SAFE AND BARRIER FREE SIDEWALKS A CRUCIAL ASPECT OF TRANSPORTATION SYSTEM AND TOURIST EXPERIENCE

Abha Negi
Global Forum for Empowerment

Urban mobility is acquiring more and more central role in planning.

With 1.8 billion tourists forecast for 2020, travel both within and into and out of the region needs to be taken into account for visitors & tourists alike while providing seamless access that is barrier free and accessible to all.

Tourist Experience

- Walking provides an up close insight about the place and makes for a great experience.
- Any tourist friendly place around the world has an extensive network of sidewalks that makes for easy access to different places that also is the backbone of transport system of that city.
- Delhi is waking up to this crucial link that ensures mobility alongside strengthening public modes of transport that are safe and accessible
- Developing safe accessible sidewalks is becoming an important aspect of transport ecosystem.
- Bringing about a change in the outlook of people at the helm of affairs (policy makers as well as agencies involved in developing transport infrastructure in the city) was achieved by hosting a series of workshops to sensitize them.
- The direct outcome of these interventions was setting up of a committee, which was responsible for undertaking, audits and providing technical inputs to the civic agencies involved in developing the related infrastructure.

Conti....

- Sidewalks provide safe access to all places including places of tourist interest monuments as well as public transport.
- Upgrading the sidewalks in Delhi is an ambitious project and developing them as safe, accessible and barrier free is the priority that is being reflected in the new projects that are being rolled out by Delhi government.
- This will make negotiating the way around more pleasurable and safe in Delhi and in turn make it a preferred destination to the tourists and visitors alike.

Current Scenario

- Only 14% of the city drives, yet most of the road space is occupied by them.
- Car-oriented design priority
- Roads in Delhi have been designed to increase the speed and ease of movement of car users.
- Inadequate design proirity to incorporate safe and continous sidewalks

Benefits of an Equitable Street Design

- Last mile connectivity enhances the access to public transport
- Encourages people to undertake short distance trips on foot thereby

- Reducing car-use which in turn brings down congestion on roads

- More people on streets than vehicles

- More equitable for all segments of the society

40% of Delhi Roads have no sidewalks

Headlines

Bad road designs putting lives at risk

TIMES NEWS NETWORK

w Delhi: Long dubbed as ngerous stretches, Ring Ro- and Outer Ring Road rema- ccident-prone through the due to higher speed limits blind spots at mouths of vers. Though traffic police undertaken work on a few ches to reduce accidents, of concerted efforts to cor- road designs and putting dequate visual alerts still them dangerous.

raffic police data shows 0 fatal accidents were re- d from Ring Road and 16 Outer Ring Road in The study for 2016 is yet to be prepared. However, cops said that they have been raising concerns about the dangerous stretches for the past two years. Nearly 43% of accidents are hit-and-run cases. Roads in Burari, Model Town, Kalkaji and Kalyanpuri were found to be the most accident-prone zones.

Research by Centre for Science and Environment shows that footpaths were built on only 55% of the length surveyed and only 10% had cycle tracks. Just 10-15% of the stretches had footpaths at least 1.8m wide, which is ideal. The kerb height, which is supposed to be about 150mm, is unacceptable at almost all stretches barring small sections. A majority of accidents take place at such places.

Other accident-prone areas include places witnessing high footfall, like bus stands, Metro stations, exchange hubs, etc.

ACCIDENT-PRONE

Cops said that most places on Ring Road and Outer Ring Road lack safe, systematic transport exchange facilities (Metro buses, buses, autorickshaw, e-rickshaw, etc) for passengers. There is also lack of proper and enough information about the facilities which causes random movement people on the road.

Another observation m by cops is that these stret have a high density of two-v elers. Stretches that have many cuts or lack U-t prompt two-wheeler ride travel on the w carriageway. Such roads to be redesigned for safe ment of vehicles.

Teams have been for identify the most accide ne zones and suggest c ve measures, includin ling speed breakers, ro kings, fixing caution informative board proper lighting.

Can’t Trust Road Signs in Delhi

PWD drive to fix faulty road signs, install new ones

YOU READ IT HERE FIRST

You can't trust road signs in Delhi

75% Of Them Don't Meet Standards, Leading To Violations & Accidents

29 June 2017

New Delhi: The Public Works Department (PWD) of the Delhi government has launched a drive to repair damaged signages and replace the faulty ones across the national capital.

As part of it, the department will also install new road signages, a survey for which is being conducted by PWD officials.

A study conducted by the Delhi based Institute of Road Traffic Education on 14 major stretches of the national capital had in June found that faulty signages may actually be behind traffic violations and the resulting accidents.

Nearly 70% of such signs are wrongly designed and placed. Of around 1,514 regulatory, warning and information signages on the surveyed stretch 1,098 (75%) do not meet the prescribed norms, it had said.

An official, who did not wish to be named, said road markings like zebra crossings and others, will also be repainted. "As part of the drive, PWD officials will put up proper road signages in place of the faulty ones and repair the damaged ones. The department will also install new road signages wherever required," the official said.

"A survey is being conducted to ascertain the number of new road signs needed in the city," he added.

Asked as to when the drive would be completed, the official said separate deadlines have been fixed by PWD engineers for

Headlines: PWD Efforts Hampered by Poor Planning

PWD Efforts In University Area Hampered By Poor Planning

Ritika.Chitlangia
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New Delhi: The intent is admirable, but experts are not impressed with the work ongoing to make Delhi University friendly for specially abled students. Since March, the Public Works Department, on the university's request, has been making changes to the infrastructure to make North Campus accessible to all.

In the retrofitting and maintenance effort, PWD is building pavements and providing ramps, installing railings, tactile paths to guide visually challenged people and removing obstacles on pavements. But the work, critics said, did not meet the guidelines of the Indian Road Congress' street design guidelines for pedestrian use.

For one, the stainless steel railings installed in front of colleges serve no purpose. They are either obstructed by trees or are too far away from the ramps. Moreover, some railings at bus stands have not been properly secured. A student responded that "railings were erected at the gates of colleges". The officials said railings at the footpaths have been installed in order to help wheelchairs.

Photos: Aditya Chattopadhyay

Broken footpath

Railing not secured

Bin a hurdle

> **There are several obstructions on the pavement, so I prefer taking the regular road**
>
> **GURDEEP**
> Visually impaired student

to be addressed to make the university disabled friendly.

However, this access audit is not being referenced, claimed Bipin Tiwari, OSD, Equal Opportunity Cell, DU. Tiwari, who has been pushing the matter with PWD for

Road to Metro stations riddled with obstacles

Ritika.Chitlangia
@timesgroup.com

New Delhi: Delhi Metro stations aren't easy areas for people trying to reach them. A study carried out by CSIR-Central Road Research Institute clearly established this, boosting the view that accessibility to public buildings necessitates the improvement of surrounding road infrastructure too.

The CSIR-CRRI study, completed in March, found that Metro stations were not easy for use due to the bad condition of footpaths, their faulty design, poor illumination and conflict areas between pedestrian and motorised users.

After a six-month study of the seven Delhi Metro stations at Mayur Vihar Phase 1, Hauz Khas, Dwarka Mor, Nehru Place, Kirti Nagar, Moolchand and Rohini West, the researchers created the Pedestrian Accessibility Index (PAI) based on public feedback on ease of accessing the stations and analyses of the road infrastructure around the stations.

Dwarka Mor station scored a high PAI of 84.22, but others were all marked at below 60, indicating low accessibility. "While stations were often disabled- or pedestrian-friendly, the approach to them was not," noted Dr Mukti Advani, senior scientist, CSIR-CRRI. "There are too many hurdles for pedestrians."

Transport experts and disabled rights activists have long demanded easier road infrastructure to encourage people to walk, cycle and use non-motorised vehicles. Unfortunately, despite laws and guidelines in place, experts say, accessibility has not been a priority for government agencies.

"The law makes its mandatory to provide infrastructure that is accessible to all, but seriousness of purpose is missing," rued Javed Abidi, honorary director, National Centre for Promotion of Employment of Disabled People.

The revised National Building Code and the Indian Road Congress code provide detailed guidelines and designs for making roads and buildings universally accessible. "Supreme Court has passed an order making it mandatory for government agencies to provide universally accessible infrastructure," said Anjlee Agarwal, founder and executive director of Samarthyam, an organisation promoting accessibility. "This makes the IRC code on universal accessibility for urban roads binding on government agencies."

The problem, experts say, is the lack of enforcement, and, therefore, the need to sensitise lower-level government officials. Government departments responsible for creating civic infrastructure are not sensitive to the needs of people with disabilities and reduced mobility such as old people, those with children, pregnant women, people with temporary ailments, etc, said Agarwal.

While Abidi said it would be fruitful to think of penalising officials and imposing penalties on defaulting contractors, Advani said: "Only at least of 1km-radius around public hotspots should the pedestrian infrastructure be accessible and can be added gradually.

Mobility Patterns

- 32% of all commuted trips in Delhi are walking trips.
- Public transport including chartered buses accounts for 42% of all trips.
- 11% are slow modes of transport such as cycles and rickshaws.
- 5% by cars and 12% by motorised two-wheelers

45% ROAD MISHAPS INVOLVE PEDESTRIANS IN DELHI

- Pedestrians most vulnerable due to faulty road design
- 259 locations across the capital as per the Delhi Traffic Police
- Dodging speeding vehicles and struggling with high sidewalks
- No right of way to pedestrians

Missing Sidewalks

Need for Equitable Street Design

- Inadequate space for pedestrians
- Missing Side walks
- Inappropriate Kerb Height
- Encroached by utilities/signage foot-over bridges, billboards, police-booths
- Inadequate amenities

Issues Observed

- Uneven, unkempt, inaccessible sidewalks with inconsistent height from road surface
- Inconsistent width of the sidewalk
- Sidewalk riddled with interruptions (College main gates), culvults/wells
- Other barriers in the form of incorrectly placed bollards, street furniture and dead trees
- Incorrect placement of tactile pavers to guide visually impaired
- Missing Warning tactile pavers
- No access to bus stops
- Missing Kerb cuts to provide access to the Zebra Crossings or sidewalks and vise a versa
- Absence of public Conveniences

Workshop for Engineers of PWD

Conti….

Conti….

On site meetings with Engineer in Chief of PWD along with his team

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Audit Details

Date of Inspection: March 5, 2018

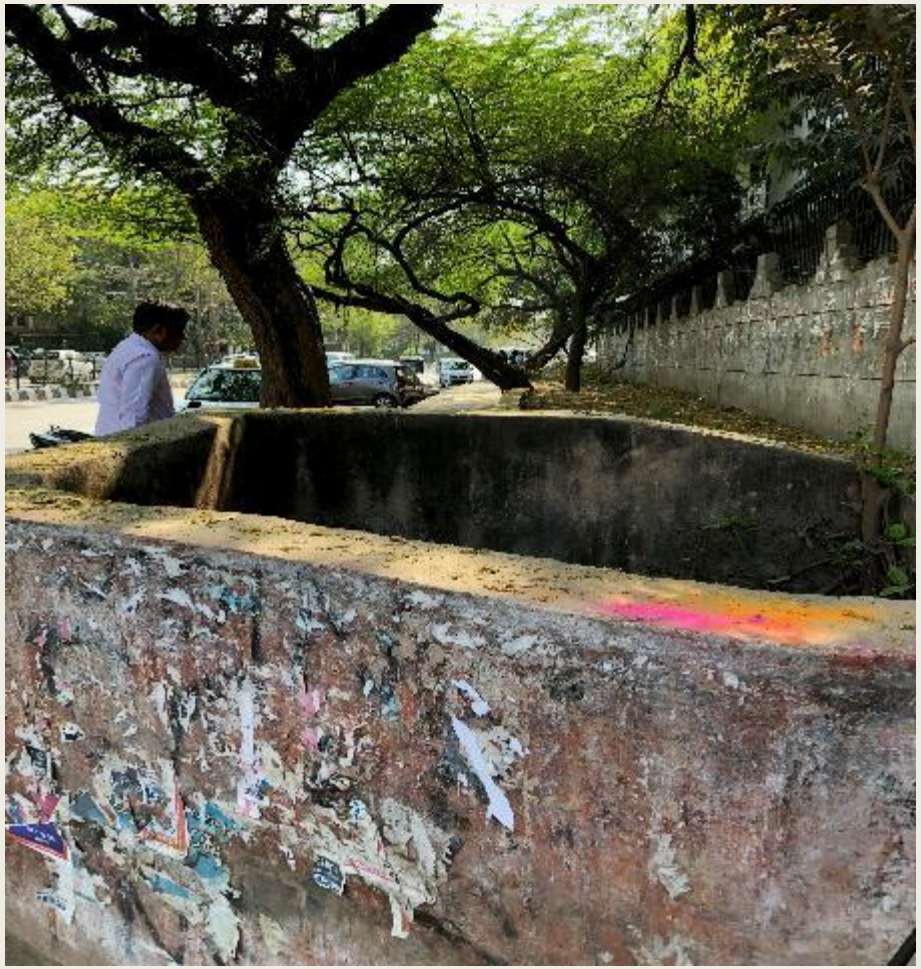
Audit Location: Benito Juarez Marg (BJ Marg)

Representation from Access Committee:

- Mr. Mukesh Meena SE
- Ms. Abha Negi (Expert)
- Mr. SK Sinha EE SW R-1
- Mr. Uday Meena AE

Audit Finding: Uneven, unkempt, inaccessible sidewalks with inconsistent height from road surface

Sidewalk riddled with, culverts/wells



DISRUPTED CONTINUITY OF SIDEWALKS BECAUSE OF THE ENTRANCE GATES OF VARIOUS COLLEGES

Other barriers in the form of incorrectly placed bollards & manhole covers

Dead Trees posing trip hazard to all pedestrians especially visually impaired and those using assistive devices

Trees in the line of Tactile Pavers

Incorrect placement of tactile blocks to guide visually impaired

Inconsistent height from road surface because of drain built under the sidewalk

No access to bus stops

Inconsistent width of the sidewalk

Barriers in the form of arbitrary and incorrectly placed street furniture

Barriers in the form of arbitrary and incorrectly placed street furniture

Missing Kerb-cuts & Tabletop ramps to provide access to the Zebra Crossings or sidewalks and slip lanes respectively & vise a versa

Absence of public Conveniences on this two Km plus road length

RECOMMENDED INTERVENTIONS TO DEVELOP ACCESSIBLE BARRIER FREE SIDEWALKS FOR ALL INCLUDING PERSONS WITH DISABILITIES

By
Abha Negi
Global Forum for Empowerment

Many City level Laws converge to safeguard the safety of pedestrians

- Central Motor Vehicles rules (CMVR) 1989 Safety Rules provide passive protection for pedestrians, stating that motorists cannot enter pedestrian way and are liable to penalty.
- Indian Penal Code (sec 283), sec 34 of Delhi Police Act -- Obstruction in public space punishable.
- Urban street vendor policy, 2007, to protect livelihood rights – recommend Guidelines for proper vending zones, as they are service providers on side
  - *The National Policy on Urban Street Vendors, 2009, approved by the Central government, recognizes street vendors (or micro-entrepreneurs) as "an integral and legitimate part of the urban retail trade and distribution system." The national policy gives street vendors a legal status and aims at providing legitimate vending/hawking zones in city/town master or development plans.*
  - *Police Act provides for penalty for jaywalking.*
  - *Persons with Disabilities Act 1995 (Sec 44) recommends guidelines for the disabled persons.*
  - *will work towards augmenting and strengthening the above city level targets and frameworks*

Source: Walkability Roundtable, Centre for Science and Environment

Urban environment

By accessible urban environment we mean the sum total of the measures that enable movement between the people's home/ dwelling and the services required, comprising of:

Road systems:

Traffic lanes that constitute a road network (roads, streets, tracks, paths) and their ancillary structures (pavements, street furniture, public lighting, car parks, sanitation systems, etc.);

Public Spaces:

Facilities open to the public: thoroughfares and gathering places that are open to all (squares, public gardens, markets, fountains, river banks, etc.);

Means of transport:

Vehicles (taxis, buses, coaches, trains etc.) and their ancillary structures (bus shelters, bus stations, railways stations, bridges, etc.).

Information and communication

- Means of information and communication combined with the techniques used to process and impart information, include:
- Signage: to enable coherent and practical use of a road system; comprising signals, signs, traffic lights, etc., which manage traffic, provide direction and inform users;
- Signposting: the graphic presentation of information involving a complex system of symbols that guide users around a given space, including arrows, logos and pictograms;
- New information and communication technologies (NICT): these refer to the techniques used to process and impart information, mainly IT, internet, mass media and telecommunications.

All the above need to adhere to an accessible format that communicates with one and all

Essential Components of all Streets

- Sidewalks
- Pedestrian crossings
- Non-motorised Vehicle lanes
- Utilities
- Public Conveniences
- Non intrusive tree-line and signage, billboards, foot-over bridges, properly aligned street furniture and rest areas

Current Site BJ Road

- The sidewalks on either side of the BJ Road need to be redeveloped as on one side are the colleges, other institutional areas and on the other side residential area.(**Developing only the colleges' side of the sidewalk will not be a sufficient measure to provide safe accessible right of way to all pedestrians including persons with disabilities**)
- The height of the sidewalk is unconventionally high due to the rainwater drain which needs to be moved to meet the required standards of the guidelines. It will also ensure there are no manhole covers that are posing a barrier/trip hazard to easy movement. Wherever a manhole is unavoidable tactile pavers need to guide the user especially those with vision impairments.
- Also the need to move the well and culvert which is eating into most of the space required for sidewalk. (**sufficient space is available alternatively other engineering measures can be deployed to mitigate this issue**)
- **Also there are no accessible public conveniences along the 2km long stretch and same need to be provided.**
- To ensure law and order as well as safety, proper area needs to be earmarked for PCR Vans etc.

Develop Continuous Sidewalks

- Sidewalks are the backbone of any effective transportation system and hence very critical aspect of mobility.
- Should be developed as a network that is connected and continuous

Treatment for Street Kerb Corners and Slip Roads

Slip roads or Free Left Turns should be avoided. Where they already exist, the following strategies may be deployed:

- **Reduce the kerb radius at the corner to calm traffic, and signalize the Slip road crossing** (full or pelican signal), in order to make the crossing safe for all users.
- **Introduce raised table top crossings at slip roads** – to allow pedestrians, cyclists and persons with disabilities to cross the road comfortably at the same level, while the raised level acts as a traffic calming device to slow down vehicles at the junction. (All BRT slip roads have this treatment and some in NDMC area too)

Design Guidelines for Sidewalks

- Interruptions should be avoided
- Minimize kerb cuts i.e. number of drive ways that cut through sidewalks to ensure pedestrian safety
- Develop a continuous sidewalks by introducing tabletop ramps wherever a driveway cuts through the sidewalk
- Sidewalks to have an even non- slip surface where the elevation of the sidewalk is maintained at no more than 150mm from the road level
- Remove all obstructions of any form from the surface of the sidewalk
- Provide visual continuity by way of design color and texture that in turn helps in traffic calming even at crossings

Note: Use of Granite as sidewalk surface should be avoided as even when torched it can be dangerously slippery

Develop Integrated Streets

- GOAL 1:

  MOBILITY AND ACCCESSIBILITY –Maximum number of people should be able to move fast, safely and conveniently through the city.

- GOAL 2: SAFETY AND COMFORT –Make streets safe clean, walkable and create climate sensitive design.
- GOAL 3: ECOLOGY –Reduce impact on the natural environment; and reduce pressure on built infrastructure.

Universal Accessibility

- Kerb Ramps
- Raised Table top Crossings
- Tactile Paving
- Auditory Signals
- Pelican Signals
- Properly aligned accessible signage

Universal accessibility is a critical aspect for all including the elderly, persons with disabilities, children, persons with temporary mobility impairments rendering them incapacitated due to injury, accident or ailments

Provide universal accessibility and civic amenities

- Provide at-grade crossings
- Provide dust-bins, signage and other public amenities
- Provide accessible public conveniences every 500mtrs for the convenience of pedestrians including the disabled persons and elderly

Accessibility Requirements

- All site furnishings must be accessible
- Site furnishings must maintain a minimum 4 foot clear accessible route, and should leave required through widths.
- Objects mounted on walls or posts with leading edges above the standard sweep of canes (27 inches) and below the standard head room clearance (80 inches) should be limited to a 4 inch maximum protrusion.
- No sidewalk element should interfere with pedestrian access to the entrance of any building; this includes the path of travel and disabled friendly access. This includes all paths of travel or exiting.
- Ideally site furnishings should be of a contrasting color to the sidewalk so as to help pedestrians with low vision or visual impairments.
- Site furnishings should leave a minimum 8 feet of clearance adjacent to accessible parking and passenger pick up zones.

Ecological Goals

- Reduce heat island effect & aid storm water management.
- Use permeable Paving
- Infiltration beds and bio filtration beds –to integrate storm water filtration and absorption into the streets

Safe Accessible and Barrier free Sidewalk

Design

- Indian cities still need to develop well designed shared road spaces, with properly demarcated pedestrian infrastructure
- Sidewalks should have a minimum width of 1.8 mtrs on both sides of the road

(Currently pedestrians are provided only a minority share of space most often less than 10% of road space and in most of the instances no space at all)

Design Standards for walking zones

- Clear walking Zone: Obstruction Free
- Walking Zone shall be 1.8 M X 2.4 M – both horizontally & vertically.
- No utility ducts, utility poles, electric, water or telecom boxes, trees, signage or any kind of obstruction should be placed within the “Walking Zone”.

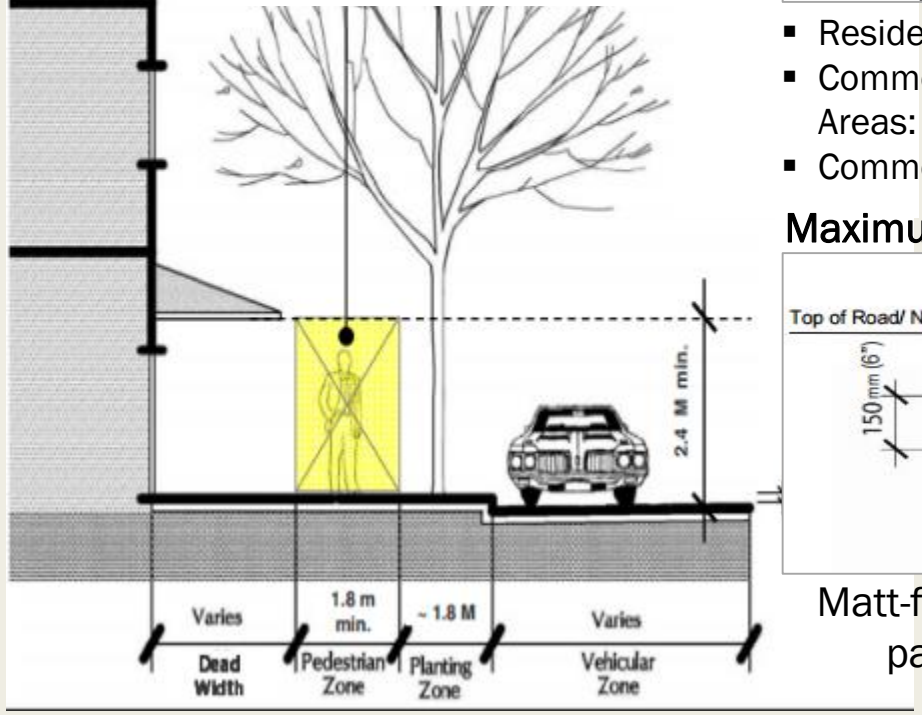
Sidewalk Width

- Since the pedestrian flow is determined by land use, the following sidewalk widths can be applied:
- Residential Areas: 2.00 M
- Commercial/ Mixed Use Areas: 2.50 M
- Commercial Nodes: 4.00 M
- In addition to the above, a requisite “dead width” is to be added to all pedestrian zones, as per IRC Standards in Section 02.

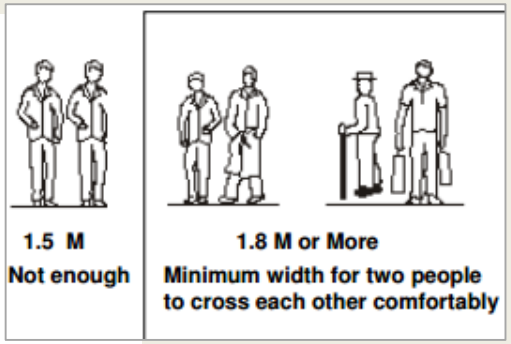
Key Design Standards: Sidewalks/Footpaths

Clear Walking Zone

No utility ducts, utility poles, electric, water or telecom boxes, trees, signage or any kind of obstruction should be placed within the “Walking Zone” in future.

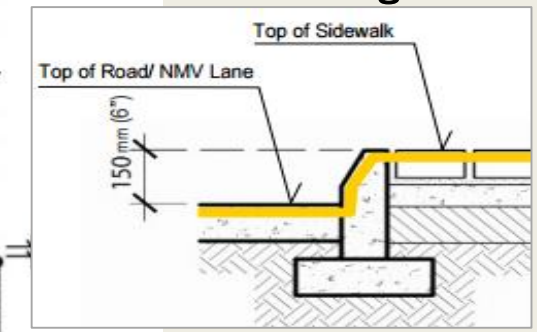


Walking Zone Width



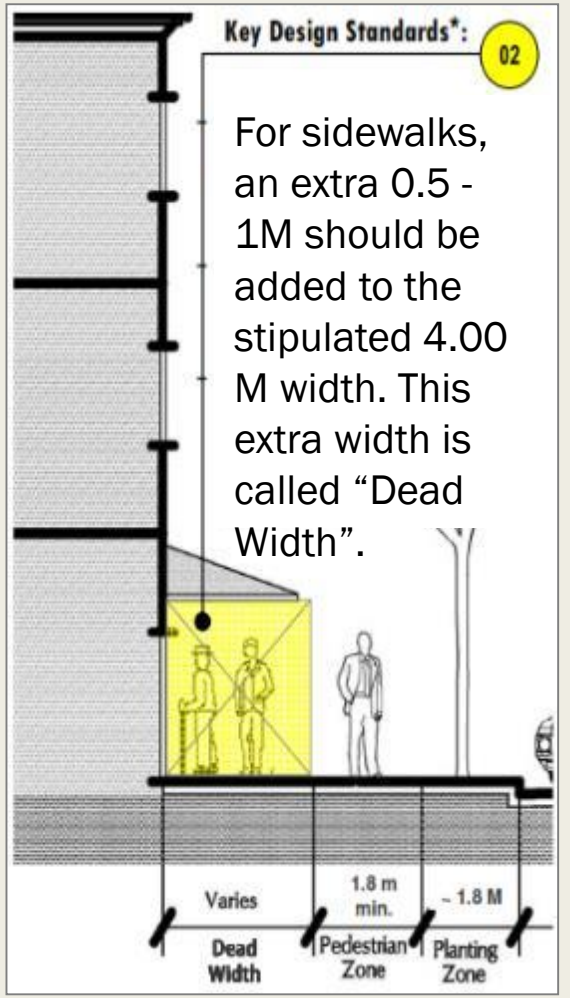
- Residential Areas: 2.00 M
- Commercial/ Mixed Use Areas: 2.50 M
- Commercial Nodes: 4.00 M

Maximum Kerb Height



Matt-finish/ anti-skid Foot path and bus stop surfaces

Dead Width



Source: Pedestrian Design Guidelines, UTTIPEC, Delhi Development Authority, New Delhi, November 2009

Sinking of Sidewalks

To avoid sinking of the sidewalks proper base needs to be made which cannot be damaged by rodents or other animals digging burrows

Sidewalk Bed being Developed in Chandigarh

While entering from the outer Ring Road it is a free left turn towards BJ Road that needs to be addressed by introducing a Table top ramp and Pelican signals

Pedestrian initiated traffic lights-Pelican Signals may be installed at mid-block crossings to make traffic stop for pedestrians, including persons with disabilities.

Placement of Street Furniture including Signage

Incorrect Placement of signage

Correct Placement of street Furniture

Street Furniture

- Streetscape elements such as furniture, lightning, paving and public conveniences provide important amenities for pedestrians.
- Street Furniture should be placed not less than:18 inches from the outside edge of the curb;2 feet from any driveway or wheelchair ramp and 4 feet at the landings
- Site furnishings may also be placed within curb extensions where sidewalk widths are extended into the parking lane.

Properly aligned Street Furniture

Placement of Street Furniture Like Signage Electricity Poles and other Utilities

- Leave a minimum of two feet wide green strip on the edge of the sidewalk adjacent to the road edge
- Plan all the utilities and signage along the green strip so that it does not interfere with clear walking space of the sidewalk and keeps it barrier free
- Where ever space allows benches could be placed off the sidewalk to make it comfortable for the users

Correct Street furniture placement along the BRT

Types of signs

- **Orientation** – **Way finding** (Street Signs)
- **Availability of Public Transit nearby** (Transit Signs)
- **Guiding Street Flow** (Traffic Signs)
- **Announcing about City's specific features or attractions** (Information Signs)
- **Conveniences** (Toilet, dustbin, hawker signs).

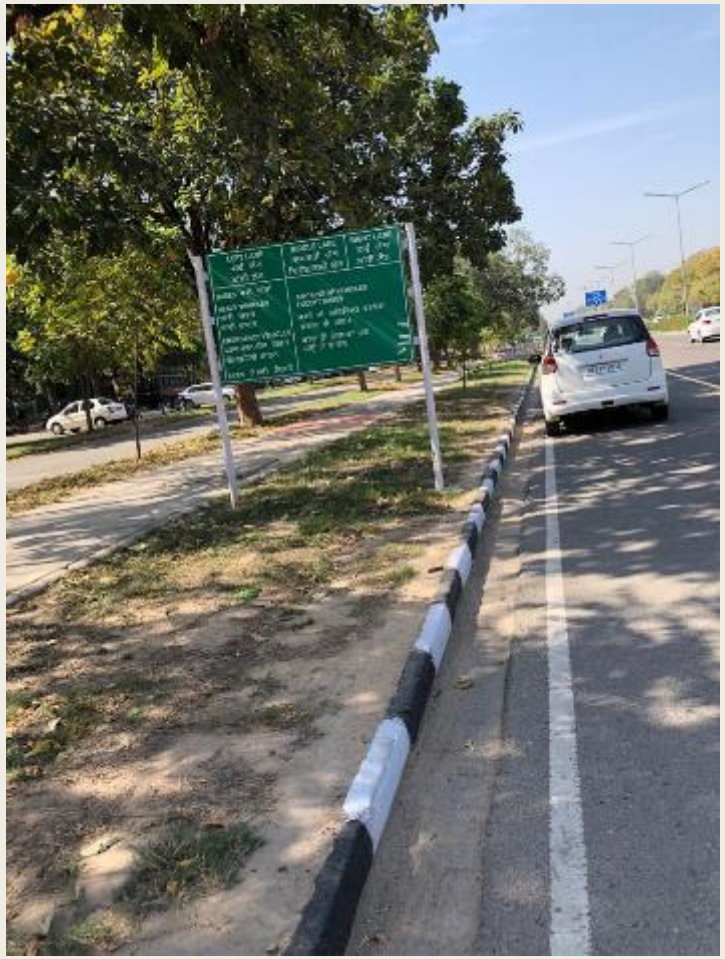
Signage Placement

- All Sign poles must be placed clear off the walking zone
- Must be clearly visible to motorist and pedestrians alike
- Must convey a clear message and orient the motorists and pedestrians alike

Directional Signage Placement

- Signage for way-finding, information as well as direction are an important aspect for motorists, pedestrians and cyclists alike..
- Hence the placement of signage becomes critical not only should the signage impart clear cut message but should not pose a barrier to the pedestrians
- Clear signage is imperative for navigation
- All posts and poles should be so arranged as to minimize the number and avoid clutter as well as impart conflicting messages.
- Placement should be in the green zone of the sidewalk towards the edge of the road for better visibility

Directional Signage Placement



Signage for amenities and general information should be visual e.g

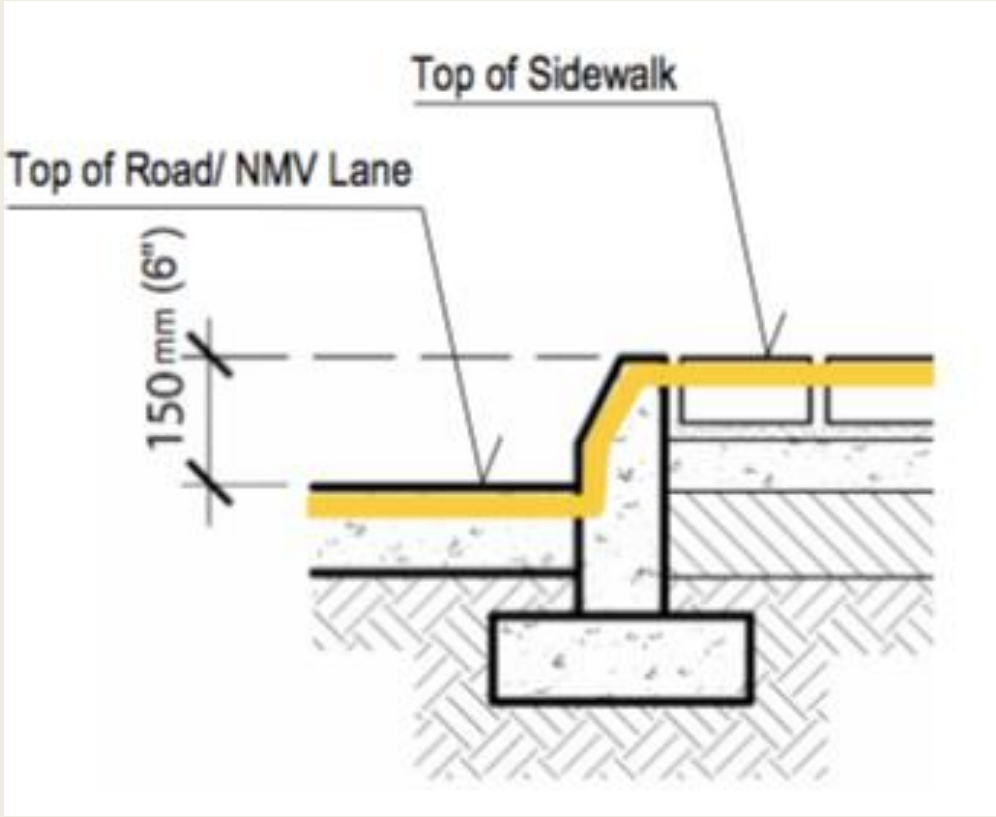
Lighting the sidewalks

- Lighting needs of the pedestrians are different from those of the on road vehicles
- It needs to be integrated with the overall lighting strategy of the street-scape and ensure pedestrian safety while negotiating the sidewalks
- Pedestrian lights should be focusing on the pavements and placed lower
- All placement of light poles must be clear of the walking zone
- While placing street lights, ensure adequate gaps and **spacing from the tree canopies** to ensure that performance of lighting is not compromised.
- Low-Mast or Pedestrian Scale Lighting (3-5 M Tall) – illuminate pedestrian-only walkways and provide supplemental light for the sidewalk.
- A minimum of 30 Lux level lighting is required

Sidewalk Kerb Height

Kerb Height

- Maximum height of a pavement should not exceed 150mm
- All sidewalk and bus stop surfaces should be mat finish and anti skid



Maximum Kerb Height

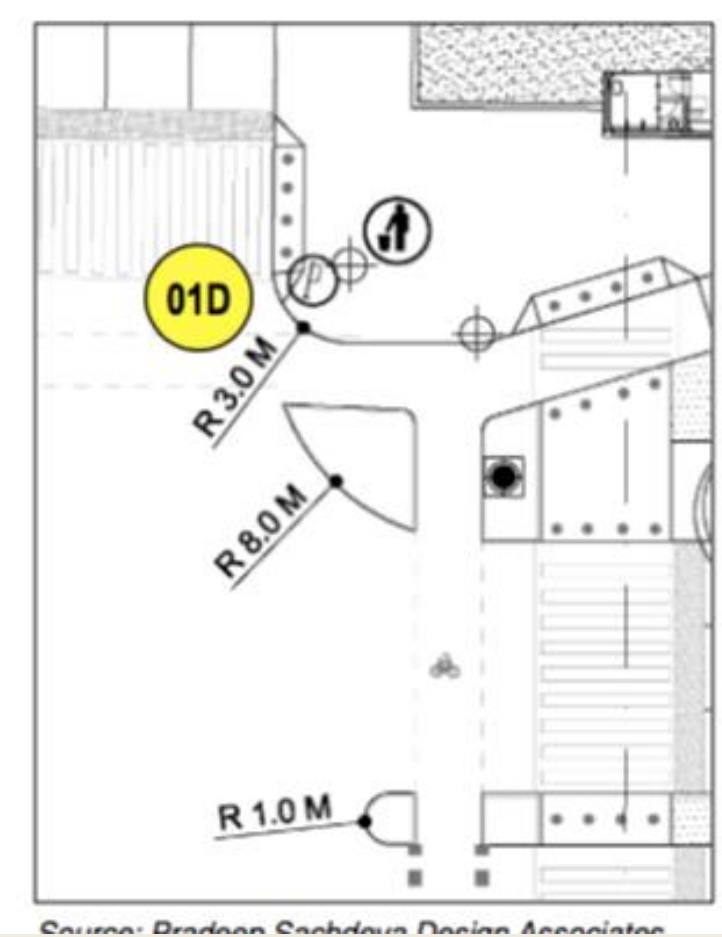
- Maximum height of a pavement (including kerb, walking surface, top-of-paving) shall not exceed 150 MM (6").
- 100 mm (4") kerb height is preferable for Arterial Roads.
- All walking surfaces should be very rough/ matt-finish/ anti-skid.
- Medians should be maximum 150mm high or be replaced by crash barriers.

Street Kerb corner and Free Left Turn Treatment towards BJ road from Outer Ring Road

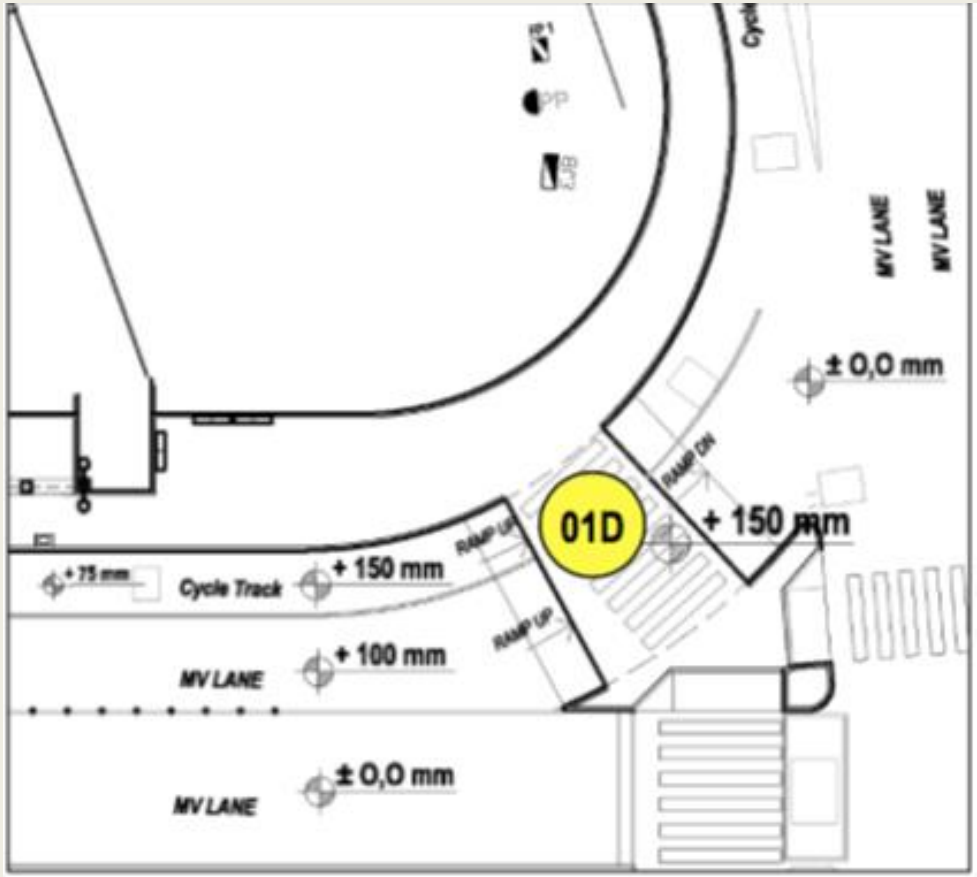
Kerb Radius and Slip Road Treatment

- Street Kerb Corners and Slip Roads: Recommendations
- **Slip roads or Free Left Turns should be avoided. In cases where they already exist, the following strategies may be employed:**
- **Reduce the kerb radius at the corner to calm traffic, and signalize the Slip road crossing** (full or pelican signal), in order to make them safe for all users.
- **Introduce raised table top crossings at slip roads** – to allow pedestrians, cyclists and physically challenged people to cross the road comfortably at the same level, while the raised level acts as a traffic calming device to slow down vehicles at the junction. (This is a highly effective device that has been applied to all slip roads along the BRT corridor and are working very well.)

Kerb Radius and Slip Road Treatment



Source: Pradeep Sachdeva Design Associates



Source: TRIPP, IIT Delhi, BRT Design Specifications, 2009

Types of Sidewalk/Footpath Kerbs

Footpath kerbs should be the following type:

- Semi-mountable (100 mm high) where traffic volumes are high
- Barrier type (150 mm high) where pedestrian volumes are high and traffic volumes and speeds are less (<25 km/hr) – so as to discourage vehicles from encroaching upon footpath space. The barrier kerb will decrease the efficiency of the left-most traffic lane.

Missing Edge Markings

Onsite Missing Edge Line

Example of a clear edge line

Kerb Stone Markings

Highest colour contrast black and yellow or black and white strips have been the colour of the kerb stones.

Colour to be used for Road Markings
Road markings need to be undertaken in Black and White or Black and Yellow colour only as these combinations provide the highest contrast and are visible from a distance. Yellow colour is used for marking parking restrictions and continuous center and barrier line markings while the alternate bands of black and white or black and yellow are used marking the kerb stones or the curb objects.

(Delhi Development Authority has laid down a set of guidelines called 'Guidelines on Road Markings'. In this, it states that the commonly used colours for road markings, including kerbs, bollards and dividers, are white and yellow. It also states that lack of standardization and proper road markings in New Delhi affect the smooth flow of traffic

The UN Convention on Road Signs and Signals, 1968 (Vienna Convention) also makes mention of road markings and recommends the colours of yellow and white internationally.) Reference article TOI

Kerb Stone Marking

Pavement Edge Lines

- Pavement Edge lines mark and indicate the edge of the road that provides a visual clue to the drivers marking the limit on the roads they can safely venture.
- During inclement weather when the visibility is poor these edge lines prompt the drivers to hug the main road.
- The placement of the edge line should be no less than 150mm from the edge. The width of the edge line should be 150 to 200mm.
- It is advisable to use a reflective material so that the edge lines are easily visible in the night too.

Kerb Cut Ramps

Kerb Ramp

- Kerb ramps link footpaths across a roadway. Kerb ramps also assist with defining the preferred crossing location for all pedestrians.
- The kerb ramps must be correctly aligned and perpendicular to the direction of travel.
- A kerb ramp provides a continuous path of travel for pedestrians with mobility impairments or wheeled devices, such as wheelchairs and prams.
- Flat landings must be located at the top and bottom of kerb ramps.

Missing Kerb cut Solution

Onsite issue of missing kerb cut

An example of the correct kerb cut

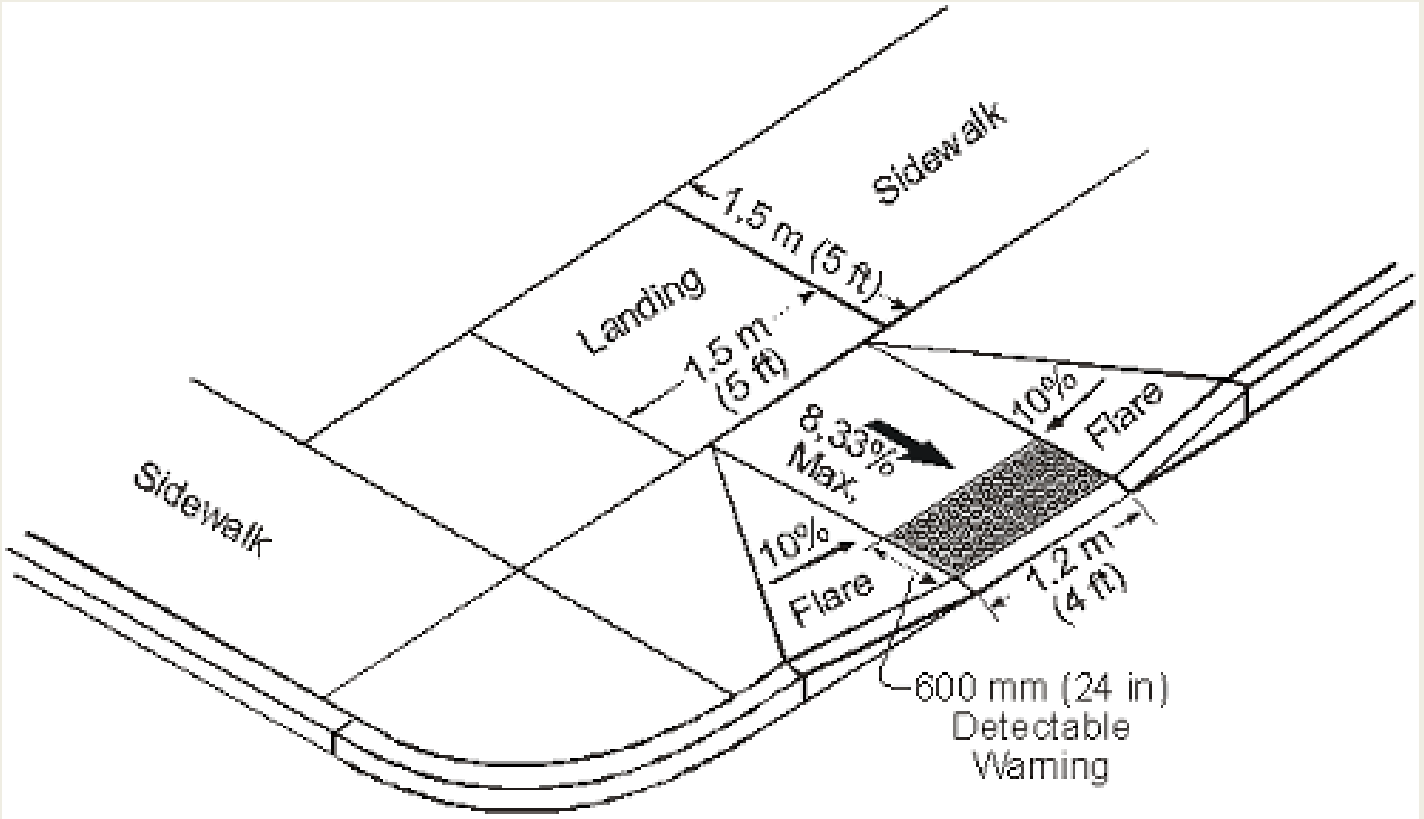
Dropped Kerb with Tactile Pavers

Dropped Kerb ramp on the footpath makes it convenient for people to cross the road especially Persons with Disabilities and reduced mobility

Kerb Ramps Design Guidelines

- Kerb ramps are cut back into the footpath (flush with roadway), at a gradient no greater than 1:12, with flared sides (1:10) providing transition in three directions.
- Width of the kerb ramp should not be less than 1.2 M.
- Tactile warning strip to be provided on the kerb side edge of the slope, so that persons with vision impairment do not accidentally walk onto the road.
- The ramps should be flared smooth into the street surface and checked periodically to make sure large gaps do not develop between the gutter and street surface.
- It is desirable to provide two kerb cuts per corner. Single ramp located in the centre of a corner is less desirable.
- Separate ramps provide greater information to pedestrians with vision impairment in street crossings.
- Mid block crossings accessible for persons with disability and elderly should be provided for blocks longer than 250M.

Kerb Cut dimensions



Kerb Ramps at the Zebra Crossing

Dropped Kerb ramp on the footpath makes it convenient for people to cross the road especially persons with disabilities and people with reduced mobility

MISSING MID BLOCK CROSSINGS BJ MARG AND THE RECOMMENDED INTERVENTION

Mid-Block Crossing

- **Extended Footway at Crossings provides better visibility of pedestrians and reduces the crossing distance.**
  Mid-block crossings should be considered at: Key civic and commercial locations

Areas with pedestrian attractors with mid- block entries like shopping areas, schools and community centers.

  - *Mid-block transit/ bus stop locations.*
  - *Long blocks (generally >150M)*
  - ***Length of the block is more than 250 M***
  - ***Crossing is not less than 60 M from the intersection***

- **All non-signalized mid-block crossings are to have auditory pelican signals and table top provisions** with flat paving/stone on the top and cobble stone may be provided on the slopes (on the road sides) for controlling vehicular speeds.

Mid-Block Crossing contd.

- Mid-block crossings must be provided at regular intervals as per the following standards:
- **Residential Areas spacing Range: Every 80 – 250m** Coordinated with entry points of complexes; location of bus, public facilities, etc.
- **Commercial/ Mixed Use Areas: High Intensity Commercial Areas spacing Range: Every 80 – 150m.**

Missing Refuge islands at the crossings

- The median acts as a ‘pedestrian refuge island’ at a pedestrian crossing,
- And it should be provided as pedestrian refuge are protected areas where people may safely pause or wait while crossing a street.
- Pedestrian refuge islands are particularly helpful as resting areas for seniors, persons with disabilities, children and others who may be less able to cross the street in one go.
- At signalized intersections, they allow slow moving pedestrians to cross in two phases.
- At non-signalized locations, these refuge islands help in providing a safe space in traffic to cross.

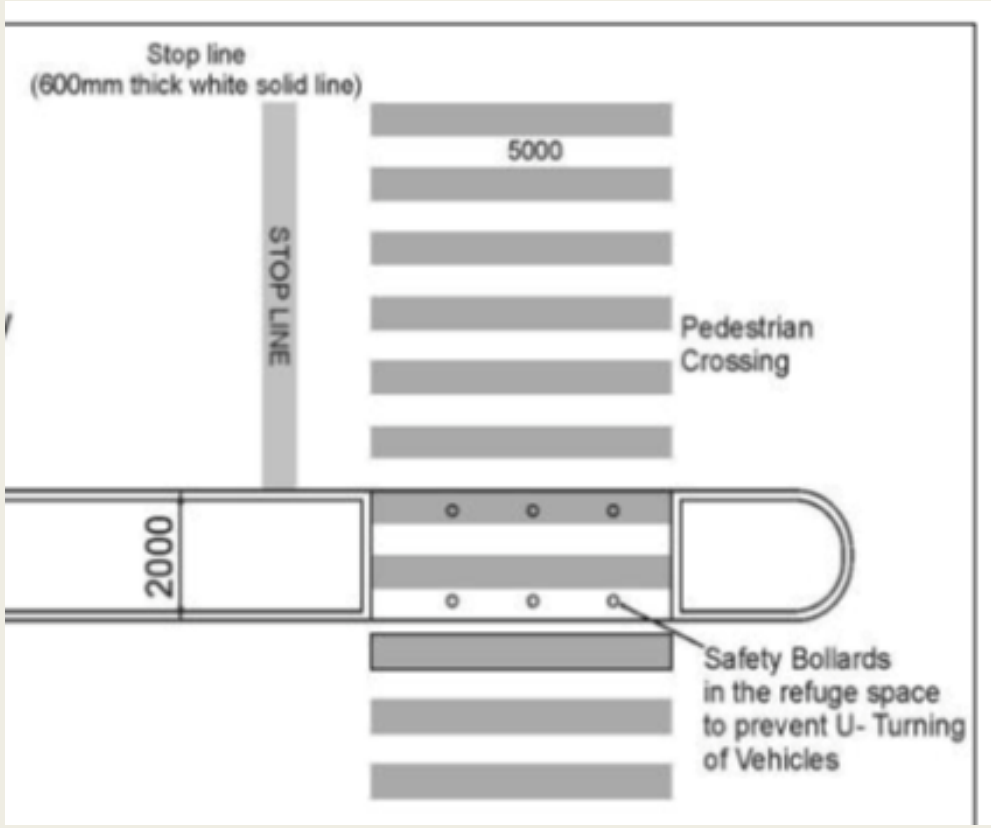
Traffic Islands

- The distance required to cross a street and the length of time that a pedestrian is exposed to traffic can be shortened with curb extensions and crossing islands.
- Curb extensions reduces the distance pedestrians must walk in the street, while crossing islands also simplify a crossing by breaking it into two pieces.
- They should be level and wide enough to accommodate wheelchairs and group of people.

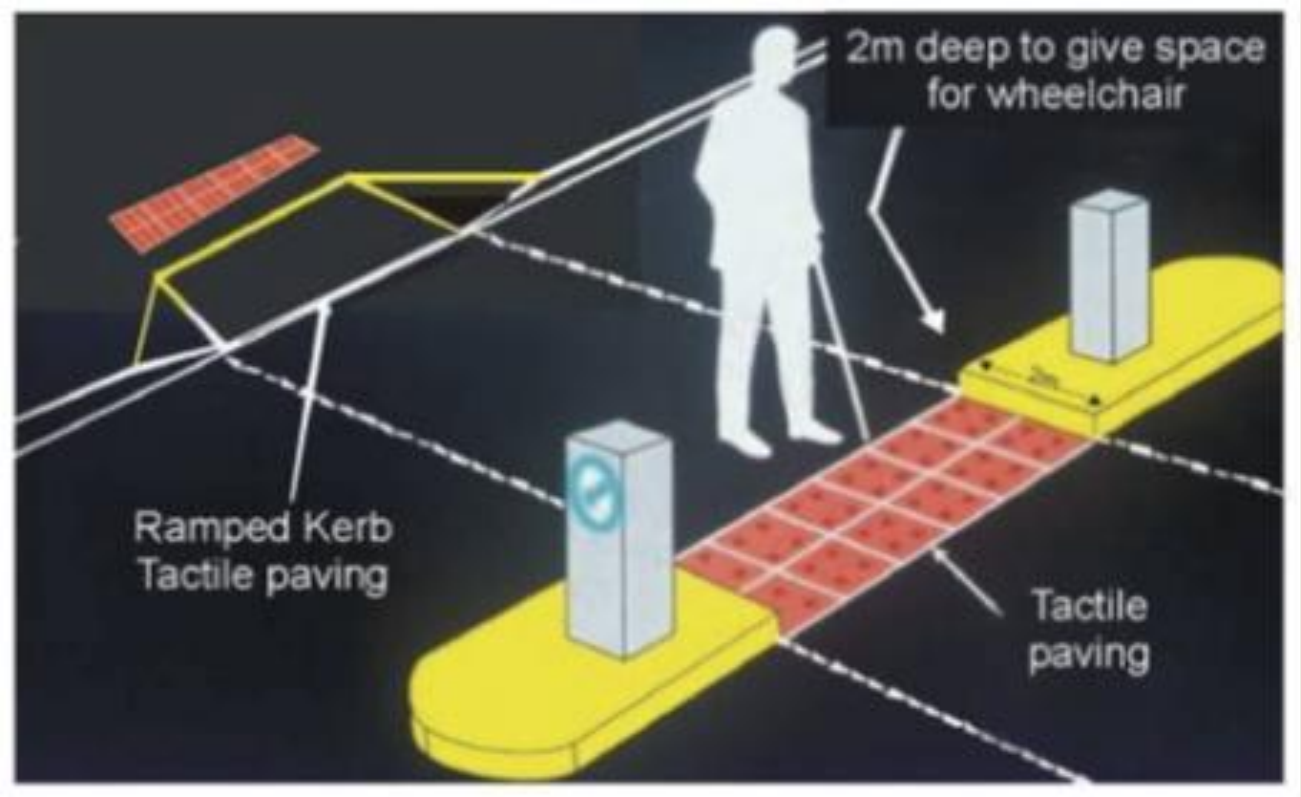
Dropped Kerb on Center Median & Refuge Island

Dropped Kerb on Center Median

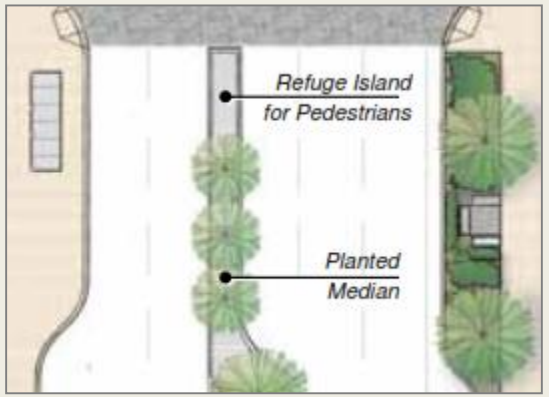
Pedestrian Refuge at Center Median with safety bollards to deter vehicles from taking U turns yet space enough for wheelchair to move freely

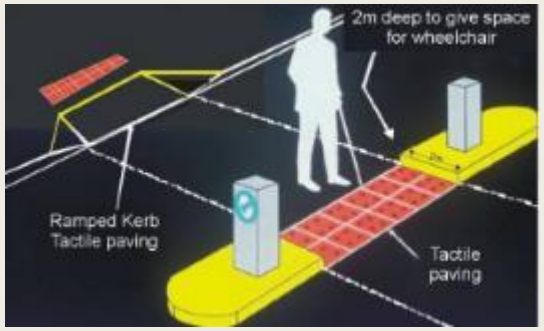


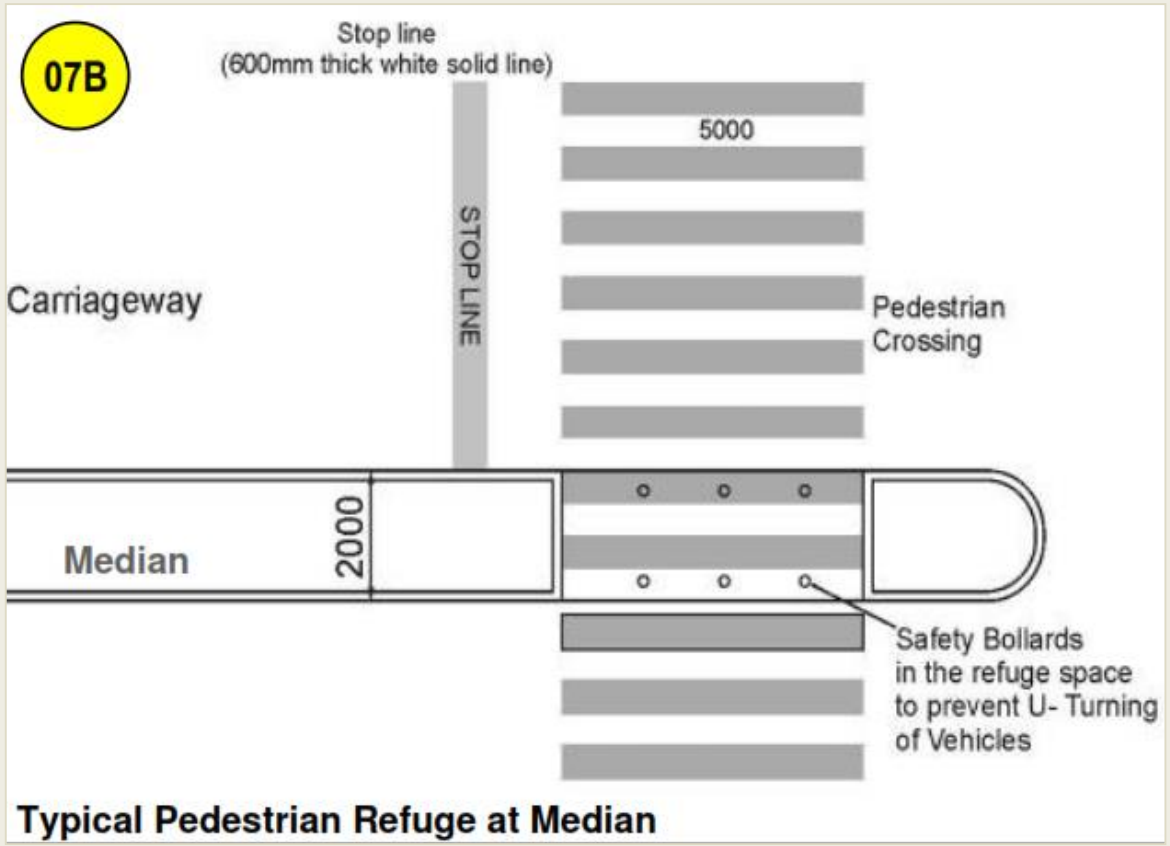
Refuge Island at the Center Median two meters deep for wheelchair space



Key Design Standards: Medians and Refuge Islands







Typical Pedestrian Refuge at Median

- Kerb Ramp at Raised Median
- 1200 MM clear waiting area
- Raised Median more than 4 M Wide

Source: Pedestrian Design Guidelines, UTTIPEC, Delhi Development Authority, New Delhi, November 2009

Way-finding

- Tactile Guiding Blocks orient the visually impaired in both external and internal built environments .
- Correct placement of guiding and warning tactile blocks is imperative for guiding persons with visual impairments

On-site Tactile Pavers

Onsite wrong placement of Tactile Guiding Blocks &missing warning Pavers

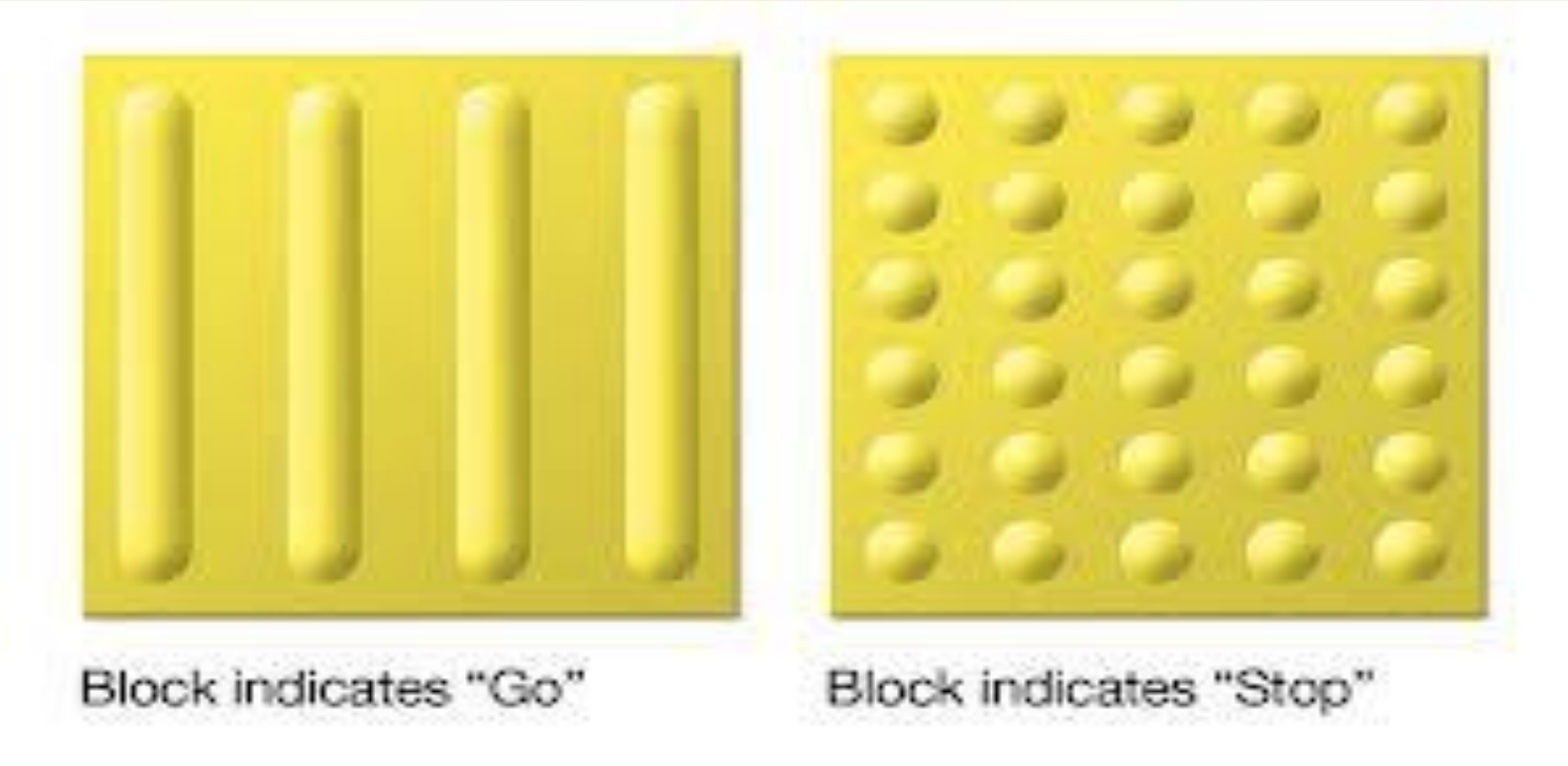
Correct Placement of Tactile Pavers

Tactile Pavers

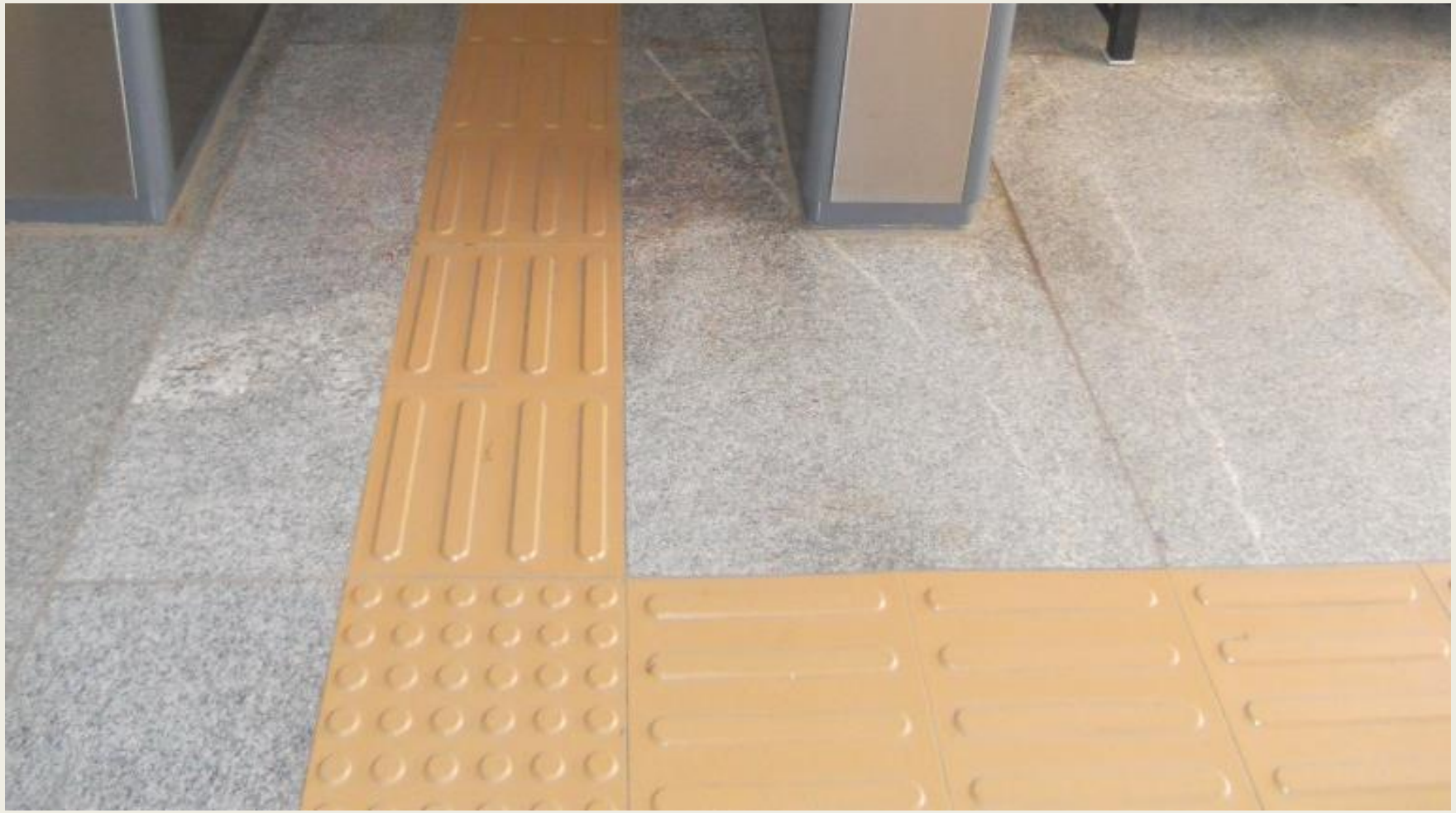
Tactile Paving is ground surface indicators that are paved on the sidewalks and public spaces to help visually impaired persons find their way around.

Guiding Block

Warning Block



Placement of tactile blocks



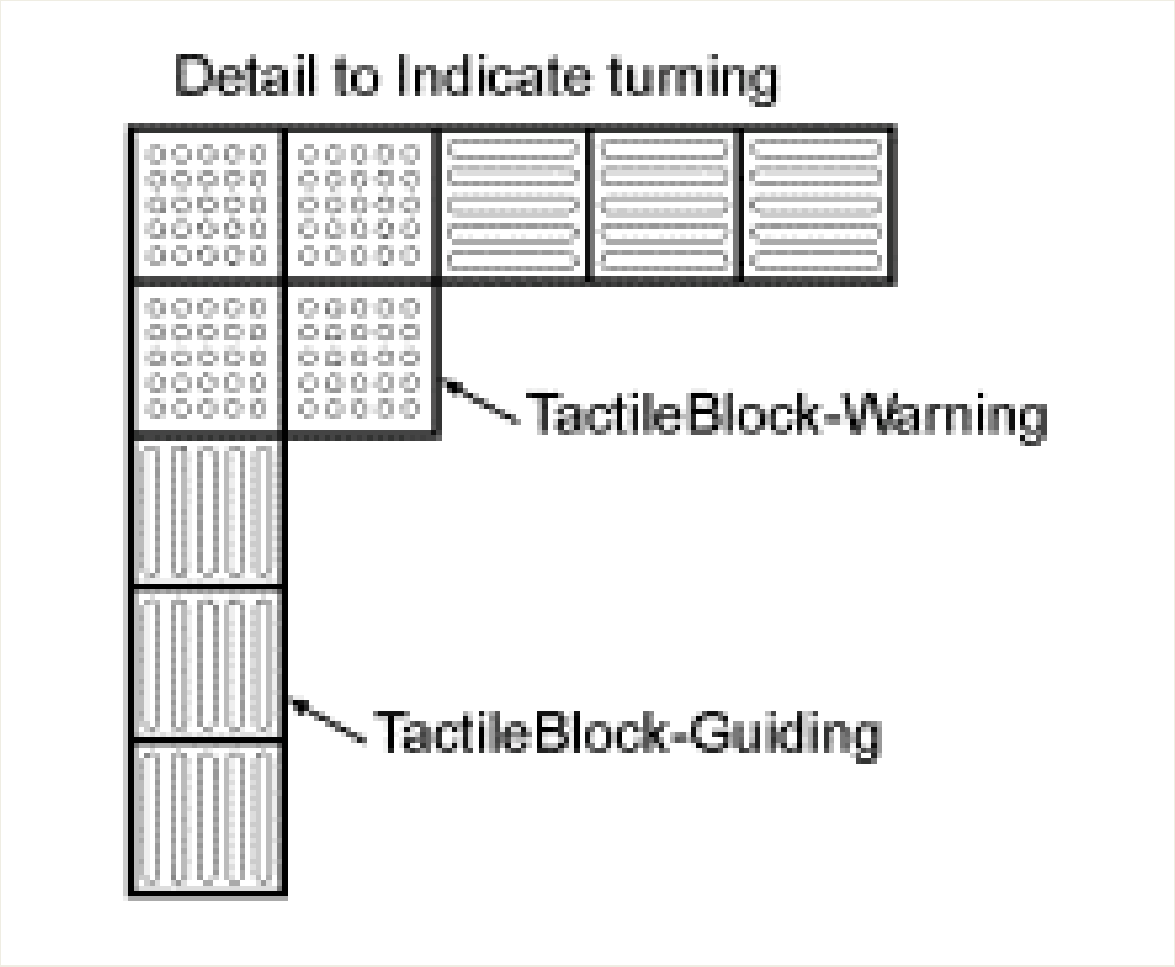
Tactile Pavers

Tactile Paving

- A distance of 600-800mm to be maintained from the edge of footpath/ boundary wall/ any obstruction
- A height of about 5mmfor the raised part of the surface is sufficient for almost all persons with vision impairment to detect, without causing too much discomfort for other pedestrians
- Tactile paving must be maintained to ensure that the profile does not erode away. Vitrified non-glazed tactile pavers are preferable.
- Tactile tiles should have a colour (preferably canary yellow), which contrasts with the surrounding surface.
- Tactile Paving should be minimum 300mm wide so that someone can't miss it by stepping over it.

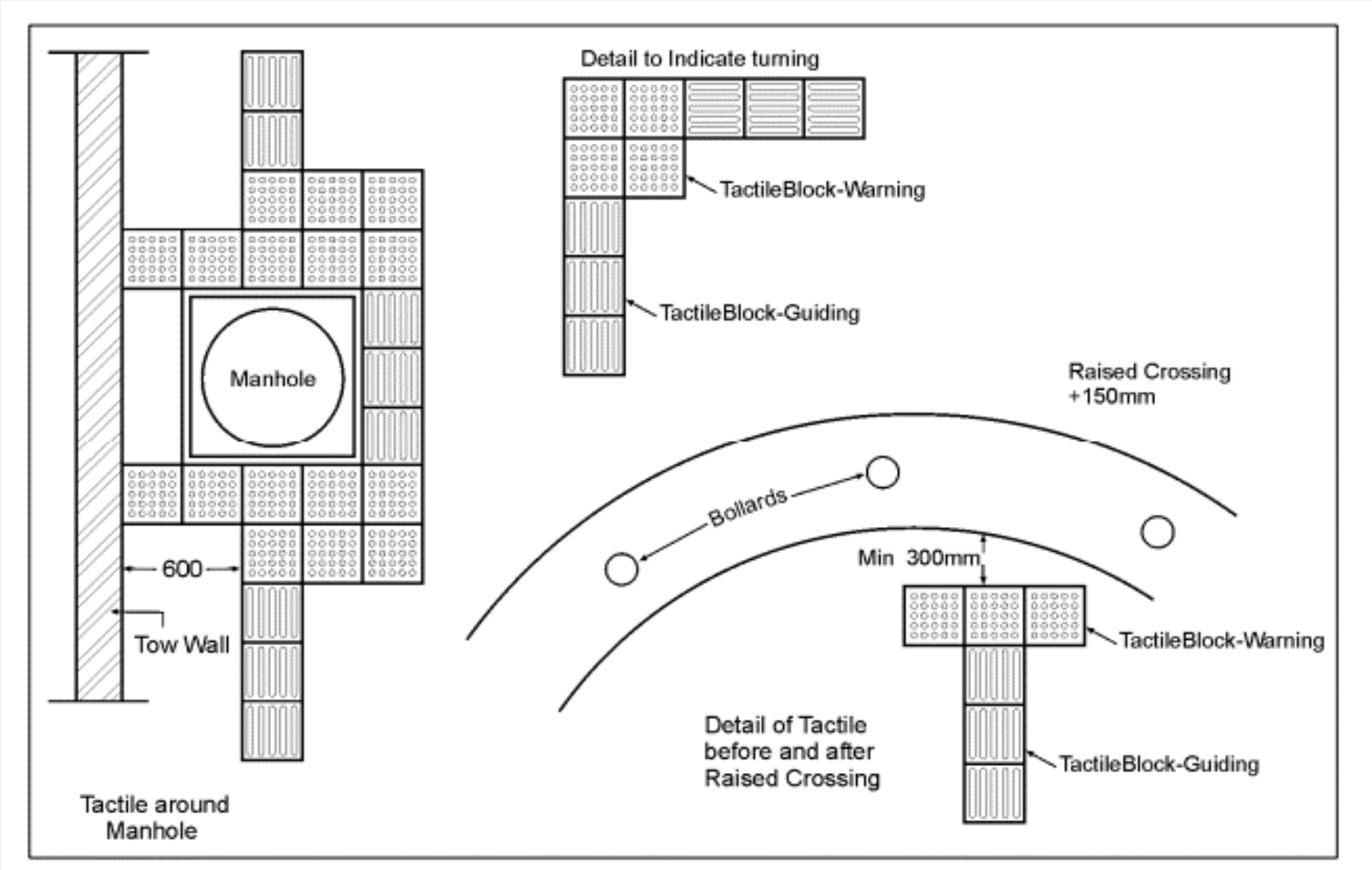
Note: Persons with vision impairment need guidance in using pedestrian areas, especially if the footway crosses larger open spaces where the usual guidance given by the edge of the footway or building base is not available, or when pedestrians need guidance around obstacles.

To indicate a turning



Tactile block layout around

- **Manhole**
- **Turning**
- **Raised Crossing**



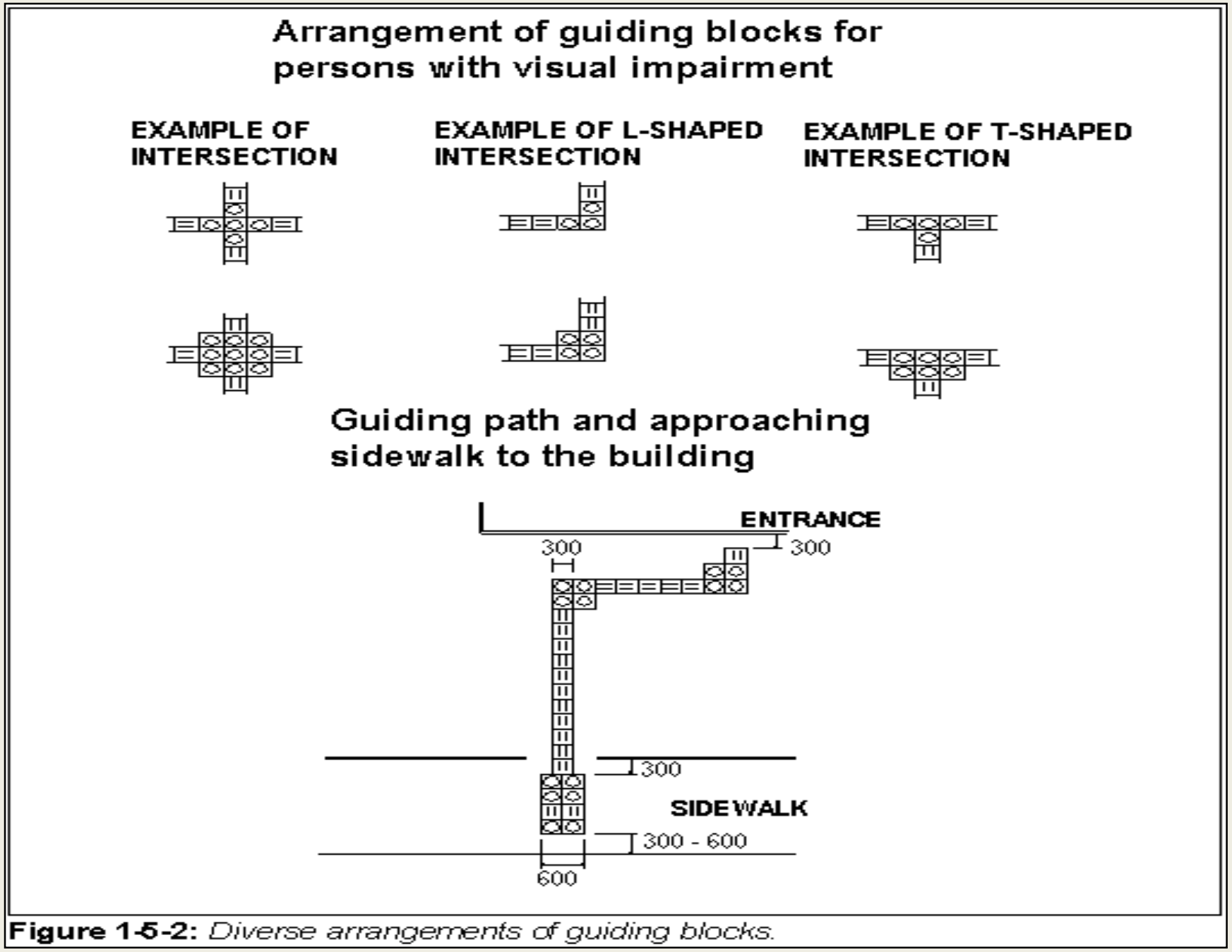


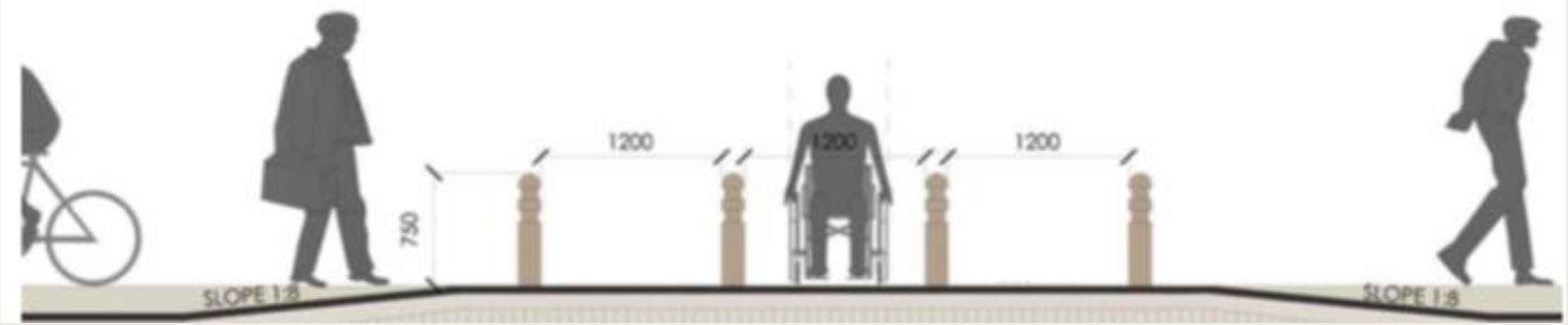
Figure 1-5-2: *Diverse arrangements of guiding blocks.*

Bollards

Onsite incorrect placement of Bollards

Correct Placement of Bollards

Correct spacing and placement of bollards



Guidelines for Placement of Bollards

- Bollards are physical deterrents that discourage encroachment of the sidewalks by motorists
- A minimum of 1200mm spacing between two bollards
- Bollards and other security barriers cannot obstruct accessible routes

Table Top Kerbs

- Raised Crossings increase visibility of pedestrians and physically slow down traffic allowing pedestrians to cross safely.

- At entry points of properties – introduce “raised driveway” or “table-top” details – where pedestrian and cycle tracks continue at their same level, but the motorized vehicles have to drive over a gentle ramp to enter the property.

Raised Table Top Crossing

Raised crossings should be located at:

- Non-signalised crossings
- At Slip Roads (free left turns)
- Where high-volume streets intersect with low-volume streets, like the institutes entrances that interrupt sidewalks, neighbourhood residential streets, and service lanes of multi-way boulevards.
- At Mid-Block Crossings

Contd…

Raised crosswalks should not be used on designated transit routes or where there are steep grades or sharp curves.

- Raised crosswalks should be flush with the sidewalk in height, and at least the width of the crossing or intersection
- Be long enough in the direction of travel to allow both front and rear wheels of a passenger vehicle to be on top of the table at the same time – typically 10 feet.

Table Top Design Guidelines:

- Raised crossings bring the level of the roadway to that of the sidewalk, forcing vehicles to slow before passing over the
- Raised Crossings also increase visibility of pedestrians and physically slow down traffic allowing pedestrians to cross safely.
- Cobble stone are not recommended on the top, but can be used on the slopes.

Table top Ramp

Safe crossing

Designated crossing space

Clearly marked and wide pedestrian crossing at grade *Copenhagen, Denmark.*

Dedicated signals

Lights and pedestrians crossing wait times. *Copenhagen, Denmark*

Dropped kerbs

Dropped kerbs facilitating easy crossing *Copenhagen, Denmark.*

Medians as stopover

Median provides a refuge while crossing streets. *Copenhagen, Denmark.*

Source: Istanbul Public Space & Public Life, EMBARQ Turkey

Pedestrian Crossings

- Pedestrians must be provided shortest possible direct access to cross and most preferred is at-grade
- Mid block crossings must be provided for active land use across the road
- At-grade crossings must be provided at all T junctions
- Grade separated crossings should be provided at highways

At Grade Signalized Crossings

- Crossings should be wider in high pedestrian demand
- Minimum 3 to 5 mt wide
- Crossings must be outfitted with kerb ramps and tactile warning blocks
- All signals to outfitted with auditory signals as well as pelican signals
- Way finding signage a must for orienting the pedestrians at intersections while ensuring that the signage itself doesn't pose a barrier to pedestrian movement

Zebra Crossing on all four sides prevent people from crossing the road diagonally

Markings at Intersections
Zebra Crossings

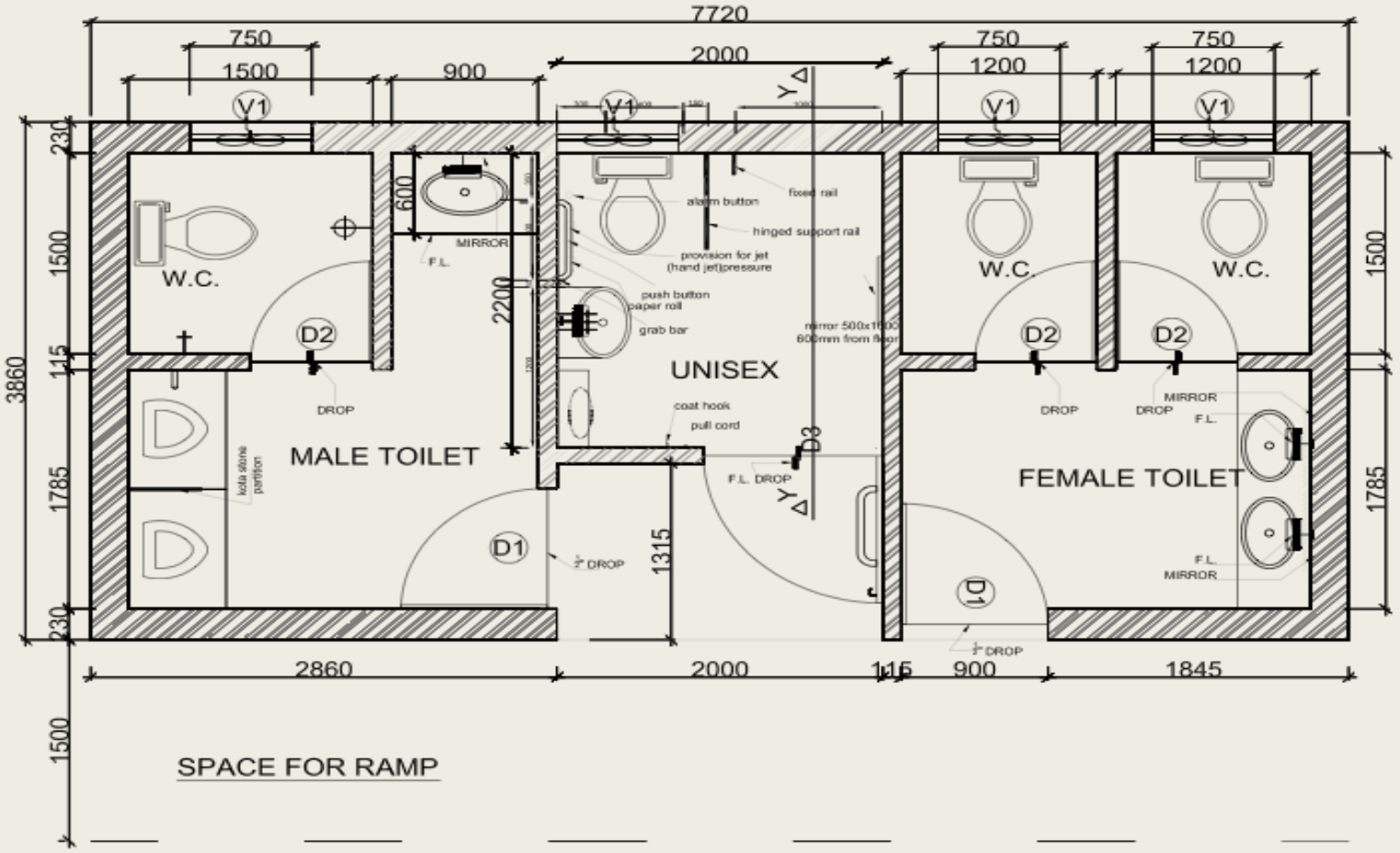
All Intersections must have Zebra crossings on all four sides of the roads for safe passage of the pedestrians. The sidewalks must drop down to road levels by way of flaired kerb cuts.

For dimensions and positioning of pedestrian crossings, IRC: 103-1988 ³Guidelines for Pedestrian Facilities´, may be referred.

Last but not the Least

- Place Dustbins along the sidewalk at regular intervals
- And Provide accessible public Conveniences at regular intervals in-keeping with the spirit of Swatch Bharat initiative
- Plan for Urban Utilities while laying the sidewalks so as to minimize disruptions for their laying as well maintenence

Accessible Toilet/Public Convenience



PLAN

Inside layout of the Accessible Unisex Toilet

Things To be kept in mind while making an Accessible Toilet

- Placement of the inner fixtures like WC and washbasin
- Ample space for transfer from the wheelchair to WC
- Use of retractable grab bars
- Non slip flooring
- Accessible toilet door should always open outwards
- Size 2200x2200 mm or minimum 2000X2200mm

Door Opening

- The Door should be minimum 1000 mm wide
- Should open outwards

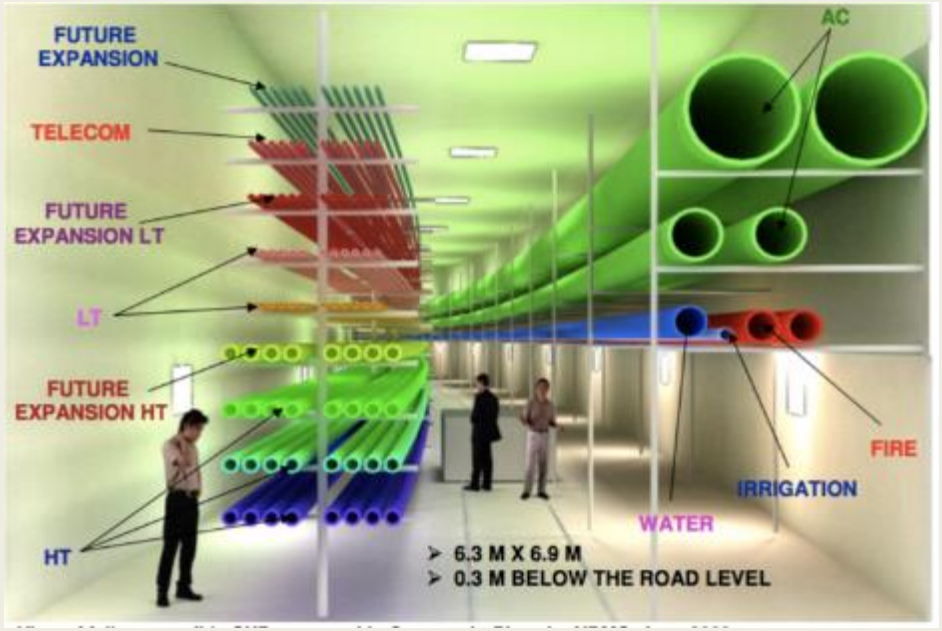
All the Urban Utilities along the BJ Marg Sidewalk need to be relocated

- Storm Water Drains
- Electric Connections for the Bus Stops
- Water line
- Electrical and telecommunication distribution lines
- Gas pipes
- And any other Urban Utility existing or might be required in the near future

URBAN UTILITIES

- Often it is seen once the sidewalk is made some department or the other digs it up to either layout or repair public utilities
- To avoid this ever ongoing practice it is advisable to adopt best practices like developing Common Utility Ducts

FULLY ACCESSIBLE THROUGH ENTRANCE CHAMBERS COMMON UTILITY DUCT AT CONNAUGHT PLACE BY NDMC



In order to cause minimum disruptions during repairs and laying out of urban utilities such as water lines, sewer, electrical and telecom distribution cables , gas pipes, etc. these must be located underground and in some cases over ground in a proper manner.

Material To be Used on Sidewalks, Ramps

Material To be Used on Sidewalks, Ramps

- ❑ Footpath-Anti skid / matt finish tiles, interlocking paving tiles, sandblasted Stone, unpolished Stone

X Polished Stone finishes

- ❑ Kerb ramps- Anti skid / matt finish tiles; Flared sides with tactile paving, exposed Cement Concrete

X Polished Stone finishes

- ❑ Tactile paving-Vitrified unglazed pavers in bright colour contrast to the flooring surface (preferably canary yellow)

X Stainless steel or metal pavers in dull slippery finsh

- ❑ Signage- Bright colour contrast big font signages on non-glare surface- acrylic, metal (fully painted) with retro reflective paints

X Glass, stainless steel, aluminum

- ❑ Bus Stops –flooring Anti skid / matt finish tiles with vitrified unglazedtactile pavers in bright colour contrast to the flooring surface

X Glazed vitrified tiles, Granite, polished Kota stone

Contd…

- ❑ Streetlights-White color, mercury lights- full cut off fixtures

X Yellow light

- ❑ Handrails- Stainless steel 304/316, OD- 40-45mm, scotch-brite or matt finish
- ❑ Table Top- Any load beaaring anti-skid pavers/tiles

X Cobbled stone

- ❑ Table top slopes (on road side)- Cobble stone may be provided

X Polished granite or any other Slippery surface

- ❑ Median refuges- Any load bearing antiskid pavers/tiles

X Cobble Stone

- ❑ Cycle tracks- Preferred Pavement Quality Cement Concrete

X CC Paver tiles and polished finishes

Note: X is Unacceptable, a definite No

Miscellaneous information

Measuring slope

Slope is calculated by computing the ratio of vertical rise to horizontal run. For example, if a ramp 6 inches in vertical height traverses a horizontal distance of **6 feet (72 inches)** then the slope is **6 / 72 = 1 / 12 = 0.083 (8.3%)**. Typically the maximum allowable slope for a ramp is written as **1:12**. To measure the slope, lay one end of a carpenter's level on the uphill side of the ramp, lift the downhill end of the tool to bring it to level (bubble in the middle), and measure the distance between the downhill bottom edge of the level and the ramp surface. See the figure. In this case the slope is **3 inches** rise over **36 inches** horizontal distance or the ratio **of 1:12**.

ACCESSIBLE APPROACH AND ENTRANCE (Exterior Routes)

- People with disabilities should be able to arrive at the site, approach the building and enter the building as freely as everyone else. At least one accessible route should be safe and accessible for everyone.
- Note: An "accessible route" may consist of doorways, ramps, curb ramps, elevators, platform lifts and other walking surfaces with a slope no steeper than 5% (1:20).

THANK YOU

March 2018