Urban Street Design and Development

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CSE Workshop on “Safe Access and Parking” -
Lytton Hotel, Kolkata 16.02.17
Encroachment on footpath

Hawkers & Bus stops

Public Utilities

Cars & Rickshaws
Need for coordinated infrastructure within road space

Sample Image from Hyderabad
Foot over bridge - Failure due to longer walking

Every 2\textsuperscript{nd} death on road is of a pedestrian
Facts!

- About 15% of road users (cars) take up 80% of road space.
- Parking of personal vehicles: Inequity in urban land use

“The overarching objective for parking is to progressively reduce the demand for parking and facilitate organized parking for all types of vehicles”
1. BIOSWALES

- Bio-swales
- Under utilized area under flyovers can be modified for bio-filtration
- Underground utility ducts
ON- STREET PARKING

On- street parking shall not interfere carriageway. Shall be in defined lots.

Street space is a scarce resource. On- street parking shall not be allowed for more than 2 hours. Short- term parking shall be made expensive.

PARKING PRICING AND ENFORCEMENT

Private vehicle Park on a ‘fully-paid, rented or owned’ space, based on ‘user pays’ principle

45% CAR USERS SHIFT TO PT IF PARKING PRICING IS INCREASED BY 500%

Willingness to Pay survey by RITES

Parking pricing worldwide

Indian cities

Source: Colliers International (2011) - CBD daily parking charges (in US $)
2. Non-Signalised High Speed Corridors

Average Peak Hour Speed - 5-10 Km/Hr

Average Off-Peak Hour Speed - 80 Km/Hr

Increased fatality for pedestrians and cyclists
1. Out of scale Infrastructure

Safety of humans, cyclists at risk
Impact and Challenges – Mobility and Safety

**Negative impacts** - air quality, road safety, energy use, affordability, universal accessibility, traffic congestion and demand for precious urban land for parking.

**Challenges of urban mobility** –
Preoccupation with mobility enhancement and infra-structure expansion rather than the realization of accessibility.

- **Strengthen and integrate various modes of transport** which are energy efficient, environment friendly, safe and affordable to the people

- **Walking, cycling, non motorised modes, IPT, public transport modes** (Bus, Metro, trains) together act as a sustainable mobility system.

- **Buses and IPT as fuel consuming and polluting modes need to opt for cleaner fuel or alternate energy source** with governmental support on fiscal matters with system planning and infrastructure design priorities
Challenges of Urban Streets –

Uncontrolled growth of motor vehicles - main cause of increased congestion during peak hours and high fatal accidents during non peak hours.

• **Universal accessibility** - most important safety aspects under inclusive planning approach.

• **Complete neglect for majority of road users** ie pedestrians (including disabled, children, women and elderly people) and cyclists due to widening of carriageway and construction of flyovers with misconceived notion of removing congestion on urban streets.

• **Highway specific design approach** - Neither congestion nor accidents have reduced in any urban area by following.

• **Segregation of traffic and controlling motorised traffic speed** should tackle both congestion and safety on urban streets.

• **Adoption of specific urban street design norms** along with adoption of specified process of planning and development of complete streets will ensure safe, smooth and regulated traffic movement.
Global experience indicates that urban street design and development -

- enhance the safety of vulnerable road users
- increase mass transit and NMT use leading to
- better air quality, low energy use and low congestion on roads benefitting large section of people with better quality of life
2. National Urban Transport Policy

As per Indian National Transport Policy:

“The Central Government would, encourage measures that allocate road space on a more equitable basis, with people as its focus.”
THE PROBLEM

- Traffic accident
- Noise, Vibration, and Air Pollution
- Traffic Speed
- Traffic volume and composition
- Impact on Land Use and Social Stability
- Appearance, Identity, and Maintenance
- Reduction of Street Activities
- Land Use and Social Stability
Integrated Planning and Development Approach

Planning, Development, Management and Inspection of urban roads and streets for - New Cities/towns as well as existing cities and towns (Restructuring and retrofitting)

• Urban Road Network – Close grid network for distribution of traffic over the network

• Urban Roads and Streets – Safe streets and equitable distribution of road space

• Access Management – Inclusive and universal accessibility

• Intersections and Interchanges – Pedestrian/NMT friendly

• Design of Streets – Complete street with provision of all road elements.

• Street Design Process – Preparation, Deliberation and Approval Stages

• Implementation and Management – Construction, audit, maintenance and management
• Pedestrian/NMT friendly streets: Sustainable street design
• Road hierarchy: According to function of road rather than land-use.
• Reservation of road space: 50% of available RoW is to be reserved for non-motorized uses, while 50% is to be reserved for carriage way.
• Priority to public transport: Bus lanes are to be provided in roads up to collector roads.
• Transport Infrastructure: Vehicle oriented flyover and traffic interchanges are to be discouraged on all roads except expressways.

Complete street concept

Order of priority
Existing Challenges

Macro level planning
**TOP DOWN APPROACH:**
- Vehicle- oriented growth
- Urban Sprawl
- Less priority for neighbourhood Development, pedestrians, NMV or cyclists!

**Loosing liveability of cities!**

The chapter discusses different urban road /street network patterns with Network planning principles and strategies for both new as well as retrofitting developments.

Safe mobility for pedestrians, cyclists and NMV users
Planning from neighbourhood level
Pedestrian focused streets

Liveable cities!
Street Zoning and Functions

The Pedestrian Zone
Frontage Zone or Dead Zone
Multi-Functional Zone (MFZ)
Planting Zone
Street Furniture Zone

Street Design Elements

All design elements are not elaborated, but mandatory street elements for different hierarchy of roads to make it active streets are provided in consolidated table.
03A Kerb Ramps*

Kerb ramps provide pedestrian access between the sidewalk and roadway for people using wheelchairs, strollers, walkers, crutches, handcars, bicycles, and pedestrians who have trouble stepping up and down high kerbs. The absence of kerb ramps prevents any of the above users from crossing streets.

Location of Kerb Ramps must align with the Zebra Crossing location and the location of Kerb-ramp on the opposite side.

At Signalized Crossings: Use Kerb Cut- Ramps

Key Design Guidelines:
- Standard kerb ramps are cut back into the footpath (kush 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 strips to be provided on kerb side edge of the slope, so that persons with vision Impairment do not accidentally walk onto the road.
- The ramps should be flared smoothly 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 center 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 should be provided for blocks longer than 250M.

O3E Continuous Pavement

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 move over a gentle ramp to enter the property.

Best Practices Not Preferable

Sidewalks and Cycle Lanes should be regarded as a transportation system which is connected and continuous, just like roadways and railways.

Key Design Guidelines:
- Avoid sidewalk interruptions by minimizing kerb cuts i.e. minimize the number of driveways that cross the sidewalk – in order to support pedestrian safety and a continuous sidewalk.
- Maintain an even surface and elevation of the pavement at 150 MM or less from surrounding road level.
- 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 move over a gentle ramp to enter the property.
- Remove all obstructions from the sidewalks.
- Consistency of design elements, color and texture, help provide visual continuity and calm traffic, even at crossings.

ESSENTIAL GUIDELINES

01E Kerb Radius and Slip Road Treatment

Free left turns: Signal-free slip roads make traffic turn corners at high speeds, making it unsafe for pedestrians and cyclists to cross.

Key Design Guidelines:
- R > 12.0 m (undesirable)
- Current Typical Delhi Road Intersection

Free left turns: Signalized “Left turning pockets” with much smaller corner kerb radii – that ensure Safe, Signalized Pedestrian crossings at junctions.

The maximum turning radius “R” allowed in the modified intersection design is 12 m; with recommended 9.0m for most intersections, especially for R/W less than 30m.

01D Kerb Radius and Slip Road Treatment

Not Preferable

Proposed Modified Intersection Design

Free left turns: Signal-free slip roads here large turning radius which allows traffic to turn at high speeds and provide less visibility making it unsafe for pedestrians and cyclists to cross.

Best Practices

Slip roads may be replaced by Signalized “Left turning pockets” with much smaller corner kerb radii – that ensure Safe, Signalized Pedestrian crossings at junctions.

ESSENTIAL GUIDELINES
Universal Accessibility is required for all sidewalks, crossings, parks, public spaces and amenities — for people using wheelchairs, strollers, walkers, crutches, handcarts, bicycles, aged people, visually or hearing impaired, and pedestrians with temporary mobility impairment or injury.

Key Design Guidelines:
- Audible crossing signals (pelican crossings) help everyone, as well as being essential for persons with vision impairments.
  - Pedestrian traffic lights should be provided with clearly audible signals to facilitate safe and independent crossing of pedestrians with low vision and vision impairment.
  - Acoustic devices should be installed on a pole at the point of origin of crossing and not at the point of destination.
- Tactile paving should be provided in the line of travel avoiding obstructions such as manholes/ tree guards/ lamp posts etc.

Key Design Guidelines:
- A slope of 8% (1 in 12) on footbridge ramps, while a slope of 5% (1 in 20) with appropriate resting places/landings is preferable.
  - Within the underpass, a handrail set 850mm-900mm (Figure 32 & 33) above the walking surface should be provided.
  - To assist visually impaired people, tactile paving/ tile and a colour contrast should be provided at the top and bottom of the flight of steps and these areas should be well lit.
  - Elevator/ lift should be provide on both the entrance/ exits and should have minimum internal dimensions of 1400mm x 1400mm.
- All Lifts to have Braille buttons and audio announcement systems.
Multi-Functional Zones with Planting

- Multi-Functional Zones on a Street may accommodate all functions described in Section 10, 4.10, as well as the following:
  - Tree Planting
  - Planting for Storm Water Management
  - Auto-Hickshaw Stands
  - Cycle-rickshaw Stands
  - Hawker Zones
  - Paik Car Parking
  - Street Furniture
  - Bus Stops
  - Traffic Police Booths, MTNL boxes, fire hydrants, junction boxes, etc.
  - Street lights, pedestrian lights

Main Principles:
- Mobility: Avenue tree plantation is a must on all streets of Delhi in order to provide shade and comfort to pedestrians.
- Ecology: Integrated Natural Drainage Systems
- Safety/Comfort: Native plantation for resistance and water conservation, Tree planting zones with native street trees and plantation are essential for shade, lowering HE and giving comfort to pedestrians. Tree planting zone should be CLEAR of the pedestrian walking zone

Current Situation
- A clear width of 1600 x 1600 must be kept free of concrete, in order to allow access of nutrients to the roots of trees.
- Tree grates allow pedestrians to walk close to trees, without discomfort to either.

Best Practices
- Continuous planting zones are suitable for areas where pedestrian volumes are less and they need to be contained within the walking zone.
- Pedestrian corridor and Utility Easements must be placed separately from the Tree Planting Zone.
- Ideally Utilities should be placed in ducts or duct banks, for easy maintenance.
- For the health of trees and preventing their disruption during utility repairs & other pavement activities, street trees must have the Standard Clearances:

<table>
<thead>
<tr>
<th>Element</th>
<th>Standard Clearance from Tree</th>
</tr>
</thead>
<tbody>
<tr>
<td>Canopy of tree</td>
<td>5 feet</td>
</tr>
<tr>
<td>Pavement or pavement padding</td>
<td>2 feet</td>
</tr>
<tr>
<td>Sidewalk (measured from edge of sidewalk at pavement)</td>
<td>7 feet</td>
</tr>
<tr>
<td>Centerline of street light</td>
<td>20 feet in cities, by type of tree</td>
</tr>
<tr>
<td>Centerline of utility pipe</td>
<td>10 feet</td>
</tr>
<tr>
<td>Extension of cross street light at an intersection</td>
<td>50 feet</td>
</tr>
<tr>
<td>Underground utility pipe or vault</td>
<td>5 feet</td>
</tr>
</tbody>
</table>

Sources: https://www.mstate.gov/transportation/road_manual/Road manuals/4.pdf

Tree Pits and Tree Grates
- Delhi High Court, the city government said on 23 Oct 2009 it would ensure "breathing space" for every tree in the Capital — by keeping a circumference of 4 feet around it concrete-free.
- The assurance came a reply to an HC Petition by which HC has concrete pavements are weakening tree roots, cutting off their water supply. This leads to stiffness of storms uprooting several trees, leading to...

Sample Detail of Precast Concrete Tree Grating.
08A Pedestrian Scale Street Lighting

- Height of Light Pole is a function of Street Width. Narrower the Street Width, lower can be the Lamp Height.
- Expert advice should be taken from lighting engineer for design calculations including for pole height, type of luminaries, etc. for achieving appropriate lighting levels at all parts of the street.

Additional Low Mast Pedestrian Scale Lighting is advised in residential areas.

30 m or narrower streets like local access lanes, alleys and pedestrian pathways can possibly be adequately illuminated with Low mast fixtures alone.

- Tree planting plan and Lighting plans (see also 9A) must be prepared in conjunction - so that tree canopies do not obstruct lighting for road users.
- Under NO CIRCUMSTANCES should the Light-pole placements interfere with the clearance of the main pedestrian walkway of the pavement. Light pole may preferably be located within the tree planting zone.

08A

Source: San Francisco Better Streets Plan

Best Practices

Street Lighting Fixtures also help define the unique character of an area.

Above: A historical neighborhood below: A modern area - both in San Francisco

09A Underground Utilities

Sample Underground Cabling Plan

Drawing Courtesy: Padre-Pacheco Design Associates

Street Design Guidelines © UTTPUC, DEC. 2009

09

Source: UTTPUC

Best Practices

Underground Utilities. Layout Guideline:

British Services

ESSENTIAL GUIDELINES

10 Public Amenity, Hawker Zones, Signage

The Kit of Parts:

- Designated Hawker Zones (10G) must be allowed to locate in areas where pedestrians tend to wait or congregate i.e. street intersections and near bus stops or major civic destinations, public offices, etc.

- X. Public Toilets (10A) should be located near every alternate bus stop and definitely located at each Rapid Transit Station (Metro/BRT). Frequency of location of toilets should be every ~500 - 800 M.

- Y. Bus Stops with Route Maps (10B) must be universally accessible, and located every ~1000-1500 M.

- Z. Auditory Pelican signals (10C) and raised table-top crossings at mid-block or T-junctions, in absence of a full traffic signal.

- Auto and Cycle-Rickshaw Stands (10D) should be provided near bus-stops, within the Multi-Functional Zone.

10A Local Bus Stop

Key Principles:
- Designate - best frequent provision, cleaning and maintenance aspects of the cleanliness of a city.
- All bus stops must be universally accessible.
- Bus Stops should preferably be located within the Multi-Functional Zone - so that they do not interfere with the 1.8 m clear walking space for passing pedestrians at the back.
- Criteria for Placement of Local Bus Stops:

MINIMUM dist. between Local bus stops should be 12 M.

Pedestrian Access:

- House is in direct, separate, integrating street-node.
- Providing clear sight lines of bus stops, for pedestrian safety.
- Features such as benches, tables, etc.

- Accessible traffic signs and symbols.
- A space for the dwell on foot-typical bus stop

- Circles of stop must not interfere with accessibility.

- Visibility:
- Clear signs should not be obstructed by trees, shrubs, etc.
- Where trees, etc. block views, the stop should be moved elsewhere.

- Noise levels should not be excessive for pedestrians.

- Heating/Lighting: Stands should have lighting to reduce maintenance and clear visibility.

- Mobility: Stands should be equipped to accommodate all users.

- Min. 3 m of clear walking space.

- Minimum distance between Local bus stops should be 12 M.

- This Bus Stop is accessible, but Clear 1.8 M Pedestrian Zone has not been left. Moreover, Space at front of bus stop for waiting passengers is highly inadequate.

- Source: UTTPUC

10B

Source: UTTPUC

ESSENTIAL GUIDELINES

10C

Source: UTTPUC

ESSENTIAL GUIDELINES
10B Public Toilets

Key Guidelines:
- Provide public toilets at a distance of every 500 – 800 M (5-8 minute walk) from each other and from any destination.
- Toilets should be located near every alternate bus-stop and at each Rapid Transit Station (Metro/BRT).
- Public toilets should be provided as a combination of general toilets and accessible toilet, where accessible toilets are marked as Multi-use toilet to be used by senior citizens, families with young children and disabled persons.
- Environmental friendly Sulabh Shauchalayas should be built as public toilets as they have the following advantages:
  - They do not smell
  - They consume very little water and are easy to clean and maintain (in contrast to conventional toilets that require at least 20 litres).
  - They have potential to tie up with other community based environmental technologies such as biogas production, etc for heating, cooking, and generating electricity.
  - They provide new employment opportunities for many.
  - Environmentally balanced wastewater treatment based on a duckweed and fish raising (aquaculture) ecosystem that provides economic opportunities for the urban poor.

(Above) Sulabh Shauchalayas

(Right) A public toilet system that incorporates local treatment and water recycling system - providing much needed water for horticulture. Source: Pradeep Subedi Design

10E Dustbins

Key Principles:
- Dustbins – their frequent provision, cleaning and maintenance are key aspects to the cleanliness of a city.
- Dustbins must be provided at each bus-stop and street intersection in order to discourage people from throwing trash on the road.

Key Concepts:
- On Source Separated Dustbins – signage for “Trash type” should be made of graphic symbols – so that even literate people can understand how to use them.
- Private Sector could be involved in manufacturing and maintenance of dustbins in return for the incentive of getting waste for recycling or tax subsidies for times it conducted as a CSR Initiative.

“Graphically explained” Source: Separated Dustbins: Shanghai.

“Graphically explained” Source: Miscellaneous, representative only.

10F Designated Hawker Zones

Key Principles:
- Signage for Wayfinding and Information of Pedestrians and Cyclists are essential for creating a public transport friendly city.
- Signage provides help to pedestrians to navigate the city with ease and safety, and have the following functions:
  - Orientation – Way finding (Street Signs)
  - Availability of Public Transport nearby (Transit Signs)
  - Guiding Right Flow (Traffic Signs)
  - Announcing about City’s specific places or attractions (Information
    Signs)
  - Cosmopolitan (Toilet, dustbin, hawker signs).
- Signs should reinforce the overall character of the specific district and be consistent throughout the city.
- Posts and poles should be arranged to minimize the number and avoid clutter.

Visual Signage is preferable for Amenity and General Information

*Source: San Francisco Better Plan

“See Also: 04”

Street Design Guidelines © UITP ICC, IDEA 2009
The approach of Street design process is to make urban streets ready for multi modal transportation networks that can safely accommodate access and travel for all users.

**Street Design Process**

<table>
<thead>
<tr>
<th>Terms of Reference</th>
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</thead>
<tbody>
<tr>
<td>Stage I: Inception Report</td>
</tr>
<tr>
<td>Stage II: Conceptual Design Options</td>
</tr>
<tr>
<td>Stage- III: “Detail Design of Approved Proposal”</td>
</tr>
</tbody>
</table>

**Type of Surveys**

- Topographic and Landscape surveys
- Land-use surveys
- Survey of pedestrian facilities
- Pedestrian and cyclist movement surveys
- Street vending and activity surveys
- Parking surveys
- Traffic surveys

**Plans Depicting Existing Scenario**

- Proposed Concept plans
- Street Design Review and Finalization
- Detailed design
Chapter

IMPLEMENTATION OF STREET DESIGN

Discussion

Highlights
- Identification of street stretch (Retrofitting)
- Identification of area (New Development)

Topographic and Landscape surveys
Land-use surveys
Survey of pedestrian facilities
Pedestrian and cyclist movement surveys
Street vending and activity surveys
Parking surveys

Concept Plan
- with Proposed sections, circulation and basic line drawings

Street Design Review and Finalization
- Community consultation, Review committee meeting

Cost Estimates and Bill of quantities
Final Detailed Design

Construction Drawing
- Street Implementation Report

Street Tender
- Terms of Reference
- Work zone Management
- Construction and Supervision
## Chapter Overview

**MANAGEMENT OF URBAN STREETS**

**ROAD SAFETY AUDITS**

### Discussion

Out of various aspects for effective management of streets, the chapter highlighted few major components.

Relevance of doing audits. Its importance in effective street design implementation and management.

### Highlights

#### Road Safety audit
- Street Asset Maintenance and Management
- Street Management Authority
- Enforcement procedure and techniques
- Traffic Management and Enforcement
- Disaster Management
- Capacity Building

#### Road Accessibility audit

- Road safety inspection

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**Road Safety Inspection Process**

1. Identify Inspection Team
2. Commence Meeting
3. Site Visit
4. Produce Recommendations
5. Road Safety Inspection Report
6. Road safety inspection
Approach for NMSH

1. Focus on people not vehicles:
2. Increase share of walking and cycling
Need for Street Rejuvenation

Panampanly Streetscape-Kochi

Better walking & cycling infrastructure

Encouragement in use of Metro & Public Transport

M.G. Road- Bangaluru

Hospital road streetscape-Kochi

Better quality of public utilities.
Street Components

- Wide sidewalks
- Cycle lanes
- Street furniture
- Wide pedestrian crossings
- Minimum lane widths
- Planter zones
- Kerb ramps
- Designated Parking
- Smart signals
1.b) Universal accessibility Plan

Source: UTTIPEC Street Design Guidelines

Tactile Paving along footpath

Audible Pelican signal-Delhi BRT

Tactile paving- Delhi BRT

Engineering configuration of floor tactile tiles

Table top crossing-London

Table top crossing-Bogota

Tactile paving on footpath leading to ramp and crossing, BRT Corridor Delhi
2) Landscaping and Place Making Scheme

As part of Kochi Metro Project
3) Junction Redesign

Before

After

NACTO Urban Street Design Guide

Sunset strip, West Hollywood

Before

After
2. Case of Bangalore

Tendersure roads in Bangalore
2. Case of Bangalore

M.G. Road in Bangalore
THANKS