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Planning for Sustainable Pedestrian Infrastructure with upcoming MRTS — An Appraisal of Walkability Conditions in Lucknow

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Abstract

Cities are for people but trends of development in transportation infrastructure within the city have prioritized vehicles over pedestrian. Even due to road tax policies vehicles edge out pedestrian from road space. Here the paper support for developing pedestrian infrastructure and providing safe, secure and convenient pedestrian infrastructure for true owners of city: 'the people'. The parameters are identified to evaluate the walkability index of Lucknow city. An attempt is also made towards providing design parameters to improve walkability conditions general as well as in consideration to upcoming MRTS infill. The paper also considers policy level support to achieve the desired walkability conditions.

1. INTRODUCTION

Walkability is an important concept in sustainable urban design approach. It is a measure of how friendly an area is for pedestrians. Walkability has many health, environmental, and economic benefits. Better walkability has shown many individual and community benefits, such as opportunities for increased social interaction, reduced crime, increased civic sense and responsibility. One of the most important benefits of walkability is the decrease of the automobile footprint from the community. Thus 'carbon emissions' can be reduced if more people choose to walk. Increased walkability has also been found to have many economic benefits both to individuals and to the public with increased efficiency of land use including accessibility, increased liveability, transportation cost savings, economic benefits from improved public health and catalyses economic growth.

In developing countries, like India, majority of the people have to walk or use public transportation. Many cities are indirectly encouraging use of public transport through introducing BRTS and/or MRTS projects thus increasing pedestrian movement. On the contrary, we observe rapid growth of vehicles on road, new proposals for flyovers or widening of roads and encourage more vehicles and the process continues, sometimes even at the cost of footpaths and pedestrian convenience and safety; thus discouraging pedestrian movement.

2. WHOSE CITY IS IT ANYWAY – PEOPLES' OR VEHICLES'?

Lucknow is soon going to adopt MRTS system. That is not only going to ease the traffic movement on roads but also increase the pedestrian movement at MRTS nodes. Almost all commuters using the MRTS at a certain part of their trips would behave as pedestrians. Therefore, we can expect mass increase in pedestrian flow at MRTS nodes. Efficiency of the MRTS is not only decided by individual performance

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but as a system for its user i.e. how users will approach the MRTS nodes and then commuters' behaviour when they walk out of the MRTS station. Thus at initial stage we need to know pedestrian behaviour within Lucknow and that city has basic pedestrian infrastructure and walkability conditions.

Economically speaking land value is a function of walkability index; thus it has to play a major role in developing urban economics. A commercial area with more walkable character fetches higher sales. Since development of cities people preferred living closer to city centers, work centers or activities of daily needs. Walkable streets have always been an essential part of vibrant urban space. Positive values are added to living within easy walking distance. But unfortunately walking is unmeasured and/or neglected while traffic planning.

3. EVALUATING WALKABILITY

Evaluating walkability is challenging as it requires consideration of many subjective factors. Basically Walkability Index comprises of three components: safety and security, convenience, and degree of government policy support. Assessing and measuring walkability through the walking audit is most common method. An established and widely used walking audit tool is Pedestrian Environment Review System (PERS) which has been used extensively in the UK. In case of Lucknow walkability is studied through walking audit, a conventional method. Certain modification in walkability audit criteria (filtration and addition of indicators or variables) has been done with considerations to Lucknow city as shown in Table 1.

Table 1 Components, Indicators and Variables for evaluating 'Walkability'

Component		Indicator		Variable
Safety & Security	1	Pedestrian Fatalities and Injuries	1	Proportion of road accidents that resulted in pedestrian fatalities
			2	Proportion of road accidents that resulted in pedestrian injuries
	2	Modal Conflict	3	5-minute interval count of pedestrians walking in street among other modes
			4	Pedestrians who do not feel safe from road accidents
	3	Crossing Safety	5	Crossing safety (1-5 LOS)
			6	*Buffer to moving vehicles with walkway
	4	Crossing Exposure	7	Average time waiting to cross
			8	Judgement: sufficient time given (for healthy adult, small children, elderly & disabled) to cross
	5	Traffic Management at Crossings	9	Type (e.g., pedestrian - phase signal) as function of number of lanes and avg. traffic speed
	6	Security	10	Perception of security from crime (1-5 LOS)
			11	Proportion of walkable roads with street lights
	7	Safety Rules and Laws	12	Existence of relevant pedestrian safety laws and regulations
			13	Enforcement of relevant pedestrian safety laws and regulations

Component		Indicator		Variable
	8	Pedestrian Safety Education	14	Presence of pedestrian safety education programme
	9	Motorist Behaviour	15	Yielding to pedestrians Convenience and attractiveness
	10	Cleanliness	16	Cleanliness of walking paths (1-5 LOS)
	11	Quality and Maintenance of Walking Path Surface	17	Pedestrians inconvenienced by poor walking path surface material (1-5 LOS)
			18	Proportion of roads without sidewalks
	12	Disability Infrastructure	19	Existence and quality of facilities for blind and disabled persons (1-5 LOS)
	13	Obstructions	20	Permanent and temporary obstacles on walking paths (1-5 LOS)
			21	*Level of (Permanent and temporary) Encroachment for private interest. i.e. Proportion of encroachment free pedestrian walkways.
	14	Walking Path Congestion	22	Pedestrian congestion (1-5 LOS)
			23	*Diversity of people
	15	Pedestrian Amenities	24	Amenities (e.g., benches, public toilets) (1-5 LOS)
			25	Pedestrian way finding signage (1-5 LOS)
	16	Trees	26	Average number of trees per km of road
	17	*Climatic Concerns	27	Proportion of walking paths with climate considerations (e.g., covered by arcades & *flow of breeze)
	18	*Environment Quality	28	*Air & Odour Quality
			29	*Acceptable Noise level for area
	19	Connectivity	30	Connectivity between residential and employmentcentres (adjacent Landuse) (1-5 LOS)
			31	*Building Accessibility from walkway
			32	*Presence of Public Transportation System
	20	*Parking Provision	33	*Availability of Parking Space
	21	*Scope of Expansion / improvement of Infrastructure	34	*Land Availability for infrastructure development
			35	*Available Right of way (ROW) for increasing pedestrian facilities and amenities.
Policy support	22	Planning for Pedestrians	36	Incorporation of pedestrian plans in transportation plan details
			37	Relative importance of pedestrians in city planning(agency self-rating)
			38	Degree of centralization among bodies responsible for different aspects of pedestrians planning
	23	Relevant Design Guidelines	39	Presence of relevant urban design guidelines
			40	Presence of relevant building design guidelines
			41	*Presence of billboard advertising rules
	24	Heritage Conservation Rule	42	*To support socio-cultural heritage of city
			43	*Implementation of ASI regulations to special area

Source: Global Walkability Index: Summary of Components, Indicators, and Variables (2005) '*' filtration/ addition of variables in context to study of Lucknow City (to above source).

Above mentioned indicators and variables are weighted on priority and availability to quantify and assess the walkability index. Walkability conditions in Lucknow are studied only at subjective level due to time constraint and insufficient data.

3.1 Situation of Pedestrian infrastructure in Lucknow

Pedestrians are the victims of the present trends of vehicular centric infrastructure development. According to Dinesh Mohan accidents claim 80,000 lives every year in India, almost 60 percent and 78 percent of those who are victims of accidents are pedestrians, cyclist or sidewalk dwellers in Delhi and Mumbai respectively. Lucknow is also following similar traffic developments. Hence we need to prioritize focus on developing traffic infrastructure for safe movement of actual possessor of city: the people or pedestrians and not the vehicles.

Lucknow city is growing fast and is expected to reach a population of 4.5 million by 2021 (Master Plan 2021 projection). Already city's roads are congested and still it is registering large number of vehicles every year (see Table 2). To accommodate these vehicles the city is developing vehicular centric infrastructure; introducing sequences of flyovers, canal road, *Shaheed path* (connecting road link for five regional highways), outer ring road and street widening programme, etc. This development process in traffic and transportation infrastructure has overshadowed the pedestrian facilities.

Major pedestrian areas within Lucknow are business districts of Hazratganj, Aminabad, Chowk and Kaiserbagh; major transit hubs (Charbagh railway station and Alambagh ISBT station); other sub city centres like Jawahar Bhawan, Lekhraj, Kapurthala, Nishatganj, Polytechnic, Vishal Khand, Patrakarpuram, Munshipuliya, etc; and tourist destination such as Hussainabad Complex. The survey was conducted

Table 2 Vehicular Growth in Lucknow in Last Ten Years

Year	Two wheeler	Car/jeep/taxi	Bus	Mini Bus	Goods Vehicle	Others	Total
1989-99	26891	4863	65	19	1072	708	33618
1999-00	31857	7801	267	42	941	826	41734
2000-01	34605	8699	153	65	694	761	44977
2001-02	36712	7725	183	26	863	638	46147
2002-03	48993	9128	152	60	1367	1026	60726
2003-04	52776	10432	93	89	1595	732	65717
2004-05	58635	10569	66	98	1890	600	71858
2005-06	62943	11081	54	225	1358	1390	77051
2006-07	60285	16532	122	98	2092	706	79835
2007-08	52482	13780	128	70	2557	993	70010
2008-09	54237	15766	174	117	2311	1790	74395
Total	520416	116376	1457	909	16740	10170	666068

Source: RTO Lucknow

Fig.1 Pedestrian Infrastructure Issues in Lucknow

(a) lack of subways and FOB forces pedestrian to cross the street through busy signals; (b)permanent obstruction by construction over sidewalk; (c) obstruction due to uncontrolled parking over sidewalks, (d) unplanned landscape reduces effective with of footpath as well as dumped construction matarial as obstruction; and (e) obstruction by ill-designed street hardware, memorials and lack of barrier free design.

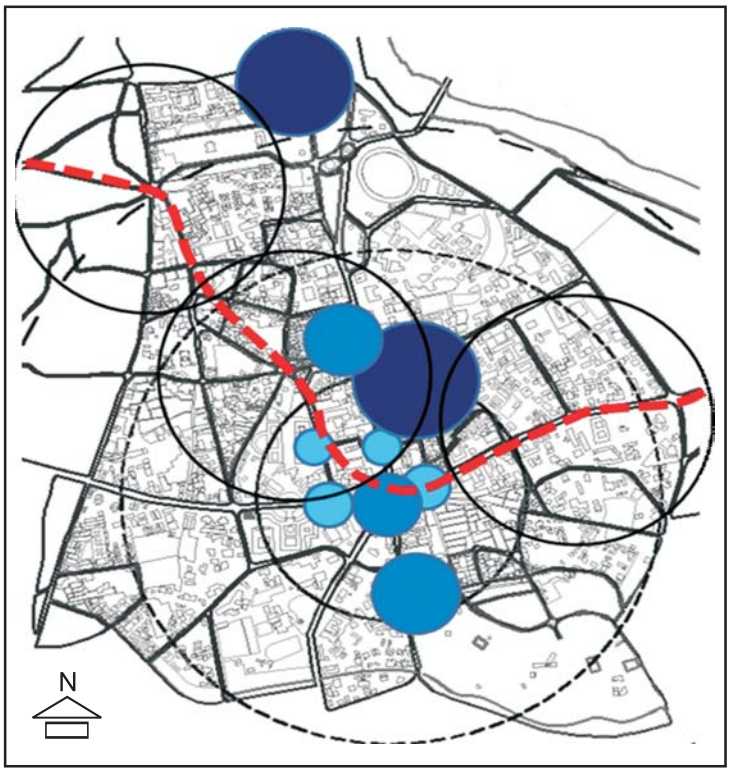
at major pedestrian areas within catchment area of proposed MRTS corridor. All these areas house high risk of accident due to pedestrian vehicular conflict. Sidewalks are missing in most of these areas while sidewalks supported by other areas are inadequate, ill-maintained or ill-designed (Fig. 1).

It was found that the best pedestrian infrastructure is provided near Ambedkar Memorial which supports least pedestrian count, while areas of Aminabad, Kaiserbagh and Lalbagh with maximum pedestrian traffic are not provided with even simple sidewalks. Hazratganj, Mahanagar and Subhash Marg are highly pedestrianized areas

Table 3 Pedestrian Count Survey

	Pedestrian	Auto	Bus
Civil Hospital Crossing	148	42	1
HazratGanj Bus stop	72	68	6
Changamal M.G. Road, Hazratganj	107	0	0
CCD Hazratganj	75	62	8
Janpath Market Entry	68	4	0
Janpath Market Exit	56	2	0
Mayfair T-Junction	121	2	0
St. Francis more	194	12	0
High Court Crossing	177	33	0

Fig. 2 Number of Pedestrian Intensity Around Proposed MRTS Interchange Hazratganj, Lucknow



Survey dated 26th Feb 2010

and have sidewalks with commercial encroachments and obstructions reducing effective width of walkways. Also due to insufficient infrastructure of parking vehicles are seen parked on footpaths thus forcing public to walk on roads. Sidewalks at both the transit hubs at Charbagh and Alambagh ISBT are encroached by street hawkers and vendors. Almost all the major pedestrian areas are along traffic speed lanes while city lacks in subways or foot over bridges for safe pedestrian movement.

In some areas of Lucknow footpaths are designed at grade to road level to provide flexibility of carriage width during peak hour but this has increased accident risk for the pedestrians. It has been seen in case of Lucknow that continuous mixed plots, large institutional plots and walled townships have increased walking distance by manifolds than the actual distance between two destinations. Overall city's traffic and pedestrian infrastructure discourages pedestrian movement.

3.2 Design Considerations towards Walkable city

There are several ways to make a community more walkable. Preferably design considerations are to be observed from users' perspective. In case of Lucknow where pedestrians are already high and would multiply with MRTS, pedestrian facilities are needed to be designed considering pedestrian behaviour.

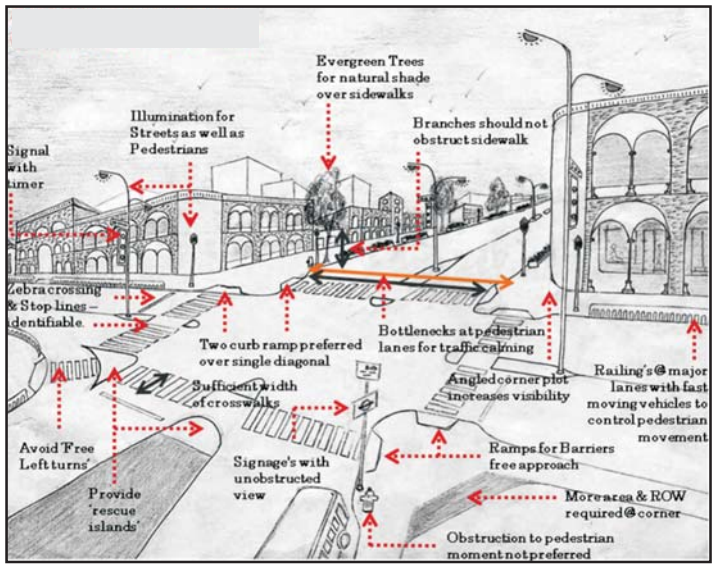
3.3 General pedestrian infrastructure design parameters

Safety and Security: Pedestrian safety design must be the prime objective of pedestrian infrastructure. The pedestrian-vehicular conflicts must be avoided.

- Place to walk are missing from major pedestrian zones. These areas should be provided with sidewalks, and with minimum standard design considerations. The sidewalks should avoid any obstructions, barriers and too much of level difference to be provided for comfortable walking space.
- Barrier free pedestrian infrastructure design approach is needed for sidewalk design considering safety for disabled, elderly as well as children.

- Safe road crossing infrastructure is needed especially for major work and commercial centres of city for safe pedestrian movement. Therefore depending on number of footfalls crossing the streets skywalks and subways must be proposed to avoid pedestrian vehicular conflict.
- In case of zebra crossing the vehicles are needed to be controlled before stop line as tendency of the Lucknowites have been to spill over zebra crossing during red signal. Hence traffic police control is equally important for safe crossings.
- Rescue islands must be an essential part of pedestrian safety if pedestrians are made to walk across the zebra crossing median.

Fig. 3 Improving Walkability (Pedestrian Friendly Approach)

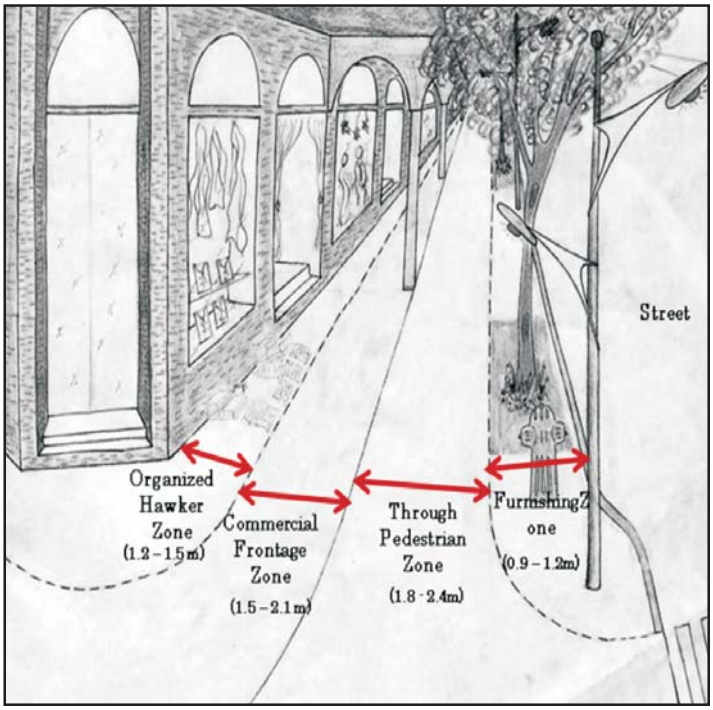


- Controlling vehicles and blaming the drivers is not the only way as it has been noticed that pedestrian themselves try to cross roads without signal, jumping over or passing through the punctures in central verge. Hence public awareness and commuters participation is also equally required. Also the punctures if provided must be designed at appropriate locations.
- Synchronised traffic signal must be provided at major junctions for vehicular as well as pedestrian movement along with timer that assures safe crossing for all including disabled, elderly and children.
- Street lights with adequate illumination along walkways ensure psychological security to pedestrians.
- Since most of the pedestrian zones are close to commercial districts or work centres, fire safety measures must also be taken under mandatory design considerations.

Convenience and Attractiveness: With upcoming MRTS, a majority of pedestrians would be commuters or consumers. Therefore in public areas like work, commercial and recreational areas, pedestrian facilities and amenities would be required.

- Provision of basic street hardware and street furniture must be assured for the convenience of pedestrians.
- Most of the walkways existing in Lucknow have hurdles and obstructions due to advertisement hoardings or commercial encroachment which are needed to be controlled.

Fig. 4 Improving Walkability (Commuters & Consumers Zone for Sidewalks along Commercial Areas)



- Regulation of street hawkers (their number and location) will provide convenience for pedestrians as well as utilize existing pedestrian infrastructure.
- Pedestrian friendly landscaping guidelines must be adopted to provide natural shade and environment without causing obstruction for pedestrians and sufficient trees must be planted. Selection of trees must be considered to avoid any obstruction due to low branching.
- Maintenance drive of walkways should be regularly conducted. This will not only ensure safe movement but also provide time for commuters and consumers to appreciate urban environment and have a glance on commercial display thus increasing sales.
- Urban Aesthetics and details are well appreciated in areas with walkable environment. Since most of the densely pedestrian areas within Lucknow are in heritage zone or old areas, pedestrian infrastructure design should also consider urban design, architectural and cultural heritage features.

Policy Support: Success of any planning project essentially requires government policy support. Pedestrian planning guidelines under 'IRC 103: guideline for inclusive pedestrian facilities (august 2009)' has already been revised to improve pedestrian infrastructure in Indian conditions by Transportation Research and Injury Prevention Programme (TRIPP). Also National Urban Transport Policy (NUTP) has been requested to formulate Unified Metropolitan Transport Authority for all major cities. These guidelines and policies must be adopted to achieve safe and sustainable transit plan. Hence, role of a transport planner thus becomes important especially in metropolitan transport planning authorities.

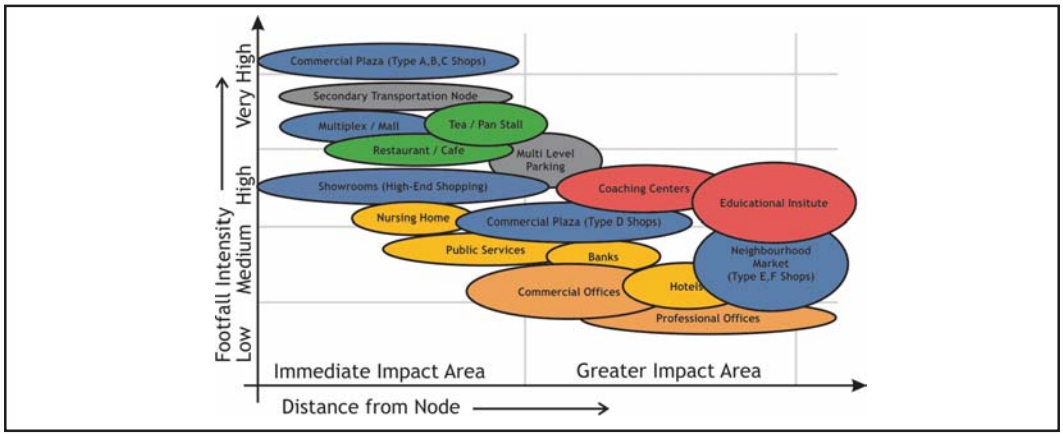
- Setting a legal framework to protect right to walk for pedestrians must be considered to support social and equity concerns in mobility planning.
- Pedestrian movement plans should be made mandatory with traffic planning.
- Traffic regulations must be made strict with penalties to control vehicular as well as pedestrian movement to ensure safety for both.

- Introducing traffic calming techniques is required at design stage for Lucknow traffic planning program, especially at major pedestrian nodes.
- Free left turns must have traffic control especially in high pedestrian zones with speed lanes. In Indian conditions usually left turn is always free. This increases the risk for pedestrians if skywalks/subways are not provided as traffic from one direction is free movement, mostly a blind turns. Under such conditions in major pedestrian areas fully pedestrian crossing time must be synchronized within signal system.
- Involvement of public to be made in decision making and planning pedestrian infrastructure.
- Safety audits and pedestrian safety education program must be conducted regularly.
- Policy planning for public mobility must also look into environment friendly approach.
- Devolution of responsibilities must be entitled to each chair of work.
- Role of NGOs and public private participation, adoption of facilities or development of infrastructure is also needed to be encouraged by cooperative and corporate sectors.
- Various examples all over world like California as well as Delhi, etc have shown that increasing land use dedicated to transport is not the solution for improving traffic conditions but smart traffic management, intelligent transportations system, mass transit system and traffic policies can play an appropriate role in resolving metropolitan traffic issues.

General Design Parameters towards Walkability at MRTS Nodes*:* With an upcoming MRTS proposal there is an expected increase in footfall at all the MRTS nodes. Therefore in addition to above mentioned considerations, walkability does not only stick to pedestrian friendly approach but also consider commuters and consumer behaviour.

- Promotion of transit oriented development (TOD) along with new urbanism planning will improve walkability conditions and revitalise existing as well as new urban centres.
- Compact and high density corridor development within MRTS catchment area will help reduce walking distances as well as travel time.
- Appropriate zoning and building regulations (control setbacks, far, height, climatic concerns, etc;) can generate comfortable physical and visual environment for commuters.
- Connectivity of pedestrian infrastructure to major origin and destination locations must be seen with respect to exit locations of MRTS stations.
- Locations of exits in case of underground MRTS stations must be decided with efficient location specific planning by minimizing the maximum destination distances, thus reducing overall commuter walking.

Fig. 5 Suitable Activity Distribution Around MRTS Node



- Urban illumination provides security to pedestrians as well as urban nightscape.
- Provision for secondary public transportation system also encourages pedestrian movement.
- Strategic location of bus and public transit stoppages (e.g. with bus bays)
- Adequate shelter facility for secondary or feeder transit service users.
- Provision of para-transit stands
- Provision of commuter's facilities and amenities including specific commercial outlets, eat outs, post boxes, billing outlets as well as public toilets around MRTS station will also facilitate and encourage commuters.

A facility location allocation has been studied as shown below for suitable activity distribution around MRTS node for commercial district. The facilities are distributed studying the commuters and consumers behaviour as pedestrian considering distance from upcoming MRTS node with expected footfall intensity at upcoming MRTS node.

Some of the considerations of pedestrian facilities and amenities at MRTS station are:

- Facilities and amenities are proposed studying pedestrian and commuters behaviour.

Table 4 Types of Commercial Units for Suitable Activity Distribution Around MRTS Node

TYPE A	TYPE B	TYPE C	TYPE D	TYPE E	TYPE F
Eateries, Xerox, Print, Bill Payment, ATMs	Clothing, Footwear, Sports, Jewelry, Watches, Book/ Stationary, Gift, Medical	Electronics, Electrical Appliances, Motor Vehicle Showroom, Furniture.	Super Markets, Bakery Sweets	Grocery, General Daily Store, Atta Chakki, Beauty Saloon	Haat, Mandi, Meat Shop, Auto Parts / Repair

- With facilities of ATM, Internet banking, credit and debit cards financial institutes and banks have reduced with number of footfalls.
- Most of the private commercial offices and professional offices deal with their major clients through tele - conferencing or internet, thus reducing footfalls.
- Various types of commercial establishments are suggested with preferable location depending on (a) its catchment region, (b) recreational or general convenience, (c) probable footfalls, and (d) economic stability over land value(or land rent) distribution.
- Bill payment shops and ATMs at node will be best suited to busy schedule of commuters.
- Secondary transport service is proposed in between node and parking to encourage use of public or para-transit system even for commuters beyond GIA linked by secondary transit system.
- Multi-level parking is adjusted at IIA and GIA interface to (a) reduce vehicular-pedestrian conflicts, (b) reduce congestion at nodes, and (c) will increase footfall at high end commercial stretch between metro node and parking increasing economic returns.
- Urban open spaces must be considered along with designing above mentioned facilities.

Special Design Features for Walkability within MRTS Catchment Area: Besides general pedestrian design parameters certain areas of old Lucknow and work centres need special pedestrian infrastructure development approach.

- **Fully pedestrianized lanes:** Most of the activities in highly pedestrianized areas are governed by public sector. Hence public sector can share a responsibility towards pedestrian movement also. Most of the public and semi-public sector can play a major role by providing setbacks for creating 'fully pedestrianized lanes'. This will also resolve the issue of increased walking distance due to gated communities and institutions. Requirement of such fully pedestrian lane is at Hazratganj, Ashok Marg, Lekhraj, Charbagh, Kanpur road (between Charbagh to Alambagh) and Moti Jheel mill area.
- **Design of Woonerf:** Old areas of Lucknow such as Aminabad, Kaiserbagh, Chowk and other areas with mix land use require some streets need to be legally prioritized for pedestrians called as Woonerf. Prioritization of designing Woonerf must be taken for selected streets in old areas of Lucknow which can be also planned for new residential township as per requirement.
- **Synchronizing traffic signals with MRTS scheduling:** To adjust with bunches of pedestrians outflow from MRTS station and disperse them accordingly over demand in the region.

Fig. 6 The Model of 'Woonerf' (above) is the Traffic Calming Strategy Widely Used in Netherlands

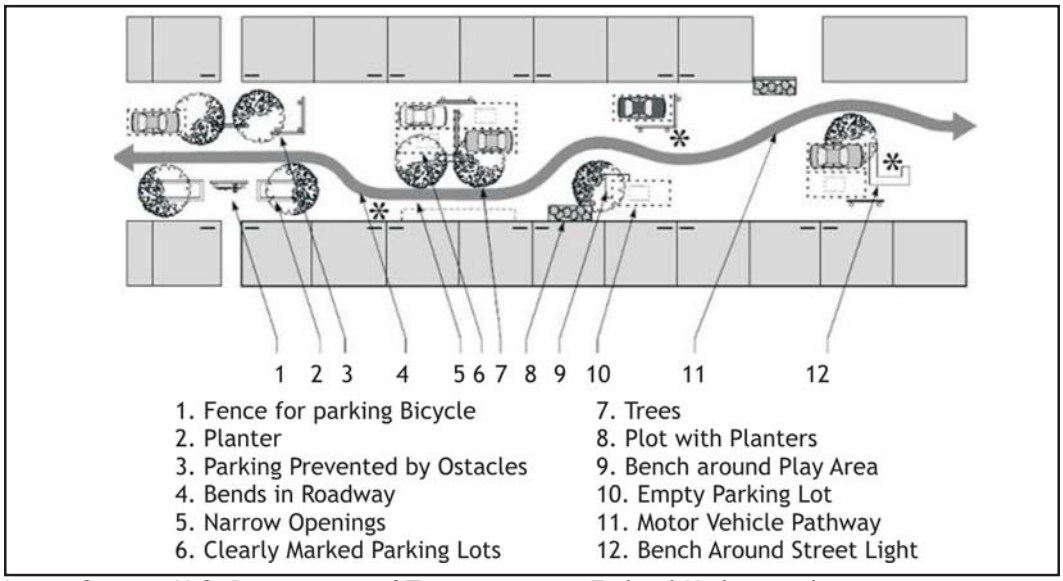
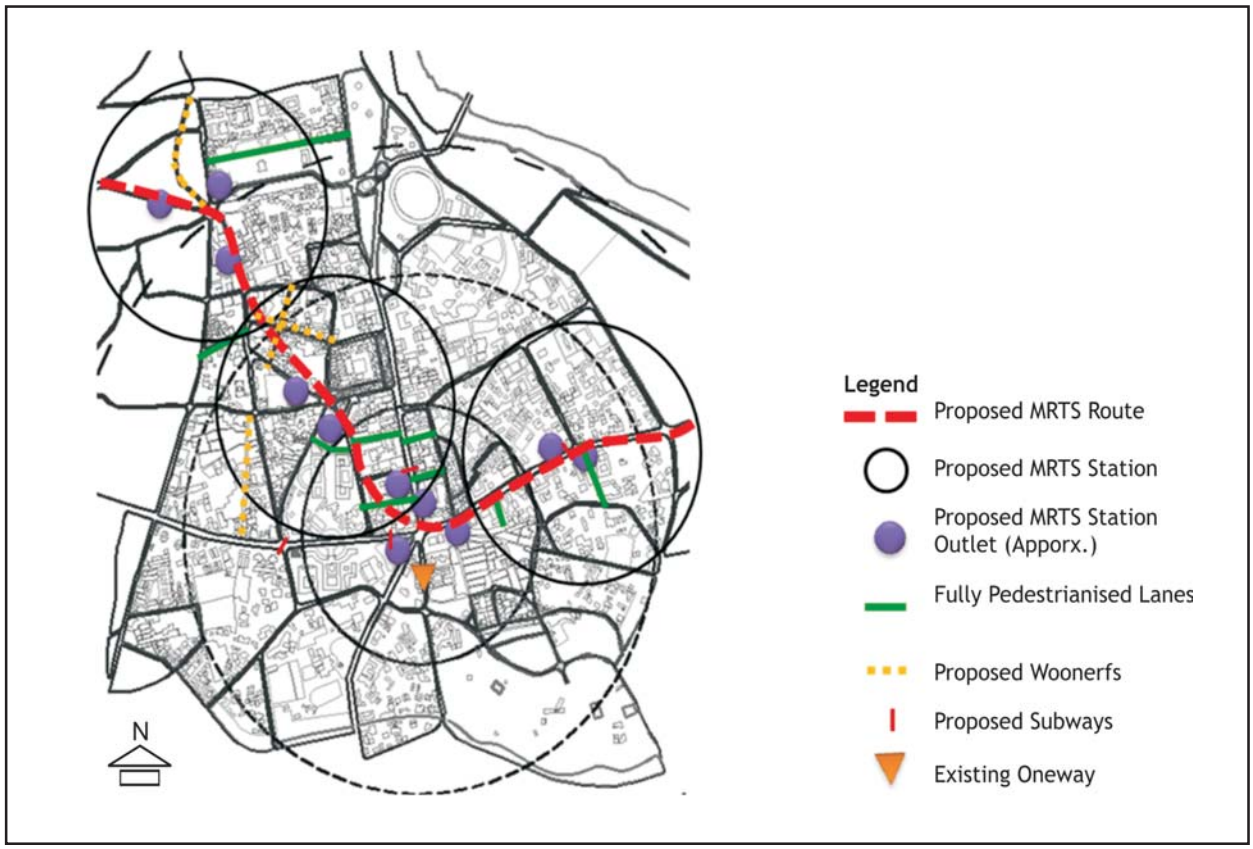


Image Source: U.S. Department of Transportation; Federal Highway Administration

Fig. 7 Few Identified Features to Enhance Walkability Conditions with Upcoming MRTS Proposal



- **Traffic police public interface units:** This can be organised to assist tourist, pedestrians and emergency services. Such units should be developed near tourist spots, recreational facilities, business and work centres.
- **Car free Zones:** This can be developed in old areas of Lucknow where people park their private vehicle on road. This could be replaced by providing them with centralized parking for the zone. Location of parking will be governed by availability of space as well as consideration for minimizing the maximum distance of the zone. Streets in these zones can also be developed as Woonerf.
- **To identify strategic location for parking provision**: Almost all stations must possess basic parking but major parking or multi-level parking should be provided at certain nodes which are close to major residential sectors within greater impact area. Location of major parking lots near residential areas must be close to MRTS nodes (within 100 m from MRTS station) while at commercial nodes it can be within 250 m to 500 m encouraging walking around MRTS nodes thus providing opportunities for commercial establishments.

4. CONCLUSIONS

Improving walkability ensures easiest way for improving liveability concerns. World is walking towards urban sustainability. Walkability enhances urbanity, social interactions, community health and sustainable environment. It can also resolve social and equity concerns in mobility planning. Lucknow can also revive its *Nawabi* culture vibrancy by planning social walkable areas, and opting for optimal solution for the habitants of the city and its culture. The first step towards walkable Lucknow city would be made by removing parking on sidewalks and utilising existing infrastructure followed by providing basic pedestrian infrastructure and amenities to all other pedestrian areas. Thereafter, maintaining and upgrading pedestrian infrastructure and encouraging pedestrians could be taken up. Also educational programmes must be conducted to generate awareness of walkability. This should be supported by structural reforms in legal framework to provide social equity to pedestrians and right to walk for efficient system development. Various development organizations need to work in coordination to achieve desired urban environment for pedestrians. Taking such steps at present would make safe, secure and convenient rostrum for upcoming MRTS commuters.

Project for Public Spaces, a non-profit organization in New York City, has distilled this idea into a slogan: 'When you plan cities for cars and traffic, you get more cars and traffic. When you plan cities for people, you get more people'. Today urban planners in India need to rethink for whom they are planning. An urban module for Indian cities is needed to be developed to retain our socio-cultural vibrancy through contribution of pedestrian sustainable approaches.