways, it was observed that most lands in Makati CBD are owned by Ayala Corporation and is strictly managed by the Makati Commercial Estate Association (MACEA) which appears to be a key reason as to why sidewalks are comparatively attractive. In contrast, in Ortigas Center, the land is owned by different developers. The developers are obliged to leave a 3m sidewalk space as easement with the planning coordinating office of Pasig City which is supposed to enforce this requirement, but in practice, this requirement is not consistently enforced. The ITDP report

also conducted pedestrian counts within the Ortigas Center which showed that pedestrian volume is mostly concentrated along Julia Vargas, San Miguel, and ADB Avenues (Figure 2).

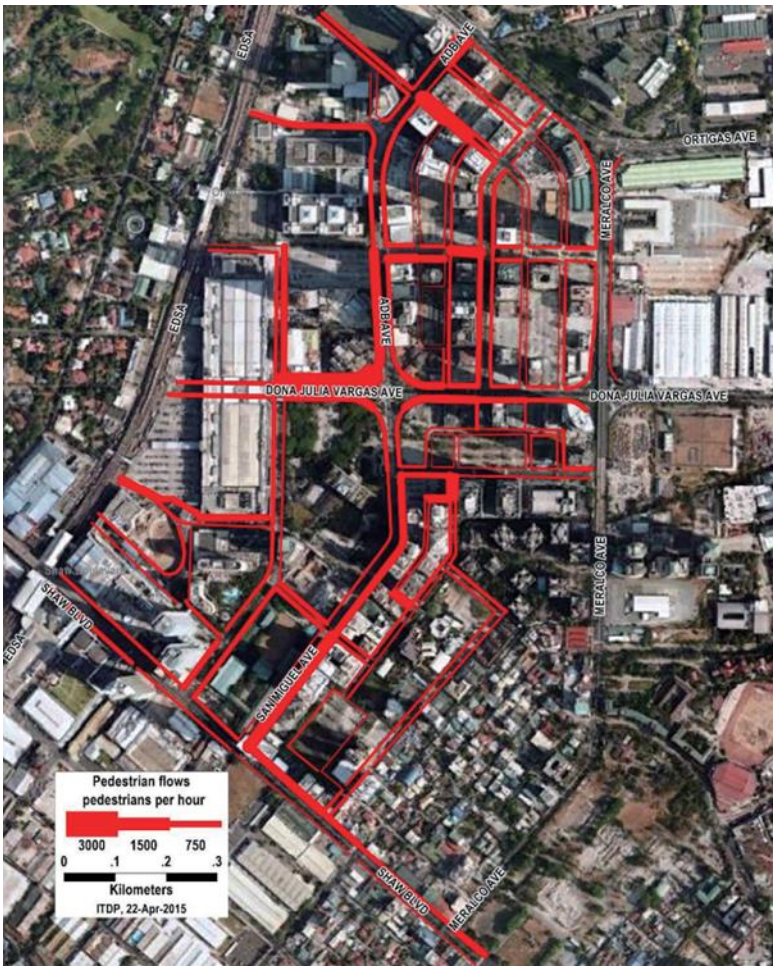

Figure 2. Pedestrian Volume per Hour

Pasig City has plans of providing an extensive pedestrian network within the CBD which would be a series of footbridges, covered walkways, elevated walkways, and walkways within buildings (Figure 3). However, most of these are not implemented yet. Pedestrian overpasses are present but are mostly located on the northern side while an elevated walkway is also present along Julia Vargas Avenue but it terminates at the intersection of ADB Avenue and San Miguel Avenue (Figure 4).

In general, this study will identify and analyze the trip type and socio-economic attribute of car users in Ortigas Center, as well as model the likelihood of choosing public transport or walking instead of using private cars through a binary logistic regression model given the introduction of pedestrian facility improvements. This will help understand how a person's likelihood to choose public transport or walking instead of using private cars will be affected given the introduction of pedestrian facility improvements for trips going in and out of Ortigas Center and trips within Ortigas Center.

Through this study, the impact of introducing pedestrian facility improvements on mode choice will be investigated and quantified. The recognition of these impacts will be important in determining what specific pedestrian facility have an actual impact on influencing mode choice which will lead to prioritization of these improvements.

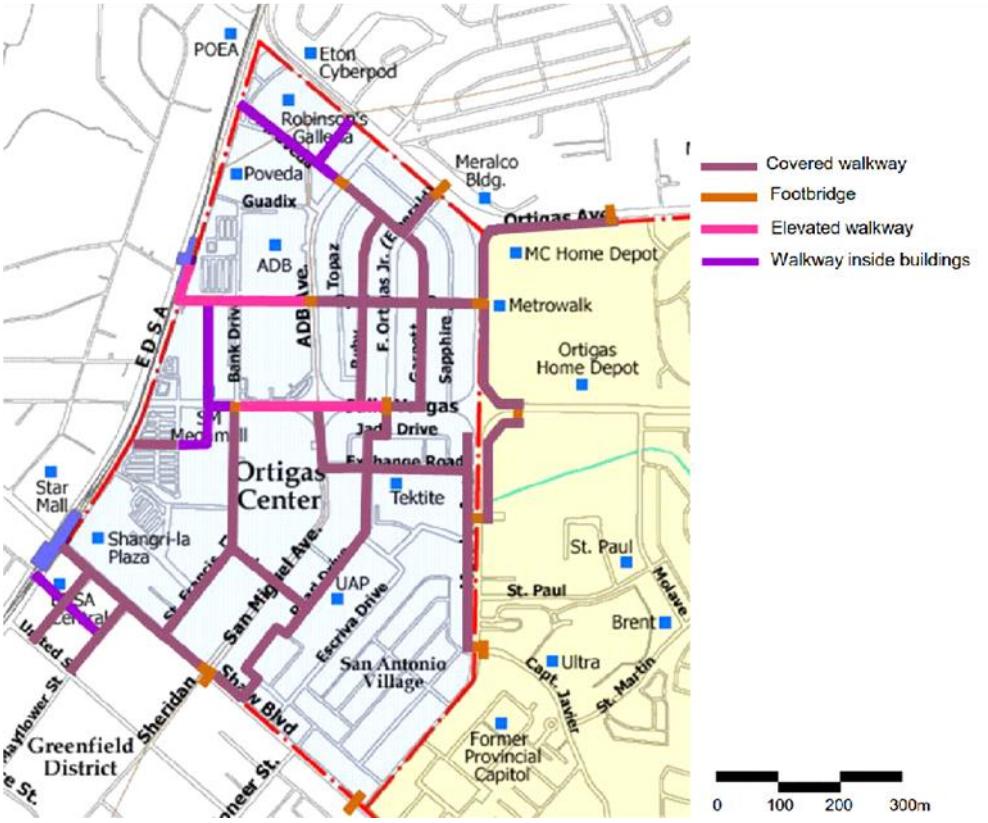

Figure 3. Proposed Pasig CBD Greenways

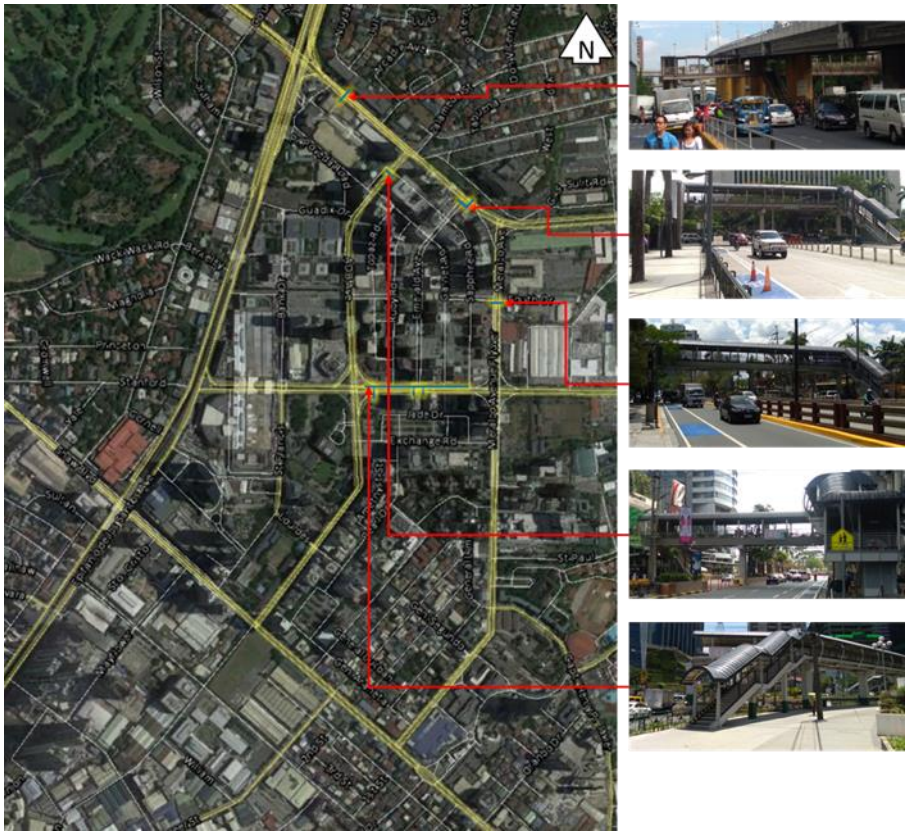

Figure 4. Existing Pedestrian Overpasses and Elevated Walkways

2. REVIEW OF RELATED LITERATURE

Rillon (1999) mentioned that walking is largely considered for its distributional, complimentary, or linkage function. Taken singly, the decision to walk is induced by the convenience it offers vis-à-vis other modes of transportation involving vehicles. When pitted against the other modes, the decision factor on the need for exercise and relaxation came out on top. However, when taken altogether, walking is not even considered as an option and even if it is, how far to walk is an entirely different proposition.

Rillon classified the pedestrian vulnerability in Batangas City into three (3) categories; namely human or social factors, physical and structural factors, and administrative arrangements. The human or social factors arise from conflicts between pedestrians and adverse situations arising from human interaction. These include confrontations with excessive number of vendors on sidewalks and streets, vagrants, mentally-challenged individuals, abusive drivers, petty criminals or other pedestrians in crowded environments. The physical and structural factors arise from restrictions on pedestrian movement and circumstances due to the inadequacy of existing pedestrian facilities. These include restrictions imposed by weather due to the absence of covered or adequately-shaded pedestrian connections between establishments or between transit points. Other factors include inadequate physical separations and buffers between pedestrians and vehicles, undelineated and undefined pedestrian crossings, unsignalized intersections, unevenly-paved sidewalks, and uncovered manholes and drainage. The administrative arrangement vulnerabilities arise from the inability of existing policies, plans, planning structures and implementing mechanisms to respond adequately and appropriately to the demands for efficient pedestrian movements.

Mateo (2001) established in her study that the condition of the street environment, the presence of street furniture and shorter path length affects pedestrian travel decision. She also mentioned that socio-demographic characteristics such as age and income affect the individual travel decision which could be considered when improving the pedestrian street environment. Other factors that affect individual travel decisions are accessibility of the area, the presence of trip attractors, point where walking was initiated and ended, as well as the frequency of trips. The study also identifies cleanliness, safety, security, convenience, and comfort as important considerations in the development and improvement of pedestrian street environment.

Ryley (2008) developed discrete choice models on the propensity to walk in Edinburgh by assessing the results of a stated preference survey. The generated models showed that for short trips, motorists are more likely to walk in response to an increase in parking costs than a rise in gas prices.

Cameña and Castro (2017) identified the determinants of walking and using NMTs in Iloilo City. Their study affirmed findings from previous studies on the socio-economic correlates of walking and NMT use. Physical environment is also another factor that was found to be influencing the individual's attitude on walking. The strongest predictor in walking was found to be significantly correlated with sidewalk quality and amount of sidewalks which suggest that any improvement in the physical environment could still positively affect the individual's attitude towards walking and conceivably increase one's likelihood to walk.

Tan (2005) observed that with the construction of the pedestrian underpasses, elevated walkways, and covered walks in the Makati CBD, the average travel distance on foot covered by pedestrians significantly increased to 700 meters from 400 meters. It has also helped reduce traffic congestion at street intersections and increased the volume of pedestrians that

use the facilities up to 200,000 on a weekday.

3. METHODOLOGY

3.1 Framework for Analysis

The study operates on the assumption that mode choice is a result of certain factors which are either inherent or external to a person. The review of related literature has shown that inherent attributes such as socio-economic characteristics and external attribute such as the condition of the pedestrian facilities influence an individual's choice of mode of transport (Figure 5).

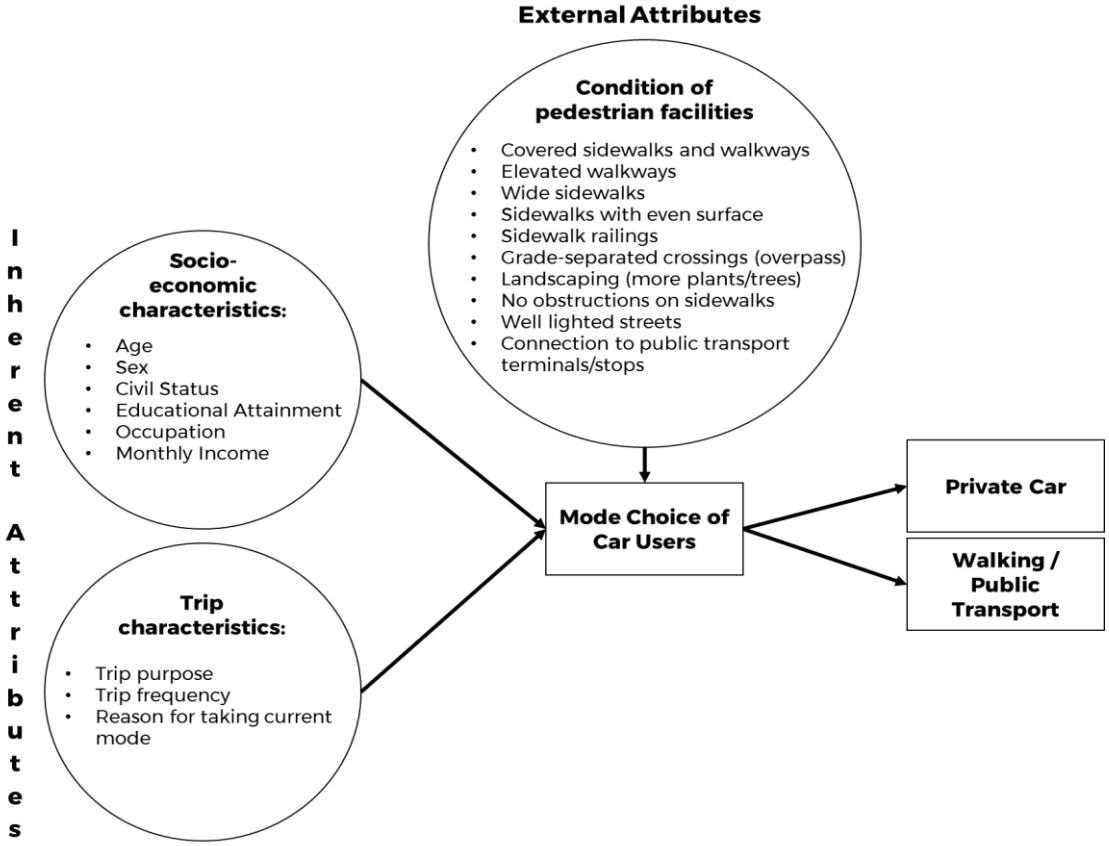

Figure 5. Conceptual Framework

The first step of the study was to establish the socio-economic profile and trip profile of the respondents via surveys. The data gathered was then tested if they have relations or associations with the proposed improvements of the physical conditions of the pedestrian facilities and their mode choice using Binary Logistic Regression. The next step was to identify suitable alignments for pedestrian facility improvements which were gathered from the responses to the hypothetical scenarios in the survey. The last step was to combine the results of the analysis and the alignment to formulate the recommendations such as programs and policies that could be implemented by the LGU and private developers (Figure 6).

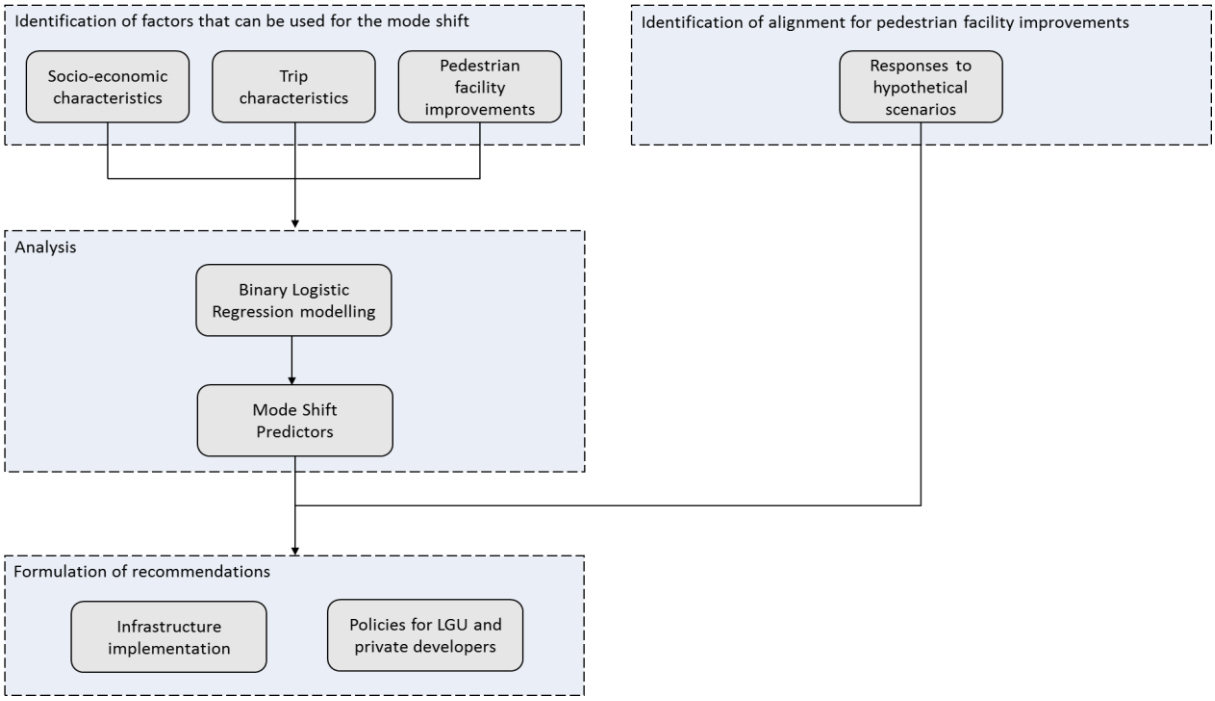

Figure 6. Analytical Framework

3.2 Data Collection

A revealed preference and stated preference survey was conducted to determine the trip characteristic and preferences of the car users in Ortigas Center that would entice them to use public transport or walking. Revealed preference is based on observation of actual behavior and is composed of socio-economic attributes as well as details of the trips that the individual had actually made while the stated preference is composed of hypothetical scenarios.

The socio-economic characteristics include age, sex, educational attainment, income, and occupation while trip characteristics include trip purpose, trip frequency, and reason for using their current mode.

Pedestrian facility improvements were proposed that could influence the mode choice such as wider sidewalks, covered walkways, more plants and trees, connection to public transport terminals, etc. The respondents were then asked if they will choose public transport or walking if these improvements are introduced to their environment.

For the survey sampling strategy, the study area was divided into 4 zones. Zones A and C are mostly commercial malls, educational institutions and several corporate headquarters while Zones B and D have mostly office buildings, residential towers, hotels, and educational institutions (Figure 7).

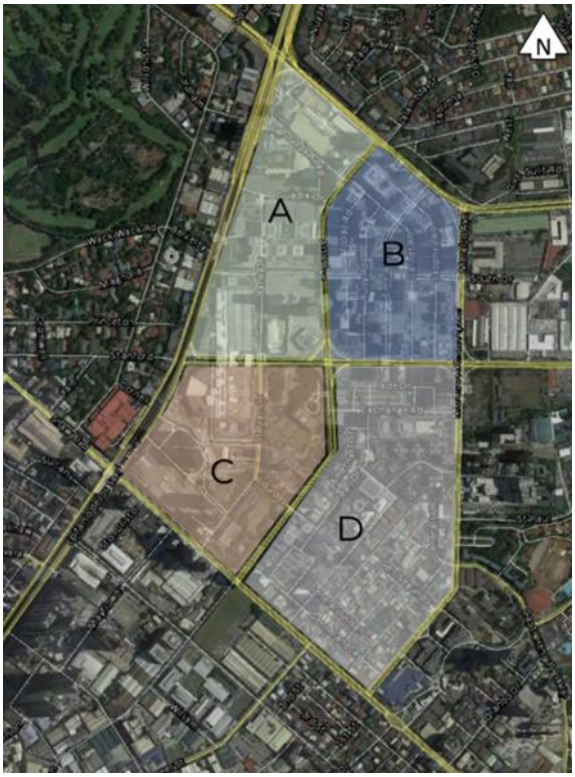

Figure 7. Zoning for Survey Sampling

Sample size was computed using Cochran's formula. Using 95% confidence interval, 0.5 population proportion and a 5% margin of error, the minimum sample size for the survey is 384 respondents. A total of 400 respondents were collected with 100 samples per zone. Survey stations were located at the designated public parking areas within the Ortigas Center because the target respondents are car-users. This included open pay parking lots and parking areas inside the malls.

3.3 Data Analysis

For the analysis, binary logistic regression through SPSS was used to come up with models and the list of predictor variables. Binary logistic regression is the appropriate regression analysis to conduct when the dependent variable is dichotomous. Like all regression analyses, the binary logistic regression is a predictive analysis and is used to describe data and to explain the relationship between one dependent binary variable and one or more nominal, ordinal, interval or ratio-level independent variables. The SPSS outputs are discussed below.

The Omnibus Tests of Model Coefficients uses chi-square tests to see if there is a significant difference between the Log-likelihoods (specifically the -2LLs) of the baseline model and the new model. If the new model has a significantly reduced -2LL compared to the baseline, then it suggests that the new model is explaining more of the variance in the outcome and is an improvement. When the Sig. values are $p < .001$, this indicates the accuracy of the model improves when we add our independent variables.

The Model Summary provides the -2LL and pseudo-R^2 values for the full model (Cox & Snell R^2 and Nagelkerke R^2). The R^2 values tell us approximately how much variation in the outcome is explained by the model. The Hosmer & Lemeshow Test of the Goodness of Fit suggests the model is a good fit to the data if $p>.05$. If the p-value is $<.05$, then the model does not fit the data. If the p-value is $>.05$, then the model does fit the data and should be further

interpreted. The Classification Table compares the model predictions to the actual observation. This is the total accuracy of the model.

The Variables in the Equation Table provides the regression coefficient (B), the Wald statistic (to test the statistical significance for each of the independent variables) and the Odds Ratio (Exp (B)) for each variable category. This would tell us the probability of an event occurring based on a one unit change in an independent variable when all other independent variables are kept constant.

4. ANALYSIS AND FINDINGS

4.1 Respondents' Profile

4.1.1 Socio-economic profile

On the average, the respondents were 36 years old with a standard deviation of about 11 years. The age of the respondents ranges from 16 to 71 years old with 61.25% between 21 to 40 years old (Table 1). Table 2 shows that 61.5% of the respondents are male while 38.5% are female. 89.5% are working while 4.75% answered that they are students. 5.75% of the respondents answered that they are housewives. 60% of the respondents are married followed by single with 34.5%. Majority or 57% of the respondents are college graduates while 33.25% are high school graduates. 4.75% finished post-graduate studies while 4.25 finished grade school.

Table 1. Frequency and Percentage of Socio-Economic Variable: Age

Age	Frequency	Percent
< 20	26	6.50
21-30	121	30.25
31-40	124	31.00
41-50	94	23.50
51-60	30	7.50
> 61	5	1.25
Total	400	100.00

Table 2. Frequency and Percentage of Other Socio-Economic Variables

Gender	Frequency	Percent
Male	246	61.5
Female	154	38.5
Total	400	100.0

Occupation	Frequency	Percent
Working	358	89.50
Student	19	4.75
Housewife	23	5.75
Total	400	100.00

Civil Status	Frequency	Percent
Single	138	34.50
Married	240	60.00
Widow/er	17	4.25
Others	5	1.25
Total	400	100.00

Educational Attainment	Frequency	Percent
Grade School	17	4.25
High School	133	33.25
College	228	57.00
Post Graduate	19	4.75
Others	3	0.75
Total	400	100.00

4.1.2 Trip profile

For the trip profile, 73% are home-work trips followed by 10% home-shopping trips. For trip frequency, 57% make multiple times a day or once a day trip followed by 16.5% for 4-6 times a week, 14.5% 1-3 times a week, and 12% for rarely.

The top reason of the respondents for using their current mode is safety with 54% followed by cost (49%), and comfort (42%) (Table 3).

Table 3. Reasons for using current mode

Reason	Frequency	Percent
Faster (Time/Speed)	118	29.5
Ease/Convenience	58	14.5
Comfort	168	42.0
Safety	216	54.0
Reliability	56	14.0
Cost	196	49.0
Weather	60	15.0
Too far to walk	160	40.0
No public transport	36	9.0
Accompanied by children	38	9.5
With luggage/equipment	10	2.5
No other way	9	2.3

4.2 Analysis on Mode Choice

4.2.1 Willingness to shift to public transport or walking

The respondents were asked if they were willing to shift to public transport or walking if pedestrian facility improvements were introduced. 61.5% answered Yes while 38.5% answered No. This will be the dependent variable of this study. The independent variables are the willingness to consider using public transport for trips coming in and out of Ortigas Center (Table 4) and for trips within Ortigas Center (Table 5).

Table 4. Willingness to Consider Using Public Transport or Walking for Trips Coming In and Out of Ortigas Center

	YES		NO	
	Frequency	Percent	Frequency	Percent
Covered sidewalks and walkways	342	85.5	58	14.5
Elevated walkways	334	83.5	66	16.5
Wider sidewalks and walkways	332	83.0	68	17.0
Sidewalks with even surface	310	77.5	90	22.5
Sidewalk railings	323	80.8	77	19.3
Grade-separated crossings	313	78.3	87	21.8
Sidewalks with landscaping	329	82.3	71	17.8
No obstructions on sidewalks	337	84.3	63	15.8
Well lighted streets and sidewalks/walkways	334	83.5	66	16.5
Connection to public transport terminals/stops	338	84.5	62	15.5

Table 5. Willingness to Consider Using Public Transport or Walking for Trips Within Ortigas Center

	YES		NO	
	Frequency	Percent	Frequency	Percent
Covered sidewalks and walkways	311	77.8	89	22.3
Elevated walkways	311	77.8	89	22.3
Wider sidewalks and walkways	310	77.5	90	22.5
Sidewalks with even surface	290	72.5	110	27.5
Sidewalk railings	301	75.3	99	24.8
Grade-separated crossings	303	75.8	97	24.3
Sidewalks with landscaping	323	80.8	77	19.3
No obstructions on sidewalks	326	81.5	74	18.5
Well lighted streets and sidewalks/walkways	322	80.5	78	19.5
Connection to public transport terminals/stops	332	83.0	68	17.0

4.2.2 Binary logistic regression

4.2.2.1 Trips going In and Out of Ortigas center

The resulting binary logistic regression for trips going in and out of Ortigas Center is:

$$\log(p/1-p) = -1.178 + 0.024*Age - 1.535*CollegeGrad + 0.370*TripFreq - 0.728*TripShopping + 0.936*PresenceIORail \quad (1)$$

Table 6. Summary of Results
for Trips Coming In and Out of Ortigas Center

Selected Cases					400
Omnibus Tests of Model Coefficients					
			Chi-square	df	Sig.
Step 5		Step	4.179	1	.041
		Block	76.477	5	.000
		Model	76.477	5	.000
Model Summary					
Step	-2 Log likelihood		Cox & Snell R Square		Nagelkerke R Square
5	453.784		.174		.237
Hosmer and Lemeshow Test					
Step	Chi-square		df		Sig.
5	9.498		8		.302
Classification Table					
	Observed		Predicted		
			Shift		Percentage Correct
			No	Yes	
Step 5	Shift	No	83	68	55.0
		Yes	47	202	81.1
	Overall Percentage				71.3

Table 7. Variables for Trips Coming In and Out of Ortigas Center

								95% C.I. for EXP(B)	
		B	S.E.	Wald	df	Sig.	Exp(B)	Lower	Upper
Step 5	Age	.024	.012	4.110	1	.043	1.025	1.001	1.049
	PresenceIORail	.936	.288	10.603	1	.001	2.550	1.452	4.481
	CollegeGrad	-1.535	.260	34.871	1	.000	.216	.130	.359
	TripFreq	.370	.093	15.669	1	.000	1.448	1.205	1.738
	TripShopping	-.728	.280	6.767	1	.009	.483	.279	.836
	Constant	-1.178	.692	2.903	1	.088	.308		

This indicates that age, educational attainment, trip frequency, trip purpose, and the presence of sidewalk railings are significant predictors of mode shift. All five predictors explain 23.7% of the variability of the mode shift and the model has a 71.3% overall correct prediction rate (Table 6). Increasing age and frequent trips were associated to an increased likelihood of mode shift while being a college graduate and shopping trips were associated to a decreased likelihood of mode shift. The presence of sidewalk railings increases the likelihood of mode shift to 2.55 times as compared to none (Table 7).

For the sub-analysis based on zones, for trips coming in and out of Ortigas Center near the malls (Zones A & C), the Hosmer and Lemeshow test shows that the model does not fit the data as the p-value is less than 0.05 (Table 8). However, for trips going in and out of Ortigas Center near office buildings (Zones B&D), the Hosmer and Lemeshow test shows that the model fits the data as the p-value is greater than 0.05 (Table 9). The resulting binary logistic regression for this sub-analysis is:

$$\log(p/1\text{-}p) = -1.596 - 2.247*\textit{CollegeGrad} + 0.411*\textit{TripFreq} - 2.606*\textit{TripShopping} + 1.539*\textit{PresenceIOWide} + 0.987*\textit{PresenceIOConnect} \quad (2)$$

Table 8. Summary of Results
for Trips Coming In and Out of Ortigas Center: Zone A&C

Selected Cases				200
Omnibus Tests of Model Coefficients				
		Chi-square	df	Sig.
Step 3	Step	4.791	1	.029
	Block	16.906	3	.001
	Model	16.906	3	.001
Model Summary				
Step	-2 Log likelihood	Cox & Snell R Square	Nagelkerke R Square	
3	214.383	.081	.118	
Hosmer and Lemeshow Test				
Step	Chi-square	df	Sig.	
3	31.106	8	.000	

Table 9. Summary of Results
for Trips Coming In and Out of Ortigas Center: Zone B&D

Selected Cases					200
Omnibus Tests of Model Coefficients					
			Chi-square	df	Sig.
Step 9	Step		-12.388	1	.000
	Block		85.805	5	.000
	Model		85.805	5	.000
Model Summary					
Step	-2 Log likelihood		Cox & Snell R Square	Nagelkerke R Square	
9	191.374		.349	.465	
Hosmer and Lemeshow Test					
Step	Chi-square		df	Sig.	
9	11.075		7	.135	
Classification Table					
	Observed		Predicted		
			Shift		Percentage Correct
			No	Yes	
Step 5	Shift	No	74	24	75.5
		Yes	26	76	74.5
	Overall Percentage				75.0

Table 10. Variables for Trips Coming In and Out of Ortigas Center: Zones B&D

								95% C.I. for EXP(B)	
		B	S.E.	Wald	df	Sig.	Exp(B)	Lower	Upper
Step 9	PresenceIOWide	1.539	.570	7.305	1	.007	4.662	1.527	14.237
	PresenceIOConnect	.987	.519	3.617	1	.057	2.684	.970	7.423
	CollegeGrad	-2.247	.416	29.205	1	.000	.106	.047	.239
	TripFreq	.411	.136	9.093	1	.003	1.509	1.155	1.971
	TripShopping	-2.606	.636	16.785	1	.000	.074	.021	.257
	Constant	-1.596	.824	3.756	1	.053	.203		

Educational attainment, trip frequency, trip purpose, presence of wide sidewalks and walkways, and the presence of connection to public transport terminals/stops are significant predictors of mode shift. All five predictors explain 46.5% of the variability of the mode shift and the model has a 75.0% overall correct prediction rate.

More frequent trips were associated to an increased likelihood of mode shift while being a college graduate and shopping trips were associated to a decreased likelihood of mode shift. The presence of wide sidewalks and walkways increases the likelihood of mode shift to 4.66

times as compared to none while the presence of connection to public transport terminals/stops increases the likelihood of mode shift to 2.68 times as compared to none (Table 10).

4.2.2.2 Trips within Ortigas center

The resulting binary logistic regression model for trips within Ortigas Center (400 samples) is:

$$\log(p/1-p) = 0.348 - 1.395*\textit{CollegeGrad} + 1.428*\textit{PresenceArndCover} \quad (3)$$

Table 11. Summary of Results for Trips Within Ortigas Center

Selected Cases					400
Omnibus Tests of Model Coefficients					
			Chi-square	df	Sig.
Step 2		Step	33.162	1	.000
		Block	75.092	2	.000
		Model	75.092	2	.000
Model Summary					
Step	-2 Log likelihood		Cox & Snell R Square		Nagelkerke R Square
2	455.170		.171		.233
Hosmer and Lemeshow Test					
Step	Chi-square		df		Sig.
2	4.864		2		.088
Classification Table					
	Observed		Predicted		
			Shift		Percentage Correct
			No	Yes	
Step 2	Shift	No	49	102	32.5
		Yes	22	227	91.2
	Overall Percentage				69.0

Table 12. Variables for Trips Within Ortigas Center

								95% C.I. for EXP(B)	
		B	S.E.	Wald	df	Sig.	Exp(B)	Lower	Upper
Step 2	CollegeGrad	-1.395	.256	29.783	1	.000	.248	.150	.409
	PresenceArndCover	1.428	.269	28.108	1	.000	4.168	2.459	7.066
	Constant	.348	.305	1.304	1	.253	1.417		

The model indicates that educational attainment and the presence of covered sidewalks and walkways are significant predictors of mode shift. The two predictors explain 23.3% of the variability of the mode shift and the model has a 69.0% overall correct prediction rate (Table 11). Being a college graduate was associated to a decreased likelihood of mode shift. The presence of covered sidewalks and walkways increases the likelihood of mode shift to 4.17 times as compared to none (Table 12).

For the sub-analysis based on zones, the Hosmer and Lemeshow test shows that the model does not fit the data as the p-value is less than 0.05 for trips within Ortigas Center near the malls (200 samples) (Table 13). However, for trips within Ortigas Center near office buildings (Zones B&D), the Hosmer and Lemeshow test shows that the model fits the data as the p-value is greater than 0.05 (Table 14). The resulting binary logistic regression for this sub-analysis is:

$$\log(p/1\text{-}p) = -0.172 - 1.803*\textit{CollegeGrad} - 2.402*\textit{TripShopping} + 1.143*\textit{PresenceArndCover} + 1.149*\textit{PresenceArndWide} \quad (4)$$

Table 13. Summary of Results
for Trips Within Ortigas Center: Zone A&C

Selected Cases				200
Omnibus Tests of Model Coefficients				
		Chi-square	df	Sig.
Step 3	Step	4.456	1	.035
	Block	28.226	3	.000
	Model	28.226	3	.000
Model Summary				
Step	-2 Log likelihood	Cox & Snell R Square	Nagelkerke R Square	
3	203.063	.132	.192	
Hosmer and Lemeshow Test				
Step	Chi-square	df	Sig.	
3	21.474	8	.006	

Table 14. Summary of Results
for Trips Within Ortigas Center: Zone B&D

Selected Cases					200
Omnibus Tests of Model Coefficients					
			Chi-square	df	Sig.
Step 4	Step		4.269	1	.039
	Block		89.533	4	.000
	Model		89.533	4	.000
Model Summary					
Step	-2 Log likelihood		Cox & Snell R Square	Nagelkerke R Square	
4	187.646		.361	.481	
Hosmer and Lemeshow Test					
Step	Chi-square		df	Sig.	
4	8.231		5	.144	
Classification Table					
	Observed		Predicted		
			Shift		Percentage Correct
			No	Yes	
Step 4	Shift	No	66	32	67.3
		Yes	12	90	88.2
	Overall Percentage				78.0

Table 15. Variables for Trips Within Ortigas Center: Zones B&D

								95% C.I. for EXP(B)	
		B	S.E.	Wald	df	Sig.	Exp(B)	Lower	Upper
Step 4	CollegeGrad	-1.803	.400	20.357	1	.000	.165	.075	.361
	TripShopping	-2.402	.611	15.441	1	.000	.090	.027	.300
	PresenceArndCover	1.143	.562	4.127	1	.042	3.135	1.041	9.438
	PresenceArndWide	1.149	.580	3.922	1	.048	3.154	1.012	9.831
	Constant	-.172	.507	.115	1	.734	.842		

Educational attainment, trip purpose, presence of covered sidewalks and walkways, and the presence of wide sidewalks and walkways are significant predictors of mode shift. All four predictors explain 48.5% of the variability of the mode shift and the model has a 78.0% overall correct prediction rate.

Being a college graduate and shopping trips were associated to a decreased likelihood of mode shift. The presence of covered sidewalks and walkways increases the likelihood of mode shift to 3.14 times as compared to none while the presence of wide sidewalks and walkways increases the likelihood of mode shift to 3.15 times as compared to none (Table 15).

These results are further supported by the ranking of pedestrian facility improvement based on importance (Table 16). Covered sidewalks and walkways have been ranked as the most important followed by elevated walkways, and wider sidewalks and walkways. Sidewalks with even surface has been ranked fourth.

Connection to public transport terminals/stops, as well as sidewalk railings, were ranked first as the second most important pedestrian facility improvement.

Table 16. Ranking of Pedestrian Facility Improvements based on Importance

Pedestrian Facility	1st Rank	Percent	2nd Rank	Percent
Covered sidewalks and walkways	1	21.5	2	20.5
Elevated walkways	3	18.0	2	17.5
Wider sidewalks and walkways	3	24.0	4	21.5
Sidewalks with even surface	4	22.0	5	18.5
Sidewalk railings	6	16.5	1	14.5
Grade-separated crossings	7	17.5	5	14.0
Sidewalks with landscaping	8	18.0	7	15.5
No obstructions on sidewalks	9	25.0	10	19.5
Well lighted streets and sidewalks/walkways	10	20.5	8	18.5
Connection to public transport terminals/stops	10	25.0	1	16.5

4.3 Hypothetical Scenarios

The hypothetical scenarios were presented to the same respondents (400 cases) which aims to identify the specific pedestrian facility improvements and route choice of the respondents. The responses are summarized in this section.

Scenario 1 and Scenario 2 are illustrated in Figure 8. Scenario 1 is “If you are in Gold Loop heading to Ortigas Home Depot for a shopping trip, what would be your ideal route?” Choices include use private car, walk via elevated walkway along Julia Vargas Avenue (1,170m), and walk along the covered walkway in Pearl Drive (1,060m). 50.5% of the respondents answered that they would use private car to reach their destination. For those that would walk, 27.5% prefers to walk via the elevated walkway along Julia Vargas Avenue while 22% prefers to walk along the covered walkway in Pearl Drive.

Scenario 2 is “If you are in ADB heading to Ortigas Home Depot for a shopping trip, what would be your ideal route?” Choices include use private car, walk along the covered walkway in Opal Road (860m), and walk via elevated walkway along Julia Vargas Avenue (850m). 50.8% of the respondents answered that they would use private car to reach their destination. For those that would walk, 35.3% prefers to walk via the covered walkway in Opal Road while 14% prefers to walk via the elevated walkway along Julia Vargas Avenue.

Figure 8. Hypothetical Scenario 1 and 2

Scenario 3 and Scenario 4 are illustrated in Figure 9. Scenario 3 is "If you are in SM Megamall heading to Metrowalk for a meeting, what would be your ideal route?" Choices include use private car, walk via elevated walkway along Julia Vargas Avenue (910m), and walk along the covered walkway in Opal Road (910m). 43% of the respondents answered that they would use private car to reach their destination. For those that would walk, 30.5% prefers to walk via the elevated walkway along Julia Vargas Avenue while 26.5% prefers to walk along the covered walkway in Opal Road.

Scenario 4 is "If you are in Strata 100 heading to Shangri-La Plaza for lunch, what would be your ideal route?" Choices include use private car, walk along the covered walkway in San Miguel Avenue and Shaw Boulevard (1,560m), and walk along the covered walkaway in San Miguel Avenue, Julia Vargas Avenue, and St. Francis (1,300m). 57.5% of the respondents answered that they would use private car to reach their destination. For those that would walk, 31.3% prefers to walk along the covered walkway in San Miguel Avenue and Shaw Boulevard while 11.3% prefers to walk along the covered walkway in San Miguel Avenue, Julia Vargas Avenue, and St. Francis.

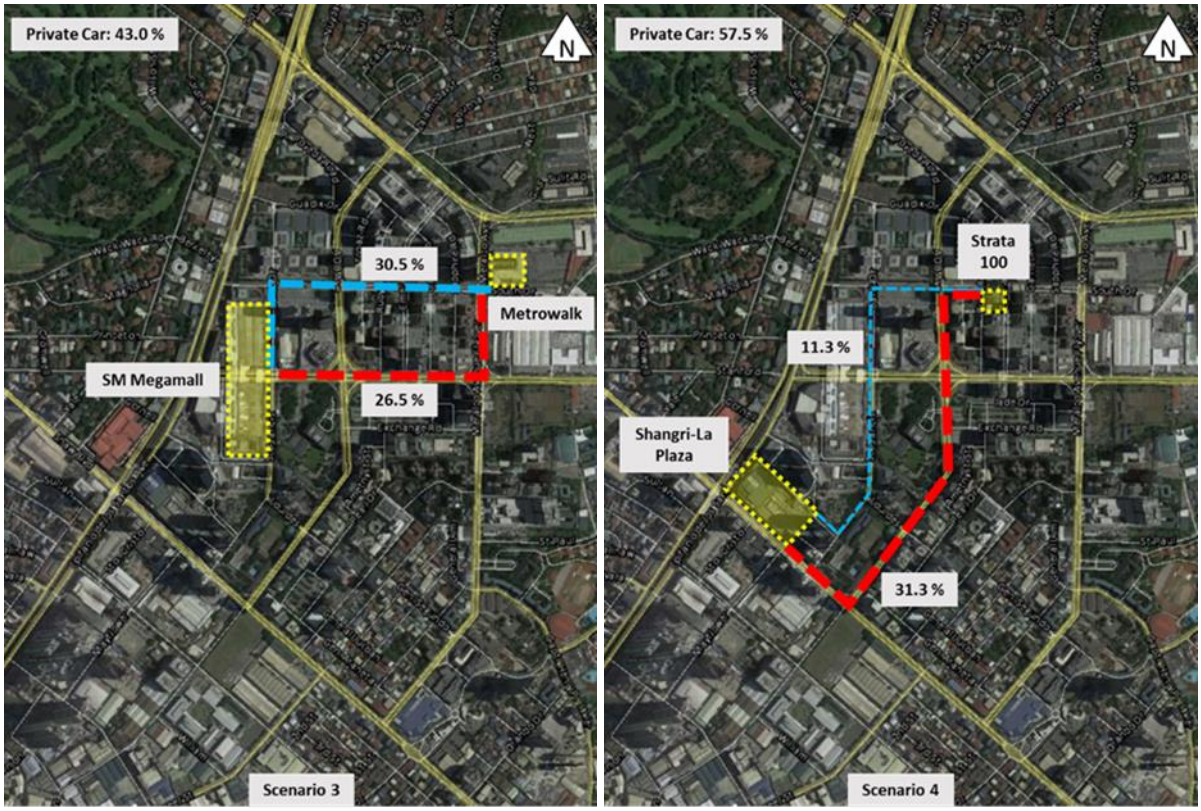

Figure 9. Hypothetical Scenario 3 and 4

Scenario 5 and Scenario 6 are illustrated in Figure 10. Scenario 5 is "If you are in UA&P and has a meeting in Robinsons Galleria, what would be your ideal route?" Choices include use private car, walk along the covered walkway along San Miguel Avenue and ADB Avenue (1,430m), and walk along the covered walkway in Pearl Drive, F. Ortigas Jr. Road, and Ortigas Avenue (1,320m). 46.5% of the respondents answered that they would use private car to reach their destination. For those that would walk, 29.8% prefers to walk along the covered walkway along San Miguel Avenue and ADB Avenue while 23.8% prefers to walk along the covered walkway in Pearl Drive, F. Ortigas Avenue Jr. Road, and Ortigas Avenue.

Scenario 6 is "If you are in Tektite Towers and has a meeting in Makati, what would be your ideal route?" Choices include use private car, walk along the elevated walkway along San Miguel Avenue and ADB Avenue to MRT Ortigas Station (1,000m), walk along the covered walkway in San Miguel Avenue and Shaw Boulevard to MRT Shaw Blvd Station (1,270m), and walk along the covered walkway in San Miguel Avenue and Shaw Boulevard to EDSA bus stop (1,270m). 53% of the respondents answered that they would use private car to reach their destination. For those that would walk, 16.3% prefers to walk along the covered walkway in San Miguel Avenue and Shaw Boulevard to EDSA bus stop, 15.5% prefers to walk along the covered walkway in San Miguel Avenue and Shaw Boulevard to MRT Shaw Blvd Station while 15.3% prefers to Walk along the elevated walkway along San Miguel Avenue and ADB Avenue to MRT Ortigas Station.

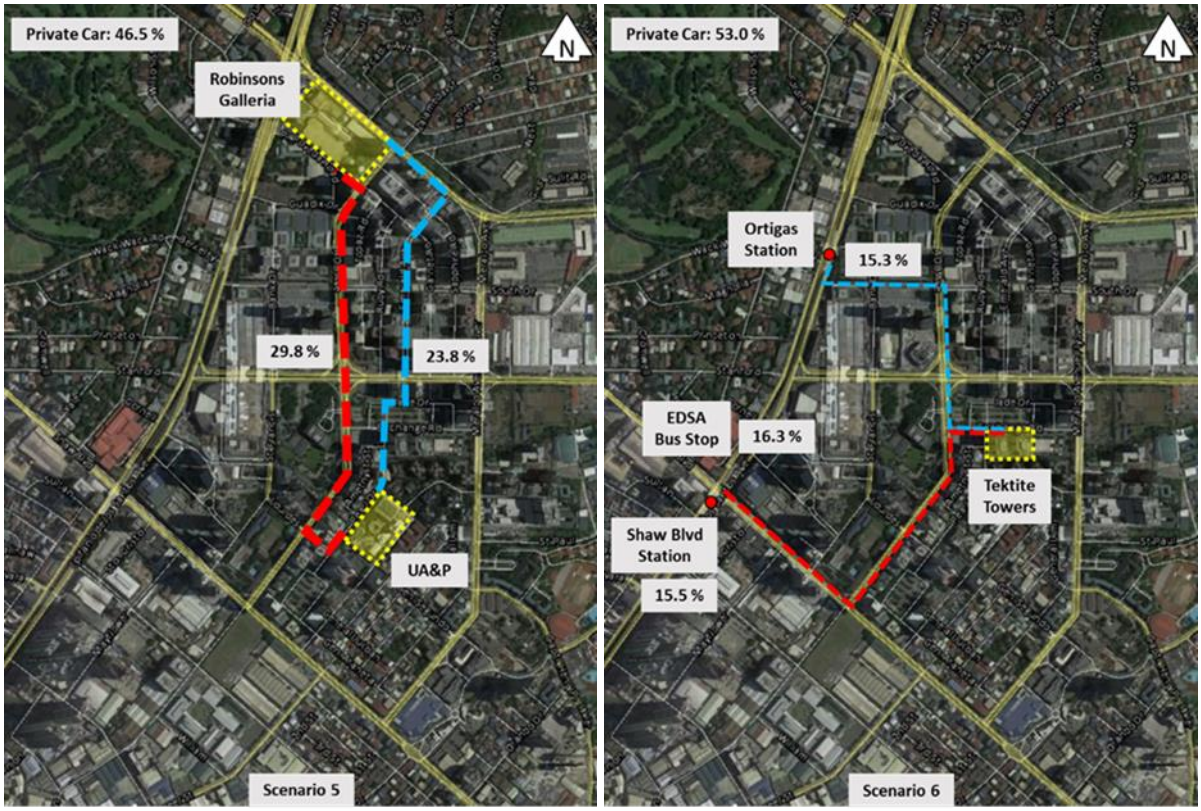

Figure 10. Hypothetical Scenario 5 and 6

Scenario 7 and Scenario 8 are illustrated in Figure 11. Scenario 7 is "If you are in Tektite Towers and has a meeting in Quezon City, what would be your ideal route?" Choices include use private car, walk along the elevated walkway in San Miguel Avenue and ADB Avenue to MRT Ortigas Station (1,000m), walk along the covered walkway in San Miguel Avenue and Shaw Boulevard to MRT Shaw Blvd Station (1,270m), and walk along the elevated walkway in San Miguel Avenue and Julia Vargas Avenue to SM Megamall bus stop (860m). 57.8% of the respondents answered that they would use private car to reach their destination. For those that would walk, 18.3% prefers to walk along the elevated walkway in San Miguel Avenue and Julia Vargas Avenue to SM Megamall bus stop, 15.3% prefers to walk along the covered walkway in San Miguel Avenue and Shaw Boulevard to MRT Shaw Blvd Station while 8.8% prefers to walk along the elevated walkway in San Miguel Avenue and ADB Avenue to MRT Ortigas Station.

Scenario 8 is "If you are in BDO Tower heading to Pasig City for a meeting, what would be your ideal route?" Choices include use private car, walk along the elevated walkway in San Miguel Avenue and Ortigas Avenue to bus/PUJ stop (970mm), and walk along the covered walkaway in San Miguel Avenue to PUJ stop (810m). 75% of the respondents answered that they would use private car to reach their destination. For those that would walk, 15.3% prefers to walk along the elevated walkway in San Miguel Avenue and Ortigas Avenue to bus/PUJ stop while 9.8% prefers to walk along the covered walkaway in San Miguel Avenue to PUJ stop.

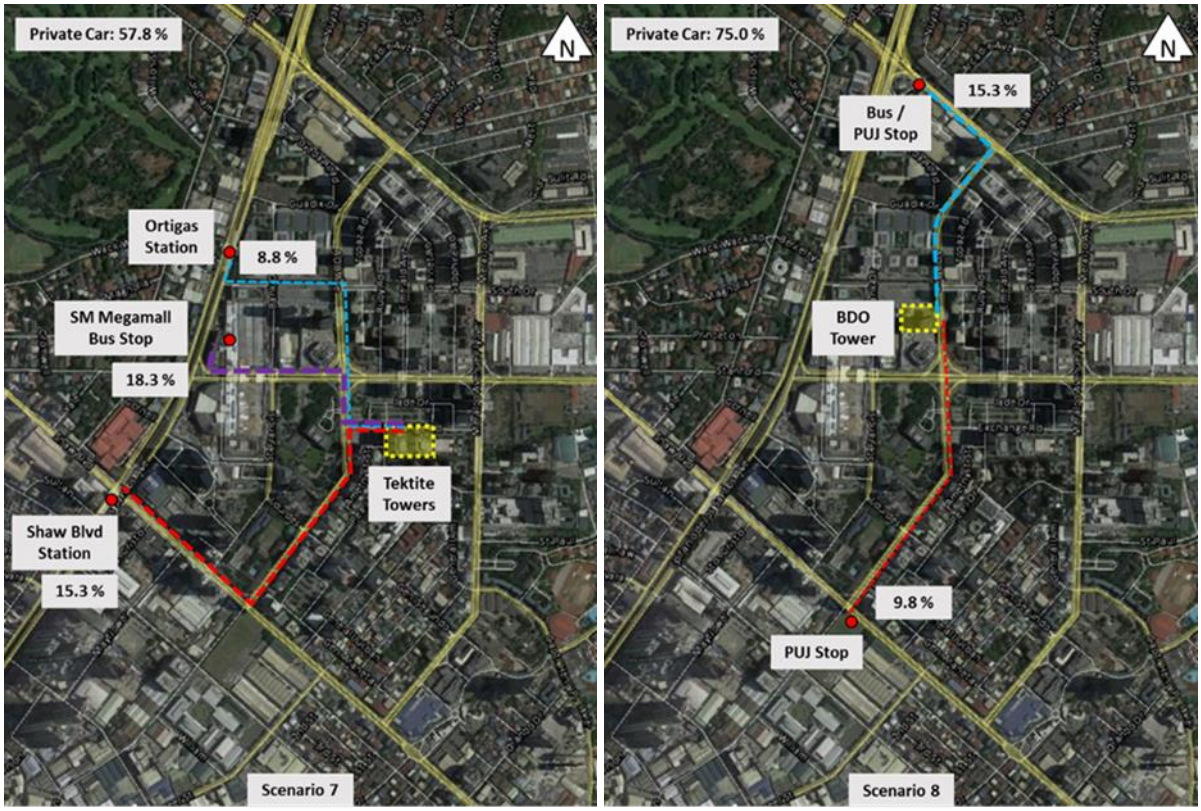

Figure 11. Hypothetical Scenario 7 and 8

5. CONCLUSIONS AND RECOMMENDATIONS

The paper was able to model the likelihood of shifting to public transport or walking instead of using private cars through a binary logistic regression model given the introduction of pedestrian facility improvements in a Central Business District in the Philippines. Explanatory variables included in the model are socio-economic attributes and trip types of respondents.

Results of the analysis show that a majority of car users are willing to shift to public transport or walking if pedestrian facility improvements are introduced. The presence of sidewalk railings increases the likelihood of mode shift to 2.55 times as compared to none for trips going in and out of Ortigas Center while the presence of covered sidewalks and walkways increases the likelihood of mode shift to 4.17 times as compared to none for trips within Ortigas Center. Educational attainment and trip purpose are likewise significant predictors of this mode shift. The negative sign in educational attainment indicates that people with higher educational attainment are least likely to shift their mode from using car to walking which could imply perhaps their intrinsic love for using their cars, or much busier schedule, etc.

However, the responses to the hypothetical scenarios tells a different story as more than half of the respondents still chose to ride their private cars. This shows that there are still other factors that people consider in their mode choice. For those who chose to walk or use public transport, they prefer to walk along San Miguel Avenue, ADB Avenue, Julia Vargas Avenue, and Shaw Boulevard even though this is much farther as compared to the alternative route. Their responses also reveal that they are willing to walk an average of 980m to reach the nearest public transit terminals as long as there are improvements in the pedestrian facilities.

The findings of this research show that introducing improvements in the pedestrian facility has a positive impact on mode shift towards public transport or walking. However, the

models with the specific pedestrian facilities analyzed in this research have yielded lower probabilities of explaining this mode shift. It is therefore recommended to pursue further analysis and evaluation of specific pedestrian facility improvements with actual alignments.

Future research should also include respondents who are car owners but are currently not using their cars going to Ortigas Center to find out their preferences which would be useful to determine what factors should be continued and replicated in other areas. Other variables that address the reasons for using private cars as well as variables regarding the trip profile should also be considered.

Based on the responses to the hypothetical scenarios, people prefer to walk along San Miguel Avenue, ADB Avenue, Julia Vargas Avenue, and Shaw Boulevard so pedestrian facility improvements should be prioritized along these alignments (Figure 12). Canopies may be constructed along these roads to provide protection from the elements (Figures 13-16).

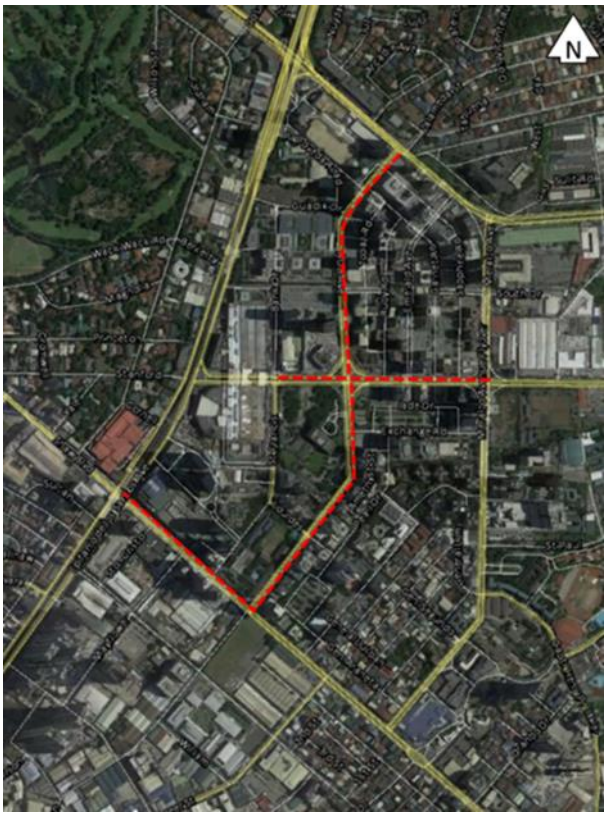

Figure 12. Priority Corridors

Figure 13. San Miguel Avenue – Before and After

Figure 14. ADB Avenue – Before and After

Figure 15. Julia Vargas Avenue – Before and After

Figure 16. Shaw Boulevard – Before and After

For planning considerations, it is recommended that land developers and estate managers provide pedestrian facilities along major roads which usually function as the main pedestrian corridors. These facilities should include wide covered sidewalks with railings that leads to public transit terminals. This way they encourage people to take public transport or walk and possibly reduce the traffic volume within their developments.

For Local Government Units (LGUs), it is recommended that they identify suitable pedestrian corridors so that they can implement improvements in the pedestrian facilities to encourage public transport or walking. They should also make sure that new developments have ample pedestrian facilities and have access to public transport.

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