

Analysis of OD Trip Patterns crossing Main Tunnel in VIT

PROJECT REPORT

Submitted for the course:

Transportation Planning and Management (CLE 3007)

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Certificate

We hereby declare that the J Component project entitled “TRANSPORTATION PLANNING - VIT UNIVERSITY MAIN SUBWAY TUNNEL” submitted by us to the School of Civil Engineering, VIT University, Vellore-14 in partial fulfillment of the requirements for the Transport Planning and Management course, is a record of bonafide work carried out by us under the supervision of PROF. SASANKA BHUSHAN PULIPATI. We further declare that the work reported in this project has not been submitted and will not be submitted, either in part or in full, for the award of any other degree or diploma of this institute or of any other institute or university.

ACKNOWLEDGEMENT

We would like to express our sincere gratitude to Sasanka Bhushan Pulipati Sir for providing his invaluable guidance, comments and suggestions throughout the course of the project. We would also like to thank each and every one of the students who took out their valuable time to answer our questions making our survey possible. We would also like to thank our fellow classmates and other project groups for their feedback and review towards the collected data and their priceless suggestions. Also we would like to thank our Dean Dr S. K. Sekar and our HOD Uma Shankar Sir for providing us this course which made us take this project and learn so much.

ABSTRACT

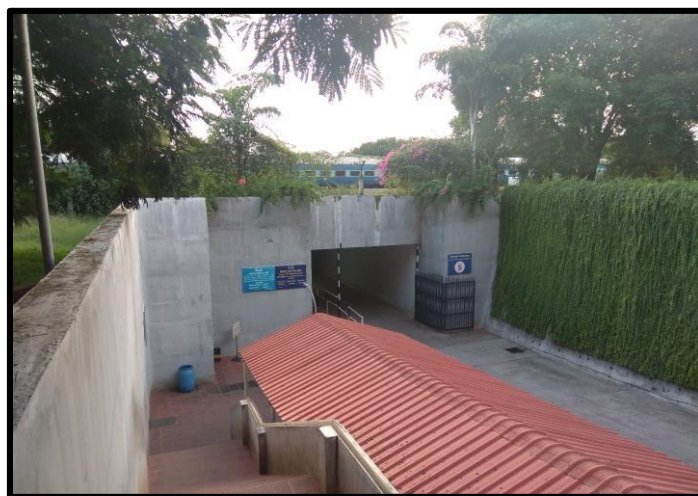
The main objective of this study is to investigate the use of the main subway in VIT University, Vellore by collection of data for various data related to origin and destination points, travel times, mode of travel, etc. Based on this data and data regarding the population data for past 5 years, we took an approximate of 5% growth rate and extrapolated the data till 2023. We found out that the main subway is already very crowded and 5 years from now, it will not hold the full population expected to be crossing the subway by 2023. So, we suggested an alternative in the form of a walkway over the same main subway. We took into consideration one real time case wherein a subway is formed between the fresher hostel blocks to SJT and approximated data for the same.

1. Introduction

The VIT Main Tunnel is the primary tunnel used by students for travelling back and from the college and the hostel. Also, this is the only tunnel open before 6AM and after 6PM, and is the only tunnel where vehicles are allowed to pass through. Also, this tunnel sees the most traffic and traffic density even though it is the largest tunnel compared to the other two.

The new, or real case scenario which we are taking into consideration is that of the fact that a new subway opens up between the fresher blocks (M, N, P, Q) and SJT. This is a highly likely possible situation since it's one of the primary requirements and there were a lot of speculations with regard to the same, and although no work seems to have started, this is the closest to a new subway or major change we can induce in change in pattern of traffic (student) movement across the tunnel.

Based on the current data, we see that approximately as many as students would be crossing the subway on an hourly/daily basis, with overcrowding during the prime times. Already, people face a lot of difficulty with regard to crossing the tunnel, especially during peak hours. This will further lead to overcrowding and safety issues for everyone. Even currently, the guards have to give in to students pushing and pulling to let them move through the vehicle pathway which raises big red flags at student safety, especially when there is a such a big population number to cater to.



2. Methods

2.1 Problem description and objective

We had to find out OD Characteristics of VIT Main Tunnel. This included studying trip pattern of students and pattern of vehicles. This would require collecting large sample of data and then analysing the pattern. This pattern would have input of - a. Origin

- b. Destination
- c. Time Required to travel
- d. Preferred Mode choice
- e. No of times they prefer using Main Tunnel

The data obtained would be used to determine the future percentage of population of VIT that will be using the Main Tunnel for travelling, and to plan the implementation of an alternative transportation system or for construction of a new path to meet travel demand.

2.2 Data Collection

Data collection was done by manual method i.e. questioning each individual about the inputs and manually entering the responses in Google Form. For recording responses and storing it we used Google Form Service that helped us to store data in Excel Sheet. The following were the Questions asked to the students –

- i. Origin
- ii. Destination
- iii. Time required to reach the destination in minutes? iv. How many times you used cabs in a week?
- v. Which mode you prefer while going to class? vi. Which mode you prefer while going outside VIT? vii. How often you use Main Tunnel in a Day
- viii. How often you use Main Tunnel in a Week?
- ix. How many times you go outside VIT in a week?
- x. What is the purpose of your trip?

The sample number of students for survey were 150 in our first attempt and 1000 in second attempt. These large data could help us understand trip pattern. The data collection summary are as follows –

1st Attempt

Date – 15/09/18

Time – 9 AM to 11 AM

Total No of people surveyed – 150 (Up and Down)

Method of Collection – Google Form

2nd Attempt

Date – 12/10/18

Time – 8 AM to 6 PM

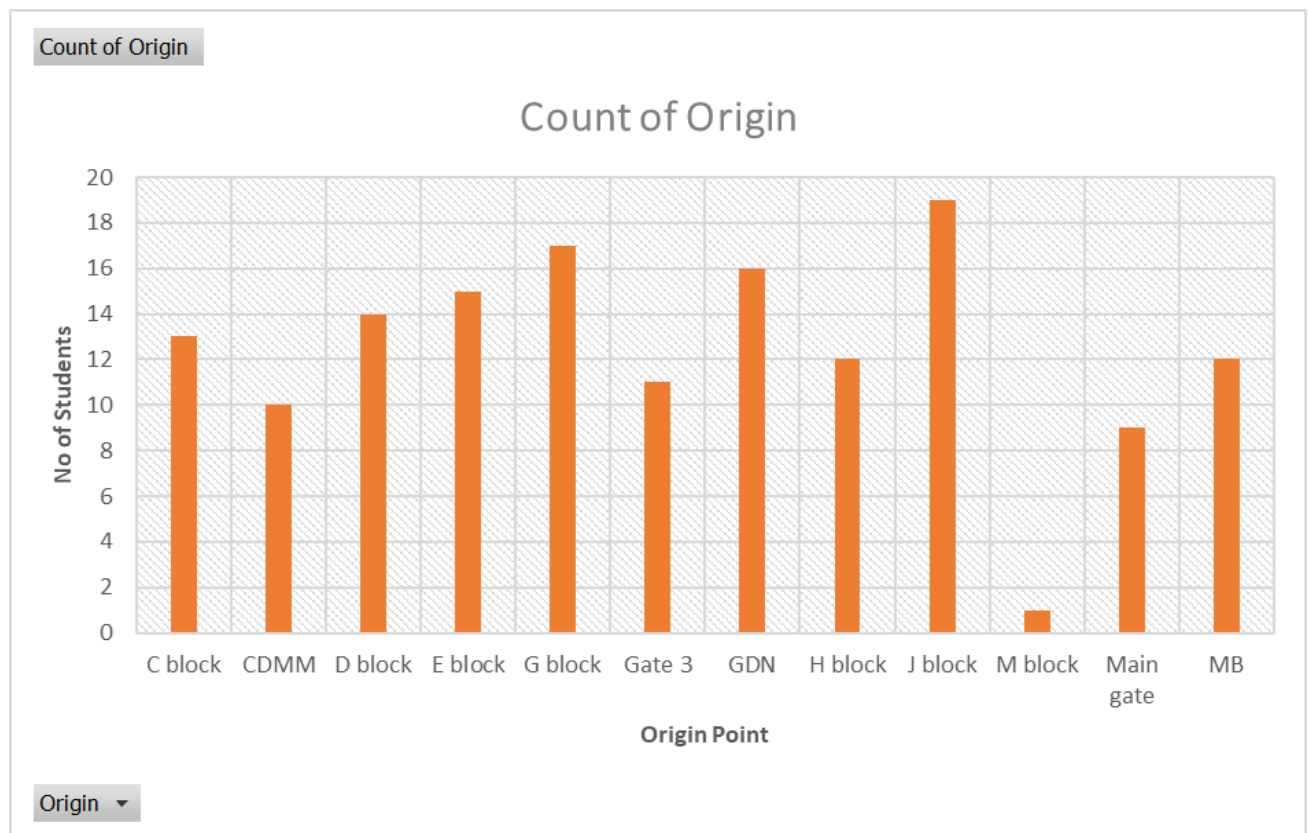
Total No of people surveyed – 1000 (Up and Down) Method
of Collection – Google Form

3 Data Analysis and Results

3.1 OD Trip Analysis

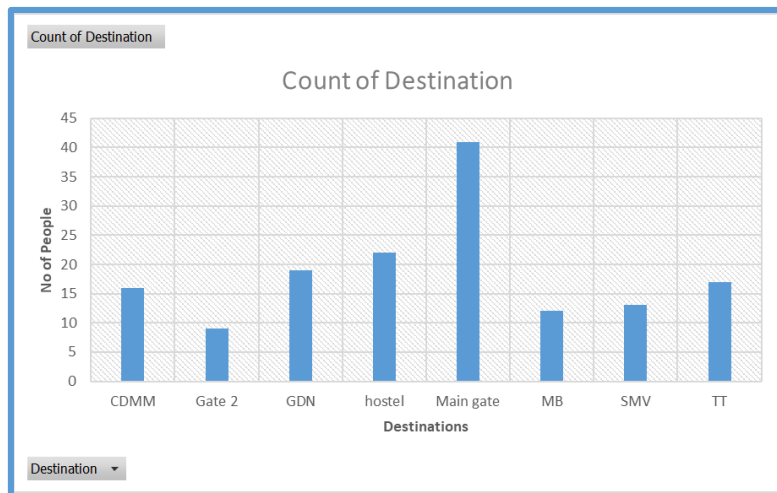
We had input from 150 people in our first attempt, we drew some conclusions about student's travel pattern from it. Following are some graphical analysis.

a) Count of Origin

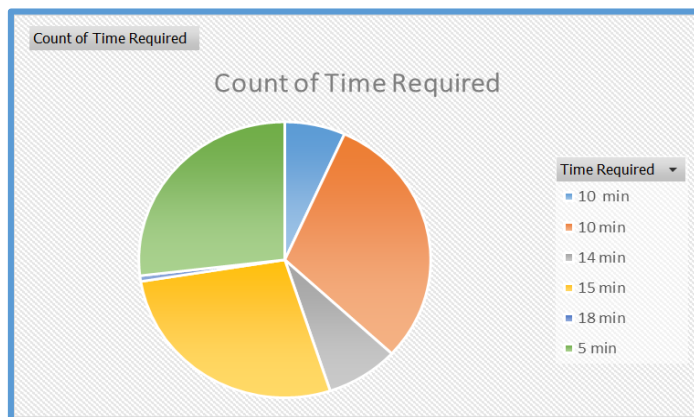


As from graph it can be said, J block and G Block students use Main tunnel the most. Whereas M block students use very less. This variation can be attributed to availability of smaller subway in east and west sides of campus. As M block has freshmen students and almost all the classes have venue in TT or SJT, so we can see less no of students. J block has the Main Tunnel in front of it.

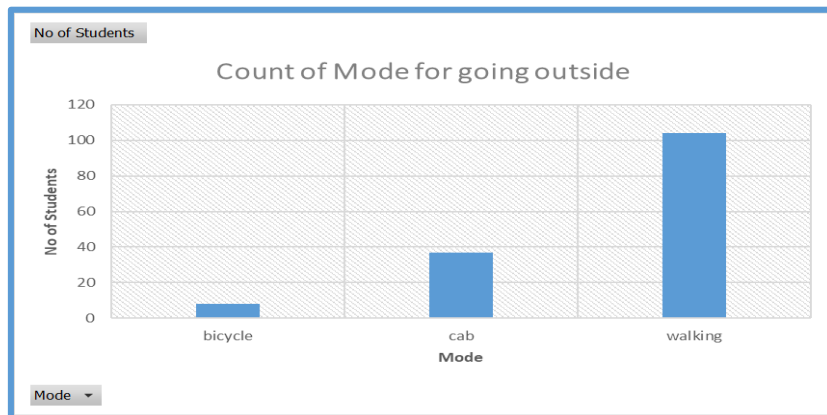
b) Count of destination



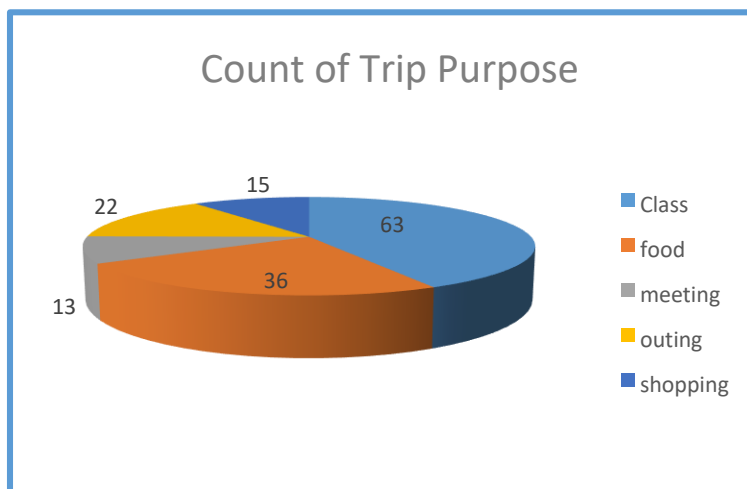
c) Time required to go from Origin to Destination



d) No of Students Vs Mode

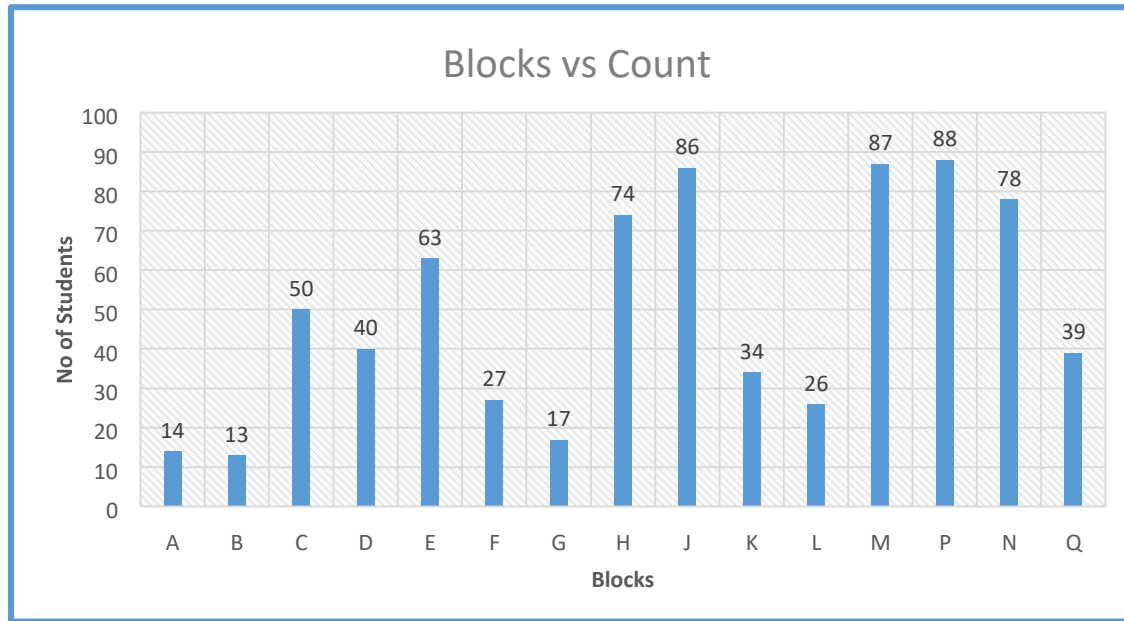


e) Trip Purpose



So from the above study we drew some points and decided to extend our analysis to larger sample of students. The 2nd attempt to Trip Analysis involved collection of data over whole day. Following are some conclusions from 2nd attempt.

Figure – Block Vs No of Students crossing tunnel from respective blocks.



As we can see K, L, A, B, G Blocks have minimum usage of tunnel. This may be attributed to availability of alternate tunnel or bus facility. Also, we can see there is significantly higher no of students from H, J, M, P, N and E blocks using the tunnel.

3.2 Applying a Trip Distribution Model to Data

From the 2nd Attempt to analyse OD Trips we implemented Uniform Growth Factor method to calculate the trips crossing tunnel after 5 yrs. The trip pattern in a study area can be represented by means of a trip matrix or origin-destination (O-D) matrix. This is a two dimensional array of cells where rows and columns represent each of the zones in the study area.

If the only information available is about a general growth rate for the whole of the study area, then we can only assume that it will apply to each cell in the matrix, that is a uniform growth rate. The equation can be written as -

$$T_{ij} = f \times t_{ij}$$

The advantages of this method are:

1. Simple to understand.
2. Preserve observed trip pattern.

3. Useful in short term-planning.

The limitations are:

1. Depends heavily on the observed trip pattern.
2. It cannot explain unobserved trips.
3. Do not consider changes in travel cost.
4. Not suitable for policy studies like introduction of a mode.

Growth factor calculation

For the growth factor calculation, we took data from previous years and averaged it out.

Also, we discussed with the other project groups and discussed what growth factor they are using for their individual projects so that we come to a standard conclusion. Further, after discussion and finally taking advice of our professor, we decided on a figure of 5% over the next 5 years, i.e., 2018 to 2023.

Data collected – tabular column

<i>Trip table for 2018</i>											
	SJT	TT	SMV	LIBRARY	MB	GDN	CDMM	GATE 2	MAIN GATE	HOSTAL	TOTAL
A block	8	6	2	3	4	2	1	1	4		31
B block	4	4	2	1	6	1	2	3	5		28
C block	5	3	13	5	8	6	8	4	3		55
D block	6	4	10	1	6	9	3	2	14		55
E block	9	5	4	2	6	12	8	7	15		68
F block	6	4	2	2	3	2	1	4	5		29
G block	2	0	8	3	9	13	7	1	6		49
H block	18	13	11	4	12	10	6	8	9		91
J block	12	8	15	3	14	11	7	9	10		89
K block	3	4	9	5	15	8	5	8	13		70

L block	8	4	7	3	9	16	8	6	11		72
M block	14	5	13	6	14	10	6	12	15		95
N block	11	8	9	5	7	6	4	6	9		65
P block	8	5	9	2	11	8	6	4	16		69
Q block	9	8	2	5	8	6	5	11	14		68
CDMM										33	33
GDN										28	28
MB										51	51
TT										64	64
SMV										83	83
GATE 3										42	42
MAIN GAT E										56	56
SJT										78	78
OTHER										55	55
										TOTAL	1424

Formula for growth factor calculation:

Future population = Current population x growth factor

Growth factor = $(1 + \text{growth factor index})^{\text{no, of years}}$

= $(1 + 0.05)^5$

= 1.05^5

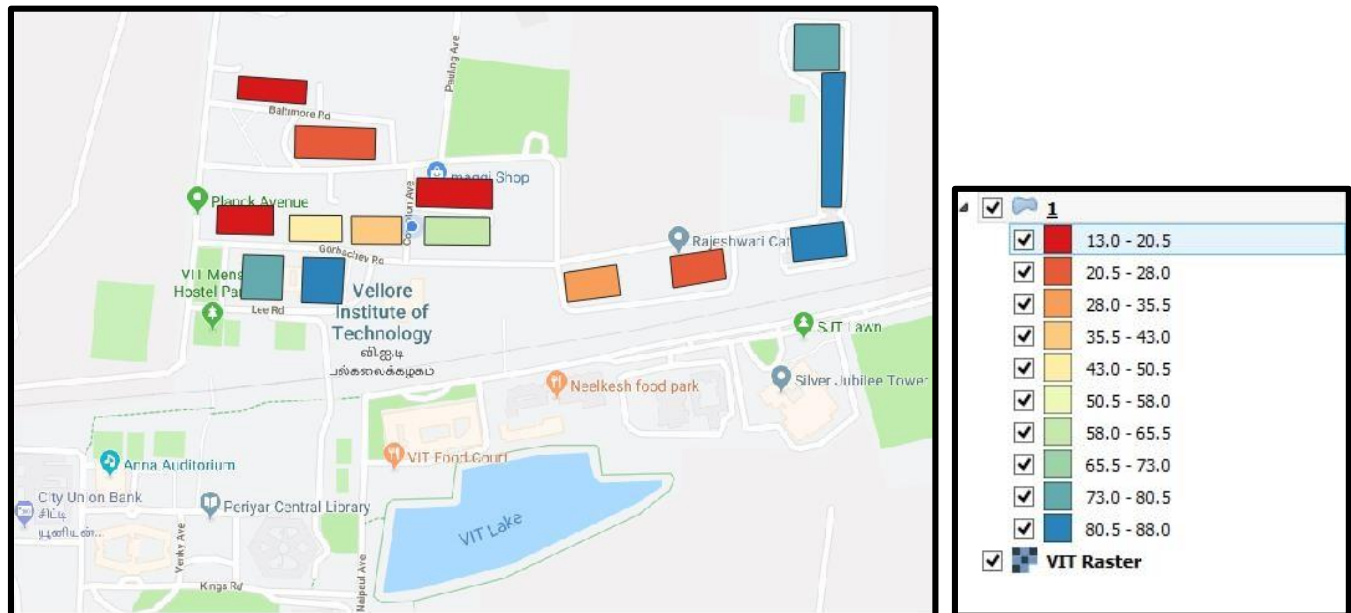
= 1.276282

Projected data (5 years – 2023)

	SJT	TT	SMV	LIBRARY	MB	GDN	CDMM	GATE 2	MAIN GATE	HOSTAL	TOTAL
A block	11	8	3	4	6	3	2	2	6	0	45
B block	6	6	3	2	8	2	3	4	7	0	41
C block	7	4	17	7	11	8	11	6	4	0	75
D block	8	6	13	2	8	12	4	3	18	0	74
E block	12	7	6	3	8	16	11	9	20	0	92
F block	8	6	3	3	4	3	2	6	7	0	42
G block	3	0	11	4	12	17	9	2	8	0	66
H block	23	17	15	6	16	13	8	11	12	0	121
J block	16	11	20	4	18	15	9	12	13	0	118
K block	4	6	12	7	20	11	7	11	17	0	95
L block	11	6	9	4	12	21	11	8	15	0	97
M block	18	7	17	8	18	13	8	16	20	0	125
N block	15	11	12	7	9	8	6	8	12	0	88
P block	11	7	12	3	15	11	8	6	21	0	94
Q block	12	11	3	7	11	8	7	15	18	0	92
CDMM	0	0	0	0	0	0	0	0	0	43	43
GDN	0	0	0	0	0	0	0	0	0	36	36
MB	0	0	0	0	0	0	0	0	0	66	66
TT	0	0	0	0	0	0	0	0	0	82	82
SMV	0	0	0	0	0	0	0	0	0	106	106
GATE 3	0	0	0	0	0	0	0	0	0	54	54
MAIN GAT	0	0	0	0	0	0	0	0	0	72	72
SJT	0	0	0	0	0	0	0	0	0	100	100
OTHER	0	0	0	0	0	0	0	0	0	71	71
TOTAL											1895

3.3 Implementation of GIS Software for data representation

We used QGIS Software to represent data on VIT Map. For this we used a vector map of VIT from Google Maps and using tools in software we could input attribute data for each block. This method basically generated a map that represented range of no of students crossing tunnel and gave each interval certain color.



4 Conclusions

The most possible and effective solution we could come up with is the construction of a walkway over the main subway itself. The primary reason for this is that there already exists infrastructure to expand into a walkway – the split stairs in front of J Block has an adequate elevation from where these can be built up. This will focus on redirection of pedestrian traffic through the walkway rather than overcrowding the subway. Also, the subway expansion would take up a lot of money, resources and time which can be overcome by a simply walkway or foot-over bridge type system. This will ensure easy flow of traffic along with future proofing in terms of traffic carrying capacity of the main subway.

PEER REVIEW

Peer Review was done by Following people

1. SAKSHI SUDITI 16BCL0049
2. PRATEEK MURARI 16BCL0062
3. PRAGYA SHUKLA 16BCL0188
4. PRATYUSH SINGH 16BCL0224

Questions asked by them and the answers which were given by us are as follows:

1. How many surveys you conducted and how did you divide the time amongst yourselves?

The data collection procedure was divided under 2 survey one was conducted on 15th September which was an instructional day and another on 12th October which was again an instructional day. The timings were of 2-hour period and 2 people would go and take survey in 2-2-hour interval.

2. Why did you opt for manual survey?

The topic was trips crossing VIT Tunnel. Therefore, to get good amount of data no previous records could be obtained from within the campus and thus a field survey was compulsory to conduct.

3. Which modelling and analysis methods you opted for and why?

We had the data for 2 hrs. for one day so first we used simple graphical analysis. The future prediction modelling was done on uniform growth factor method as there was large dataset (1000+) so we used CAGR in Uniform growth factor as we had made assumptions for growth rate.

4. How was your surveying experience?

The overall experience was good and on the working day it was observed that many students didn't take part in the survey, as they were concerned about misuse of their data. But we convinced them about "**Use of information for academic purpose only**" and their inputs will never be shared to any other person.

Individual Contribution

Vishwajeet Singh - 16BCL0257. I was Group Leader for the project. My responsibility was making work plans and generating ideas and execution of all works. My works in 3 reviews were as follows –

Review 1

- **Made a 60 hours plan** for overall project and scheduling different levels of works at different times. We had discussed a few questions that were to be answered in Review 1. Following are the questions –
 - a) What will be the procedure to conduct OD Trip Analysis?
 - b) What sample size can be taken for survey?
 - c) Where the collected data can be used and how? Review 2
- **Preparation of survey Questionnaire** – I had prepared questions that can be given to students. Had a discussion with all other members of group about number of questions that can be put and its content.
- I was **not involved in data collection** in 1st attempt. However, I did the analysis part, **preparation of Graphs in MS Excel.** Review 3
- **Survey** – Did survey for OD Trips for 2 hours by individual interview with one of our group member.
- **Model Preparation** – Discussed and tried implementing various models to predict future travel pattern. Had discussion with faculty and senior students about rate of growth of students in VIT.
- **QGIS** – Prepared Map of *OD Trip Analysis* in QGIS. The data collected in 2nd attempt was used to prepare map. This map represented no of students from each block using VIT Main Tunnel.
- **Peer Review** – I sent our project to other teams for peer review and then we answered their questions collectively.

Name: - Keshav Reg. No: - 16BCL0251

Review 1:

Played a significant role in discussing various aspects of project and formulating plans by searching the related work on the web.

Review 2:

Played a significant role in the collection of the data in front of main tunnel by the personal interview.

Prepared the PowerPoint presentation.

Review 3:

Prepared the present trip matrix and also the future trip matrix in MS Excel.

Name: - Yash Ajmera Reg. No: - 16BCL0409

Review 1:

Helped in discussing various aspects of project and formulating plans by searching the related work on the web and how to proceed.

Review 2:

Helped in the collection of the data in front of main tunnel by the personal interview.

Prepared the google form.

Review 3:

Continued the work for the collection of data in front of the main tunnel.

Suggested some ideas for the modelling.

Helped in compilation of the work.

Name: Vishwajeet Singh Reg: 16BCL0199

Contribution in TPM project: -

1. Collection of data on the subway near to H block, taking information like origin, destination, preference for cabs. How often they use the subway in a day and on weekends
2. Making model of a foot over bridge which can serve as an alternative for reducing the crowd on subway. Model has been made by using Google sketchup software.

3. Compiling all data collected from surveys in form of pie charts, line charts, graphs, etc. and doing the statistical analysis of the data.

Name: Chintan Thobhani Reg: 16BCL0205

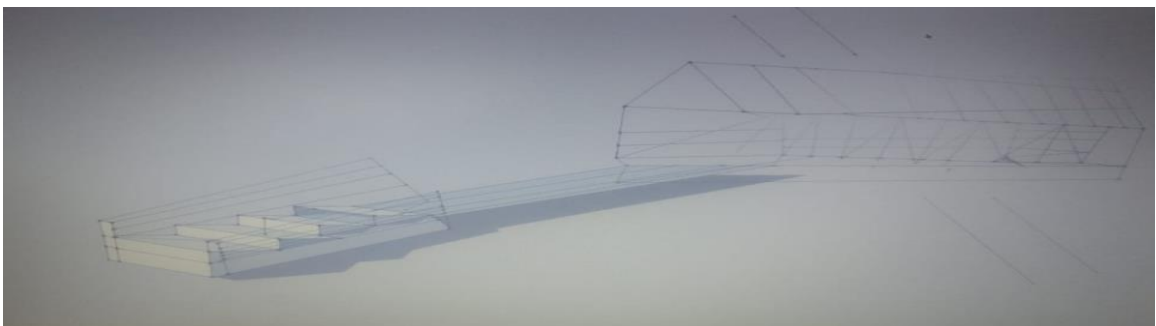
Contribution in TPM project: -

1. Collection of data on the subway during the evenings, taking information like origin, destination, preference for cabs, how often they use the subway in a day and on weekends, etc.
2. Brainstorming on alternatives, suggestion of real time situation, etc. Talking to the other groups for peer review, discussion on growth factor.
3. Compiling all data collected from surveys in form of pie charts, line charts, graphs, etc and doing the statistical analysis of the data.
4. Making of report, write-ups of the abstracts and other data, adding the Excel sheets to the report, etc.

Name: Manish Singh

Reg No.: 16BCL0197

1. Discussed various aspects of projects with member and searched it on web regarding the data required to proceed the project.
2. Prepared questionnaire in google form such that it can help in collecting data from tunnel through student.
3. Collection of data on subway near main tunnel, said them to fill the google form that was prepared.
4. Made model of foot over bridge using google sketch up software which as an alternative in reducing crowd at main tunnel.



5.

