Chapter VIII

Walking Accessibility

8.1 Walking Accessibility Model for Manila

The purpose of this section is to evaluate factors that influence the propensity to walk to reach station. The roles of factors that might influence the walking behavior to access transit station were examined. There are many alternative modes to reach mass transit station in the study area. To illustrate, Table 8.1 shows the various access modes and access speed to reach mass transit stations.

Table 8.1 Various Access Mode and Its Speed to Reach Station

Access Mode	Access Speed (kph)				
	Observation	Average	St.Dev	min	max
nonAC bus	7	6.34	1.32	5.28	8.23
AC bus	17	3.18	3.04	0.72	9.89
Jeepney	294	6.66	3.70	1.04	19.20
Private Car	23	10.80	5.14	3.17	21.70
Fx (mega taxi)	16	5.23	4.05	0.71	19.20
Taxi (regular taxi)	2	5.28	n.a.	5.28	5.28
Pedicap (human powered)	42	4.86	1.73	2.30	12.00
Tricycle taxi	163	8.83	5.26	0.96	36.80
Non-walking mode	**564**	**7.17**	**4.42**	**0.71**	**36.80**
Walking mode	**379**	**4.84**	**2.67**	**0.64**	**19.20**

These data were summarized from the itinerary trip data in which respondents reported their access mode and access time. The access speed was calculated by dividing the measured access distance and reported access time. Note that the data in the table was obtained from 943 of 1071 observations. It can be seen in the table that the speed of *pedicap* (human powered mode) is similar to the walking speed.

As discussed extensively in the literature, the propensity to walk to a transit station depends on several factors other than the distance. These factors can be classified into groups, namely travelers' socioeconomic characteristics, accessibility characteristics, and other characteristics of transit stations. As conducted in previous walking accessibility studies, the binary choice model is employed to examine the

tendency of mass transit users to walk in order to access mass transit station. The model is used to test the hypothesis that the propensity to walk to reach mass transit station is a function of distance to the station, socioeconomic characteristics, and characteristics of station area.

Socioeconomic characteristics that may influence travelers' access mode choice include gender, age, education level, martial status, occupation, and car availability. Characteristics of a station, such as walking amenities, number of available feeder modes, and land use of surrounding station area can affect the choice of walking to the station. Under the modeling framework, coefficient estimation for binary logit model of the probability of walk and non-walk trip to transit station is presented in Table 8.2. It can be seen in the table that the first model (BL-1) is a walking accessibility model with characteristics of the station area. The second model, BL-2, was built upon the first one by adding the socioeconomic variables. Only the significant variables in the first model are incorporated to the second model. The third model, BL-3, is the final model that incorporated all significant variables.

Table 8.2 Estimation Result of Walking Access Model (Manila)

Parameters	BL-1	BL-2	BL-3
Constant Term	0.8064 (3.9)**	0.7249 (2.99)**	0.9069 (2.88)**
Mode Attributes			
Access distance (meters)	-0.0048 (-13.81)**	-0.005 (-14.63)**	-0.005 (-14.83)**
Transit route in station area	-0.0207 (-1.4)		
Office, school, retail in station area	0.0408 (5.38)**	0.0388 (5.04)**	0.0401 (5.24)**
Socioeconomic Parameters			
Gender (1-women;0-men)		-0.3384 (-1.84)*	-0.3787 (-2.09)**
Age (years)		0.0114 (0.71)	
Education (1-bachelor; 0-othersie)		-0.2537 (-1.28)	
Marital status (1-single; 0-otherwise)		0.1186 (0.37)	
Employee (1-employed; 0-otherwise)		-0.0992 (-0.47)	
Car availability (1-a car is available)		-0.4209 (-1.22)	
Statistics Parameters			
Log-likelihood at zero	-635.3727	-635.3727	-635.3727
Log-likelihood at convergence	-388.1090	-383.9884	-386.8977
Number of obs	943	943	943
LR chi-squared (dof)	494.53	502.77	496.95
Prob > chi2	0.0000	0.0000	0.0000
Pseudo R2	0.3892	0.3956	0.3911
%-correct prediction	77.62%	77.94%	78.69%

note: coefficient (t-ratio);** significance at the level of 5%; * significance at the level of 10%

As can be seen in the table, the constant terms of all three models are positive and significant. This indicates that walking is the preferred access mode to reach the

station, *ceteris paribus*. The estimation result for the coefficient of access distance is as expected. It shows that the probability to walk to access mass transit station decreases as the distance to station increases. This finding concurs with the results of many walking accessibility studies previously discussed in the literature review.

The coefficient of the number of feeder modes in the station area was expected to have negative effect on the choice of walking. The estimation result shows the expected sign, but the coefficient is not significant. The model result shows as well the role of land use characteristics along the way to station. Various types of land use influences the probability of accessing mass transit station by walking. This result is similar to those of Cervero [11] who found that mixed land use within coverage area of transit station area encourages more walking to access the station.

8.2 Walking Accessibility Model for Bangkok

The walking accessibility model for Bangkok data was developed by similar approach with Manila data. Table 8.3 shows the results of walking accessibility model based on the Bangkok data.

Table 8.3 Estimation Result of Walking Access Model (Bangkok)

Parameters	BL-1B	BL-2B	BL-3B
Constant Term	0.3678 (6.83)**	0.3749 (4.18)**	0.3461 (3.51)**
Mode Attributes			
Access distance (meters)	-0.0056 (-6.17)**	-0.0065 (-5.8)**	-0.0062 (-5.88)**
Transit route in station area	-0.0004 (-0.02)		
Office, school, retail in station area	0.0174 (1.9)*	0.0232 (2.04)**	0.0198 (1.98)**
Socioeconomic Parameters			
Gender (1-women;0-men)		-1.2914 (-1.68)*	-1.5956 (-2.23)**
Age (years)		0.062 (2.03)**	0.0444 (1.91)*
Education (1-bachelor; 0-othersie)		-1.0905 (-1.48)	
Marital status (1-single; 0-otherwise)		0.2332 (0.27)	
Employee (1-employed; 0-otherwise)		0.2155 (0.23)	
Car availability (1-a car is available)		-0.9499 (-1.28)	
Statistics Parameters			
Log-likelihood at zero	-87.2288	-87.2288	-87.2288
Log-likelihood at convergence	-45.5534	-38.7616	-40.4564
Number of obs	217	217	217
LR chi-squared (dof)	83.35	96.93	93.54
Prob > chi2	0.0000	0.0000	0.0000
Pseudo R2	0.4778	0.5556	0.5362
%-correct prediction	76.02%	76.53%	77.04%

note: coefficient (t-ratio);** significance at the level of 5%; * significance at the level of 10%

As can be seen in the table, the model of BL-1B and BL-2B are the models with characteristics of station area and socioeconomic variables, respectively, while the BL-3B is selected as the final model.

Like in Manila, walking is the preferred access mode to reach station. The roles of the distance to station and mixed land use development along the way to station also appear significant.

These walking accessibility models concur with the earlier study that was carried out by Chalermpong and Wibowo [47]. The authors developed the walking choice model of access for several mass transit stations and found that walking to access station is highly competitive based on the data set. It was found as well that the coefficient of the distance variable was highly statistically significant and negative, implying the declining propensity to walk with increasing distance.

8.3 Notes on Walking Accessibility Model

The aim of the development of walking accessibility model is to evaluate factors that influence the propensity to walk to reach station with the expected role of station characteristics.

There are many access mode reported in the survey in both of the study areas. Walking as access mode in Manila and Bangkok data covered the proportion over 30% for both study areas. It also revealed that walking to reach station is not easy to do. In Bangkok, for instance, there are many obstructions on sidewalks, such as street vendors, food stalls, utility polls, telephone booths, so much so that pedestrians sometimes must walk on the road surface to avoid these obstructions. There are many narrow streets (locally named *soi*) in Bangkok street network, and almost all of them have no sidewalk.

The comparison of two walking accessibility models from two study areas reveals interesting findings. First at all, in both of the study areas almost all socioeconomic variables were not significant. It could be said that no statistical evidence was found that the propensity to walk to reach station is influenced by individual characteristics. The insignificant effect of socioeconomic parameters on walking tendency to access transit station was also found in Chalermpong and Wibowo [47] who carried out a similar study in Bangkok. The study of walking accessibility for Singapore Mass Rapid Transit found as well that the socioeconomic

parameters of did not statistically influence the tendency of walking to access station [8].

These research findings are quite different from similar studies that were carried out in the developed countries. For instance, Loutzenheiser [23] found that in the case of BART System in San Franscisco Bay Area, the variable of age, gender, race, and car availability were some variables that have strong roles on influencing the propensity to walk to access mass transit station. In the cases of tropical countries, the finding in this study and previous ones seem to suggest that socioeconomic variables, including car availability, have no role on the propensity to walk to access station, except gender.

As regards to gender, it is revealed that in both study areas men are more likely to walk than women. The same results were found for the case of Singapore [8] and BART [23].

The final model from both of the study areas revealed that high density of mixed land use, represented by number of offices, schools and retail shops within station area, has positive correlation with the probability to walk to access station. This finding is similar to Cervero [11] who found the mixed land use within coverage area of transit stop encourages more walking to reach the station, in the case of BART.

Overall, result of the walking accessibility model revealed that walking distance is not the only factor affecting the propensity to walk to transit stations. After controlling for the distance, it is found that station-specific characteristics, i.e. station vicinity, appear to have substantial influence on access behaviors. Different stations, with different walking amenities, physical characteristics, land use patterns, street network structure, and connectivity to other mode of transportation, seem to exert different levels of influence on the propensity to walk.