Mode Choice of University Students and the Possibility of Mode Shifting to the First Urban Railway Line in Hanoi, Vietnam

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Abstract: This study aims to examine the travel mode choice of university students in a developing country where motorcycles have been dominating traffic systems. The study also explored the possibility of mode shifting to the first urban railway line Cat Linh-Ha Dong considering the current mode used and the willingness to pay of the students. With the data collected from 396 students in five universities in Hanoi, Vietnam, a conditional logit regression model was developed to explore individual and alternative specific variables influencing the mode choice for studying trips. Key findings show that current mode usage having a strong effect on the tentative choice of Cat Linh – Ha Dong railway as a means of travelling to universities. Research results are beneficial for transport planners and transport authorities to develop appropriate transport planning strategies.

Keywords: Travel behavior; Mode choice; Urban railway; Willingness to pay; Mode shifting.

1. INTRODUCTION

Universities are more than solely academic places because they are major employers, investors, customers and users of products and services. On a regional and national scale, they have a major economic impact. Universities have many comparisons with small towns, distinguished by their large scale, their own neighbourhoods, their own unique population with traditional day-to-day events, and often even their own infrastructure. Many university-related activities have various effect on the transport and environmental structures nearby.

It is not just universities that have great ability to affect traffic behavior themselves. Students have some influence over their course schedule and may prevent peak traffic hours in this way. Moreover, regular schedules contribute to the frequent movement of people on a university campus during the day. Most university students are unmarried and have no kids, and therefore have less social commitments that affect their options for accommodation and transport. The relatively lower income and younger age of students correspond to a higher proportion of active commuting modes of transport.

While students comprise a considerable proportion of the population of a city, their travel behavior is not well investigated (Khattak et al., 2011). Therefore, studying the travel behavior of university students will reveal fundamental and useful details about the relationship between the campus environment and the travel demand of students, which is very important for designing transport policies (Zhan et al., 2016).

Higher education enrollment in Vietnam has increased significantly over the last decade. According to statistics of the Ministry of Education and Training in 2019, Vietnam's education system had 235 universities, including 170 public universities and 65 private universities. Big cities such as Hanoi, Ho Chi Minh City are home to these higher education institutions. These cities are known for their thriving economy, high population density, better facilities for health

care, and efficient transport network. By seeking to high-quality education in Vietnam, more students are likely to move into these cities with the presence of these good facilities, and the government's goal of internationalizing Vietnam's higher education system.

In shaping the urban environment and the transport networks of such cities, the concentration of higher education institutions plays an important role. It is important for the development of transport strategies, policies and planning to explore and understand the travel behavior and safety situation of students in the university community. Cat Linh – Ha Dong is the first urban railway line in Hanoi and to be tentatively operated in the middle of 2021. This first line has important role to facilitate the first-time experience of people for the usage of high-quality public transport service, especially for students since there are 18 universities and academic institutes locating along this corridor. In a long term, this line is expected to be the trunk network of Hanoi urban railway system.

The purpose of this research is to explore the mode choice of university students in Hanoi, Vietnam and to understand different factors that could influence their mode choices. The study was collected based on a field survey conducted at five universities located along Cat Linh-Ha Dong urban railway corridor. The students were given five alternate travel modes, including walking, cycling, motorcycle, bus and Cat Linh - Ha Dong urban railway, to choose their dominating mode choice under given conditions. The research used a conditional logit model to estimate multiple variables that affect the mode choice of the student. In view of the above, the purpose of this research is to provide a better understanding of Vietnamese higher education (university and college) students' travel behavior to and from their university campuses. This will help notify a range of measures that could be considered to decrease motorcycle usage and facilitate mode shift to the first Cat Linh-Ha Dong urban railway line. Then, it is possible to reduce the amount of traffic congestion across college campuses and the number of traffic incidents involving students.

The paper begins with a literature review, a brief overview of the field of research, accompanied by a methodology debate. Results of model estimation are then discussed, along with a summary of the results. Discussions and conclusions are given in the last section.

2. LITERATURE REVIEW

Various studies have investigated the mode choice of transport users. However, studying on the variables affecting mode choice of college students are seldom (Whalen et al., 2013), particularly in developing countries.

Previous research has examined how student travel behavior is affected by individual characteristics such as socio-economic, demographic and psychological variables. Akar et al. (2013) found that the use of bicycles by women university students may be more sensitive to the proximity of bike facilities. Compared to female students, male students were more likely to walk or cycle, and graduate students were more likely than undergraduate students to walk (Delmelle and Delmelle, 2012). While the research by Zhou (2016) also found that male students are more likely than female students to bike or walk to the campus, he discovered that undergraduate students are more likely than other students to bike or walk to the campus, which contradicts the work of Delmelle and Delmelle (2012). Similar to the results of Delmelle and Delmelle (2012) and Zhou (2016), male students were more likely than females to walk or cycle. Eom et al. (2009) found that undergraduate students and on-campus residents were interested in more travel activities than graduate students and off-campus students with respect to undergraduate and graduate students. Bicycle ownership was found to be a major influence factor for the choice of student mode (Zhan et al., 2016), while in a rural Thailand study it was found that vehicle ownership is the most significant factor correlated with the choices of student

mode choices (Limanond et al., 2011). Finally, the research by Kerr et al. (2010) explored the psychological factors affecting the choice of travel for students and discovered that the behavioral intention to travel by car was the best predictor of conduct of car commuting.

In previous studies, the environment, cost and time of travel are also found to have the potential to influence university student mode preference. Travel cost and time are found to be the most sensitive factors to university students (Danaf et al., 2014; Shannon et al., 2006). Shannon et al. (2006) found that travel time is the most significant obstacle to changing the mode of travel from cars to modes of cycling or walking for students. On the other hand, the variations between the fashion preference patterns of Beirut American University students and the general population of the Greater Beirut Region were examined (Danaf et al., 2014). They noticed that minimizing bus travel time by offering shuttle services or sharing taxis could be promising strategies for AUB students to move from car to public transport mode. While university students at McMaster University, Canada, were found to be very sensitive to travel costs (Whalen et al., 2013), they found that sensitivity could differ across modes of travel. They also found that environmental variables such as street and sidewalk density are impacting modal choices. Rodríguez and Joo (2004) found that the attractiveness of non-motorized modes among students and employees at the University of North Carolina-Chapel Hill was significantly correlated with local topography and sidewalk availability.

Finally, other studies have shown that the student's model preference is jointly decided by a variety of variables. Lavery et al. (2013) analyzed the modality of students at McMaster University, Canada and their findings show that a variety of factors like attitudinal and spatial/land use variables affect student mode preference. In comparison to active travelers, their result shows that active travelers appear to have a higher modality and thus are not captive to a single mode, unlike those who use motorized modes. Students at the Ruhr University Bochum were found that their mode choice decisions were jointly decided by situational factors (infrastructure availability, transit accessibility, travel characteristics and cost) and psychological factors (intentions, values, norms and attributes of individuals) (Klöckner and Friedrichsmeier, 2011).

It is evident, based on the above literature review, that there is lack appropriate study focusing on the travel conduct of university and college students in Vietnam. Once again, most of the studies examined apply to students in developed countries with very few studies in developing countries, where the number of motorcycles is high in most cases. This research is required on this basis, as it will examine the travel behavior of university students in the context of a developing world. Since university students' travel behavior is dynamic and specific (Limanond et al., 2011), a deeper understanding of the choice of mode for students will enable universities and stakeholders to develop and strengthen policies, programs and facilities to facilitate a sustainable mode of travel, such as public transport and non-motorized transport (Shannon et al., 2006). The number of private vehicles that use road networks can be minimized by introducing these strategies. As a result, it will reduce the level of congestion, the number of traffic incidents and the effect on the environment. On the other hand, supporting the use of active modes can contribute to health benefits for learners (McCormack and Shiell, 2011; Shannon et al., 2006). Active travel, such as walking and cycling, has been described as one way to achieve the objective of rising physical activity in public health (Shannon et al., 2006).

3. DATA AND METHODOLOGY

A cross-sectional survey was conducted in Hanoi in May 2020 when the Covid-19 pandemic was well controlled in Vietnam. All the universities and schools opened and operated in the new normal. The travel interview survey was conducted to collect data on student' travel mode

choice to school. A structured questionnaire was administered in five large universities located along Cat Linh – Ha Dong corridor. They were University of Transport Technology (UTT), Hanoi University (HANU), Vietnam National University - University of Science (HUS), Vietnam National University - University of Social Sciences and Humanities (USSH), and Posts and Telecommunications Institute of Technology (PTIT). As a large number of students were studying at these institutions, these academic institutions were selected for the survey. Motorcycles, accompanied by walking, cycling and bus, were the most common means of transport for school travel.

The survey required the respondents to complete a structured questionnaire including both revealed and stated preference questions. In April 2020, a pilot survey was performed, and the questionnaire was updated until the full-scale survey took place in May 2020. The questionnaire is divided into two main sections: students' socio-economic characteristics and travel features. Information on gender, student year, family income, motorcycle rider license, vehicle ownership, the number of vehicles in a household was collected in the first section of the questionnaire. Students were also asked to name the site of their campus and their normal place of residence. Using Google Maps, the researchers estimated the distance between a place of residence and a university campus on the basis of this knowledge (place of residence and university campus).

Information on travel behavior, such as the main mode of travel used, as well as travel time to university, was collected in the second section of the questionnaire. The students were also asked to show the key reasons why a specific mode of transport was chosen. Students were given an opportunity at the end of the questionnaire to indicate whether they were willing to shift to Cat Linh-Ha Dong railway, their willingness to pay and their expectation of quality for this new, effective and secure urban railway system.

3.1. Sampling

There are over 230 universities and schools in Hanoi. Some of these universities have a large number of students (over 20,000 students), while others have less than 2000 students. In view of the catchment area of the new Cat Linh-Ha Dong urban railway line, the size of the sample that would substantially reflect the population had to be identified, given the number of universities and the variety of student numbers. The sampling was carried out in two distinct stages: (1) the selection of universities to participate in the survey and (2) the selection of students (respondents) to participate in the survey from selected universities.

In the first stage, five universities were selected as a sample to participate in the survey. These institutions locate along the Cat Linh – Ha Dong corridor which are in the catchment area of this new urban railway line. The main entrances of these universities are in the walking distance to access to the railway stations (less than 500 meters).

The collection of respondents was the second stage of the sampling process. The minimum sample needed is 383 for a population of more than 100,000 with a 5% error margin and 95% confidence level from the sampling determination table (Parker and Rea, 1997). In selecting students from selected institutions to participate in the survey, a purposeful sampling technique was used. A percentage of the total sample was allocated to be chosen for the interview, based on the student population at each university. Finally, 17.7% of the sample was eventually selected from UTT (represented by 70 students); 23.2% from HANU (92 students); 21.5% from HUS (85 students); 16.2% from USSH (64 students); and 21.5% from PTIT (85 students). There were 396 student respondents who were used in this analysis after the data was reviewed for errors and cleaned up.

3.2. Conditional logit model

Binomial logit and probit techniques are two of the statistical techniques used to evaluate discrete choices, especially for binary choice problems. However, the multinomial logit approach is most commonly used for problems involving the choice between three or more groups. An extension to the previously practically unused multinomial logit model is a framework called conditional logit, a model that is well suited to the behavioral modeling of polychotomous choice situations (Hoffman and Duncan, 1988). In choice behavior models, the conditional logit model is especially suitable, where the explanatory variables which include characteristics of the alternatives of choice (for example, time or cost) as well as characteristics of individuals making these choices (such as income or age).

A conditional logit (CL) model is used in this paper to explore the option of transport mode to universities in Hanoi, Vietnam, by university students. The assumption that passengers will prefer the travel mode that offers the greatest usefulness under some conditions is made in disaggregated models. In such a scenario, the utility function consists of both a fixed and a random term. Based on the random utility theory (Gaudry et al., 1977), a function that depends on mode characteristics (Z) and the characteristics of the person (X) and an additive error term is the utility associated with each mode of transport. The function of a utility is formulated as follows:

$$U_{ij} = X_i\alpha_j + Z_{ij}\beta + \varepsilon_{ij} \quad (1)$$

where U_{ij} is utility value of the jth travel mode chosen by the ith traveler; X_i is the vector of regressors describing the characteristics of the individual and Z_{ij} is the vector of regressors describing the characteristics of the jth alternative for individual i, with the corresponding parameter vectors denoted by α and β respectively and ε_{ij} is the error term. The CL model extends the multinomial logit (MNL) model to include the attributes of the choice variables (such as travel time and travel cost) as well as the attributes of the individuals (such as gender, family income, vehicle ownership).

The probability P_{ij} of the jth travel mode chosen by the ith traveler is given by the following formula:

$$P_{ij} = \frac{e^{X_i\alpha_j + Z_{ij}\beta}}{\sum_{k=1}^{J} e^{X_i\alpha_j + Z_{ij}\beta}} \quad (2)$$

In this research the total choice set included five options (Walking; Bicycle; Motorcycle; Bus; Cat Linh – Ha Dong Urban railway). The parameters in the CL model can be estimated using the maximum likelihood approach. For J categories, J-1 coefficient will be estimated, where the other category is used as the reference level. The estimated coefficients describe how the effect of X and Z variables on the probability of choosing each alternative relative to the reference category variable.

4. RESULTS

4.1. Data characteristics

At the completion of the data cleaning of the field survey, the total number of respondents received was 396 (167 females and 229 males) (Table 1).

In relation to the year of studies, the majority of respondents (39.6%) were in the third year of their studies, followed by 23.2% in the final (fourth) year of studies. Students in the first and second years accounted for 17.2 % and 19.9 % of the respondents. The level of family income of a student was divided into five categories, representing the level of living status

recommended by the World Bank. Nearly 28% of the students involved in the study came from a low-income family at the time of the survey (the income of entire family was less than 5 million VND per month). From the study, 72.2 % of students received an official license that allowed them to ride a motorcycle. It was also requested that respondents include the number of motorcycles in their household. The outcome indicates that almost 36 % of students indicated that their households had more than two motorcycles, 40.4 % had two, and 21.2 % had just one motorcycle. There were only 14 students who didn't have a motorcycle in their homes (4 %).

Table 1. Characteristics of survey sample

Variable	Category	Frequency	Percentage (%)
Gender	Male	229	57.8
	Female	167	42.2
Year of student	First year	68	17.2
	Second year	79	19.9
	Third year	157	39.6
	Final year	92	23.2
Monthly household income (million VND*/month)	<5	112	28.2
	5~10	126	31.8
	10~20	107	27.0
	20~40	38	9.6
	> 40	13	3.3
Number of vehicles in a household	Bicycle		
	None	123	31.1
	One	196	49.5
	Two	60	15.2
	More than two	17	4.3
	Electric Bicycle		
	None	246	62.1
	One	139	35.1
	Two	9	2.3
	More than two	2	0.5
	Motorcycle		
	None	16	4.0
	One	78	19.7
	Two	160	40.4
	More than two	142	35.9
	Car		
	None	294	74.2
	One	84	21.2
	Two	10	2.5
	More than two	8	2.0
Motorcycle rider license	Yes	286	72.2
	No	110	27.8
Travel distance	< 1km	117	29.5
	1km – 3km	83	21.0
	3km – 5km	33	8.3
	5km – 10km	73	18.4
	> 10km	90	22.7

* As at the time of this study, $1 was equivalent to 23,300 VND.

Table 2 shows the distribution of transport modes and average travel times taken by students to travel to their university campuses. It can be seen that more than 44% of university students travelled to school by motorcycles. 34.8% of students walked to school while 16.2% used bus. Bicycle is the less popular mean used by university students as it accounted for only 0.5%. Walking had the lowest average travel time of 9.6 min. This is followed by riding a motorcycle (25.8min) and cycling (30.0min). Travelling by bus has the longest average travel time (43.0 min).

Table 2. Mode of transport distribution and travel time.

	No. of respondent	Percentage (%)	Average travel time (min)
Walking	138	34.8	9.6
Bicycle	2	0.5	30.0
Bus	64	16.2	43.0
Motorcycle	175	44.2	25.8
Other	17	4.3	-
Total	396	100	

In developing countries, motorcycles have been a dominant means of transport, so it is not surprising that male and female university students are still the most common mode of travel to school (53.6 % and 36.3 % respectively). Most second-year students prefer active ways (walking and bus) to get to school in the sample studied, although just 31.1% ride by motorcycle. The possible explanation for this curious pattern may be that, after one year on the waiting list, second year students choose to transfer to dormitories located within the university campus. Since the rental fee is much lower, the dormitories are appealing to non-local students.

With regard to the family income of the students, the proportion of middle-aged students travelling to their university campuses using motorcycles is higher than that of low-income families (48.5% compared to 33.0%), and even double the age of high-income families (88.9%). It is clear that students who have a rider's license prefer to use a motorcycle to school with regard to motorcycle rider license, even though non-motorized forms or public transport could be a better choice. Over 54.4% of students walk, while 32% ride by bus to their universities because they can't get a motorcycle.

Most students currently walking to school live within a kilometer radius of their university campuses, as shown in Table 3. Of the 115 students traveling less than one kilometer, 91.3 % walk, 18.7 % use motorcycles and no public transport is used by students. Interestingly, many students (50.6%) continue to use a motorcycle to get to school within a short distance (1km-3km). This figure shows the dependency of university students in developed countries on the motorcycle. Students also prefer a motorized mode for long distance trips (more than 3 km) (more than 70 %).

4.2. Conditional logit model specification

For the dependent variable, the conditional logit model utilizes the motorcycle as the reference group. The model contains two types of independent variables: (1) individual specific variables such as gender, year of student, license of motorcycle rider, ownership of motorcycles, and distance of travel; and (2) alternative specific variables such as time of travel. For the fitted conditional logit models, Table 4 shows the approximate parameters. A good fit is indicated by the diagnostic results of the fitted model.

Table 3. Sample characteristics by mode of transport to work.

Variable	Transport mode (%)			Total sample size (n)
	Walking	Bus	Motorcycle	
Gender				
Male	32.7	13.6	53.6	220
Female	42.0	21.7	36.3	157
Year of student				
First year	30.3	22.7	47.0	66
Second year	43.2	25.7	31.1	74
Third year	34.5	16.2	49.3	148
Final year	39.3	6.7	53.9	89
Monthly household income (million VND/month)*				
<5	37.7	29.2	33.0	106
5~10	41.3	17.4	41.3	121
10~20	42.7	8.7	48.5	103
20~40	7.9	7.9	84.2	38
> 40	11.1	0.0	88.9	9
Motorcycle rider license				
Yes	29.9	11.3	58.8	274
No	54.4	32.0	13.6	103
Number of motorcycle in a household				
None	50.0	43.8	6.3	16
One	41.3	25.3	33.3	75
Two	39.7	19.2	41.1	151
More than two	28.9	6.7	64.4	135
Travel distance				
< 1km	91.3	0.0	8.7	115
1km – 3km	31.6	17.7	50.6	79
3km – 5km	6.7	23.3	70.0	30
5km – 10km	0.0	28.4	71.6	67
> 10km	0.0	24.4	75.6	86
Willingness to join the new urban railway line				
Yes	41.7	18.2	40.1	242
No	27.4	14.8	57.8	135

* As at the time of this study, $1 was equivalent to 23,540 VND.

Travel time is generally found to be a significant predictor of preference of travel mode in previous studies (Beirão and Sarsfield Cabral, 2007; Frank et al., 2008). Results from the approximate conditional logit model show that travel time has a major influence on the choice of mode for school transport by students. The approximate odds ratio (OR = 0.936, $p < 0.001$) shows that students are less likely to select transport mode with longer travel time. The finding is confirmed by the findings of previous studies on the choice of mode for students in Hamilton (Whalen et al., 2013) and Beirut (Danaf et al., 2014), where students were found to be less likely to prefer longer-duration transport modes. Our results, however, contradict other studies

where it has been found that travel time has a positive and important relationship with mode choice (Basmajian, 2010; Diana, 2008; Ory and Mokhtarian, 2005). The context in which those studies were performed tends to indicate this contradictory result. The importance of the negative travel time coefficient suggests that the reliability of a mode of transport is very significant and is a major factor in choosing a mode of travel. Currently, the versatility and durability of this mode of transport have made students dependent on motorcycles.

Table 4. Estimates of conditional logit model.

Variable	Walking			Bus		
	Coefficient	Standard Error	Odds ratio	Coefficient	Standard Error	Odds ratio
Individual-specific variables						
Gender						
Male	-.384	.385	.681	-1.331	.436	.264
Female	Ref.			Ref.		
Year of Student						
First year	-.895	.193	.409	.474	.197	1.607
Second year	.024	.198	1.024	2.108	.207	8.229
Third year	-.543	.203	.581	.933	.215	2.542
Final year	Ref.			Ref.		
Family motorcycle ownership						
None	2.908	.204	18.319	4.942	.218	139.992
One	1.423	.211	4.151	1.874	.222	6.514
Two	.882	.218	2.415	1.808	.232	6.101
Three	.604	.227	1.829	.758	.252	2.133
More than three	Ref.			Ref.		
Motorcycle rider licence						
Yes	-2.325	.513	.098	-2.802	.463	.061
No	Ref.			Ref.		
Travel distance						
< 1km	4.991	.239	147.146	-17.085	.190	3.803E-08
1km – 3km	2.090	.242	8.081	-.341	.200	.711
3km – 5km	-.071	.251	.932	-.560	.209	.571
5km – 10km	-16.589	.261	6.243E-08	.071	.212	1.074
> 10km	Ref.			Ref.		
Intercept	-4.305	.030		-18.314	.000	
Choice-specific variables						
Travel time (min)	-.066	.029 ***	.936			
Sample size	377					
Log-likelihood	-151.78					

a Motorcycle is used as reference level.
* 10% Significant level.
** 5% Significant level.
*** 1% Significant level.

The travel time for public transport services in Vietnam, on the other hand, is often long, largely due to the extremely long waiting and transfer times. Therefore, the public transit system needs to be strengthened in terms of efficiency, frequency, reliability and accessibility in order to attract students. This can be accomplished by the growth and extension of the public transport system to all universities and schools, as well as by increasing the frequency of service at high-demand institutions. Table 3 shows that reliability is one major reason affecting university

students' choice of a mode. Consequently, it is not surprising that most students rely heavily on motorcycles. The policy of establishing an efficient and effective public transport system would allow students to move from motorcycles to public transport, thus reducing their dependency on motorcycles.

The cost analysis is included in the model. However, the alternative-specific travel cost was negative, it was not significant in the model. The potential reason for this outcome may be that the majority of students interviewed for this study were highly motorcycle dependent. Even for short distance trips that can be undertaken by other alternative modes with lower costs such as walking or cycling, motorcycles were used. In addition, the motorcycle operating cost is not significantly high, making it possible to buy motorcycles for many students. In the conditional logit model, this could explain why travel costs are not a significant variable.

In terms of gender, male students are less likely to travel to school by walking (OR = 0.681, p = 0.046) or bus (OR = 0.264, p = 0.005). In contrast, male students are more likely to travel by motorcycle. This finding is consistent with previous studies on students' mode choice. In his work, (Zhou, 2012), found that the coefficient on gender shows that female significantly choose biking or walking as their mode of transport to school.

Depending on the student's year, the likelihood of using public transport to go to school is extremely important. The model shows that first, second, or third-year students are more likely to travel to school by bus than fourth-year students (OR= 1.607, OR= 8.229 and OR= 2.542, respectively). As first year students is not familiar with the new university environment and most of them come from rural areas, public transport is often used by this group. However, as they become acquainted with the university climate, they would choose to get a motorcycle license, buy a motorcycle and move to a new home, further from the university, but with high-quality facilities and lower rental fees. In particular, for third year and final year students, as part of their studies, they are expected to take internships in different organizations located within and outside Hanoi to obtain some experience before they graduate from college. Thus, for these groups, owning a motorcycle is important.

As expected, motorcycle ownership as well as having the license to ride are both highly significant. Students whose family do not own motorcycle are more likely to walk and travel by bus to school (OR = 18.31 and OR = 139.99 respectively). With the increase of motorcycle ownership of student's family, the probability that they walk and travel by bus to school decrease respectively.

Students with a license to ride are more likely to travel by motorcycle rather than walking and travelling by bus to school (OR = 0.098 and OR = 0.061 respectively). It is not surprising that the probability of using private transport is highly significant for students owning a motorcycle. In fact, in developing countries many people rely heavily on motorcycles due to their mobility, survivability, and accessibility (Srinivasan et al., 2007).

4.3. Willingness to use the first urban railway line Cat Linh – Ha Dong

Cat Linh - Ha Dong is the first urban railway line of Hanoi to be operated in the middle of 2021. As part of the master plan for the development of the mass rapid transit networks, this line plays an important role in creating a habit of traveling using high quality public transport services.

To conduct the survey, the new urban railway line Cat Linh – Ha Dong was described in detailed about the route, the location of stations, the headway and the tentative range of ticket fee. This line will be reliable, comfortable and easy to access. The study explored the possibility that student using the first urban railway Cat Linh – Ha Dong. Among 396 students be interviewed, 64% of them intend to use this line in the future (Table 5).

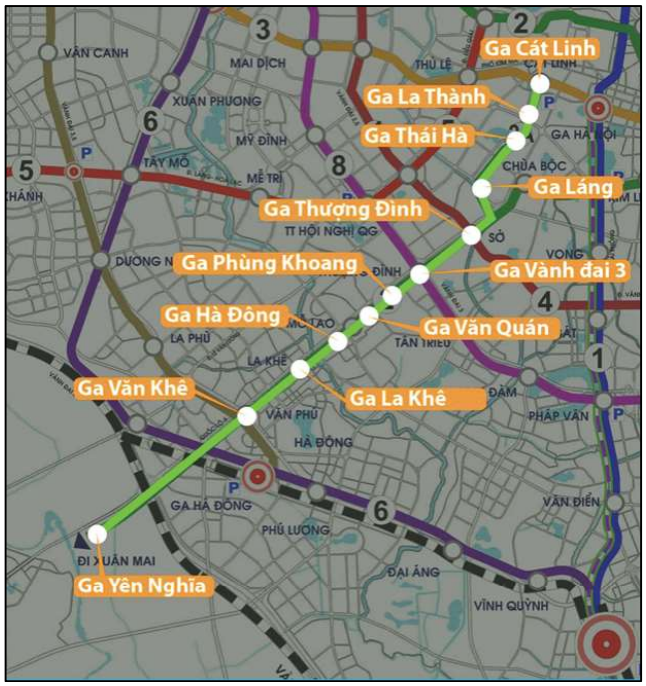

Figure 1. Location of 12 stations along Cat Linh – Ha Dong railway line

The results show that a high proportion of students going to school by walking (73.2%) and bus (68.8%) intend to use Cat Linh - Ha Dong urban railway while only 55.4% of students who are riding a motorbike intend to use this line in the future. This number is also consistent with the motorcycle riding license results, that 70.9% of the students having driving license intend to use the railway line.

Table 5. The possibility to use the first urban railway line Cat Linh – Ha Dong

		Intend to use the first urban railway Cat Linh – Ha Dong (%)		Total sample size (n)
		Yes	No	
Current mode to school	Walking	73.2	26.8	138
	Bus	68.8	31.3	64
	Motorcycle	55.4	44.6	175
Year of student	First year	60.3	39.7	68
	Second year	63.3	36.7	79
	Third year	63.1	36.9	157
	Final year	67.4	32.6	92
Motorcycle driving license	Yes	60.8	39.2	286
	No	70.9	29.1	110

There is no significant difference between the year of students in selecting urban railway for travel in the future. The percentage of the first, second, third and final-year students plan to use the railway are 60.3%, 63.3%, 63.1% and 67.4% respectively.

The study also explored the willingness to pay for the Cat Linh - Ha Dong ticket. In order to design the ticket level, the tickets range of conventional buses and current BRT system (range from 8,000 VND to 15,000 VND) are used for reference. Finally, the survey offered four groups

of ticket prices (below 6,000 VND; 6,000 VND - 10,000 VND; 10,000 VND - 15,000 VND; and above 15,000 VND) for students who intend to use this urban railway to make the most appropriate selection.

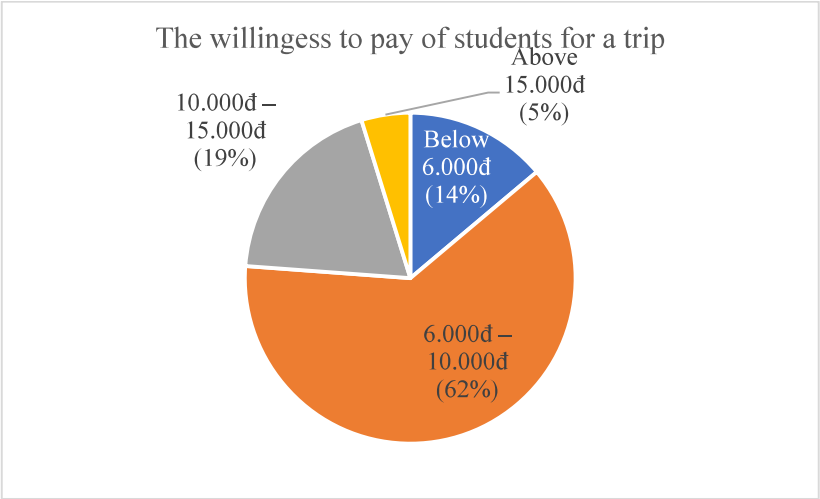

Figure 2. The willingness to pay of student for Cat Linh – Ha Dong railway

Survey results show that, students who plan to use the Cat Linh - Ha Dong railway (252 students out of 396 students, accounting for 64%), select the ticket range (6,000 VND to 10,000 VND) with the highest percentage (62%), while only 5% of students select the fare above 15,000 VND for one trip. In addition, 14% of student are willingness to pay for fares below 6,000VND and 19% of them select the range VND 10,000 - VND 15,000. The results show that the ticket price of conventional buses (6,000 VND) and current BRT system (10,000 VND) having a significant influence on willingness to pay of students. Most students confirm that they are able to use Cat Linh - Ha Dong railway if the ticket price is equivalent to the existing public transport (conventional bus and BRT).

The study had a further analysis of the student's willingness to pay by gender, the current mode choice, household income and motorbike ownership of the household (Table 6). The study confirmed that household monthly income has a great influence on the student's willingness to pay for the railway tickets. Students from families with high income (the group of 20 ~ 40 million VND/month and above 40 million VND/month) are able to pay for the ticket over 15,000VND (16% and 16.7% respectively). More female students (69.1%) are willing to pay for the ticket rate 6,000 VND - 10,000 VND than male students (57%), while a higher rate of male student (22.5%) are willing to pay for the ticket range 10,000VND - 15,000VND than female students (14.5%). At the medium ticket range (6,000 VND - 10,000 VND), more second and third year student are willing to pay than first and last year students.

The willingness to pay for the medium ticket range (VND 6,000 - VND 10,000) of students who are walking and traveling to school by bus is 69.3% and 72.7% respectively, comparing with a lower rate of students (51.5%) who are riding a motorbike. This result once again confirms the impact of current ticket prices of conventional bus on the willingness to pay for the Cat Linh - Ha Dong ticket.

Table 6. Willingness to pay for the ticket range of Cat Linh – Ha Dong urban railway

	Willingness to pay for the ticket range of Cat Linh – Ha Dong urban railway (%)				Total sample size (n)
	<6.000đ	6.000đ – 10.000đ	10.000đ – 15.000đ	> 15.000đ	
Gender					
Male	16.2	57.0	22.5	4.2	229
Female	10.9	69.1	14.5	5.5	167
Year of student					
First year	22.0	51.2	22.0	4.9	67
Second year	8.0	74.0	14.0	4.0	79
Third year	10.1	66.7	16.2	7.1	157
Final year	19.4	53.2	25.8	1.6	92
Current mode to school					
Walking	15.8	69.3	11.9	3.0	138
Bus	13.6	72.7	11.4	2.3	64
Motorcycle	12.4	51.5	29.9	6.2	175
Travel distance					
< 1km	12.6	71.3	10.3	5.7	117
1km – 3km	13.5	61.5	23.1	1.9	83
3km – 5km	21.7	56.5	17.4	4.3	33
5km – 10km	7.5	60.0	25.0	7.5	73
> 10km	18.0	52.0	26.0	4.0	90
Household monthly income (millions VND/month)					
<3	25.0	60.0	10.0	5.0	33
3~6	20.4	67.3	8.2	4.1	79
6~10	10.8	72.3	15.7	1.2	126
10~20	14.5	53.6	27.5	4.3	107
20~40	4.0	52.0	28.0	16.0	38
> 40	0.0	33.3	50.0	16.7	13
Household motorcycle ownership					
None	50.0	30.0	0.0	20.0	16
One	24.6	59.6	14.0	1.8	78
Two	9.4	67.9	17.9	4.7	160
Three	7.7	59.6	30.8	1.9	92
More than three	7.4	63.0	18.5	11.1	50

The study also examined the quality requirements of students with five criteria: (1) Good provision of information on routes, schedules, fares; (2) Good walkway to the station; (3) The car is equipped with air conditioning; (4) The car is equipped with wifi; and (5) Security, not pickpockets, stealing in the car. Students rate the importance level from 1-5 on the Likert scale for successive criteria, with a score of 5 for "Very important" and graded to 1 for "Really unimportant".

Survey results show that security is the most important criteria with very important requirement (4.75), followed by information (4.68). The provision of air conditioning and wifi are considered to be medium important level with the point of 4.15 and 3.94 respectively.

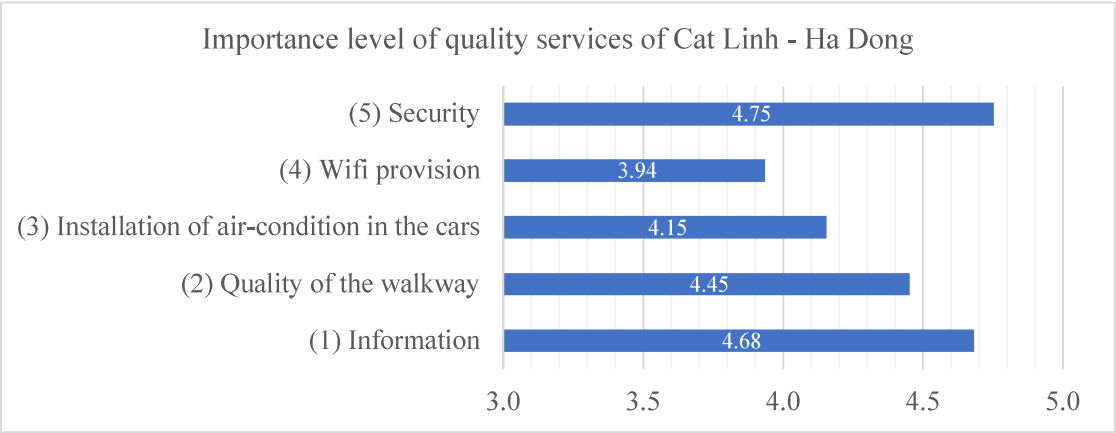

Figure 3. The quality requirements of students for Cat Linh – Ha Dong

5. DISCUSSIONS AND CONCLUSIONS

Universities and transport planners will create and enhance strategies, initiatives and infrastructure aimed at encouraging safe modes of transport, such as public transport, walking or cycling, through understanding students' travel behavior. The reduction in the use of private vehicles would have the effect of mitigating the level of traffic congestion and the environmental effects on university campuses.

This study examines the travel mode choice of university students to school in Hanoi, Vietnam. In order to explore individual and alternative unique variables affecting the mode choice of students, a conditional logit regression model was developed. The findings show that travel time, gender, student year, family income, ownership of motorcycle rider licenses, ownership of motorcycles, and travel distance are all significant factors affecting students' travel mode choice.

It is found that student year to be a new factor that affect mode choice of students. Students in the first year were found to be significantly more likely to travel to school via public transport than second, third or final year students. Thus, a university campus with more first year students should be considered to be a large attraction when developing a public transport system. The findings of the research show that an effective strategy to encourage the use of active modes by university students might be to provide more student apartments on or near university campuses.

The result also demonstrates that household's motorcycle ownership does not impact the mode choice of the students. Motorcycles are the dominant mode of transport in many cities in Vietnam, due to the flexibility and durability of this mode of transport. It is widely used also for short distance trips with the low running cost of motorcycles, which can be undertaken by other alternative modes with lower costs, such as walking or cycling. It is therefore necessary to encourage students to take advantage of public transport (conventional bus and the first urban railway line).

Cat Linh - Ha Dong urban railway has important role to facilitate the first-time experience of people for the usage of high-quality public transport service, especially for students who are living and studying densely along this corridor. The tentative usage of this line depends significantly on the current travel behavior of students. The students who are walking and taking a bus without a motorbike-driving license accounts for the highest percentage of using the Cat Linh - Ha Dong railway. However, the student's willingness to pay depends largely on the current ticket prices of conventional buses (6,000 VND) and BRT system (10,000 VND).

The results showed that nearly 62% of students, who plan to use the Cat Linh - Ha Dong railway, are willing to pay at the ticket price of 6,000 VND - 10,000 VND. It is not a high fare for a high-quality public transport. This feature has implications for public transport authorities and policy makers.

It is also revealed that a sole focusing on public transport network investment is not enough, it is necessary to make attention on the accessibility (especially the walkway quality) and determine suitable ticket range for different transport user groups. Students who are mostly in low-income group should have incentives to encourage them to travel by public transport, instead of using motorcycles for short-distance trips. These empirical results will provide the basis for railway operating authorities and decision-making organizations to improve the quality of public transport services and the attractiveness of the urban railway system in Hanoi.

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