



## Urban Railway Development in Hanoi and the Possible Impacts on Mode Shifting: Experiences from Young Transport Users

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**Abstract:** This study aims to explore the travel behaviour of young travel group to understand different factors that could influence their mode choices, and their willingness to shift to the first urban railway line in Hanoi. This will help notify a range of measures that could be considered to decrease motorcycle usage and facilitate mode shift to public transport system. 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, especially the dominant of motorcycle riding, 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 behaviour; Travel time; Urban railway; Willingness to pay; Mode shifting.

### 1. Introduction

The development of new metro systems over the previous two decades demonstrates a worldwide interest in urban rail transit infrastructure. Every new urban railway line has the potential to alter the present modal split, which is now dominated by private (car or motorcycle) transport users. A feasibility study is undertaken for any new or expanding metro system, focusing primarily on existing mobility challenges, travel demand, proposed new infrastructure, and the environmental and financial aspects of a new metro project.

Nevertheless, the consideration of potential transport users, their mode preferences,

willingness to shift to metro, and the conditions that would encourage such a switch are not fully captured. As a result, it's often difficult to tell what the public thinks about a new service or whether they'll use it in the future. The real demand for metro services is frequently substantially lower than expected due to several flaws in feasibility studies. As a result, a poll of potential metro users near a planned metro line was created to look into people's readiness to switch to metro and to include soft aspects that could help.

Cat Linh – Ha Dong is the first urban railway line in Hanoi and has been officially operated in the early of November 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 as young transport user group, 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.

Young transport users such as students contribute a significant proportion of the travel demand, their mode choice is not well examined [1]. As a result, researching university students' travel habits will disclose valuable and helpful information on the relationship between the campus environment and student travel demand, which is crucial for developing transport policies [2].

The purpose of this research is to explore the travel behaviour of young travel group (mainly students) to understand different factors that could influence their mode choices, and their willingness to shift to the first urban railway line in Hanoi. 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. 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 young transport users.

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 and mode shifting of transport users. However, studying on the variables affecting mode choice of young travel group are seldom [3], particularly in developing countries.

Previous research has examined how student travel behaviour is affected by individual characteristics such as socio-economic, demographic and psychological variables. Akar et al. (2013) [4] 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 [5]. While the research by Zhou (2016) [6] 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) [5]. Similar to the results of Delmelle and Delmelle (2012) [5] and Zhou (2016) [6], male students were more likely than females to walk or cycle. In terms of undergraduate and graduate students, Eom et al. (2009) [7] discovered that undergraduate students and on-campus residents were more interested in travel activities than graduate students and off-campus students. Bicycle ownership was found to be a major influence factor for the choice of student mode [2], 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 [8]. Finally, the research by Kerr et al. (2010) investigated the psychological elements influencing students' mode choices and discovered that the behavioural intention to travel by automobile was the strongest predictor of car commuting behaviour [9].

Previous research has revealed that the environment, cost, and time of travel can all influence university student mode preference. The most sensitive considerations for university

students are travel expense and time [10], [11]. According to Shannon et al. (2006), the most major barrier to students switching from cars to modes of cycling or walking is trip time. The differences in fashion preference patterns between Beirut American University students and the general population of the Greater Beirut Region, on the other hand, were investigated [10]. They found that reducing bus travel time by offering shuttle services or sharing cabs could be viable options for AUB students who want to switch from driving to public transport. While students at McMaster University in Canada were discovered to be extremely sensitive to travel expenditures [3], they found that sensitivity could differ across modes of travel. They also discovered that contextual factors like street and sidewalk density influence mode choices. The appeal of non-motorized modes among students and employees at the University of North Carolina-Chapel Hill was found to be highly connected with local geography and sidewalk availability, according to Rodriguez and Joo (2004) [12].

Finally, other research have found that a range of factors influence a student's modal preference. Lavery et al. (2013) analysed 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 modal preference. In compared to individuals who utilize motorized modes, their findings reveal that active travellers appear to have a greater modality and hence are not bound to a single mode. Situational factors (infrastructure availability, transit accessibility, trip characteristics, and cost) and psychological aspects were shown to influence students' modal choice decisions at Ruhr University Bochum (intentions, values, norms and attributes of individuals) [13].

Based on the aforementioned literature assessment, it is clear that there is a need for more research into the travel behaviour of young travellers in Vietnam (university and college students). Again, the majority of the studies

reviewed are for students in affluent nations, with only a few studies in poor countries, where the number of motorcycles is typically high. This research is required on this basis, as it will examine the travel behaviour of university students in the context of a developing world. Since university students' travel behaviour is dynamic and specific [8], 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 [11]. By implementing these strategies, the number of private vehicles using road networks can be reduced. As a result, there will be less traffic congestion, fewer traffic accidents, and less environmental impact. On the other hand, supporting the use of active modes can contribute to health benefits for learners [11], [14]. Active travel, such as walking and cycling, has been described as one way to achieve the objective of rising physical activity in public health [11].

### 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 modal 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.

Respondents were required to fill out a structured questionnaire that included both revealed and stated preference items. A pilot survey was conducted in April 2020, and the questionnaire was modified until the full-scale survey was conducted in May 2020. The questionnaire is divided into two sections: socioeconomic characteristics of students and travel characteristics. The first component of the questionnaire included information on gender, student year, family income, motorbike driving license, car ownership, and the number of vehicles in a household. Students were also asked to identify their campus and their usual living quarters. On the basis of this knowledge, the researchers approximated the distance between a place of living and a university campus using Google Maps (place of residence and university campus).

Information on travel behaviour, 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 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 round, a sample of five universities was chosen to participate in the survey. These institutions are located along the Cat Linh – Ha Dong corridor, which is part of the new urban railway line's catchment area. These universities' main gates are within walking distance of 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) [15]. A structured sampling strategy was utilized to choose students from designated colleges to participate in the survey. Based on the student population at each university, a proportion of the overall sample was chosen for the interview. 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 behavioural modelling of polychotomous choice situations [16]. In choice behaviour 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 [17], 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  $j$ th travel mode chosen by the  $i$ th traveller;  $X_i$  is the vector of regressors describing the characteristics of the individual and  $Z_{ij}$  is the vector of regressors describing the characteristics of the  $j$ th alternative for individual  $i$ , with the corresponding parameter vectors denoted by  $\alpha$  and  $\beta$  respectively and  $\varepsilon_{ij}$  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  $j$ th travel mode chosen by the  $i$ th traveller is given by the following formula:

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

In this research the total choice set included five options (walking; bicycle; motorcycle; bus; others). 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) as in Table 1.

Many respondents (39.6%) were in their third year of studies, followed by 23.2 % in their final (fourth) year of study. Students in their first and second years made up 17.2% and 19.9% of the respondents, respectively. A student's family income was classified into five categories, each matching the World Bank's suggested level of living status. At the time of the survey, about 28% of the students in the study came from a low-income family (the income of entire family was less than 5 million VND per month). 72.2 % of students acquired an official license allowing them to ride a motorcycle as a result of the study. Respondents were also asked to list the number of motorcycles in their home. According to the results, over 36% of students said their homes had more than two motorcycles, 40.4 % said they had two, and 21.2 % said they only had one motorcycle. Only 14 students did not have a motorcycle at home (4%).

Table 2 shows the distribution of transport modes and average travel times taken by students to travel to their university campuses. 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 (25.8 min) and cycling (30.0 min). Travelling by bus has the longest average travel time (43.0 min).

Motorcycles have always been a popular source of transport in poor countries, so it's no surprise that male and female university students still use them to get to school (53.6% and 36.3% respectively).

Most second-year students prefer 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.

Regarding the family income of the students, the proportion of middle-income 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%).

Students who have a driving's license prefer to use a motorcycle to school regarding motorcycle driving license, even though non-motorized forms or public transport could be a better choice.

**Table 1.** Characteristics of survey sample

<b>Variable</b>	<b>Category</b>	<b>Frequency</b>	<b>Percentage (%)</b>
<b>Gender</b>	Male	229	57.8
	Female	167	42.2
<b>Year of student</b>	First year	68	17.2
	Second year	79	19.9
	Third year	157	39.6
	Final year	92	23.2
<b>Monthly household income (million VND*/month)</b>	<5	112	28.2
	5~10	126	31.8
	10~20	107	27.0
	20~40	38	9.6
	> 40	13	3.3
<b>Number of vehicles in a household</b>	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
<b>Motorcycle driving license</b>	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
	Yes	286	72.2
	No	110	27.8
<b>Travel distance</b>	< 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 23,540 VND (VND - Vietnam Dong).

**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	

**Table 3.** Sample characteristics by mode of transport to school

Variable	Transport mode (%)			Total sample size (n)
	Walking	Bus	Motorcycle	
<b>Gender</b>				
Male	32.7	13.6	53.6	220
Female	42.0	21.7	36.3	157
<b>Year of student</b>				
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
<b>Monthly household income (million VND*/month)</b>				
<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
<b>Motorcycle driving license</b>				
Yes	29.9	11.3	58.8	274
No	54.4	32.0	13.6	103
<b>Number of motorcycle in a household</b>				
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
<b>Travel distance</b>				
< 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
<b>Willingness to join the new urban railway line</b>				
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 (VND - Vietnam Dong)

According to the findings, 54.4% walk to their institutions, while 32% take the bus since they can't afford a motorcycle. As indicated in Table 3, the

majority of students who walk to school today live within a kilometre of their university campuses. For student who travelled less than one kilometre (115

students), 91.3% walked, 8.7% rode motorcycles, and none of them took buses. Surprisingly, many pupils (50.6%) still ride their motorcycles to school even they had very short distance (1km-3km). This diagram depicts university students' reliance on motorcycles in developed countries. For long-distance journeys (more than 3 km), motorcycles are also preferred by students (more than 70%).

#### 4.2. Conditional logit model specification

The conditional logit model uses the motorcycle as the reference group for the dependent variable. The model has two categories of independent variables: (1) individual factors including gender, year of study, motorcycle license, motorcycle ownership, and travel distance; and (2) alternative specific variables like travel time. 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.

Travel time is generally found to be a significant predictor of preference of mode shifting in previous studies [18], [19]. 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 [3] and Beirut [10], 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 [20]–[22]. 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.

In contrast, travel time for public transport in Vietnam is frequently long, owing to unusually long waiting and transfer periods. To attract students, the public transport system must be improved in terms of efficiency, frequency, reliability, and accessibility. This can be achieved through expanding and extending transport to all universities and schools, as well as increasing service frequency at high-demand universities. Table 3 reveals that one of the most important factors influencing university students' mode choice is reliability. As a result, it's no surprise that the majority of students rely extensively on motorcycles. Students would be able to transition from motorbikes to public transport if the policy of developing an efficient and successful public transport system were implemented, minimizing their reliance on motorcycles.

The analysis model incorporates a cost analysis. The alternative-specific travel cost, on the other hand, was negative and thus not relevant in the model. This result could be explained by the fact that the majority of the students interviewed for this study were heavily reliant on motorcycles

Motorcycles were employed even for short distance trips that could have been accomplished more affordably by other transport modes, such as walking or cycling. Furthermore, the cost of operating a motorcycle is not too high, allowing many students to own motorcycles. This could explain why travel costs aren't a major variable in the conditional logit model.

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) [23], found that the coefficient on gender shows that female significantly choose biking or walking as their mode of transport to school.

The possibility of using public transport to get to school varies depending on the student's year.



According to the model, first, second, and third-year students are more likely than fourth-year students to use the bus to school (OR= 1.607, OR= 8.229 and OR= 2.542, respectively). Because first-year students are unfamiliar with the new university environment and the majority of them are from rural areas, they frequently use transport. However, when they become more familiar with the university context, they may decide to obtain a motorcycle license, purchase a motorcycle, and relocate to a new residence that is further away from the university but offers better amenities and lower rental prices. Third- and fourth-year students, in particular, are expected to complete internships in various companies located inside and outside of Hanoi as part of their studies in order to gain experience before graduating from college. As a result, possessing a motorcycle is essential for

these individuals.

Motorcycle ownership, as well as having a valid driver's license, are both extremely important. 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 driver's license are more likely to ride their motorcycle to university rather than walk or take the bus (OR = 0.098 and 0.061, respectively). It is reasonable that students who possess a motorcycle have a higher likelihood of using private vehicle. In fact, because of their mobility, survivability, and accessibility, motorcycles are widely used in developing countries [24].

**Table 4.** Estimates of conditional logit model

Variable	Walking			Bus		
	Coefficient	Standard Error	Odds ratio	Coefficient	Standard Error	Odds ratio
<b>Individual-specific variables</b>						
Gender						
Male	-0.384	0.385	0.681	-1.331	0.436	0.264
Female	Ref.			Ref.		
Year of Student						
First year	-0.895	0.193	0.409	.474	0.197	1.607
Second year	0.024	0.198	1.024	2.108	0.207	8.229
Third year	-0.543	0.203	0.581	0.933	0.215	2.542
Final year	Ref.			Ref.		
Family motorcycle ownership						
None	2.908	0.204	18.319	4.942	0.218	139.992
One	1.423	0.211	4.151	1.874	0.222	6.514
Two	0.882	0.218	2.415	1.808	0.232	6.101
Three	0.604	0.227	1.829	.758	0.252	2.133
More than three	Ref.			Ref.		
Motorcycle driving licence						
Yes	-2.325	0.513	0.098	-2.802	0.463	0.061
No	Ref.			Ref.		
Travel distance						
< 1km	4.991	0.239	147.146	-17.085	0.190	3.803E-08
1km – 3km	2.090	0.242	8.081	-0.341	0.200	0.711
3km – 5km	-0.071	0.251	0.932	-0.560	0.209	0.571
5km – 10km	-16.589	0.261	6.243E-08	0.071	0.212	1.074
> 10km	Ref.			Ref.		
Intercept	-4.305	0.030		-18.314	0.000	
<b>Choice-specific variables</b>						
Travel time (min)	-0.066	0.029 ***	0.936			
Sample size	377					
Log-likelihood	-151.78					

a Motorcycle is used as reference level.

\* 10% Significant level.

\*\* 5% Significant level.

\*\*\* 1% Significant level.

### 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 operated in 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 proposed 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).

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. 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.

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 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.

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.

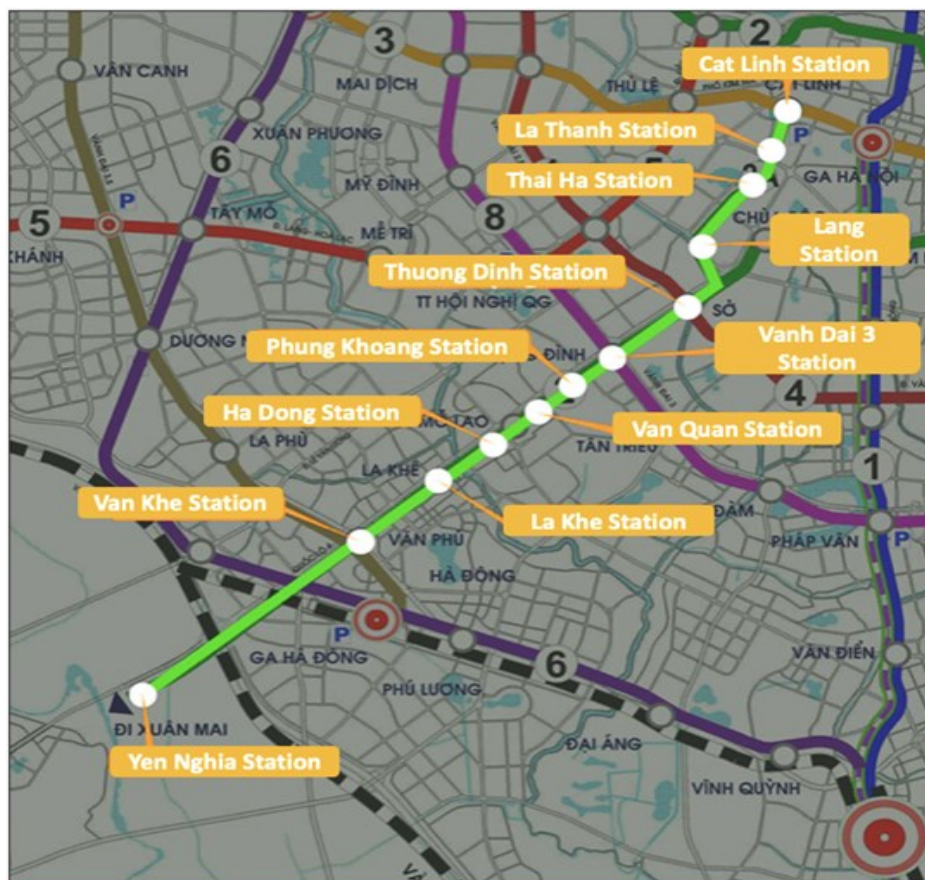


Fig 1. Location of 12 stations along Cat Linh – Ha Dong railway line

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	
<b>Current mode to school</b>	Walking	73.2	26.8	138
	Bus	68.8	31.3	64
	Motorcycle	55.4	44.6	175
<b>Year of student</b>	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
<b>Motorcycle driving license</b>	Yes	60.8	39.2	286
	No	70.9	29.1	110

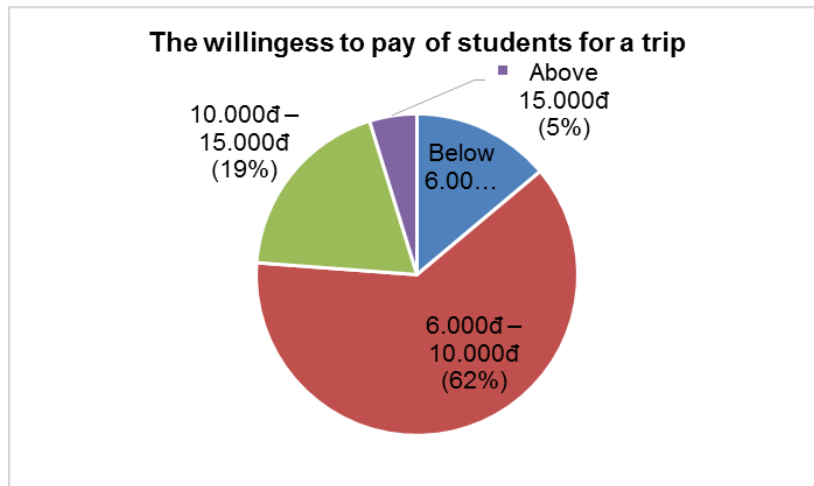


Fig 2. The willingness to pay of student for Cat Linh - Ha Dong railway

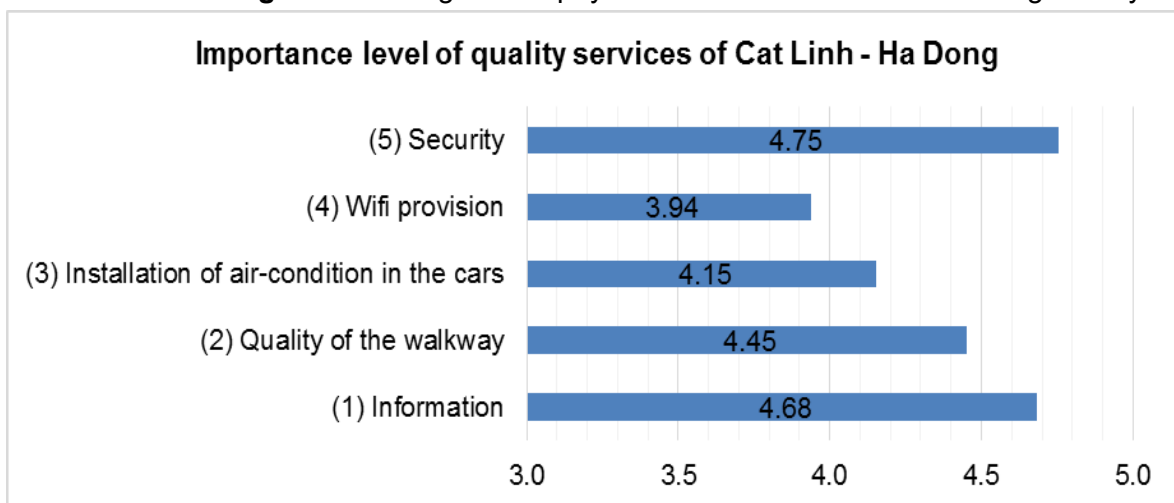


Fig 3. The quality requirements of students for Cat Linh – Ha Dong

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	
<b>Gender</b>					
Male	16.2	57.0	22.5	4.2	229
Female	10.9	69.1	14.5	5.5	167
<b>Year of student</b>					
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
<b>Current mode to school</b>					
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
<b>Travel distance</b>					
< 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

**5. Discussions and conclusions**

Urban railway development facilitates the reduction in private vehicle usage that would have the effect of mitigating the level of traffic congestion and the environmental effects on studying areas, such as university campuses.

This study examines the possible impacts of urban railway development on the mode shifting based on travel behaviour of young transport users in Hanoi, Vietnam. The findings show that travel time, gender, student year, family income, ownership of motorcycle driving licenses, ownership of motorcycles, and travel distance are all significant factors affecting student' travel mode choice.

Student year has been revealed to be a new element that influences students' mode choice. Students in the first year were shown to be much more likely than students in the second, third, or fourth years to use transport to get to school. As a result, a university campus with a large number of first-year students should be regarded a major appeal when planning a public transport system. According to the findings of the study, providing more student accommodations on or near university campuses could be an effective strategy for encouraging university students to use active modes.

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. Because of the low operating costs of motorbikes, it is extensively used even for short travel distance that could be accomplished more affordably by other modes of travel, such as walking or cycling. As a result, it is critical to encourage students to use 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 young travel group who are living and studying densely along this corridor. The tentative usage of this line depends significantly on the current travel behaviour 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.

The study also reveals that the willingness to pay for Cat Linh - Ha Dong railway line for studying trip purpose is relatively low. The acceptable ticket price depends largely on the current ticket prices of conventional buses (6,000 VND) and BRT system (10,000 VND). 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.

The study confirms 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), the

quality of railway service (security and safety), and suitable ticket range for different transport user groups. Young transport users 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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