Social - Friendly Sustainable Mobility in Indian Campuses

Dibin Rasool [1], Dr. Mahua Mukherjee[2]

[1]M.Arch. student, Department of Architecture and Planning, IIT Roorkee, India

[2]Associate professor, Department of Architecture and Planning, IIT Roorkee, India

Abstract

Development in campus transportation results in wide range of circulation and sometimes become the obstacle to pedestrian movement in the campus itself. It is necessary that a sustainable mobility system within the campus to be developed to cope with immediate and future need of the campuses. This paper analyses the issues related to implementation of sustainable campus mobility in Indian campuses. With the help of sustainable mobility survey analysis, the paper identifies the user friendly sustainable campus mobility parameters for the campuses in India.

Keywords:

Sustainable mobility, Indian campuses, campus transportation, sustainable mobility system

Introduction

Motorised vehicles are more desired than any sustainable transportation system available within the campus, but in most of the campuses are required facilities for short journey taken around campus area. Besides that, motorised traffic brings air and sound pollutions, unhealthy life style and safety issues to the pedestrians in the campus. That brings the importance of sustainable transportation in the campus (walking, cycling and other alternative sustainable mode of transport systems). Programs have to be developed to reduce the number of motorised vehicle within the campus and increase the sustainable mode of transportation. For reducing the motorised vehicle different methods can be used in the campus like reducing parking, relocation of parking, increasing the parking cost within the core areas of the campus etc. For increasing sustainable transportation in campus also have different options like increasing pedestrian and bicycle network, incentives for sustainable transportation etc. This will also help to reduce the vehicular moment. But social mentality should be developed for better implementation of these sustainable initiatives.

1. Literature review

Drowns (2004) claim that different factors are influenced in increasing number of vehicles over sustainable mobility including population increase, income growth, decreased driving cost and availability of roads. **Donald Shoup (2008)** stated that parking prices also influence in increasing the number of vehicles. According to him parking prices are very small fraction of price for the parking space development. Different sustainable mobility programs are innovated for deal these issues related with transportation. There are different methods are developed for evaluate these sustainable mobility improvement programs. Nozik (1998) basic quantity evaluation method and Thomas River University performance indicator methods are best examples for the evaluation. In Nozik's quantitative method analyse, the difference in number of motorised vehicle before and after the implementation of sustainable mobility considered, but in Thomas river University performance indicator method, analysis of sustainable mobility based on the five parameters including a) The cost to the university/community partners, (b) Level of impact, (c) complexity, (d) Degree of autonomy and (e) level of potential support for the sustainable program.

2. Sustainable mobility programs for campuses

In campuses; sustainable goals, reduction of parking demand, aesthetic aspects of the campus and reduction surrounding community pressure are the influencing factor of the sustainability program development. Nine sustainable campuses including University of Hawaii at Minoa(1), University of California Berkeley(2), Indiana University Bloomington(3), Stanford University(4), California State University(5), Thompson River University(6), Buffalo Niagara Medical University(7), J. Craig Venter Institute La Jolla(8), Vancouver Island University(9) are selected and developed campus sustainable mobility program matrix for deeper understanding of different sustainable mobility programs applied all around the world (Table1).

Table 1: Sustainable mobility programs in different campuses

TDM programmes	universities								
	1	2	3	4	5	6	7	8	9
1. Transport choice improvement									
a)ride share program	✔	✔	✔	✔	✔	✔	✔	✔	✔
b) Guaranteed ride home program	✔		✔		✔	✔	✔	✔	✔
c) shuttle buses	✔	✔		✔		✔		✔	
d) peer to peer (P2P) car rental	✔								
e) Bicycle infra structure (paths, loker and shower room, repair)			✔	✔	✔	✔	✔	✔	✔
f) Pedestrian improvement (access, saftey, way finding , minimize conflit)			✔		✔				✔
g) Transit programmes (acces, marketing, incentivize)			✔	✔	✔		✔	✔	
h) Inter modal trips						✔			
i) part time use of alternative transportation								✔	
j) Expand bus waiting areas									✔
k) Preferred designated routes for emergency or delivery	✔								
2. Incentives / Discentives									
a) U pass program	✔								✔
b) Lower parking permit price for car pools		✔							
c) Bus - transit subsidy/ pass program		✔	✔	✔		✔			✔
d) Subsidy/ pre tax deduction in ride share services		✔	✔			✔	✔	✔	
e)Transit pre tax purchase		✔							
f)increased parking price			✔	✔		✔		✔	✔
g) member spot rewards/ prizes			✔	✔					
h) parking permit buy back			✔						
i) Free car rental voucher for commute club member				✔					
j) Incentivizing bicycle community							✔	✔	
k) permit price dicount to low emitting and high efficient vehicle								✔	
3. Land use management									
a) limit parking supply in upper campus surface	✔	✔	✔		✔	✔			
b) shared parking brokerage/ car pool areas	✔		✔						✔
c)parking facility for ride share vehicles	✔					✔			
d) Increase bicycle parking (long term & short term)(covered)	✔	✔			✔				✔
e) Parking relocation (remote parking)			✔		✔			✔	
f) Occasional parking program			✔						
g) Increased use of reserved parking space			✔						
h) Preferential car free housing					✔				
i) More on campus housing						✔			
j) Storage and charging station to electric vehicle								✔	
k)Install general loading zone									✔
4. Policies anfd institutional reform/ programmes									
a) Transport management association	✔								
b) Avenue to address bicycle and pedestrian issues outside the campus	✔								
c) TDM marketing initiatives/ events	✔		✔	✔	✔		✔		✔
d) bike buddies program/ commuter club	✔		✔	✔					✔
e) centralised transportation information center	✔	✔							
f) TDM coordinator			✔		✔	✔			✔
g) Flexible work (Class) arrangement/ tele commuting policy			✔		✔	✔			✔
h) Online commute information				✔			✔		✔
i) Bicycle loan/ education program				✔	✔				✔
j) Trip reduction membership program					✔				

Based on sustainable programs of respective Institutional webs

3. Study area

In Indian campuses, sustainable goals/green initiatives are the driven force of sustainable campus mobility development. In this study, Indian Institute of Technology Roorkee (IITR), Indian Institute of Technology Delhi (IITD) and Graphic Era University Dehradun (GEU Dehradun), located Roorkee, Delhi and Dehradun are the three campuses considered for the analysis. IITR and IITD campuses spread over 356 and 325 acre respectively considered as larger campuses in India but GEU spread over 30 acre considered as medium- smaller campus in India. These three campuses are considered sustainable campus mobility as a part of development in the campus.

4. Research methodology

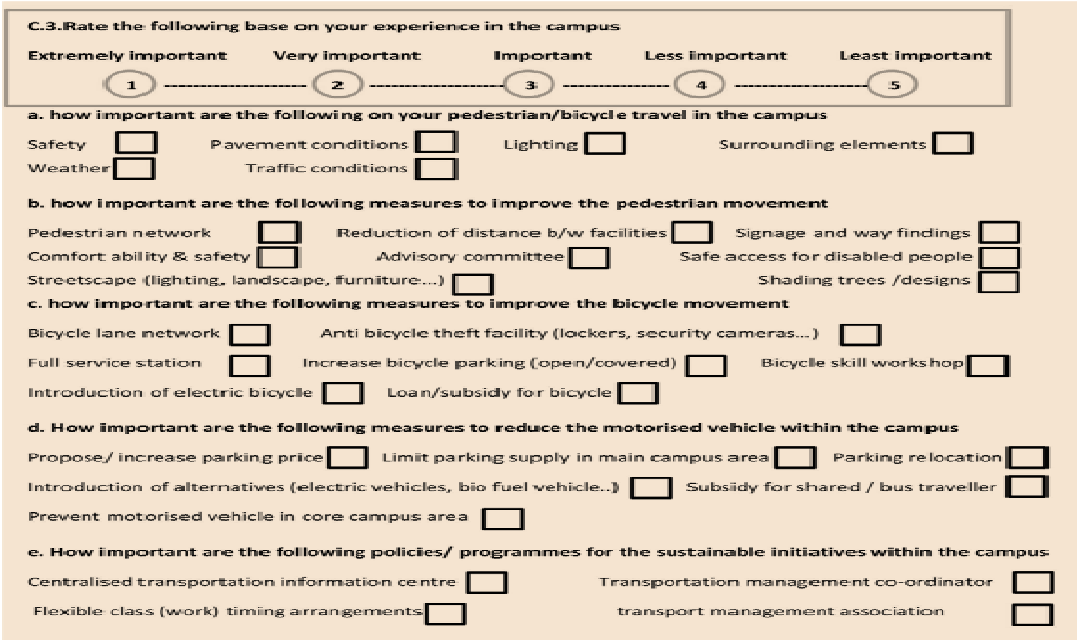
This paper mainly focused on the development of prioritised sustainable campus mobility parameters in Indian campuses. As discussed earlier, many

sustainable mobility parameters exist in different campuses all over the world. Paper mentions about analysis considered for the prioritised relevant sustainable mobility parameters in Indian campuses based on user responses. Survey analysis helps to understand the social response of the community. Discussion on this analysis leads to the conclusion and recommendation with prioritized and relevant sustainable campus mobility parameters to the Indian campuses.

4.2. Campus mobility program Survey analysis

The response of the Indian campus community to the sustainable mobility programs is an important parameter for understanding the significance and possibility of successfulness of programs in the campuses. This analysis was done by questionnaire survey with multiple answers on IIT Roorkee, IIT Delhi and GEU Dehradun. These questions were based on five basic aspects of sustainable mobility including improvement of active transportation like walking, cycling etc., reduction of motorised vehicle and programs and policies for campus sustainable mobility initiative. This questionnaire based on the rating of different measure to be taken for the improvement in pedestrian, bicycle development and reduction in vehicular movement. Each measure is derived from open preliminary questionnaire survey, sustainable campus mobility literature, case study of applicable sustainable mobility program. Level of acceptance of these measurements can be analysed through responses of campus community.

100 samples collected from the IITR and IITD campuses and 75 samples were collected from GEU including students, staffs and faculty through offline and online. Result of each question was analysed using Linkert scale (1 to 5 scales) (table2, 3, 4, 5 and 6).


C.3.Rate the following base on your experience in the campus

Extremely important (1) Very important (2) Important (3) Less important (4) Least important (5)

a. how important are the following on your pedestrian/bicycle travel in the campus

Safety ☐ Pavement conditions ☐ Lighting ☐ Surrounding elements ☐
Weather ☐ Traffic conditions ☐

b. how important are the following measures to improve the pedestrian movement

Pedestrian network ☐ Reduction of distance b/w facilities ☐ Signage and way findings ☐
Comfort ability & safety ☐ Advisory committee ☐ Safe access for disabled people ☐
Streetscape (lighting, landscape, furniture...) ☐ Shading trees /designs ☐

c. how important are the following measures to improve the bicycle movement

Bicycle lane network ☐ Anti bicycle theft facility (lockers, security cameras...) ☐
Full service station ☐ Increase bicycle parking (open/covered) ☐ Bicycle skill workshop ☐
Introduction of electric bicycle ☐ Loan/subsidy for bicycle ☐

d. How important are the following measures to reduce the motorised vehicle within the campus

Propose/ increase parking price ☐ Limit parking supply in main campus area ☐ Parking relocation ☐
Introduction of alternatives (electric vehicles, bio fuel vehicle..) ☐ Subsidy for shared / bus traveller ☐
Prevent motorised vehicle in core campus area ☐

e. How important are the following policies/ programmes for the sustainable initiatives within the campus

Centralised transportation information centre ☐ Transportation management co-ordinator ☐
Flexible class (work) timing arrangements ☐ transport management association ☐

Fig.1: Sample questionnaire

Table2: Pedestrian / bicycle travel influencing parameter chart

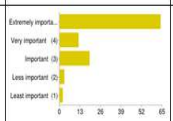
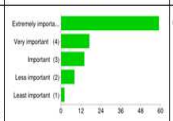
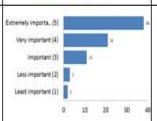
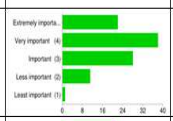
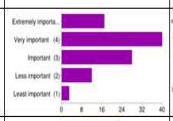
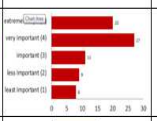
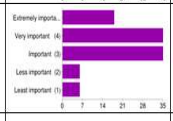
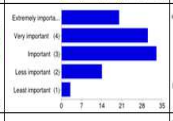
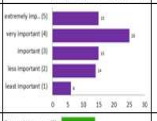
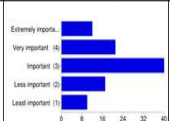
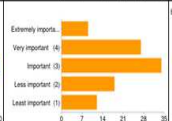
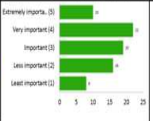
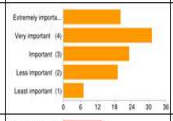
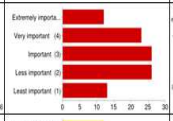
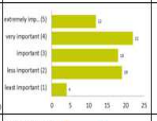
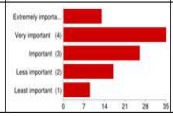
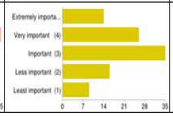
parameter	Universities			Result
	IIT Roorkee	IIT Delhi	GEU Dehradun	$\sum(W_{1\ to\ n} * X_{1\ to\ n})/\sum X_{1\ to\ n}$
safety				4.3 4.2 4.2
Pavement condition				3.7 3.6 3.6
Lighting				3.5 3.5 3.4
Surrounding elements				3.1 3.0 3.1
Weather				3.4 3.0 3.3
Traffic condition				3.3 3.2 3.4

Table3: Pedestrian improvement measures chart

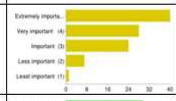
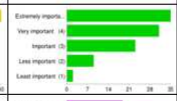
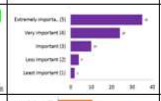
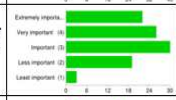
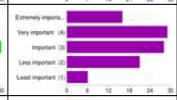
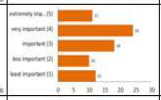
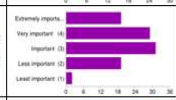
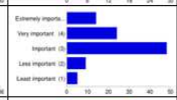
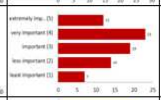
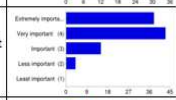
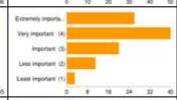
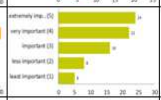
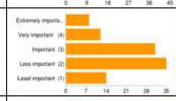
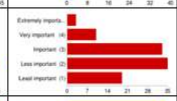
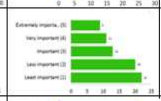
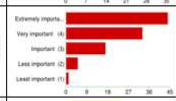
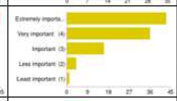
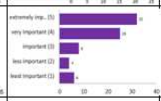
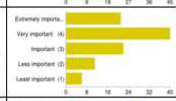
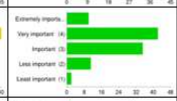
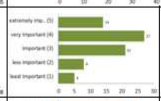
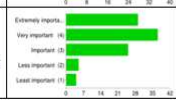
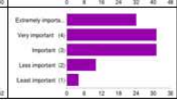
Parameter	Universities			Analysis
	IIT Roorkee	IIT Delhi	GEU Dehradun	$\sum(W_{1\ to\ n} * X_{1\ to\ n})/\sum X_{1\ to\ n}$
Pedestrian network				4.0 3.9 4.1
Reduction of distance b/w facilities				3.4 3.3 3.2
Signage and way findings				3.4 3.3 3.3
Comfortability& safety				4.1 3.8 3.8
Advisory committee				2.6 2.4 2.5
Safe access for disabled people				4.1 4.2 4.0
Streetscape				3.6 3.5 3.5
Shading trees/ design				3.8 3.6 3.4

Table4: Bicycle improvement measures chart

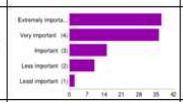
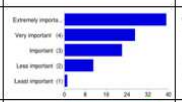
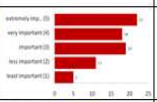
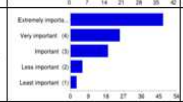
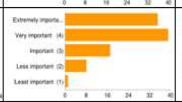
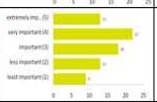
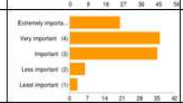
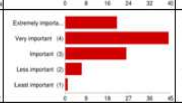
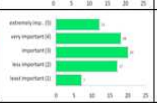
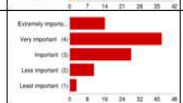
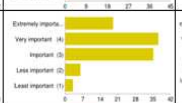
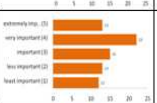
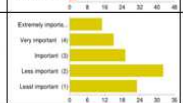
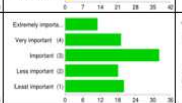
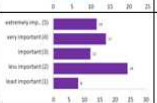
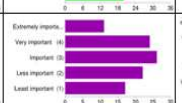
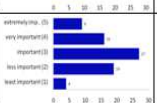
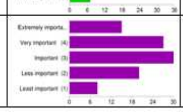
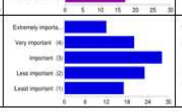
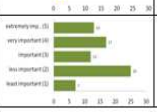
Parameter	Universities			Analysis
	IIT Roorkee	IIT Delhi	GEU Dehradun	$\sum(W_{1\ to\ n} * X_{1\ to\ n})/\sum X_{1\ to\ n}$
Bicycle lane network				4.0 3.9 3.5
Anti-bicycle theft facility				4.1 4.0 3.7
Full service station				3.6 3.8 3.1
Increase bicycle parking				3.6 3.6 3.1
Bicycle skill workshop				2.6 2.8 3.1
Introduction of electric bicycle				3.4 2.9 3.1
Load/ Subsidy for bicycle				3.2 2.9 3.0

Table5: Motorised vehicle reduction measures chart

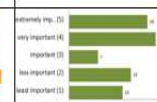
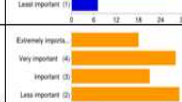
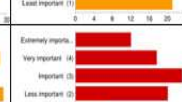
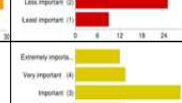
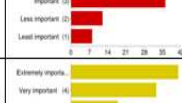
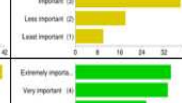
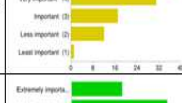
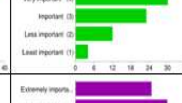
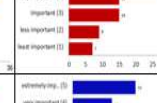
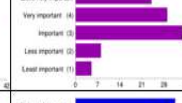
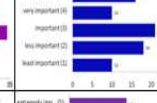
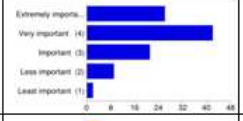
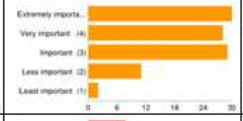
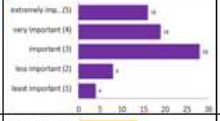
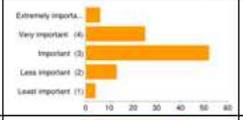
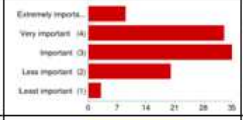
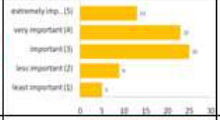
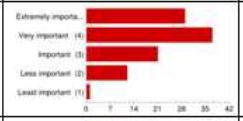
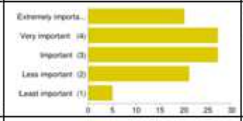
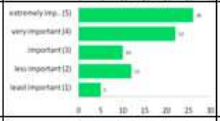
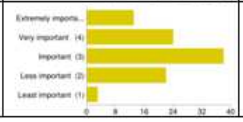
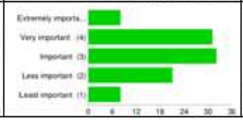
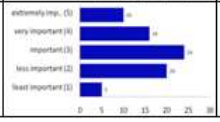
Parameter	Universities			Analysis
	IIT Roorkee	IIT Delhi	GEU Dehradun	$\sum(W_{1\ to\ n} * X_{1\ to\ n})/\sum X_{1\ to\ n}$
Proposed / increase parking price				3.1 2.9 3.2
Limit parking supply in main campus area				3.2 3.1 3.0
Parking relocation				3.2 3.1 3.2
Introduction of alternatives				3.9 3.7 3.6
Subsidy for shared/ bus traveller				3.5 3.6 3.1
Prevent motorised vehicle in the core campus area				3.4 3.4 3.1

Table5: Programs/ policies for sustainable mobility initiatives chart

Parameter	Universities			result
	IIT Roorkee	IIT Delhi	GEU Dehradun	$\Sigma(w_{1 \text{ to } n} * x_{1 \text{ to } n})/\Sigma X_{1 \text{ to } n}$
Centralised transport. information centre				3.8 3.7 3.5
Transport. management coordinator				3.2 3.3 3.4
Flexible class/ work timing arrangement				3.8 3.4 3.7
Transport management association				3.2 3.1 3.1

5. Discussion on analysis

In survey analysis, priority of each sustainable campus mobility parameter identified and quantified in a scale of 1 to 5. This help to rearrange sustainable campus mobility parameters in the priority wise. Survey analysis shows the social aspects of the Indian campus\ community. According to the survey, users of Indian campuses were more concern about safety, pavement conditions while walking or using bicycle. Due to the existing controlled traffic system in the campuses, users were less concern about it unless there is a tech or cultural seasons occur, but users rated all the parameters in the Table 2are important or more important for the implementation.

According to survey, pedestrian network, Comfort & safety, shading trees/ design and safe access for disabled people were more important than formation of advisory committee while considering the parameters of pedestrian improvement in the campus. Users were finding more relevance in development of secured and effective infra-structure than a controlling body which regulate the existing transportation system (Table 3). For Bicycle improvement also users were give more importance to the secured and effective infrastructure and facility development than awareness programs like bicycle skill workshops. Users also considered introduction of electric bicycle and subsidy and loan for bicycle were important in the existing scenario (Table 4).

For the reduction of motorised vehicle in the campus, users were more concern about the introduction of alternative mobility system and subsidised shared/ bus travel than increasing the parking price and limit the parking supply of vehicle in the campus. Users believed that lack of active transportation is the major issue to be address in Indian campuses (Table 5). In programs/

policies, user considered centralised transport information centre and flexible class/training arrangements are more important parameters to be considered for the sustainable mobility initiative in the campus (Table 6). User considered associations and co-ordinators for transport management will be unnecessary expenses of money and time.

Supporting and promoting the active transportation facilities like walking and cycling is more effective way to bring a swift towards sustainable transportation in campus than bringing barriers to the motorised vehicle. For the successful development of sustainable campus mobility programs in Indian campuses, detailed sustainable campus mobility programs based on the priority have to consider for the implementation. Optimised form of socially acceptable analysis will help to develop indigenous sustainable campus mobility proposal for region to region.

6. Conclusion

In India with different cultural and technological background, need more indigenous programs for the successful implementation of sustainable campus mobility within the campuses. This paper intended to optimise the existing sustainable campus mobility parameters in Indian condition. All possible sustainable mobility systems in the campuses may not be socially acceptable at each area having different cultural and social background. It will in turn affect the implementation and success of usage as sustainable element of design in the campus. Socially acceptable elements are to be considered for the implementation of any sustainable mobility management system in the campuses. The Possibility of more innovative indigenous sustainable campus mobility program development is existing in this area of study. More specified sustainable mobility programs will enhance the clarity and usability of Indian sustainable campus mobility implementations.

References

Toor, W. & Havlick, S. (2004). Transportation and Sustainable Campus Communities: Issues, Examples, Solutions. Washington, D.C.: Island Press.

Watterson, B. (2011). Transportation Demand Management on UNC's Campus: Evaluation, Best Practices and Recommendations for Reducing Single-Occupancy Vehicle Use, Master's Thesis at The University of North Carolina at Chapel Hill, 8: 11.

Balsas, C. (2003). Sustainable Transportation Planning on College Campuses. Transport Policy. 10: 35.

Victoria Transport Policy Institute. (2010). TDM Online Encyclopaedia. Retrieved from http://www.vtpi.org/tdm/tdm12.htm

Thompson River University, Transportation division. (2012). Transportation Demand Management Strategy [Data file]. Retrieved from http://www.tru.ca/shared/assets/tdm