TRANSPORT PROBLEMS 2022 Volume 17 Issue 3
PROBLEMY TRANSPORTU DOI: 10.20858/tp.2022.17.3.14

Keywords: transport mode choice; off-campus students; hilly terrain; multinomial logistic regression

Benjamin L. SAITLUANGA[1]*, Lal HMANGAIHZELA[2]

TRANSPORT MODE CHOICE AMONG OFF-CAMPUS STUDENTS IN A HILLY ENVIRONMENT: THE CASE OF AIZAWL, INDIA

Summary. In recent years, the transport mode choice of students of higher educational institutions has become a subject of increasing interest. Investigating the modal choice of students, who form a considerable section of the population, is crucial for sustainable urban transport planning and understanding the quality of life of students. Reviews of previous studies have indicated that hilly cities in less developed countries are neglected in transportation studies. The present paper investigates the travel behaviour of non-local, off-campus college students in Aizawl – a fast-growing hilly city in northeast India. The study found that transport mode choices are influenced by interrelated factors, including socio-economic background, demographic, availability of transport mode and location of housing. It was also found that walking and public buses are the most preferred modes of commuting among the studied college students. Female students who rent houses near their colleges are more likely to walk than their male counterparts. On the other hand, male students belonging to high-income families tended to travel by private vehicles from their residences, which are located relatively far away from colleges. The study argues for the enhancement of the intake capacity of residential hostels inside the campus to improve the growing transport problem of off-campus students in the city.

1. INTRODUCTION

Recently, there has been growing interest in the travel behaviour of college and university students in both developed and developing countries [1,2]. Despite forming a considerable proportion of a city's population, the travel behaviour of students is poorly understood. Moreover, the transport mode choice of off-campus students is different from that of the general population [3]. Investigating the travel behaviour of college and university students is important not only for sustainable urban planning but also for assessing the quality of life of students. Commuting to schools and colleges has an important influence on the economic condition and environmental quality of a city, as well as the physical health and social well-being of students [4, 5]. Compared to developed Western cities, cities in less developed countries are less likely to provide a decent quality of transport to students.

The majority of college students in India are off-campus, non-local students who have migrated to towns and cities for higher education. Due to the scarcity of residential hostels inside the campuses, they usually live in rented houses or as paying guests. With the increasing demand for affordable housing, rent is becoming one of the most significant expenditures for off-campus students [6]. Although universities and colleges provide residential hostels to students within the campus at subsidised rates, most of them are not able to accommodate the majority of their students. Higher educational institutions in the top seven biggest cities of India are able to accommodate only 25-30% of their students within their campuses [7]. Migrant students have to settle in private rental housing,

[1] Mizoram University, Department of Geography & Resource Management; Aizawl, Mizoram, India-796004; e-mail: bena.sailo@gmail.com; orcid.org/ 0000-0001-6626-5325
[2] Mizoram University, Department of Geography & Resource Management; Aizawl, Mizoram, India-796004; e-mail: zela199123@gmail.com; orcid.org/0000-0001-8323-5515
* Corresponding author. E-mail: bena.sailo@gmail.com

usually sharing with friends or relatives. They usually stay near the college campus to minimise travel costs and travel time. However, the unavailability of affordable housing in the vicinity of campuses and other socio-economic factors have compelled others to live relatively far away from colleges. Without any support from the government or institutions, students living in rental housing have to travel by their own choice of transport.

Small and medium cities in hilly regions of the Global South are relatively neglected in transportation studies. Only a few studies on transportation in hilly areas have been conducted in developed countries [8, 9]. Moreover, the majority of the previous studies on the transport mode choice of university students have focused on a single university [10-13]. Thus, it is advocated to conduct a survey involving multiple institutions due to locational differences which may affect one's mode of transport choice [14]. The present study is an attempt to examine the travel behaviour of off-campus, non-local college students in Aizawl City, Mizoram. It tries to fill the research gaps in the travel mode choices of students in higher educational institutions in hilly cities in less developed countries where no proper study has been conducted. The paper also investigates determinants of the transport choices of off-campus students from multiple colleges in different locations in a medium-sized hilly city. In the present study, a survey was conducted among students of multiple colleges to investigate their mode of transport choices.

2. LITERATURE REVIEW

A number of studies have been carried out on the transport mode choices of students in various cities. Walking, bicycle, motorcycle, car, and bus have been found to be the most commonly used modes of transport by students [1, 15-17]. In their study on transport mode choice of K-12 students in Gainesville, Florida, Ewing et al. [8] selected four modes of transport (walking, school bus, bicycle and car). Whalen et al. [1] considered walking, bicycle, bus and car in their study of the transport mode choices of McMaster University students in Hamilton, Canada. Zhang et al. [16] used five alternative modes (walking, car, bus or subway, bicycle and others) in their study of the travel behaviour of university students in Beijing, China.

The popularity of a particular mode of transport depends on the choices of commuters, which, in turn, are influenced by a number of interrelated factors. Previous studies have shown that the most commonly identified factors that determine travel mode choices are income, gender, age and ownership of vehicles; travel cost; travel time; the availability and accessibility of specific modes; the physical environment and urban form; individual attitudes and economic status [17, 18]. In his study in Los Angeles, Zhou [18] identified six groups of variables that determine transport mode choice. They are physical environment and urban form; mode-specific factors, including availability and access; personal attributes; trip characteristics, such as distance and travel time; the presence of transportation demand management measures, including parking costs; and psychological factors, such as habits and attitudes. On the other hand, Hu et al. [17] identified only built environment factors, socio-economic factors, attitudinal factors, and the trip chain as determining factors in people's transport mode choices in their study conducted in a small Changting City in China.

Socio-economic background is considered one of the most important determinants of a student's mode choice of transport. Active modes of transportation like walking and cycling are more popular among low-income students, while car ownership increases as income increases [15, 19-21]. The effect of gender on transport mode choice is ambiguous in the previous literature [9, 22]. Some studies found that females are more inclined to walk to commute to school than male students [23, 24], while others found the opposite [10, 20]. The majority of past studies also found that males are more likely to cycle than females [5, 10, 18].

Cultural attributes also affect people's choices of transport mode. In a male-dominated society like India, female students are found to be more dependent upon their parents' vehicles in comparison to boys, who travel to school more independently by bicycle or other modes of transport [5]. Males were more often independently mobile than females because of attitudinal factors [5, 22]. However, some studies have reported that gender had no significant effect on transport mode choices [26, 27].

Choice of transport mode also varies from one place to another depending upon the region's terrain. Hilly environments and unfavourable weather conditions may discourage urban commuting by active modes of transportation like walking and cycling [8, 22]. At the same time, higher residential density is found to be associated with higher pedestrian activity [15]. More diversified land use (e.g., pedestrian or bicycle paths) also positively affects non-motorised modes [8, 19].

Trip characteristics like trip distance and travel time are highly influenced by the physical environment and urban form. Housing location is also an important determinant of the travel mode choices of off-campus students since their activities mostly occur between their residences and colleges. A number of studies observed that students who lived closer to schools were more likely to walk or cycle to school than those who lived at greater distance [15, 28-30] and that the proportion of cars used increased as the distance between students' residences and schools [10, 17, 18]. On the other hand, in their study in Tehran, Iran, Shokoohi et al. [31] found that shorter distances to school did not lead to increases in walking and bicycling due to safety concerns and attitudes.

3. METHODOLOGY

3.1. Study Area

The study area is the administrative capital of the Himalayan state of Mizoram – one of the most literate states in India. With a total population of 293,416, the city comprises 26.89 per cent of the entire population of the state per Census 2011. The city has a relatively high density of motor vehicles, with 144 cars and 234 two-wheelers per 1,000 households according to Census 2011 [32]. The public transport services in the city include buses and taxis (both car and two-wheeler) only. The car and two-wheeler taxis are informal services having a nearly ubiquitous network, while the bus service is more regulated but limited in its geographical coverage. Motorcycles are popular among youth because of the hilly topography, narrow roads, and urban sprawl that limit travelling on other modes of transport. Two-wheeler taxis were introduced recently to facilitate urban mobility. Due to topographical barriers, cycling is not considered appropriate for travel.

Aizawl City is the educational centre of the state, where 68 per cent of the college students from all parts of Mizoram have enrolled in 11 undergraduate colleges and one postgraduate college. The majority of the colleges are clustered within the inner and outer core areas of the city (see Fig. 1). The clustering of higher educational institutions in a highly monocentric city is negatively affecting the movement of motorised vehicles.

3.2. Data and Methods

Data was collected through a web-based survey due to restrictions imposed by the COVID-19 pandemic to follow the traditional method of data collection. This method has the additional advantage in that colleges were shut down, and migrant students who had returned to their respective villages and towns sent back their responses. Students from 11 colleges in Aizawl were invited to participate in the survey, which was conducted during the month of February 2021. Since there was no travel activity due to the complete lockdown at the time of the survey, data was collected on participants' transport mode choices and factors affecting these choices before the COVID-19 pandemic only. We received 760 responses from the total number of 10,681 enrolled students. After removing on-campus students and those who lived with their parents, the total number of valid responses received from non-local, off-campus students was 430 (see Table 1).

Following Whalen et al. [1], Hu et al. [17], Zhou [18] and McDonald [33], a multinomial logistic regression (MNL) was employed in this study. MNL is one of the most widely used modelling techniques for studying transport mode choices [5]. It has been employed to examine the relationship between a nominal dependent variable and independent variables [11]. In this study, a number of variables were identified to represent factors influencing the transport mode choices of students. These factors included gender, family income, distance to college from home, time taken to travel to college,

the density of the neighbourhood, connectivity of public bus routes and traffic congestion. Coefficients of independent variables are evaluated with beta (B) coefficients, significant values and odds ratios. The odds ratio measures the effect of a one-unit increase in the value of the independent variable on the odds that students will choose the alternative travel mode vis-a-vis the reference mode [17]. Since private vehicles have the smallest number of observations, it was selected as the reference mode.

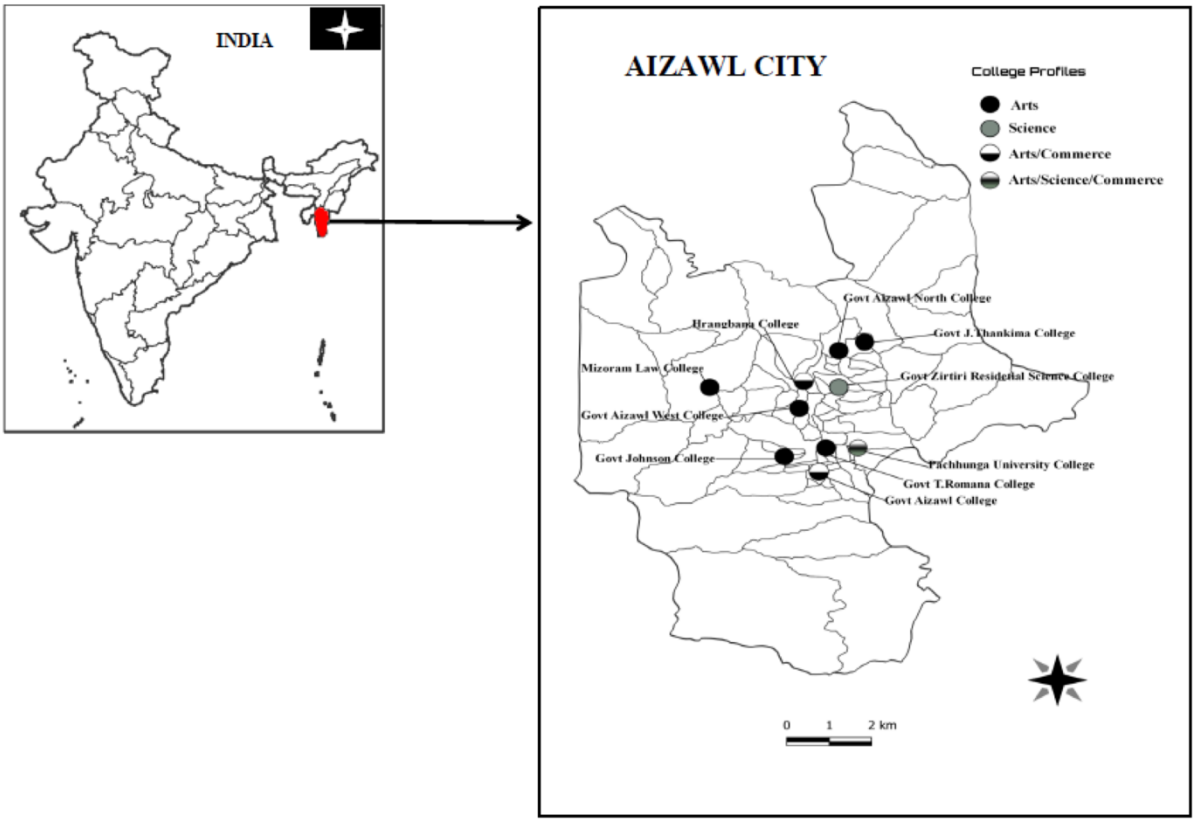

Fig. 1. The Study Area – Aizawl, India

4. RESULTS AND DISCUSSION

4.1. Descriptive analysis

Walking and public buses are the most popular modes of transport among migrant college students in Aizawl City (Table 2). On the other hand, taxis and private vehicles are the least common choices among the available modes of transport in the city. Unlike in other cities [11-13], cycling is not a preferred mode of transport among students of Aizawl because of the rugged and hilly terrain of the city.

Walking is more popular among female students in comparison to their male counterparts. More than half of the female respondents chose walking over other modes of transport. It is the most popular choice among low-income groups, those who live near colleges and those who live in relatively dense neighbourhoods. An inverse relationship between walking and the distance between home and college was observed, as 73 per cent of off-campus students who live within 1 kilometre chose the walking mode. Students prefer walking for short-distance travel since walking shortens their travel time by allowing them to follow the steeply inclined footpaths rather than the winding main roads.

Public buses are the second most preferred choice of transport mode across gender and income groups. However, the popularity of public buses declines as family income increases. Buses are the most popular mode of transportation among college students who live far away from college due to the

cheap fare. However, public bus road connectivity is highly limited in unplanned Aizawl City due to its unfavourable terrain. Since a number of localities are not connected to a public bus line, many students have to walk some distance from their apartments to access public transport vehicles. Those who choose public buses take the longest time to reach their colleges mainly due to the distance factor and traffic jams.

Table 1

Study sites and sample respondents

Name of College	Total Number of Students	No. of Samples	Percentage of Samples
Govt. Hrangbana College	1758	84	4.78
Pachhunga University College	2389	41	1.72
Govt. J. Thankima College	609	55	9.03
Govt. Aizawl North College	1299	37	2.85
Govt. Aizawl College	1069	64	5.99
Govt. Aizawl West College	866	16	1.85
Govt. Johnson College	855	71	8.30
Govt. T. Romana College	1072	21	1.96
Govt. Zirtiri Residential Science College	604	30	4.97
Govt. Mizoram Law College	160	11	6.88
Total	**10,681**	**430**	**4.03**

Significant gender bias was observed in the ownership of private vehicles among off-campus students. It is interesting that private vehicles, which are the least popular choice of transport mode among female students, are relatively popular among male students. The popularity of motorcycles among economically well-off college students is related to affordability, the lack of transit facilities, reduced travel time, and the availability of on-street parking lots. Private vehicles like motorcycles are affordable to a few students from high-income families, and they are considered less secure in crowded traffic conditions. As a result, female students prefer taxis over private vehicles for commuting to their colleges. The popularity of private vehicles among students increases as their income and the distance to college increase.

4.2. Multinomial Logistic Regression

Logistic regression was employed to examine the relationship between transport modes and factors determining off-campus students' mode choices for commuting to their respective colleges. As shown in Table 3, which displays the model fitting information, the reduction in the log-likelihood from the baseline model (939.971) to the final model (625.487) was assessed with a chi-square statistic. The difference between the two (314.483) indicates that the change is significant, which means that the final model is better than the original model (p-value <0.01). The pseudo R-squares of Cox and Snell and Nagelkerke are 0.536 and 0.591, respectively.

Table 4 shows that all independent variables included in the model are significant except the density of neighbourhood. The chi-square value of the variables indicates the impact of every individual predictor for fitting the model. In this case, the chi-square value of the traffic jam variable was the highest (114.725), indicating the prime importance of the particular variable in the model.

Table 5 shows the multinomial logit model of transport mode choices among the off-campus students in Aizawl City. The coefficient on gender is negative and highly significant for the walking, bus, and taxi modes. The negative sign indicates that male students prefer private vehicles over other modes for commuting to college. The odds of choosing a private vehicle over a taxi were higher than for the walking and bus modes. The odds ratio of the taxi mode (0.085) indicates that for every 100

male students who would choose a private vehicle, only 8.5 would choose the taxi mode. The odds of other modes are also notably high (0.176 for the walking mode and 0.236 for the public bus mode. All of the respondents who chose private vehicles for commuting to college used motorcycles. Motorcycles are not only inexpensive and fashionable, but they are also mobile and efficient for escaping traffic jams without parking problems. However, private vehicles are affordable for only a few students from high-income families.

Table 2

Descriptive Statistics

	Overall%	Walk%	Bus%	Taxi%	Private%
Gender					
Male	60.73	40.56	35.34	4.42	19.68
Female	39.27	54.04	30.43	11.18	4.35
Family income					
<10000	28.78	46.61	39.83	5.08	8.47
Rs. 10000-Rs 30000	37.56	44.16	36.36	8.44	11.04
Rs. 30000-Rs. 50000	14.88	49.18	26.23	6.56	18.03
>Rs. 50000	18.78	45.45	23.38	7.79	23.38
Distance					
<500 m	16.10	87.88	6.06	3.03	3.03
500 m-1 km	20.24	72.29	16.87	2.41	8.43
1 km-3 km	27.32	36.61	38.39	10.71	14.29
>3 km	36.34	19.46	51.01	8.72	20.81
Travel time					
<15 min.	24.39	66.00	13.00	6.00	15.00
15 min.-30 min.	35.85	42.18	34.01	5.44	18.37
30 min.-45 min.	26.59	41.28	40.37	9.17	9.17
>45 min.	13.17	27.78	55.56	9.26	7.41
Density of neighbourhood					
>1000	5.61	13.04	60.87	8.70	17.39
1000-5000	30.00	44.72	35.77	5.69	13.82
5000-15,000	15.85	36.92	36.92	13.85	12.31
15,000-25,000	31.71	56.15	22.31	6.15	15.38
<25,000	16.83	47.83	37.68	4.35	10.14
Public Bus Route connected					
Available	55.85	42.79	38.43	4.37	14.41
Not available	44.15	49.72	27.07	10.50	12.71
Traffic jam					
<10 min.	29.51	91.74	3.31	0.83	4.13
10 min.-20 min.	33.66	43.48	26.81	8.70	21.01
20 min.-30 min.	29.02	10.92	63.03	10.92	15.13
> 30 min.	7.80	12.50	65.63	9.38	12.50

The coefficients of family income on the walking and public bus modes are statistically significant, indicating the significant influence of family income on the choice of transport mode. In comparison to students belonging to low-income families, students from high-income families are more likely to go to college by private vehicles as indicated by the negative coefficient. On the other hand, students from low-income families are more likely to walk or take public buses than private vehicles.

Distance is another important variable affecting transport choice. The odds ratio of travelling by private vehicle increases as the distance between the college and home increases. The odds ratio for walk mode indicates that with a one-unit increase in distance, the chance of preference for private vehicles for commuting to college increases 3.85 times. Generally, it is difficult for the low-income groups in our study area to own private vehicles.

Table 3

Model Fitting Information

Model	Model Fitting Criteria			Likelihood Ratio Tests		
	AIC	BIC	-2 Log Likelihood	Chi-Square	df	Sig.
Intercept Only	945.971	958.019	939.971			
Final	673.487	769.875	625.487	314.483	21	0

Table 4

Likelihood Ratio Tests

Effect	Model Fitting Criteria			Likelihood Ratio Tests		
	AIC of Reduced Model	BIC of Reduced Model	-2 Log Likelihood of Reduced Model	Chi-Square	df	Sig.
Intercept	742.873	827.212	700.873	75.386	3	0
Gender	692.249	776.588	650.249	24.761	3	0
Family income	680.977	765.316	638.977	13.489	3	0.004
Distance	715.52	799.859	673.52	48.032	3	0
Travel time	685.836	770.175	643.836	18.348	3	0
Density	670.607	754.947	628.607	3.12	3	0.373
Route	677.355	761.695	635.355	9.868	3	0.02
Traffic jam	782.212	866.551	740.212	114.725	3	0

Table 5

Multinomial Logit Model (MNLM) of Transport Choice

	Walk			Bus			Taxi		
	B	Sig.	Exp(B)	B	Sig.	Exp(B)	B	Sig.	Exp(B)
Gender (Male)	-1.735	0	0.176	-1.445	0.002	0.236	-2.468	0	0.085
Family income	-0.399	0.027	0.671	-0.607	0	0.545	-0.332	0.155	0.717
Distance	-1.348	0	0.26	-0.39	0.107	0.677	-0.487	0.121	0.614
Travel time	0.985	0	2.679	0.603	0.008	1.828	0.423	0.174	1.526
Density	0.210	0.182	1.234	0.023	0.874	1.023	-0.069	0.742	0.933
Route	-0.334	0.388	0.716	0.213	0.558	1.238	NA	NA	NA
Traffic jam	-1.288	0	0.276	0.706	0.004	2.027	0.499	0.145	1.646
The reference category is private.									

Off-campus students who travel in their own vehicles are more likely to spend less travel time in comparison to other modes of transport. The odds ratios of walking and public buses are 2.679 and 1.828, respectively, indicating that students are likely to spend 2.679 and 1.83 times longer when walking or taking the bus than when using a private vehicle to commute to college over the same distance. Private two-wheelers are not disturbed by traffic jams which enables them to reach colleges

within a short time. On the other hand, public transport modes like buses and taxis are comparatively slow, particularly during peak hours.

Traffic jams are one of the biggest problems related to mobility in Aizawl City. The logistic regression model shows that migrant students who travel by public transport like buses and taxis are more affected by traffic jams in comparison to those who travel by private vehicles. Since walking is not affected by traffic jams, the negative coefficient of the walking mode (-1.288) indicates that students who choose to walk spent less time getting to college than those who travelled by private vehicle.

5. CONCLUSION

The transport mode choice of off-campus college students in Aizawl City is highly dependent upon the socio-economic background of the students, as well as the availability and accessibility of the mode of transport. Despite a lack of pedestrian sidewalks, walking was found to be the most preferred mode of transport among the students in this study. In contrast to findings in other countries, walking is more popular among female students than male students. Those who cannot afford private vehicles have to rent apartments within walking distance of their colleges. Among the long-distance commuting students, those who belonged to low-income families preferred to travel by public bus mainly due to the low travel cost, while male students from high-income families tended to travel on their own motorcycles. Female students usually avoid riding motorcycles.

Our findings suggested that traffic jams, distance, gender, travel time, family income and connectivity by bus route are important determinants of the choice of mode of transport among off-campus students. Long-distance commuting students who travelled by bus and taxi were most affected by traffic congestion. Narrow and winding roads with increasing traffic have posed an immense challenge to the accessibility and quality enhancement of public transport. Due to shortages of bus line connectivity, commuters usually take multiple modes, including walking, taxis and buses, to reach their destinations. Moreover, transit buses in the city are generally of poor quality, irregular and overcrowded during peak hours. Private vehicles and taxis are not affordable to many students from rural areas. Non-availability and inadequate access to public transport and affordable housing affect the physical and mental well-being of off-campus students who travel back and forth every day from college to their apartments. A lack of affordable housing near colleges, limited and low standards of public transport infrastructure and inadequate pedestrian safety are degrading the study environments of non-local off-campus students. Under these circumstances, enhancements to the intake capacity of residential hostels through the construction of new hostels inside college campuses are crucial to enhance the quality of life of off-campus students from low-income families.

References

1. Whalen, K.E. & Páez, A. & Carrasco, J.A. Mode choice of university students commuting to school and the role of active travel. *Journal of Transport Geography*. 2013. Vol. 31. P. 132-142.
2. Nguyen-Phuoc, D.Q. & Currie, G. & De Gruyter, C. & Young, W. How do public transport users adjust their travel behaviour if public transport ceases? A qualitative study. *Transportation Research Part F*. 2018. Vol. 54. P. 1-14.
3. Zhou, J. From better understandings to proactive actions: Housing location and commuting mode choices among university students. *Transport Policy*. 2014. Vol. 33. P. 166-175.
4. Black, C. & Collins, A. & Snell, M. Encouraging walking: the case of journey-to-school trips in compact urban areas. *Urban Studies*. 2001. Vol. 38. P. 1121-1141.
5. Singh, N. & Vasudevan, V. Understanding school trip mode choice – The case of Kanpur (India). *Journal of Transport Geography*. 2018. Vol. 66. P. 283-290.
6. Christie, H. & Munro, M. & Rettig, H. Accommodating Students. *Journal of Youth Studies*. 2002. Vol. 5. No. 2. P. 209-235.

7. JLL & FICCI. *Co-living: Reshaping rental housing in India*. 2019. Available at: https://ficci.in/events/24295/ISP/Co-living_Reshaping-Rental-Housing-India.pdf.
8. Meeder, M. & Aebi, T. & Weidmann, U. The influence of slope on walking activity and the pedestrian modal share. *Transport Research Procedia*. 2017. Vol. 27. P. 141-147.
9. Müller, S. & Mejia-Dorantes, L. & Kersten, E. Analysis of active school transportation in hilly urban environments: A case study of Dresden. *Journal of Transport Geography*. 2020. Vol. 88. P. 102872.
10. Delmelle, E.M. & Delmelle, E.C. Exploring spatio-temporal commuting patterns in a university environment. *Transport Policy*. 2012. Vol. 21. P. 1-9.
11. Boyd, B. & Chow, M. & Johnson, R. & Smith, A. Analysis of effects of fare-free transit program on student commuting mode shares: BruinGo at the University of California at Los Angeles. Transportation Research Record. *Journal of the Transportation Research Board*. 2003. Vol. 1835. P. 101-110.
12. Limanond, T. & Butsingkorn, T. & Chermkhunthod, C. Travel behavior of university students who live on campus: A case study of a rural university in Asia. *Transport Policy*. 2011. Vol. 18. No. 1. P. 163-171.
13. Uttley, J. & Lovelace, R. Cycling promotion schemes and long-term behavioural change: A case study from the University of Sheffield. *Case Studies on Transport Policy*. 2016. Vol. 4. No. 2. P. 133-142.
14. Hasnine, Md.S. & Lin, T.Y. & Weiss, A & Habib, K.N. Determinants of travel mode choices of post-secondary students in a large metropolitan area: The case of the city of Toronto. *Journal of Transport Geography*. 2018. Vol. 70. P. 161-171.
15. Ewing, R. & Schroeer, W. & Greene, W. School Location and Student Travel: Analysis of Factors Affecting Mode Choice. *Transportation Research Record: Journal of the Transportation Research Board*. 2004. Vol. 1895. P. 55-63.
16. Zhang, R. & Yao, E. & Liu, Z. School travel mode choice in Beijing, China. *Journal of Transport Geography*. 2017. Vol. 62. P. 98-110.
17. Hu, H. & Xu, J. & Shen, Q. & Shi, F. & Chen, Y. Travel mode choices in small cities of China: A case study of Changting. *Transportation Research Part D*. 2018. Vol. 59. P. 361-374.
18. Zhou, J. Sustainable commute in a car-dominant city: Factors affecting alternative mode choices among university students. *Transportation Research Part A*. 2012. Vol. 46. P. 1013-1029.
19. Pan, H. & Shen, Q. & Zhang, M. Influence of Urban Form on Travel Behaviour in Four Neighbourhoods of Shanghai. *Urban Studies*. 2009. Vol. 46. No. 2. P. 275-294.
20. Ermagun, A. & Samimi, A. Promoting active transportation modes in school trips. *Transport Policy*. 2015. Vol. 37. P. 203-211.
21. Li, S. & Zhao, P. The determinants of commuting mode choice among school children in Beijing. *Journal of Transport Geography*. 2015. Vol. 46. P. 112-121.
22. Goeverden, C.D. Van & Boer, E. De. School travel behaviour in the Netherlands and Flanders. *Transport Policy*. 2013. Vol. 26. P. 73-84.
23. Leslie, E. & Kremer, P. & Toumbourou, J.W. & Williams, J.W. Gender differences in personal, social and environmental influences on active travel to and from school for Australian adolescents. *Journal of Science and Medicine in Sport*. 2010. Vol. 13. No. 6. P. 597-601.
24. Samimi, A. & Ermagun, A. Students' tendency to walk to school: Case study of Tehran. *Journal of Urban Planning and Development*. 2012. Vol. 139. No. 2. P. 144-152.
25. Scheiner, J. School trips in Germany: Gendered escorting practices. *Transportation Research Part A: Policy and Practice*. 2016. Vol. 94. P. 76-92.
26. Haybatollahi, M. & Czepkiewicz, M. & Laatikainen, T. & Kyttä, M. Neighbourhood preferences, active travel behaviour, and built environment: An exploratory study. *Transportation Research Part F*. 2015. Vol. 29. P. 57-69.
27. Wilson, E.J. & Marshall, J. & Wilson, R. & Krizek, K.J. By foot, bus or car: children's school travel and school choice policy. *Environment and Planning A*. 2010. Vol. 42. P. 2168-2185.
28. McMillan, T. The relative influence of urban form on a child's travel mode to school. *Transportation Research Part A*. 2007. Vol. 41. P. 69-79.

29. Kelly, J.A. & Fu, M. Sustainable school commuting – understanding choices and identifying opportunities: a case study in Dublin, Ireland. *Journal of Transport Geography*. 2014. Vol. 34. No. 219. P. 221-230.
30. Easton, S. & Ferrari, E. Children's travel to school – the interaction of individual, neighbourhood and school factors. *Transport Policy*. 2015. Vol. 44. P. 9-18.
31. Shokoohi, R. & Hanif, N.R. & Dali, M. Influence of the socio-economic factors on children's school travel. *Procedia-Social and Behavioral Sciences*. 2012. Vol. 50. P. 135-147.
32. Saitluanga, B.L. *Towards a sustainable smart city: The case of Aizawl*. ORF Special Report 73. New Delhi: ORF. 2018. 15 p.
33. McDonald, M.C. Children's mode choice for the school trip: the role of distance and school location in walking to school. *Transportation*. 2008. Vol. 35. P. 23-35.

Received 02.03.2021; accepted in revised form 02.09.2022