

ACCESSIBILITY TO TRANSIT STATION IN MULTI MODAL TRANSPORT FRAMEWORK FOR DELHI

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ABSTRACT

Recently, Multi Modal Transit Station has been recognized as a symbol of 'Urban Identity' and 'Urban Mobility' in Delhi which integrates built environment with multiple modes and provides an important link to complete the journey. It is either as a single station or an interchange hub, accessed by human, mechanical and vehicular system. Hence, it is important that such transit station must meet minimal level of service and be a part of overall efforts to improve transit services for increasing rider ship. In this context, Multi Modal Oriented Design (M₂OD) is used which defines neighborhood character in design and provides mobility friendly environment. It also encourages a mix of mobility options to cater needs of both present and future travel demands. Further, the role and responsibilities of transit operators, facilitators and users are crucial to extend better accessibility to transit station.

Key words : *accessibility, multi modal transport, transit station, multi modal oriented design.*

1.0 Introduction

A Multi Modal Transit Station (MMTS) is defined as mobility friendly built environment which accommodates choice of modes i.e. public transport (metro, bus, etc), auto mobiles (two/three wheelers, cars, etc) and non-motorized mode (pedestrians, bicycles, etc). The design concept of such built environment requires supportive access pattern of multiple modes with proper integration, transfer facilities, safety and ease of use for all commuters. Similarly, the planning, design and engineering aspects of accessibility to multi modal transit station encompasses public space, streets, road environments, transport vehicles & infrastructure such as bus stops, ticket machines, parking, information system, etc. Such accessibility brings built environment and multi modes much closer and provides an important link to the whole journey.

The accessibility to transit station is affected by travel pattern by modes, traffic volume in the vicinity of the station, traffic volume destined to the station, potential characteristics of the surrounding areas, etc. Generally, multi modal transit station has accessibility of almost all modes and design of transit station must provide physical facilities to each mode. Similarly, segregation between

modes is also essential particularly between pedestrians & other modes; and between public & private modes for better and safe mobility of commuters in the station area. At least, two independent access routes are required to each station. Similarly, access route for emergency and service vehicles are also essential for each station. Emergency vehicles such as fire brigade vehicles, ambulance, etc must have access to all sides of the station. When the system is in operation, service vehicles such as feeder bus services, RTV, etc must be accommodated in areas other than passenger entry zone.

2.0 Access Vs Accessibility for Multi Modal Public Transport System

Access and Accessibility are two distinct characteristics of any public transport system. Access to public transportation is the opportunity to use the service. It may be interpreted in terms of proximity to and cost of using transport services. If the distance or barriers to access a service are too great at either the trip origin or destination, then it is unlikely to be utilized as a mode of travel. Similarly, if cost is either too expensive (i.e. cheaper modes exist) or unaffordable then utilization of the service is also unlikely. Contrarily, accessibility is the suitability of the public transport network to get individuals from their system entry point to their system exit location in a reasonable amount of time. Thus, accessibility encompasses the operational functioning of a system for regional travel. Access greatly impacts the public transportation system and complements service accessibility (Murrya *et al.*, 1998).

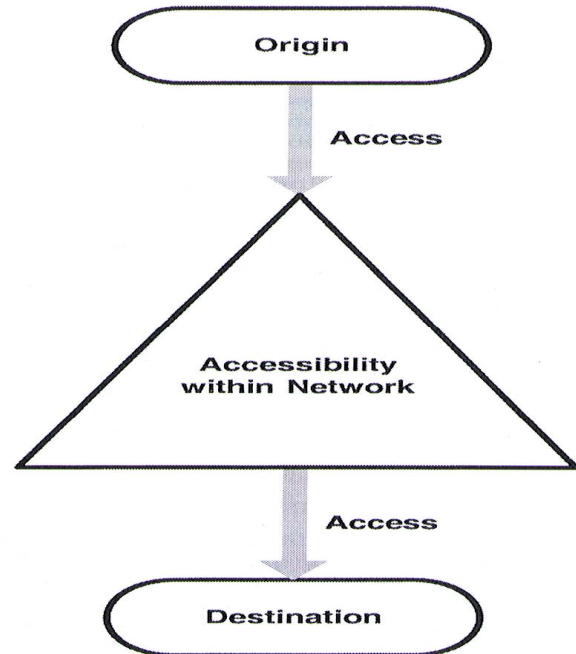


Fig. No. 1:
Access Vs Accessibility in Public Transport System

Figure No. 1 illustrates the relationship between ‘access to public transport’ and the ‘accessibility of the public transport system’. Further, access and accessibility are dependent upon each other if the public transport system is to be successful and well utilized. Similarly, ‘origin access’ and ‘destination access’ have different impacts on public transport.

3.0 Multi Modal Transport Systems for Delhi

Multi Modal Transport System (MMTS) is Public Transport which relates to single trip consisting of combination of modes i.e. vehicle modes (bus, metro, car, tram, etc.) or service modes (private/public) between which the traveler has to make a transfer. Transfer is an essential part of multimodal trip and traveler has to change modes at transfer nodes. Hence seamless travel is an important characteristic of the system (Kumar *et al.*, 2007). The Master Plan for Delhi - 2021 also advocates about multimodal transport system as future transport mode in the capital city (Delhi Development Authority, 2007). The Ministry of Urban Development, Govt. of India formulated National Urban Transport Policy, 2006 with the broad objective to ensure safe, affordable, quick, comfortable, reliable and sustainable access for the growing number of city residents to jobs, education, recreation and such other needs within cities. One of the methods to achieve such objectives is to “enabling the establishment of quality focused multi modal public transport systems that are well integrated, providing seamless travel across modes” (Govt. of India, 2006)



Fig. No. 2 : Delhi Metro : An Image of Public Transport in India

In Delhi, there are four options for accessing multi modal transit stations either at a single station or at interchange station:

- i. Accessibility by Non-motorized Transport (NMT),
- ii. Accessibility by Intermediate Para Transit(IPT),
- iii. Accessibility by Public Transport (PT),
- iv. Accessibility by Private Transport (i.e. car, two wheelers, etc.)

The performance of a public transport system is largely affected by the proximity of public transport stops to the zonal population. The performance of public transport access can be improved by incorporating more dynamic proximity measures, service considerations, demographic and socioeconomic factors.

4.0 Transit Station and Stops: Concept of Level of Service Factor

Transit station and stops are also called as Transportation Terminals. Their rider ship can be enhanced by increasing convenience, comfort and attractiveness. For a typical transit trip, 10-30% of travel time is spent in waiting and transfer. Hence, it is important to assess various features to evaluate ‘Transit Station and Stops’ based on level of service. These factors can be prioritized from high to low importance, and graded from A (best) to F (worst). Table No. 1 describes “Transit Station and Stop: Level of Service Factors” as shown below (*Victoria Transport Policy Institute, 2010*):



Fig.No. 3: View of Transit Station and Stop

Table No. 1: Transit Station and Stop: Level of Service Factors

S.N.	Features	Description	Indicators
i.	Weather protection	Users protected from sun and rain.	<ul style="list-style-type: none"> • Bus shelters and covered platforms. • Shade trees and awnings. • Enclosed waiting rooms.
ii.	Sense of Security	Perceived threats of accidents, assault, theft or abuse.	<ul style="list-style-type: none"> • Perceived transit passenger security. • No. of accidents and injuries. • Reported security incidents. • Visibility and lighting. • Official response to perceived risks.
iii.	Comfort	Passenger comfort.	<ul style="list-style-type: none"> • Seating availability and quality. • Space (lack of crowding). • Quiet (lack of excessive noise). • Fresh air (lack of unpleasant smells) • Cleanliness of stations and nearby areas.
iv.	Efficiency	Ease and speed of station activities.	<ul style="list-style-type: none"> • Ticket purchasing. • Baggage checking and collecting. • Security inspections.
v.	Accessibility	Ease of reaching transit stations and stops.	<ul style="list-style-type: none"> • Distance from transit stations and stops to destinations. • Walkability (quality of walking conditions) in areas serviced by transit. • Park & Ride facilities. • Bicycle parking availability. • Taxi service availability.
vi.	Transit Oriented Development	Quality of development in areas near transit stations and stops.	<ul style="list-style-type: none"> • Quality and density of development within 500 meters of transit stations. • Walkability (quality of walking conditions) in areas serviced by transit. • Affordability of housing within 500 meters of transit stations.
vii.	Universal Design	Accommodation of diverse users including people with special needs.	<ul style="list-style-type: none"> • Accessible design for stations and nearby areas. • Ability to carry baggage. • Ability to accommodate disabled commuters.
viii.	User Information	Ease of obtaining information on transit routes, schedules, fares, connections, and destinations.	<ul style="list-style-type: none"> • Accuracy and understandability of information at stops, stations, destinations, as well as availability on Internet, telephone. • Real-time transit vehicle arrival information. • Availability and quality of way finding signs, maps and other information for navigating within the station and to nearby destinations. • Quality of announcements. • Availability of information for people with special needs (audio or visual disabilities, inability to read or understand the local language, etc.). • Availability of pay telephones.
ix.	Courtesy and responsiveness	Courtesy with which passengers are treated.	<ul style="list-style-type: none"> • Behavior of staff with passengers.. • Ease of filing a complaint. • Speed and responsiveness with which complaints are treated.
x.	Aesthetics	Attractiveness of transit stations and stops.	<ul style="list-style-type: none"> • Attractiveness of stations and stops. • Attractiveness of station areas.



Fig. No. 4 : Waiting and Circulation Space inside Transit Station

It is important to ensure that all transit stations and stops must meet certain in minimal level of service. Multi modal transit station must have full services in integrated manner for safe& easy accessible to users. Hence, transit stations and stops improvement are considered as part of overall efforts to improve transit services and increases transit rider ship.

5.0 Access to Transit Station by Non-Motorized Transport

5.1 Pedestrian Access

All passengers, regardless of access mode, enter the station as pedestrians. Hence, provisions for pedestrians and their safe movement are an essential access consideration. Direct and safe approach for pedestrians should be provided from all adjacent streets and major developments into the station. Pedestrian access facilities should be designed to accommodate the estimated “Peak Five Minute Patronage” at “Level of Service E” (*Fruin, 1971*).

- Pedestrian networks should be designed to ensure that 60% of all residents living within 500 metre of a transit station have only a maximum 500 metre walk to transit station.
- Cul-de-sac design should include pedestrian access-ways that reduce distances to bus services on the adjacent higher order bus streets.
- Continuous and direct footpath networks that permeate neighborhoods increase the catchments for public transport because it takes less time to walk from home to bus/metro.
- Pedestrian networks should be most developed in multi modal transit areas.
- Safe, convenient and/or controlled road crossing points should be provided to stops with high passenger usage.

Direct pedestrian connections to surrounding major developments, existing proposed, should be encouraged to improve passenger comfort and convenience and to attract additional patronage. Connections can be underground, elevated, or sheltered walkways at grade.

5.2 Bicycle Access

Good bicycle access can increase the service area of transit stations. The demand for bicycle facilities is very much dependent on demand and supply as well as encouragement policy of ULBs in terms of reasonable parking charges for longer duration, less charges for metro smart pass holders, etc. Generally, roadways that are adequate for motor vehicles may not be suitable for bicycles. The ability of existing access roads is also important to provide a safe and convenient bicycle route between the transit station and main roads of the neighborhoods. Bicycle parking facilities should be

located to provide protection from weather, theft and conflicts with other modes. Parking areas i.e. active areas with high pedestrian activity, or under the observation of station attendants, are preferred. The location should be well lighted and designated by a sign as bicycle parking facility. The parking facility should be closer to station entrance and nearby roadway so as not to require the bicyclists to walk the vehicle long distances through pedestrian areas.

Several types of bicycle parking facilities are available. They vary in their cost, space requirements, protection affordability, and utilization. They fall into three categories: i. Locker facilities; ii. Racks which lock the frame and wheels; iii. Racks or fixed objects which require the bicyclists to use their own chain. Parking facilities that secure both wheels and the frame are preferred. Delhi metro provide free bicycle parking for Delhi metro pass holders on priority basis.

5.3 Cycle Rickshaws Access

Cycle rickshaws has significant share in urban mobility. It is pollution free, low cost access mode to multi modal public transport. Legislation and traffic enforcement regulations have to be introduced to prohibit the operation of cycle rickshaws along specific routes or within particular areas of the city as per prevailing land uses. The level of traffic enforcement is a direct function of various Urban Local Bodies (ULBs) which are invariably limited. It is constraint of ULBs efforts at supervising, operation and monitoring of cycle rickshaws in the municipal limits (*Rao et a.,1990*). However, sufficient on-street parking for cycle rickshaws at metro station and improved cycle rickshaw design may provide better accessibility and safety to the commuters.

6.0 Accessibility by Intermediate Para Transit (IPT)

Various modes of IPT such as auto, taxi, phatphat, etc are considered as feeder modes which brings the passengers from various parts of the neighborhood to the multi modal transit station. Hence, IPT zone is desirable, preferably with loading on the left hand side, adjacent to the main entrance of the station and weather protection should be provided. IPT area must be covered and seating may be provided.



Fig. No.5: Role of Auto as Feeder Mode at Pragati Maidan Transit Station

7.0 Accessibility by Public Transport

Bus loading/unloading zones is considered as a part of transit station design. Bus stop design capacity for a station is based on the individual requirements for each station either as a single station, interchange station or integration point. Loading zones for buses should be located to provide the most direct and safest multimodal transfer. Exclusive bus loading/unloading areas should also be provided. The following designs may be used for various types of bus loading zones, depending on specific conditions:

i. **Recessed Bus Bay:** It is used where more mixed traffics are on the road. The bus loading zone is recessed from the through traffic lane. A recessed bus bay is designed parallel to close enough to the curb so that passengers may enter and leave any door by an easy step to the curb. Upon leaving, the merging lane enables the bus an easy re-entry into the through traffic lane. The loading zone should have a 3mt wide lane, and total length for a two bus loading are should be 73.2 mt (Refer Fig. No. 6). For each additional bus required, an additional 24.4 mt length should be added at curbside.

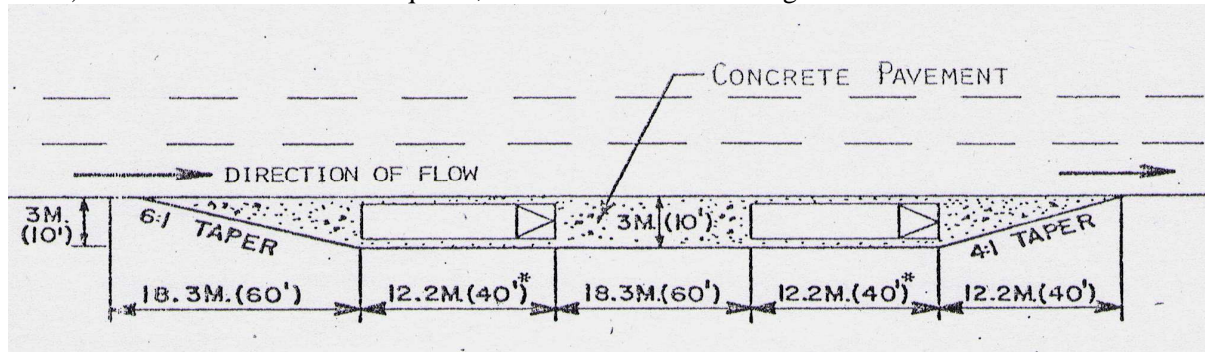


Fig. No.6: Recessed Bus Bay

ii. **Parallel- to-curb Bus Bays:** It should have 3 mt wide lanes and an overall length of 73.2 mt. This layout for bus loading area provides the minimum roadway width but requires the longest length for a bus loading zone. The critical movement in this layout is moving into position ahead of the parked bus. This leaves the rear door of the bus offset from the platform curb by approximately 0.45 mt.

iii. **Sawtooth Bus Bays:** Sawtooth bus bays reduces the length of loading zone and therefore reduces walking distances but increases the width of the roadway.

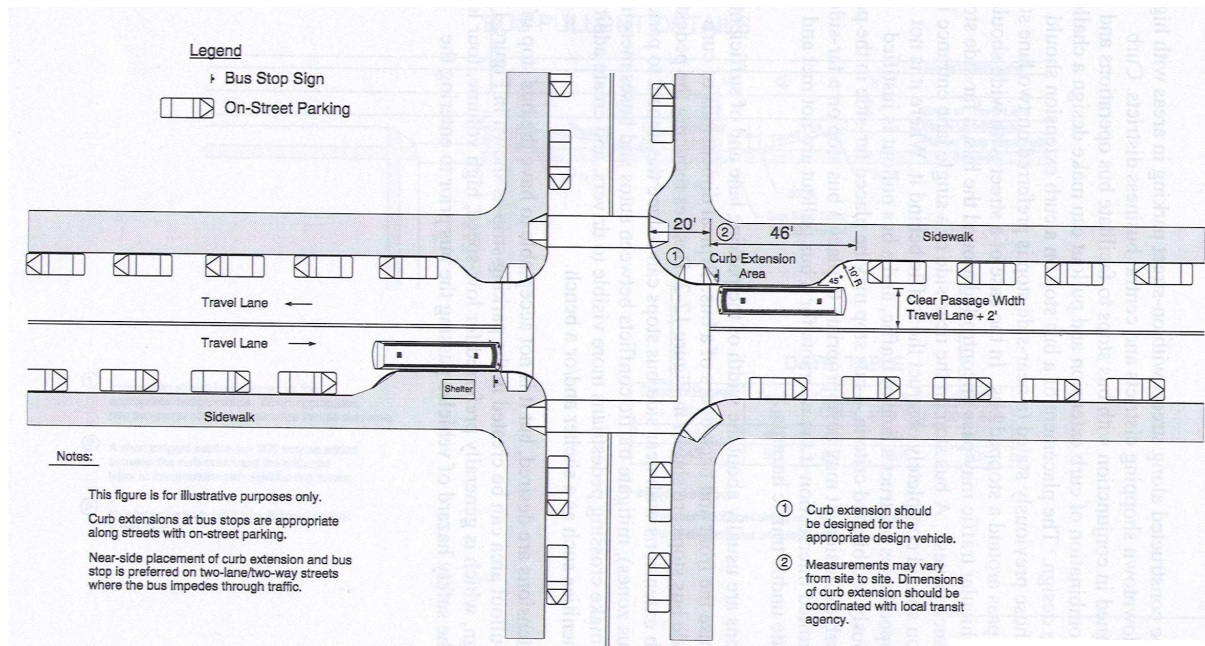


Fig. No. 7: Design of Bus Stop with Curb Extension.

In Delhi, bus loading zone is not a part of “paid area” of the station. If the concept of flat fare structure exits (i.e. no charge for transferring from bus to metro, no barrier intermodal transferring) then bus loading zone can be designed as an extension of the “paid area” of the station but these area must be fenced off or otherwise separated from parking lot, and some degree of surveillance or entry control is required to prevent pedestrians from entering the area. If bus loading zone is a part of transit station, then travel time and inconvenience is reduced by eliminating the need to obtain and turn in transfers or to pass through fare gates. Bus boarding time is reduced as both doors can be used.

Similarly, operating cost is also less (because fewer transfers to print/encode and collect/count can be eliminated).

Bus zone in transit station are must be sheltered, well lighted and visible from the street and adjacent buildings. It is also desirable that shelter or canopy must be connected to the station entrance. 'Bus Zone' area should be clearly marked. Signs in 'bus zone' and 'transit station', directing patrons to the proper bus loading area, and bus stalls, displaying specific bus routes, etc should be prominently displayed.

8.0 Accessibility by Private Modes

Delhi metro provides parking space for car, two wheelers at the station. Entry and exit points should be at mid block and in no event less than 46 mt from an intersection. Parking aisles should be lined perpendicular to the station entrance/exit are to minimize the no. of potential conflicts between pedestrians and automobiles. If perpendicular aisle geometry is not possible, pedestrian walkways can be created across the aisles by well marked 1.5 mt wide paths.

Collapsible posts or signs should be used to delineate drives and pedestrian. Major pedestrian walkways should be raised 0.15 mt above the parking pavement. Since, queuing of automobiles is more severe when leaving parking facilities, the lots should be located so that there will be some 'stringing out' of drivers as they walk to their cars. When fee is charged for parking, the preferred collection methods are either by permit or by central fee deposit boxes. Fee collection upon entrance is likely to lead to short queues while collection upon exit to long queues. Right angle parking should be used because it allows better circulation, more orderly parking, and in most cases has lower average area requirement per space.

9.0 Improvement of Access to Transit Stations /Stops

Every commuter needs safe and convenient routes to get to and from transit station. A commuter prefers about 5 to 10-minute walk to and from transit station. Typically, a commuter walks to a transit stop, board the bus or train, get off, and then walk to their final destination. Thus, the commuter's needs as pedestrians extend beyond the transit stop to and from the surrounding neighborhood.

Generally, transit agencies take responsibility only for their stops, stations, and parking lots, and not for sidewalks, crossings, or other pedestrian elements on nearby streets. As a result, pedestrians must often cross busy streets and cut through parking lots to get to the bus stop or train station. Hence, provision of sidewalks makes bus stops and train stations more accessible. Safe and convenient crossings are also essential, especially for midblock bus stops. New stops and stations can be placed with pedestrian (and bicycle) access in mind.

9.1 Access to Transit Stops located on Surface Street (Ground)

Transit stations at surface may be hub of bus, rail, tram, BRTS, light rail, etc. Each such transit station must fulfill the location requirement of Passengers (i.e. stops must be near places where there's an expectation of riders), Access (if a stop can't be located right where riders are, they must be able to get to the stop conveniently) and Traffic characteristics (buses can't always stop where riders want to be because of complex traffic patterns, especially at intersections). Therefore, access to transit also involves selecting the right location for stops, especially for bus stops located on surface streets.

(a) **At Transit Stops**

The safety of pedestrians can also be enhanced using a variety of transit operation improvements (such as consolidating, relocating or eliminating stops) usually implemented by the transit agency in cooperation with the road authority. Convenient access by passengers must remain at the forefront of all transit stop.

(b) **At Mid Block**

When a transit stop is located midblock, a single crossing should be provided to serve both directions of bus travel. If a crosswalk is marked midblock, it should be behind the bus stop for several reasons: Pedestrians cross behind the bus, where they can see oncoming traffic (crossing in front of a bus blocks visibility); Bus driver can accelerate as soon as passengers have left the bus; Bus driver won't accidentally hit a pedestrian crossing in front of the bus, out of the driver's cone of vision,; etc.

(c) **At Intersection**

At intersections, farside stops are usually preferred for a variety of safety and operational reasons. One safety advantage is that pedestrians cross in back of the bus. Operationally, a far side stop often improves intersection capacity by allowing motor vehicles to make left turns even when the bus is in loading and unloading position.

9.2 Access to BRT Stops on dedicated Rights-of-Way

Transit agencies provide 'Park-and-Ride' facilities at BRT stations for riders who commute from distance places to the station. Once these riders park their cars, they become pedestrians as they walk through the parking lot to the station itself. These parking lots can present challenges for pedestrians walking to the station. Pedestrians can be at risk of being struck by motorists looking for, driving into, and backing out of parking spaces; they must also park cars and buses on access roads and passenger drop-off areas.

'Park-and-Ride' facilities can be designed to reduce these risks to pedestrians. Sidewalks can be built between rows of facing cars so that pedestrians don't have to walk in the aisles. Pedestrian routes should cross access roads where drivers can expect and see them. Bus loading areas should be positioned so that pedestrians don't have to cross between parked buses. Because hundreds of people may get off a train at once, there must be enough sidewalk space adjacent to the station entrance so that no one is forced to walk along the roadway.

9.3 Access to BRT on Surface Streets

Bus rapid transit often operates in a hybrid mode; it can run on dedicated rights-of-way on special tracks and also act like a bus on streets. Often the special tracks are laid in the median of a wide thoroughfare or boulevard.



Fig. NO. 8: Accessibility to BRT on Surface Street in Delhi

Stations are typically far apart to improve operational efficiency. This creates situations where stops attract a large number of riders within a busy street environment. It needs to provide enough waiting area for passengers; safe and convenient street crossings; ensuring that waiting, crossing, boarding, and de-boarding passengers don't interfere with the flow of pedestrians; etc.

9.4 Design of Transit Stations /Stops

At transit stations/stops, waiting for the bus or metro can be made more pleasant. Shelters with seating can offer protection from rain, snow, wind, and sun. Similarly, shelters at frequently-used bus stops and at outdoor rail stations can be provided. The shelters should be positioned so riders in wheelchairs have enough room to enter and exit the shelter. The sidewalk behind the shelter should be wide enough for two wheelchair users to pass each other and to handle the expected levels of pedestrian activity, including those who are just walking by. The best location for bus shelters is in the furniture zone, away from the walking zone.

Schedules and route maps should be placed at transit stations/stops to orient riders. Current technology makes it easy to have video monitors with bus arrival times in real time, displaying the number of minutes until the next bus or train and its destination. Nighttime lighting is important for passenger safety and security. Lighting makes it easier for riders to watch their step so they don't trip on station escalators or while boarding the bus. With lighting, drivers are more likely to see riders crossing the street. Riders are more secure while they're waiting because they can see their surroundings and watch for suspicious activity. Transit station must be made accessible to riders with disabilities.



Fig. No. 9: Accessibility to Delhi Metro for Riders with Disabilities.

11.0 Accessibility to Transit Station as Multi Modal Interchange

Transit station acts like a multi modal interchange where physical action of transferring between services or modes as part of the passenger's journey or it can be the physical location that provides access to the public transport system. Interchange can be either an inconvenience imposed by the configuration of public transport network or an opportunity for passengers to take advantage of reduced travel time and/or costs. Infact, interchange is a strategic public transport network which allows 'services to be connected', 'volume of passengers', balance between 'those using the interchange as a point of access& egress' and 'those using the interchange to transfer between services'.

Multi modal interchange facilities serve metro to metro, bus to metro, car to metro, rail to metro movements. In the vicinity of public transport interchange facilities, the interface between large vehicles (bus) and small vehicles (cars) should be planned for and managed. There should be safe and convenient covered waiting areas and paths between two modes for commuters. Where park-and-ride facilities are provided, access should be from the higher order street (if possible) to reduce impact on the local street network and to make access easier. The various ways of making use of park and ride facilities during non-peak periods should be considered. It will increase passive surveillance by creating 'public eyes' and can generate extra revenue. Off-line facilities such as park-and-ride, kiss-and-ride, bus lay-over facilities, IPT parking, etc also provide better accessibility to transit station. All interchange locations having high frequency services may have shelter & shade, seats, lighting, pick off/drop off site, telephones, extensive system information, etc.

11.0 Accessibility to Transit Station/Stops: Current Practices in Delhi

11.1 "Cycle-for-Hire Scheme" was initiated by Dellhi Metro and Delhi Bicycling Club which encourage people to use bicycles for short distances at Delhi University Metro station and near by areas. The charge of a bicycle on rent is Rs 10/= for 4 hours. After being popular "Cycle-for-Hire Scheme ", Delhi Metro started the same in other Metro stations. The Delhi Bicycling Club was started by ITDP India, an NGO engaged in research and advocacy for green, sustainable and equitable transport policies. It is estimated that Delhi with its wide roads can become a heaven for cyclists, if the Govt. spends 1/1000 part of its expenditure on building cycling tracts (*Indian Express, New Delhi edition dated 01.01.2009*). However, such scheme attracts commuters to transit station for further journey in neighboring areas.

11.2 Pedestrian way to the BRT Corridor in Delhi

Pedestrian way to the BRT Corridor in Delhi is one the examples to provide safe and comfortable sidewalk to access public transport. In Delhi, BRT is a component of multi modal transport system. The following provisions make pedestrian movement safer:

- Roadway design has retained the continuity of the sidewalks. It has wide and well surfaced sidewalks and is disable friendly.
- Sidewalks are easily negotiable by women, children, senior citizens, as the height is close to 15 cm. Width of sidewalks varies from 1.5 mt (minm) to 4.5 mt (maxm) along the corridor. Sidewalks are well lit.
- Crossings are easily accessible with kerbed ramps and there is a holding area for people to wait at the side and at the pedestrian refuge islands.
- Pedestrian path on the BRT corridor has the least permanent and temporary obstructions on the sidewalks

The sidewalks are continuous. The pedestrian don't have to get off and on the footpath as they used to before the corridor was constructed. Its salubrious environment invites more pedestrians to get easy and safe access to BRT services (*Centre for Science and Environment 2009*).

11.3 Park and Ride Facility at Delhi Metro Station

Park-and-ride facilities provide parking for people who wish to transfer from their personal vehicle to public transport. Such facilities are available at Delhi Metro stations. Different parking rates for car, two wheelers, cycles, etc are available according to parking duration. Site design of such facility is very crucial for easy entry and exit. Design features must be in compliance with applicable design standards, specifications, operating standards, and any other local requirements that may apply.

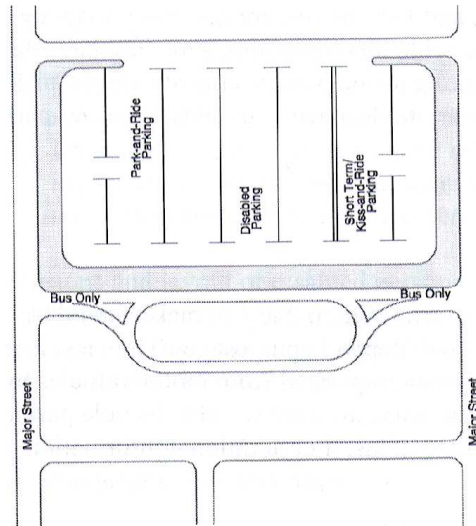


Fig. No.10 : Park -and-Ride Facilities along Two Adjacent Streets

For Park and Ride Facility

Mode	Stall size	Aisle
width		
Standard car	2.6 mt x 5.5 mt	18.3 mt to 18.9 mt
Compact car	2.3 mt x 4.3 mt	14.6 mt to 15.8 mt.

Design features such as entrances and exits, internal circulation, shelter location, illumination, landscape preservation and development, and passenger amenities are generally site specific and used to maximize the efficiency and usefulness of the facilities.

12.0 Transit Station Area Development

Transit station particularly in the framework of multi modal transport system is mainly based on transit oriented development which involves the coordination between land use planning and transit planning. Multi modal transit station is always planned as high density mixed land use areas with transit friendly design. Higher densities have been permitted for office use because offices generate more transit rider ship per sq.mt than residences. Similarly, zoning regulation must permit some floors to retail commercial uses. However, front of transit ways can be permitted for restaurants, coffee houses, etc.



Fig. No. 11: Surrounding Environment at and around Transit Station in Delhi

Parking management is also an integral part of transit station area development. Proper parking facilities at the station reduce transfer time attracting the personalized vehicle users to the transit services. A lesser parking fee at station increase the share of transit mode. The parking should preferably be underground as it permits higher development densities and free the street level for retail uses and other development that encourages pedestrian use. In Vancouver, at Metro Town Station, 10,000 free parking spaces have been provided to support the station area development (*Jain & Parida 2001*). Design of park-and-ride lot locations should not preclude development opportunities.

Similarly, automobile traffic in and around station areas should be managed to facilitate station access. Topographical constraints should be overcome through steps, ramps, grading, etc and shade trees and other weather protection features should be provided.

Multi Modal Transit Oriented Design (M₂OD) encompasses a diverse family of land use planning and site design concepts designated to encourage a mix of mobility options. It does not give preference to any mode but create a balance between various modes so that they may work to complement each other. M₂OD consider the following attributes to enhance the accessibility to transit station:

- **People Place:** Transit station area is a place for people/commuters. Hence, it must be well used, safe, comfortable, and attractive; and need to be distinctive and offer variety, choice and fun.
- **Streetscape Design:** M₂OD should promote and enrich the qualities of existing urban places at neighborhood and street level. It is important to develop streetscape design elements for each of the transport corridor by incorporating various architectural elements.
- **Urban Form:** Transit station is considered as a part of urban design and sky line. It is blended with different building forms, colors, materials, textures, forms, etc. Such areas should be integrated physically and visually with its surroundings having better access by foot, bicycles, bus, cars, metro, etc. Amenities that are stimulating, enjoyable and convenient should be offered to a wide range of possible users.
- **Transit in Landscape:** These areas should provide balance between the natural and the manmade environment and utilize each locations intrinsic resource – the climate, land form, landscape, and ecology – to maximize the experience. Design must put such built environment in proper landscape environment.
- **Design in Flexibility:** New development near and around transit station take very little time. New development needs to be flexible enough to respond to future change in use, lifestyle, and demographics. Flexibility must be evident in the use of property, public spaces, and infrastructure. Integration of any new modes with the station area requires more space for loading, unloading, transfer, integration, parking, traffic management, etc.

M₂OD is a capital intensive investment in transit area to cater needs of both present and future travel demands. Hence, such design and its outcome must be economically viable, well managed, and well maintained. Finally, M₂OD for transit area defines neighborhood character in design and provide multi modal mobility friendly environment.

13.0 Concluding Remarks

Good transit station demands transparent, functional simplicity and needs to be integrated well into the urban fabric. “Station that looks like Station” must have architectural expression, vertical articulation to understand space and use it more easily, sculptural qualities to express local climatic forces, steel-glass structure into urban forests and gardens, etc. (*Moffat 2004*). Multi modal transit station is an example of integration of ‘engineering art’ into ‘building design’ to create iconic new forms which requires highly engineered environment to get accessed by human, mechanical and

vehicular system. In Delhi, multi modal transit stations have been rediscovered as ‘urban identity’ and ‘sense of place’ which demands a package of measures designed to improve the integration and attractiveness of public transport network, including better and quality focused accessibility to these services.

Accessibility to multi modal transit station can be improved by (i) develop a balance & successful multi modal access plan; (ii) reducing penalties of interchange through efficient operation; (iii) strategies to achieve seamless journey through better physical design; (iv) commercial exploitation opportunities at stations; (v) agreed minimum standards of passenger facilities; (vi) time competitive & cost effective transit feeder services; (vii) safety & security of both transit users and operators, etc. In fact, accessibility to multi modal transit station is a matter of infrastructure design, management, land use & development, fare policies & traffic restraint measures, environmental quality, local economical activities, etc. Hence, role and responsibilities of transit operators, facilitators’ and users are crucial to extend better accessibility. It is also worthy to adopt ‘learning experience’ and ‘art of modern transit station design’ in international perspective at city level for better and easy mobility and linkages among commuter buses, rail, high speed train service like metro, exclusive land based service like BRTS, other motorized and non-motorized transport at multi modal transit station.

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