Evolution of Pedestrian Facility within University Campus: A Case Study of MUET Jamshoro

Zaid Khan[1], Prof. Dr. Agha Faisal Habib[2], Heer Soomro[2], Shahbaz Ali[2], Muhammad Saleem Raza[2], Shahzaib Ahmed Jameel[2]

[1]*Faculty of Transportation Engineering and Vehicle Engineering, Budapest University of Technology and Economics, Hungary,*
[2]*Mehran UET-Jamshoro, Sindh, Pakistan*

Abstract: **Compared to other road users, Pedestrian and factors related to pedestrian have gotten somewhat rarer consideration in literature, although it is often underlined that road and traffic factors appear to explain only minor part of pedestrian walking and crossing behavior. University campuses are deemed as major trip attractor. Such level of activities indulges more traffic causing more problems for pedestrian. With university enrollment increasing substantially, making the condition more unsatisfactory. The understanding of pedestrian behavior in universities may lend a hand in the enhancement of design and planning of road and traffic environment, and consequently the improvement of pedestrian safety, comfort and level of service. The intent of this investigation is exploration of factors related to pedestrian walking behavior in university campus. More precisely, this research aims to capture and analyze key elements affecting pedestrian mobility on daily basis namely pedestrian's attitude, perception, behavior, preference and habits. A questionnaire was designed aiming to record prime human factors of pedestrian walking behavior and perception. The net total of 485 responses were recorded and analyzed through SPSS software.**

Keywords: **Behavior and Perception, Pedestrian Facilities, Sustainable Campus, Walkways.**

I. INTRODUCTION

Universities can be designated as small cities keeping the fact that there lies a large number of working, studying and business staff. These large number of people must be provided with adequate facilities to fulfill the requirement of mobility and accessibility. In such scenario, the campus planner must play their active role. A huge number of problems can be countered (e.g. Global warming, health problems, energy consumption, air pollution etc.) with planners & designers paying special attention towards the improved walking conditions of campus. Universities around the world are transforming towards sustainability by adopting strong pedestrian and bicycle plans. Walking can be named "Green Mode of Travel" as it is environmental friendly and promote better health conditions. Moreover, the university members having low budget will be largely benefitted by the integration of walking facilities (i.e. Sidewalks, Mid-Block Crossings, Landscape and Trees, Markings, Safety Sign Boards, Curb Ramps, etc.) along the busiest routes of the campus.

With the preliminary observation of about three years, it is evident that most prominent mode of transportation is university transit and followed by private transport. Walking is the third most frequent mode of mobility at MUET, Jamshoro. These observations show that fewer number of campus members use walking than other modes of travel. This research is intended to draw the attention of university policy makers, planners, designers and administrators to build such facilities which would encourage the safe, efficient and adequate walking conditions to promote sustainable campuses with fewer dilemmas (environmental, economical & social). The pedestrian oriented campuses will be the top priority of upcoming research.

II. PROBLEM DEFINITION & METHODS

A. Background

Mehran University of Engineering and Technology is a well reputed engineering institute of Sindh. Every year this institute enrolls the large number of students in different departments. The total number of road users include the students of undergraduate, post-graduate, PhD and other administrative, working and teaching staff. A rough estimate suggests that the number of road users in the campus exceeds 6500 each day. Being a graduate of Civil Engineering Department MUET Jamshoro, I have been observing on daily basis that a considerable proportion of road users adopt the walking as their primary mode of travel within the campus. However, there are no sufficient pedestrian facilities within campus. Having said that, the current situation is open to a lot of risk to pedestrians as their mobility is on the same road where the traffic flows.On the other hand, the motivation for this research work is the dedication of coming up with the international standards. In the developing countries the planners and designers of the campus pay special attention towards the walking facilities within the campus. Which in turn, motivates the students to adopt walking as their primary mode of mobility within campus. A well planned network of sidewalks decreases the use of motorized vehicles which eventually promotes the "sustainability".

B. Encountered Difficulties

➢ Pedestrians has difficulty walking along roadway and crossing the road during high vehicle speed or high volumes.
➢ Pedestrians has difficult time in crossing, waiting and walking in the vicinity of university as the buses and private

    vehicles move on same track.

➢ There are conflicts between left-turning and right-turning vehicles.

➢ Significant number of school children encounter difficulty in crossing and similarly the vehicles encounter difficulties in their smooth flow.

➢ There is no proper road marking on busiest points where road crossing as well as traffic flow is frequent.

➢ There is excessive delay to pedestrians prior to getting the chance to walk through intersection.

➢ Some of the intersections within university premises have insufficient sight distance where the risk of accident is high.

C. Objectives & Scope of Research

➢ This research emphasizes the importance of pedestrian walkways within the university campus as an effective, cheap and comfortable way of connectivity within the departments.

➢ This research highlights the current scenario of MUET, Jamshoro with respect to the availability of pedestrian facilities.

➢ Looking after the above situation, the research team set the main task of this research work to investigate the needs of pedestrian walkways along with additional facilities.

➢ This research will focus on the quantitative and qualitative facts, figures and data, obtained via a questionnaire survey of targeted audience.

➢ The gathered data will be processed to determine the design parameters and priorities of the walkways and ultimately will be useful to layout a proper plan for pedestrian network within the campus.

➢ The following research will also investigate all possible advantages and benefits of pedestrian walkways which will overcome walking problems and shaping MUET into modern university. Furthermore, this study could exaggerate developing authorities to adopt the solutions presented by our work.

D. Research Methodology

By preliminary observation, it is evident that Mehran University of Engineering and Technology, Jamshoro has not yet considered any measures regarding the pedestrian walkways. Considering the walking as "green mode of travel" it is of immense importance to work out a Pedestrian walkway network plan to provide comfort, ease and safety for pedestrian with effect in minimum amount of time.

A working strategy was produced in the form of a flow chart. Starting from the identification of available pedestrian facility to the problems encountered, the existing road network within the study area and the proposed target routes to be examined. The target routes are selected on the basis of three years of observation and experience within university premises.

For further study, a questionnaire was developed in this process to successfully know the perspective and point of view of pedestrians for its implementation and making roads less chaotic and pedestrian friendly. This required accurate data and effective analysis to decide the suitable pedestrian walkway network and propose implementation techniques. Figure 1 shows the manner & mechanism taken to achieve the study objectives.

After recognition of the problems encountered, a questionnaire (Figure 2(a) and Figure 2(b)) was developed which included the questions regarding: demographics; behavior towards travelling; behavior and perception towards walking; perception regarding existing walking facility and the response towards implementation of pedestrian walkways network. When the data collection process ended, the gathered information was processed in SPSS Software to generate the statistical figures.
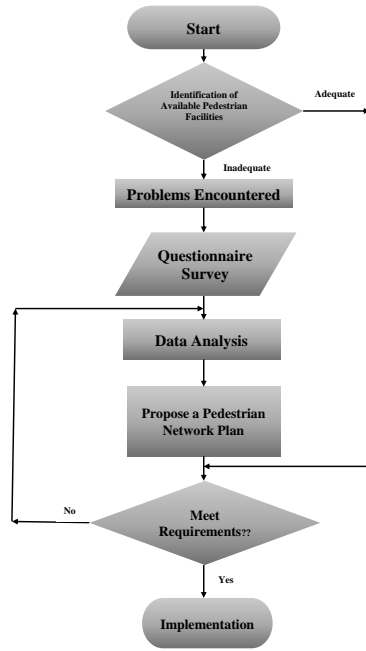
Fig. 1. Conceptual Framework of Research Methodology

Figure 2(a). Final Questionnaire Part 1

Figure 2(b). Final Questionnaire Part 2

III.   DATA ANALYSIS AND RESULTS

Before going out into the field and conducting the survey straight away, some office work had to be done by research group. The information regarding the enrollment of students was collected from the Admission Department of the campus. In particular, the information was about number of student present in each department, their sub division in batches and further division of male and female.

A. Data Distribution

To represent the data according to the actual distribution of students in campus, the weightage of each department was calculated, followed by division of batches and gender distribution. The weightage was actually the percentage of students in each field with respect to total number of students in the campus. The total sample size i.e 500 was divided according to the weightage of each field and number of questionnaires were assigned to each field.

After carefully assessing the numbers, it was suspected that the Female to Male ratio in certain departments was considerably low. To represent the female point of view clearly, it became necessary to set a fix proportion for each gender. Therefore, around 75% of overall questionnaires were assigned to male and 25% to female. Rest of the proportioning with respect to each department and batch were kept unchanged.

The total number of questionnaires reduced to 485 from the actual number of 500. Fifteen questionnaires were rejected during manual assessment, due to the either undeniable fallacies or due to some sort of biases and illogical combination of responses. Those questionnaires were considered to be filled "non-seriously" and were eliminated immediately. The Table 1 represents the final questionnaire distribution with following abbreviations:

AR Architecture Engineering, **BM** Biomedical Engineering, **CE** Civil Engineering, **CS** Computer System Engineering, **CRP** City & Regional Planning, **CH** Chemical Engineering, **EE** Environmental Engineering, **ES** Electronic Engineering, **EL** Electrical Engineering, **IN** Industrial Engineering, **ME** Mechanical Engineering, **MN** Mining Engineering, **MT** Metallurgy & Material Engineering, **MTE** Mechatronics Engineering, **PG** Petroleum & Natural Gas Engineering, **SW** Software Engineering, **TE** Textile Engineering & **TL** Telecommunication Engineering.

Table 1: Distribution of Questionnaires among each Department, Batch & Gender

Gender * Department * Batch Cross tabulation

Batch			AR	BM	CE	CH	CRP	CS	EE	EL	ES	IN	ME	MN	MT	MTE	PG	SW	TE	TL	Total
																					Department
17	Gender	Male	2	2	11	3	2	4	2	10	5	3	6	3	3	3	3	4	2	4	72
		Female	3	3	2	1	0	3	2	2	3	2	0	0	2	1	1	3	2	2	32
	Total		5	5	13	4	2	7	4	12	8	5	6	3	5	4	4	7	4	6	104
F16	Gender	Male	2	1	14	5	2	5	3	10	5	3	11	2	2	3	5	7	3	4	87
		Female	2	3	1	2	1	4	2	3	2	1	1	0	0	1	1	5	2	3	34
	Total		4	4	15	7	3	9	5	13	7	4	12	2	2	4	6	12	5	7	121
16	Gender	Male	3	1	13	5	3	6	2	9	7	3	10	3	3		5	6	3	5	87
		Female	3	3	1	2	2	3	2	2	3	1	1	1	1		1	4	2	2	34
	Total		6	4	14	7	5	9	4	11	10	4	11	4	4		6	10	5	7	121
15	Gender	Male	4	2	14	7	3	5	3	14	7	4	10	3	5		7	6	4	7	105
		Female	4	4	1	1	2	4	2	1	3	1	1	0	0		0	5	3	2	34
	Total		8	6	15	8	5	9	5	15	10	5	11	3	5		7	11	7	9	139
Total	Gender	Male	11	6	52	20	10	20	10	43	24	13	37	11	13	6	20	23	12	20	351
		Female	12	13	5	6	5	14	8	8	11	5	3	1	3	2	3	17	9	9	134
	Total		23	19	57	26	15	34	18	51	35	18	40	12	16	8	23	40	21	29	485

B. Analysis Tool

The software which has been used in the representation and analysis of data collected for this research work is SPSS. SPSS means "Statistical Package for the Social Sciences" and was first launched in 1968. Since SPSS was acquired by IBM in 2009, it's officially known as IBM SPSS Statistics but most users still just refer to it as "SPSS".

C. Results

1) Demographics

The analysis of data and results are represented on the basis of demographics represented in Figure 3.
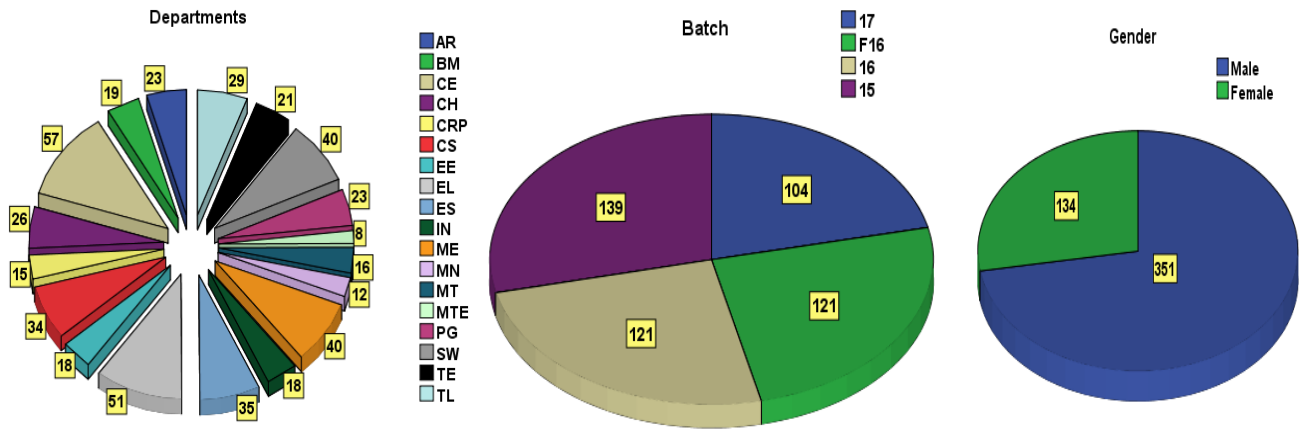

Figure 3: Department, Batch and Gender Count
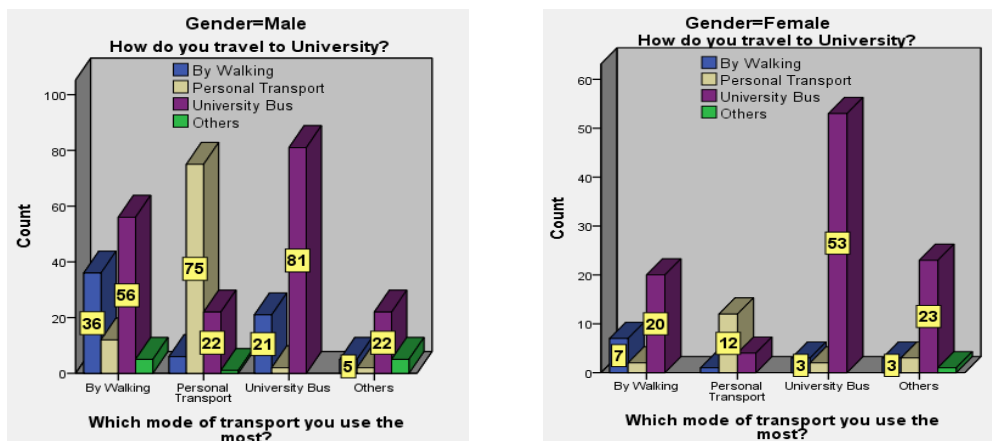
2) Gender wise travel behavior

Figure 4: Travelling behavior of Male and Female

The figure above is the graphical representation of travelling behavior of Males and Females. On breaking down the numbers, for the question "Which mode of transport you use the most?", it was found that among total number of 351 males: 31% chose Walking, 29.6% chose University Bus and 29.6% chose Personal Transport. On further breaking down, for the cross question "How do you travel to university?", among the males who chose "Walking" as the mode which they use the most: 51.4% opted University Bus, 33% chose Walking while 11% selected Personal Transport. Among the males who selected "University Bus" as the mode which they use the most: 77.9% opted University Bus, 20.2% chose Walking and only 1.9% selected Personal Transport.

For the question "Which mode of transport you use the most?" it was found that among total number of 134 females: 43.3% chose University Bus, 21.6% chose Walking and 12.7% chose Personal Transport. For the cross question "How do you travel to university?", among the females who chose "Walking" as the mode which they use the most: 68.7% opted University Bus, 24.1% chose Walking while 7.2% selected Personal Transport as their mode of travelling to university.

From the above research, the conclusion can be drawn that, when it comes to **most used mode of transport**, Males tend to Walk more than Females, however Females tend to use University Bus more than Males. In general, regardless of gender, Walking is the second prominent mode of transport used by students, following the University Bus.

When it comes in the context of **travelling towards university**, both genders created the similar trend. For travelling towards university, most prominent mode comes out to be University Bus. The reason defining this behavior can be the fact that the university campus is out of city Hyderabad and Jamshoro as well.
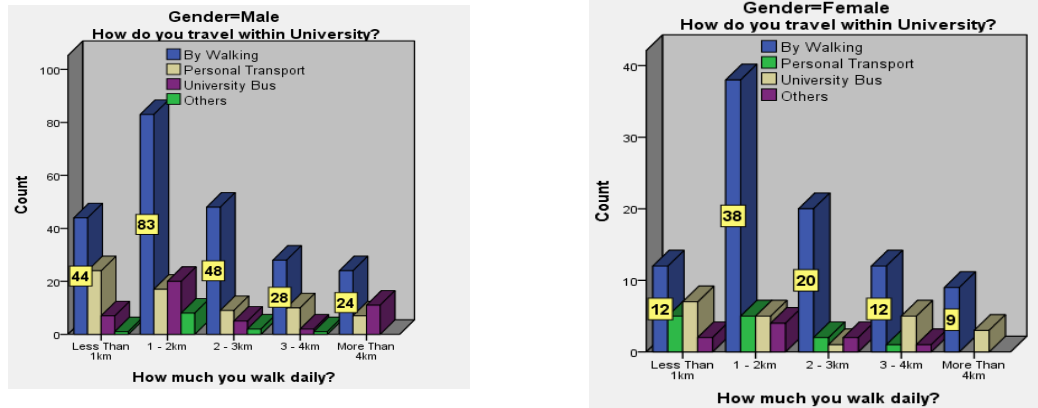
3) Gender wise walking motivation

Figure 5: Walking Motivation of Male and Female

The Male and Female responses for the cross questions are illustrated in the figure above. Since the main focus is **walking motivation**, the discussion is only focused on it. Following is the breaking down of data.

Among the total number of 351 Male respondents:
- 21.7% walk Less than 1km daily and 57.9% among them chose Walking as their mode of travel within university.
- 36.5% walk 1-2km daily and 64.8% among them chose Walking as their mode of travel within university.
- 18.2% walk 2-3km daily and 75% among them chose Walking as their mode of travel within university.
- 11.6% walk 3-4km daily and 68.3% among them chose Walking as their mode of travel within university
- 12% walk More than 4km daily and 57.1% among them chose Walking as their mode of travel within university.

Among the total number of 134 female respondents:
- 19.4% walk Less than 1km daily and 46.2% among them chose Walking as their mode of travel within university.
- 38.8% walk 1-2km daily and 73.1% among them chose Walking as their mode of travel within university.
- 18.7% walk 2-3km daily and 80% among them chose Walking as their mode of travel within university.
- 14.2% walk 3-4km daily and 63.2% among them chose Walking as their mode of travel within university.
- 8.9% walk More than 4km daily and 75% among them chose Walking as their mode of travel within university.

In the context of **mode of travel within the university**, 67.9% of total female respondents and 64.7% of total Male respondents, chose Walking. In general, regardless of gender, 65.6% of total respondents chose Walking as their mode of travel within university. From the above research it is evident that, within university premises, the most prominent mode of travel is "Walking".

4) Batch wise walking behavior in campus

Under this heading a general response of each batch has been investigated over two consecutive questions in the questionnaire:
  1 How often do you walk on "ROADSIDE" in MUET?
  2 How often do you walk on "FOOTPATH" in MUET?
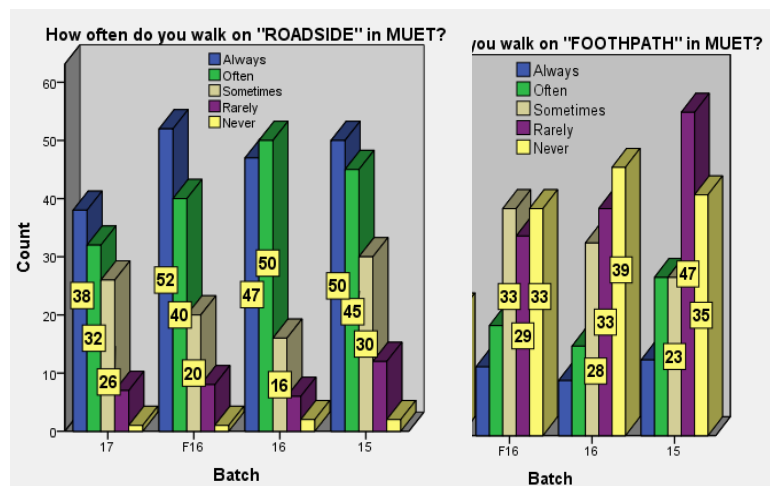In the questionnaire, these questions are placed at 14th and 15th position respectively.

Figure 6: Response to Question 14 and 15 of questionnaire by each batch

For the question "How often do you walk on "ROADSIDE" in MUET?" more than 60% of responses were "Always" and "Often" in case of each batch. It means that senior as well as junior students have a similar belief that the pedestrians in MUET walk on Roadside due to lack of Pedestrian Walkways.

For the question "How often do you walk on "FOOTPATH" in MUET?" more than 75% of responses lies on the right half of the scale i.e "Sometimes", "Rarely" & "Never". This set of response, again, suggests that students of each batch believe there are inadequate Footpaths for Pedestrians.

5) Safety perception of each Department

A department wise comparison has been carried out with respect to question regarding safety perception. Following question is analyzed: "Which route do you think is most unsafe for Pedestrians?". The response to this question will be beneficial to judge the most unsafe route in the campus, the routes along which there is an immediate need of Pedestrian Walkways and the volume of Pedestrian along each route which may be used as a component of design dimensions of Pedestrian Walkways. Figure 7 shows the responses of each department to aforementioned question.
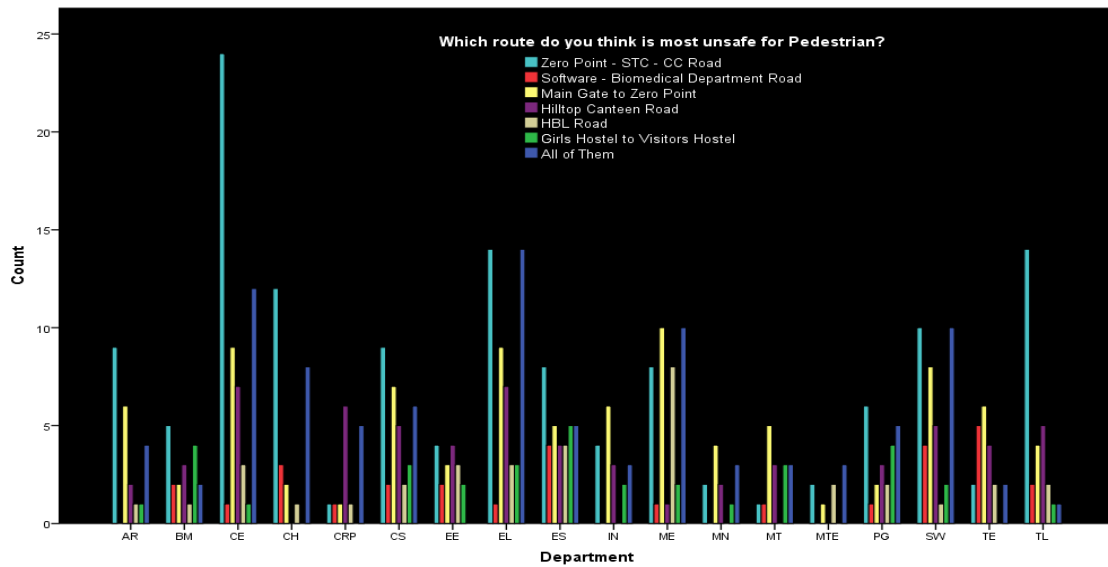

Figure 7: Perception of each department for most unsafe route.

- The majority of students in Department of Architecture, Bio-Medical, Civil, Chemical, Electrical, Electronics, Mechatronics, Petroleum & Gas, Software and Telecommunication Engineering believed that most unsafe route is "Zero Point-STC-CC Road".
- While the majority of students in Department of Industrial, Mechanical, Mining, Metallurgy and Textile Engineering believed "Main Gate to Zero Point" is the most unsafe route.
- The majority of students in Department of City and Regional Planning and Environmental Engineering believed that "Hilltop Canteen Road" is the most unsafe route.

6) Overall Perspective
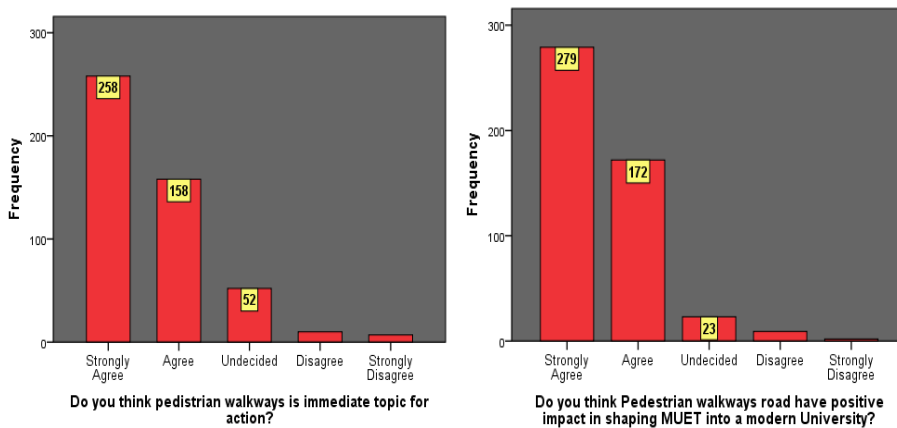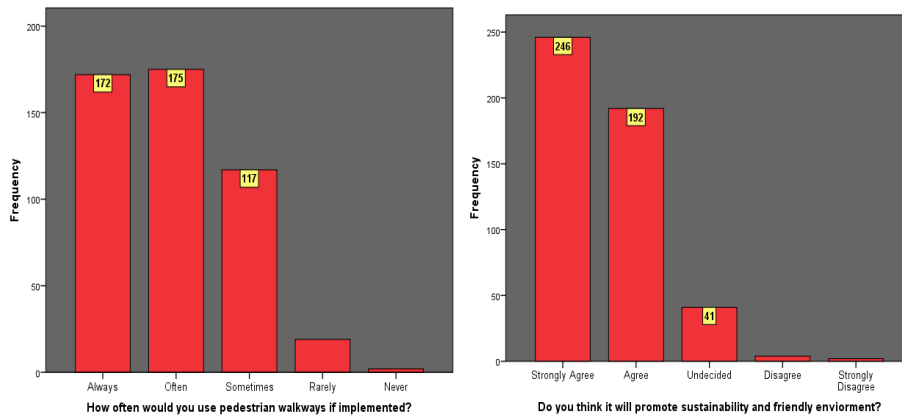
Figure 8(a), 8(b), 8(c) & 8(d): Overall perspective regarding pedestrain walkways implementation.

IV. CONCLUSION

It took more than one week to feed all the data in IBM SPSS Software. After running the analysis from each perspective, the following conclusions were drawn from the results:

- For travelling towards university, University Bus is the most prominent mode of transport, followed by Personal Transport and Walking. However, for travelling within university, walking is the most prominent mode of transport followed by Personal Transport and University Bus.
- On the daily basis over 37% of students walk 1-2km, over 18% of students walk 2-3km, over 12% of students walk 3-4km and over 11% walk more than 4km in university premises.
- 45.4% of respondents Agree and 43.3% of respondents Strongly Agree that pedestrian in MUET walk on roads instead of footpaths. Feedback of every batch, analyzed separately, formed a similar trend of responses.
- 29.9% of respondents Agree and 53.2% of respondents Strongly Agree on "there are no sufficient footpaths for pedestrians in MUET".
- The most popular timing of highest pedestrian traffic volumes are Morning and Afternoon.
- Over 37% of the respondents Agreed and over 48% of respondents Strongly Agreed that they walk because it's healthy.
- Over 40% of the respondents Agreed and about 43% of respondents Strongly Agreed that in short trips, they prefer to walk.
- On asking about the current satisfaction level of walking facilities over 32% of respondents Disagreed while 27.8% of respondents Strongly Disagreed.
- On asking about the most unsafe route for pedestrians: The majority of students in Department of Architecture, Bio-Medical, Civil, Chemical, Electrical, Electronics, Mechatronics, Petroleum & Gas, Software and Telecommunication Engineering believed that most unsafe route is "Zero Point-STC-CC Road" ; while the majority of students in Department of Industrial, Mechanical, Mining, Metallurgy and Textile Engineering believed "Main Gate to Zero Point" is the most unsafe route and the majority of students in Department of City and Regional Planning and Environmental Engineering believed that "Hilltop Canteen Road" is the most unsafe route.
- Over 39% of the respondents Agreed and over 50% of respondents Strongly Agreed that implementation of pedestrian walkway network will promote sustainability and friendly environment.

V. RECOMMENDATIONS

It will be highly appreciated by students, faculty as well as working staff that the administration and higher authorities of MUET Jamshoro take some actions towards the enhancement of walking conditions within university. It is highly recommended that the footpaths should be immediately integrated on the most unsafe routes of University (discussed under Section III.C.5) as it would not just provide safety to pedestrians but also the smooth flow of traffic will be ensured.

Although this work is first of its kind and the analyzing method is rather simplest, I would like to encourage my juniors to further continue this work and to analyze it with more advanced methods to obtain more accurate results. Due to lack of time, we could not dive deep in the design of pedestrian design. However, this work can be used in future to work out the design dimensions of footpaths on the basis of pedestrian volume on each route.

REFERENCES

[1]. Eleonora Papadimitrioua, Sylvain Lassarreb, George Yannisa (WCTR 2016 Shanghai) "Human factors of pedestrian walking and crossing behavior ".
[2]. Darcin Akin (2000) " EVALUATION OF PEDESTRIAN CROSSWALKS IN AN URBAN ENVIRONMENT".

[3].   Zohreh Asadi-Shekari ∗, Mehdi Moeinaddini 1, Muhammad Zaly Shah (2013) "A pedestrian level of service method for evaluating and promoting walking facilities on campus streets".
[4].   Carlos J.L. Balsas, "Sustainable transportation planning on college campuses".
[5].   Haris Murwadi and Bart Dewancker (2017) "Study of Quassessment Model for Campus Pedestrian Ways, Case Study: Sidewalk of the University of Lampung".
[6].   Yu Zhanga, Makarand Gawadea, Pei Sung Linb, Trenda McPhersonc (CICTP 2013) "Educational Campaign for Improving Pedestrian Safety: A University Campus Study".
[7].   PINAR KARATAŞ (2015)"DETERMINATION OF PEDESTRIAN LEVEL OF SERVICE FOR WALKWAYS: METU CAMPUS EXAMPLE".
[8].   "Assessing the impact of traffic on behavior and perceptions of safety using an in depth interview technique", by Julian Hine
[9].   Carol Holland∗, Ros Hill (2009) "Gender differences in factors predicting unsafe crossing decisions in adult pedestrians across the lifespan: A simulation study".
[10].   Inger Marie Bernhoft *, Gitte Carstensen (2007)," Preferences and behaviour of pedestrians and cyclists by age and gender".
[11].   Daphne Evans and Paul Norman," Understanding pedestrians' road crossing decisions: an application of the theory of planned behavior"
[12].   The Campus Road Planning and Design Research by Junbin Xu, Zhiyong Zhang, Jian Rong
[13].   Campus Sustainability: Student's Perception on Campus Physical Development Planning in Malaysia by M.Z. Abd-Razak, N.K.F Mustafa, A.I. Che-Ani, N.A.G. Abdullah, M.F.I Mohd-Nor.
[14].   Highway Capacity Manual by Transportation research board.
[15].   15. Campus Transportation & Parking Plan by Carl Walker, Inc.
[16].   16. Campus Transportation Demand Plan by University of Hawai'i at Manoa.
[17].   17. Transportation Safety Issues by John J. Zogby Ron R. Knipling Thomas C. Werner.
[18].   18. Samrat Kumar and Sarang Jokhio (2016), "Vissim Based Simulation Analysis, Road Network of Mehran University of Engineering & Technology", bachelor Thesis, Mehran University of Engineering & Technology.
[19].   19. 16. Federal Highway Administration (FHA). "Roundabouts: An Informational Guide." Report No. FHWARD-00-067. 2000. p 2.
[20].   20. V.P. Sisiopiku and D. Akin," Pedestrian behaviors at and perceptions towards various pedestrian facilities: an examination based on observation and survey data".
[21].   21. Marcin Budzyński and Lucyna Gumińska, "Pedestrian safety in road traffic – studies, recommendations and proposed improvements".
[22].   22. YINAN ZHENG (2016)," PEDESTRIAN OPERATIONS IN URBAN NETWORKS WITH CONSIDERATIONS OF VEHICLE INTERACTIONS".
[23].   23. Gabriel Lyle Dobbs (May 2009)," PEDESTRIAN AND BICYCLE SAFETY ON A COLLEGE CAMPUS: CRASH AND CONFLICT ANALYSES WITH RECOMMENDED DESIGN ALTERNATIVES FOR CLEMSON UNIVERSITY".