

Analysis of University Students Travel Behaviour: En Route to Sustainable Campus

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Abstract

Objectives: To analyse travel behaviour of university students, preparation of web based questionnaire and descriptive analysis of the collected data. **Background:** Travel pattern is the key element in transportation studies to understand and identify transportation needs. Therefore, in order to program feasible and sustainable transport system plans, the travel pattern studies were usually performed to discover the factors that encourage a sustainable transportation system. **Methodology:** By categorizing the students into two groups (on-campus and off-campus residents), they were requested to provide their daily travel information along with their personal information. A new web based survey instrument was developed and it was administered through online. One full day data was collected and the same was used for the analysis. VIT University, Vellore, Tamil Nadu was selected as the study area. **Findings:** The results show a significant difference in travel patterns of students residing on-campus and off-campus. The data also shows the significant variance in mode usage, travel time and travel cost of the students, especially between on-campus and off-campus residents. This study will be helpful in analysing the existing transportation infrastructure and further it leads to establishment of better infrastructures, various transport planning strategies and policies for the sustainability of the campus. **Improvements:** This paper is limited to only descriptive analysis, if modelling component is added, the study would be enhanced. The accuracy of this analysis can be improved by considering more number of samples data.

Keywords: Trip Analysis and Mode Choice, University Students, Web Questionnaire

1. Introduction

University students show intricate and distinct travel behaviour and they are belittled in most travel studies although their proportion in travelling public is significant¹. Hence it becomes necessary to understand the travel behaviour of university students particularly their reliance on the private modes for commuting within, to and from the campus. This data can help the university management to work towards improving the policies, programs and infrastructure that can encourage students' use of public transport or non-motorized modes of travel.

In case of large universities it stands out to be critical since the students travel patterns directly influences the congestion levels in nearby streets thereby causing

significant impacts on the well-being of students and employees, as well as that of residents and businesses in the university neighbourhood. Travel pattern is the key element in transportation studies to determine the relation among several modes of transport which influences the development for that area. In order to encourage a sustainable transportation system, travel pattern studies are usually performed to determine the factors and to program feasible and sustainable transport system plans. University campuses have high concentration of trips during some specific hours. These campuses are often of the largest employers in small to medium size cities and it is therefore critical to examine the factors affecting campus mobility. Even though, many studies reported the analysis of travel behaviour, however very few studies

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have highlighted the importance of travel behaviour of the students and its impact of existing transport network. Hence, there is a huge scope in addressing the university students travel behaviour.

²Examined the travel behaviour of students and they observed that safety, travel cost, environment and travel time are the most influencing factors. ^{3,4}Studied the travel behaviour of students at Texas University and McMaster University, respectively. They observed that travel time and travel cost are the two important factors affecting students travel mode choice. They have developed mode choice models for further support to their studies. ⁵Attempted to study the impact of campus layout on mode choice. A survey was conducted in UTM (urban) and SUT (rural) universities. The key finding is that the layout of the campus also affects the mode choice of the students.

⁶Had developed a new way of campus transportation to overcome the traffic planning, parking requirements in the Universities and surrounding community. They developed a travel demand model in such a way to decrease the single occupant vehicles by introducing student and employee bus pass programs but they did not focus on the sustainable campus. ⁷Conducted a survey at American university of Beirut to find the difference in mode choice patterns of students but they could not achieved because of the small sample size and the missing data in the survey. ⁸Analyzed 7 day travel patterns of university students by conducting a manual survey with series of questionnaires. They found the activity patterns on weekdays and weekends are entire different. In this study also the accuracy of data limited due to less sample size. They also observed and suggested that web based questionnaires will be more convenient and also achieves more response rate. Further, many other studies reported about the descriptive analysis of the student travel surveys to understand the travel behaviour of university students across the globe^{9,10}.

¹¹Conducted a study at an Australian university and they tried to examine the contribution of public transit to daily walking. Further, they found that transit users achieved higher levels of daily steps than other mode users except walking. Later studied the relationship between the travel behaviour and the physical activities of the students. ¹²Of University of Tasmania conducted an offline and web based survey to find travel behaviour of students from different regions of Tasmania and to facilitate future transport services. They found online survey was the most suitable approach. ^{13,14}Studied about the

style of travelling of the students and they also found that students are desired to meet the friends and tend to travel more than the older. From the above literature, it has been clearly understood that the students travel behaviour is entirely different than the normal individual travellers. In the literature, it has been observed that most of the studies related to the universities in developed countries. But by considering the diversity in the population (multi-cultural and multi-lingual), it has been necessary for understanding the travel behaviour of university students from developing countries. Hence, this study focused on analysing the travel behaviour of students from southern part of the India i.e. VIT University, Vellore, Tamil Nadu. Next section describes about the study area and methodology.

2. Study Area and Data Collection

Due to increase in traffic volume in the major roads adjacent to VIT University, a high level of congestion is experienced within the town's road network especially during the peak hours. The main reason for this congestion is the conflict between through traffic and local traffic. Hence, there is a necessity of understanding the travel characteristics of the university students who are residing on-campus and off-campus. This necessity leads to initiate the present study. The study area, VIT University situated in Vellore city, which is an administrative headquarters of Vellore District in the South Indian state of Tamil Nadu, India. The city covers an area of 87.915 Square kilometres and has a population of 5,02,000 (Census, 2011). Vellore city is the hub of two of the India's top ten educational institutions, Christian Medical College and Hospital and VIT University. VIT University, formerly called Vellore Engineering College, is an Indian institute of higher education and a deemed university under the Section 3 of the UGC Act. The university draws students from 50 countries as well as from every state in India. VIT has a lush green campus which spreads about 350 acres and has all the required amenities to the individuals and also the world class facilities. The campus has its own water supply and backup electricity supply along with shopping complexes to cater to the needs of residents. Every effort has been made at the Vellore Institute of Technology to provide the best facilities for students who live on campus. By having 18 student hostels (15 men's hostels and 3 women's hotels) with a total student strength of more than 30,000, the institute produces enormous number of

trips and also it attracts many, Figure 1 shows the map of VIT University. Most of the trips of on-campus residents are produced from hostels and attracted to the 10 schools of VIT during the weekdays. The institute is running an internal transport in the form of shuttle cabs (shared taxi) to meet the transport demand inside the university. Other significant modes of travel in the university are bicycle (mostly used by on-campus residents), two wheelers and cars (used by off-campus residents). The rest of the transport demand is covered by walk.



Figure 1. VIT University Campus map (Google map).

A web based survey instrument is prepared to collect the personal information and travel information of the VIT university students. The questionnaire is administered through online. The questionnaire consists of two pages. First page starts with the explanation about object of the survey and other student personal characteristics. Student personal characteristics include the details about their residence (off-campus or on-campus), name/registration number, age, gender, pursuing degree, branch, driving license and vehicle ownership. Further, different questionnaire's prepared for the on-campus and off-campus students based on their characteristics. The second page of the questionnaire contains the details about their travel characteristics includes residential location, daily travel distance, travel cost, travel time, waiting time for public transport. The major of this study is to developing the transport infrastructure towards the sustainable campus. By keeping this in view, a question included in the survey instrument regarding the bicycle track. This question provides the data about whether the students willing to shift from their regular modes to bicycle or not if there is provision for separate bicycle track in the campus.

3. Data Analysis

The web based questionnaire is circulated among the students through online. Constant reminders and requests

were made for avoiding non-response from the individuals. A random sampling method was adopted and also made sure that the collected data stratified evenly in all the groups of people. From the data collection, after removing the invalid responses, a total of 100 responses are considered for this pilot study. The respondents in the data were aged between 17 and 34. Table 1 gives the percentage of the respondents based on their pursuing education and their residence category. In total data, 89% of the respondents residing on-campus and remaining 11% are off-campus residents.

From the data, it was observed that off-campus students had longer travel time compared to on-campus students and their choice of modes are different than on-campus residents. Though there are considerable number of foreign students and non-resident Indians studying in the university, but their numbers are under-represented due to their apathy towards giving the sample (Table 1). Further, male to female ratio observed in the study is 85:15. Further, 92% of the samples obtained from Indian nationals, 5% from non-residential Indians and 3% from foreign students. Although responses from non-Indian category were less, their travel patterns were significantly different from others.

Table 1. Sample size of the respondents in relative to their residence and pursuing degree

Variable	Percentage (%)
Degree	
Under Graduate	93.8
Post Graduate	4.1
PhD	2.1
Residence	
On-campus	89
Off-campus	11

The vehicle ownership of the off-campus residents are dominated in the study due to the long distance travel between their residence and university campus. More than 60% of the on-campus residents don't have any vehicle. Their primary mode of transport might be either walk or shuttle cab. Further, it was observed that, depending upon the travel distance and travel cost, off-campus students who residing near to the campus within in 5 km boundary) owning only bicycle and the students who needs to travel longer distances to reach campus owning two wheeler or car.

Figure 2 shows the mode choice characteristics of students in the university. It clearly shows that more than

50% of the students prefer to use walk mode as their primary transport than shuttle cab, bicycle or auto. Since, most of the respondents are on-campus respondents who prefer to walk to their respective schools which serve two purposes either to save their travel cost or to maintain a physical exercise by walking. After walk mode, majority of people using shuttle cab (14.8%) than bicycle (5.72%) even though they need to spend money from their pocket. This clearly indicates the attitude of the students to give preference to comfort.

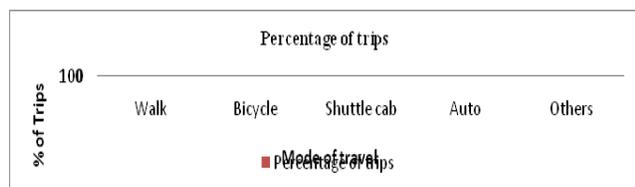


Figure 2. Percentage split of trips based on mode.

Further, for encouraging non-motorized transport in the university, an opinion survey also conducted along with the travel survey about the separate bicycle track in the university. The responses received from the survey shows that only 40% of the students wants to use if separate bicycle track is provided in the campus. These results again show the students apathy towards doing physical work.

Table 2 shows the average trip rates of on-campus residents and off-campus residents. The average trip rate of on-campus residents is considerably higher than the off-campus residents. The difference in trip rate might be due to the shorter trips of on-campus residents. Further, most of the trips of on-campus residents are maintenance and leisure trips.

Table 2. Average trip rates of students

Students category	Average trip rate per day		
	Male	Female	Average
On-campus residents	5.078	4.33	4.704
Off-campus residents	4.667	3.67	4.1685

Table 3 provides the statistics related to the average trip rate per day based on modes of travel. Due to the short trip making nature of the on-campus residents, the average trip rate by using walk mode is more when it

compared with the other modes of these category of students. Further, the campus also designed in such a way that it encourages students to choose walk by having wide and shaded footpaths. Auto rickshaw and other motorized modes are preferred by off-campus residents when it compared with the on-campus residents.

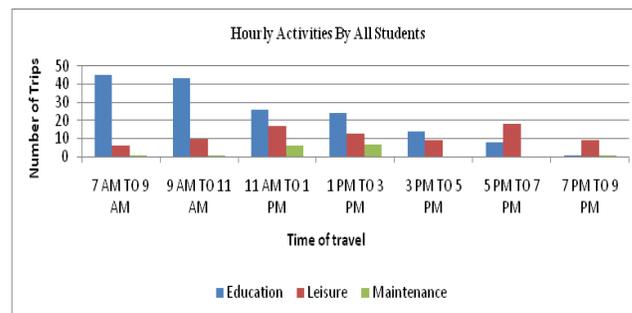


Figure 3. Hourly activities of students.

Students primarily perform three types of trips based on their purpose in a day. They are education/work related trips, leisure trips and maintenance trips. Figure 3 indicates the peak hour for education trips is between 7 am to 9 am (45 trips), which goes on decreasing in the later part of the day, while leisure activities are more in 5 pm to 7 pm of the day. Students make maintenance trips during noon more than any other time of the day. Students mostly prefer morning session to make all of their education trips while the latter half they are utilizing for leisure and maintenance activities.

Table 3. Average trip rates of students based on mode of travel

Modes of travel	Average trips/day
Walk	3.94
Bicycle	0.23
Shuttle cab	0.71
Auto	0.1
Others	0.1

Tables 4 and 5 provided statistics for the percentage of trips made by the students based on their purpose in relation with their pursuing degree and category. More than 60% of the trips are related to education in both under graduate and post graduate categories. Students make more leisure trips than maintenance related trips and the number exceeding 30% in case of undergraduates and 40% in case of off-campus residents. Maintenance activi-

ties are less than 10% for all students living in on-campus and off campus. Since, campus has many canteens and dining places, students use this opportunity and consequently making fewer trips for the above said purpose.

Table 4. Percent proportion of trips based on degree of study

Degree	Maintenance (%)	Education (%)	Leisure (%)
Under graduate	6.4	63.1	30.5
Post graduate	9.1	63.7	27.2
PHD	12.5	37.5	50

Table 5. Percent proportion of trip rates based on their purpose and student category

Student category	Maintenance (%)	Education (%)	Leisure (%)
On-campus	9.2	61.1	29.7
Off-campus	8	52	40

Figure 4 provides the percent proportion of trips based on the purpose in relation with different modes of travel. Since, the university provides accommodation to the students and majority of the students residing on-campus, the major mode of travel is walk mode. Though students make their weekend trips with other modes, but for weekdays, majority of the travel is related to education which is covered by walk mode. Depending on the mode opted by the students to commute in the campus or off-campus, the travel cost varies significantly. For on-campus residents, university runs a shuttle cab, which costs around Rs. 10/- from anywhere to anywhere in the campus. Major modes of travel to university by off-campus residents are bus, two wheeler, car apart from the non-motorized transport systems like bicycle and walk.

The average travel cost of the off-campus residents are observed as higher than the average travel cost of the on-campus residents. The longer travel distance between their residential location and the university campus might be the reason for higher average travel cost. From the survey sample, it was observed that off-campus male residents are spending an average travel cost of Rs. 10/-, at the same time female students are spending a minimal

travel cost of Rs. 46/- for their daily travel. Similarly, on-campus male students are spending a travel cost of Rs. 11.5/- for their daily travel, at the same time female students are spending Rs. 16/- for their daily travel. From these statistics, it can be inferred that male students are spending more amount on travel when it compared to female students. This might be due to the specific travelling behaviour of male students i.e. they prefer to travel in groups and they are using walk mode for the same.

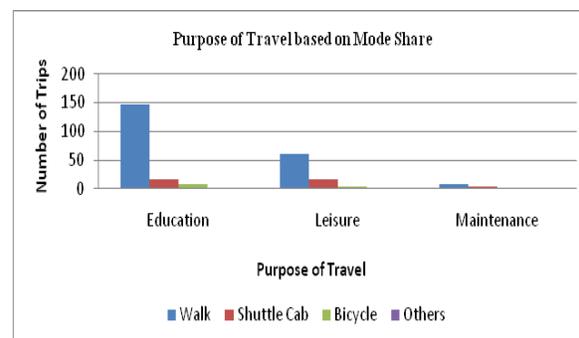


Figure 4. Purpose of travel based on mode share.

4. Conclusions

This paper focuses on the analysing the travel behaviour of university students. The strength of this study lies in comparison of travel patterns of on-campus and off-campus residents in terms of their mode choice, purpose of trip, travel distance and travel cost. The university campuses like VIT, produces and attract more number of trips compared to other urban areas and subsequently results of this study different from other urban areas. Students' forms an influential group among society to change attitudes for selection of travel patterns and establish the communities based on sustainable mode choice. It is necessary to understand their travel patterns and developing a sustainable mobility system within the campus to cope with immediate and future need of the campuses. The results from the study helpful in infrastructure development, designing new parking facilities, encouraging students to use public transport and non-motorized form of travel and also at the same time increasing safety by minimizing the conflicts during peak hours.

Some specific results obtained from the study are:

- Average trip rate is more in on-campus residents than off-campus residents.
- Many factors influences mode choice of students like travel time, travel cost, age, gender,

distance, vehicle and license ownership. Among these factors, travel time, travel cost and vehicle ownership play a major role in travel patterns of off-campus residents.

- Off-campus residents are spending less travel cost for making trips when it compared with the on-campus residents.
- More than 50% of the students don't want a separate bicycle lane in campus.

The travel pattern and activities of university students were successfully obtained by conducting a pilot survey. The major drawback of this pilot study is the lesser sample size. An extensive travel survey is planned for the original study and then the derived statistics might provide the realistic values. Further, the one-day travel survey can be extended to two days (one weekday and one weekend) or one week travel survey, so that it can lead to development of a trip generation model with the support of extensive data analysis.

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