Chapter 17: Road Design for Pedestrians with Disabilities (Kerbs, Crossings, Footpaths)

Introduction

Modern road design must be inclusive and accessible to all users, including people with disabilities. The traditional approach to road infrastructure often neglected the mobility needs of individuals with visual, auditory, or physical impairments. However, the principles of Universal Design and guidelines such as those outlined in the Rights of Persons with Disabilities Act (RPwD), 2016 (India), and international standards like ADA (Americans with Disabilities Act) and ISO 21542, have necessitated a paradigm shift in road planning.

This chapter delves into the critical components of accessible road design — *kerbs*, *pedestrian crossings*, and *footpaths* — with a focus on usability, safety, and independence for people with disabilities. These infrastructural elements should not just be functional but must ensure dignity and equality in access.

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1. Design Philosophy for Accessibility

Universal Design focuses on creating environments that can be accessed, understood, and used by all people, regardless of age, size, ability, or disability. In the context of road infrastructure, this implies:

- Equitable use of pedestrian facilities.
- Flexibility to accommodate diverse abilities.
- Simple and intuitive navigation.
- Low physical effort for usage.
- Perceptible information through multiple sensory channels (visual, tactile, auditory).

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2. Footpaths (Sidewalks)

Footpaths are critical for pedestrian movement and must be designed with the needs of all users in mind.

2.1 Width and Clearance

- Minimum clear width should be **1800 mm** to accommodate two wheelchairs passing each other.
- In constrained urban areas, **1200 mm** is the minimum permissible, but passing spaces must be provided every 25–30 meters.
- Clear headroom of **2100 mm** is mandatory.

2.2 Surface and Texture

- Surfaces must be **firm, level, slip-resistant**, and **non-reflective**.
- Avoid materials that create glare or uneven surfaces (e.g., cobblestones).
- Tactile Ground Surface Indicators (TGSIs) must be installed:
  - **Warning tiles** (e.g., truncated domes) at intersections.
  - **Directional tiles** to guide the visually impaired.

2.3 Gradient and Cross-Fall

- Longitudinal gradient should not exceed **1:20** (5% slope).
- Cross-fall (side slope) should be limited to **1:50** to avoid imbalance in wheelchairs.

2.4 Obstructions and Hazards

- Street furniture (e.g., poles, benches, trees) should be placed outside the minimum clear path.
- Any unavoidable obstacle should have a **contrasting color base** or be detectable by a cane.
- Overhanging signs or tree branches must not encroach into head clearance.

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3. Kerbs and Kerb Ramps

Kerbs often act as barriers for wheelchair users and must be carefully designed to facilitate smooth transitions.

3.1 Kerb Height

- Maximum height should be **150 mm**, but ideally **100 mm** or less.
- At crossings, kerbs must be **flush** or provided with ramps.

3.2 Kerb Ramps

- Must be provided at **every pedestrian crossing, bus stop**, and building entry.
- Gradient should be no steeper than **1:12** (8.33%).
- Minimum width: **1200 mm**.
- Must have **tactile indicators** at the top and bottom to warn visually impaired users.
- Should include **flared sides** if adjacent to foot traffic.

3.3 Detectable Warnings

- Contrast in color and texture at ramp transitions.
- Use of tactile paving to warn of vehicular areas or steps.

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4. Pedestrian Crossings

Crossings must enable people with disabilities to traverse roads safely and confidently.

4.1 Location and Geometry

- Should be aligned with **natural pedestrian desire lines**.
- Crossings should be **at right angles** to the kerb wherever possible.
- Raised pedestrian crossings preferred at local streets to slow down vehicles.

4.2 Signalization and Controls

- **Audible signals** (beeping sounds) for visually impaired users.
- **Tactile push buttons** with Braille instructions and LED lights.
- Countdown timers and **visual cues** for all users.

4.3 Surface Design

- Use of **anti-skid materials**.
- Contrasting colored paint for zebra markings.
- **Tactile paving** to indicate beginning and end of crossing.

4.4 Refuge Islands

- For wide roads (more than 10 meters), **refuge islands** must be provided.
- Minimum width: **1500 mm** to accommodate a wheelchair or mobility device.
- Tactile paving must be installed on both entry and exit sides.

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5. Additional Accessibility Features

5.1 Wayfinding Aids

- **Directional signage** in large fonts and contrasting colors.
- **Braille maps**, tactile route models in major public areas.
- Integration with **digital navigation aids** (e.g., Bluetooth beacons for blind users).

5.2 Lighting

- Uniform, glare-free lighting on footpaths and crossings.
- **Illumination level**: At least **20 lux** on pedestrian paths.

5.3 Drainage

- Footpaths and ramps must include **adequate drainage** to prevent water-logging.
- Use of **slot drains** over open surface drains.
- Covers for manholes must be flush with the surface.

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6. Maintenance and Audit

6.1 Regular Inspection

- Accessibility features must be maintained regularly.
- Immediate repair of damaged tactile indicators, kerb ramps, or uneven pavements.

6.2 Accessibility Audit

- Conducted periodically using universal design checklists.
- Involve user groups including persons with disabilities during audits.

6.3 Temporary Disruptions

- Construction sites should provide **alternative accessible routes**.
- Use of **audible alerts**, barriers, and signage for detours.

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7. Legal and Regulatory Framework (India-Focused)

- **RPwD Act, 2016**: Mandates accessibility in public infrastructure.
- **Harmonised Guidelines and Standards for Universal Accessibility in India (2021)** by MoHUA.
- **National Building Code (NBC) 2016**, Part 3: Development Control Rules.
- **IRC Guidelines**:
  - IRC:103-2012 (Guidelines for pedestrian facilities)
  - IRC:104-2012 (Guidelines for wheelchair-accessible facilities)

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8. Inclusive Bus Stops and Transit Interfaces

Public transport access is a key part of road infrastructure. Ensuring that bus stops are accessible allows people with disabilities to fully participate in civic life.

8.1 Bus Stop Placement and Design

- Should be integrated into **continuous accessible footpaths**.
- Shelters must provide **seating with armrests**, **minimum 1800 mm turning radius** for wheelchair users.
- Entry to shelters should be **step-free**, with **non-slip surfaces**.

8.2 Bus Boarding Interface

- **Raised platforms (curb height: 300–350 mm)** to reduce vertical gap between bus and footpath.
- Provide **ramps or kneeling buses** to accommodate boarding by wheelchair users.
- Use **audible bus arrival announcements**, route number in **large fonts**, and Braille identifiers at bus stops.

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9. Traffic Calming Measures for Safer Pedestrian Movement

Traffic calming helps protect vulnerable users like those with disabilities by reducing vehicle speeds.

9.1 Raised Crosswalks

- Flat-topped speed tables functioning as pedestrian crossings.
- Surface should contrast with the road using **colored paving or thermoplastic paint**.
- Must have **tactile warning tiles** on both sides.

9.2 Chicanes and Neckdowns

- Chicanes slow vehicles by introducing lateral shifts.
- Neckdowns (bulb-outs) **shorten crossing distance** and improve visibility for pedestrians.

9.3 Speed Bumps and Rumble Strips

- Avoid abrupt humps that cause discomfort for mobility-impaired users.
- If rumble strips are used, they must not interfere with **wheelchair wheels or canes** — smoother versions preferred in pedestrian spaces.

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10. Technology Integration for Enhanced Accessibility

Smart city elements can dramatically improve navigation and safety for disabled pedestrians.

10.1 Smart Crossings

- Use **adaptive traffic lights** that extend crossing time when sensors detect slower movement.
- Integrate **Bluetooth Low Energy (BLE) beacons** to guide blind users via smartphones.

10.2 Accessible Navigation Apps

- GPS-based apps like **Seeing AI**, **Aira**, and **RightHear** can guide users using voice.
- Must be supported with a **digitized accessible infrastructure map** maintained by municipal bodies.

10.3 RFID and NFC Tags

- Placed at kerbs, signals, and footpath entries to communicate information like direction or obstacle warnings to visually impaired users.

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11. Special Considerations for Specific Disabilities

Not all disabilities have the same accessibility needs. Tailored design considerations are necessary.

11.1 Visually Impaired Users

- **Tactile paving** with specific layout rules (e.g., direction bars vs. warning domes).
- Minimized visual clutter and well-maintained guide rails.

11.2 Hearing-Impaired Users

- Reliance on **visual cues**, LED-based pedestrian lights.
- **Vibration-based notifications** or visual timers at crossings.

11.3 Mobility-Impaired Users

- Adequate resting spaces every 50–75 meters.
- Avoid gravel or grassy areas on key paths.
- Ensure **flat transitions** at every intersection and ramp junction.

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12. Urban Retrofitting for Accessibility

Most cities have legacy infrastructure. Retrofitting for accessibility is often more challenging than designing afresh.

12.1 Prioritization and Mapping

- Use GIS-based tools to **identify barriers** and prioritise high-use pedestrian zones.
- Engage **persons with disabilities** in walkability audits.

12.2 Cost-Effective Retrofitting Measures

- Installing **portable ramps** at high-footfall locations.
- Replacing steep kerbs with **modular kerb ramps**.
- Repainting faded tactile tiles or crossing marks with **contrasting paints**.

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13. Role of Stakeholders in Accessible Road Design

Designing accessible roads isn't just a technical issue—it involves collaboration among multiple stakeholders.

13.1 Urban Planners and Engineers

- Must be trained in universal design principles.
- Use **inclusive design checklists** during planning approval.

13.2 Local Governments and Municipalities

- Responsible for enforcing **accessibility codes** in public projects.
- Should establish **grievance redressal portals** for reporting access barriers.

13.3 Community and Disability Advocacy Groups

- Involve disabled individuals during pilot testing of new infrastructure.
- Support **public awareness drives** on respecting accessible infrastructure (e.g., not blocking tactile paths).

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14. Case Studies: Accessible Road Projects

14.1 Chennai Smart Streets Initiative

- Integrated tactile paving, wheelchair ramps, and widened footpaths across central areas.
- Used **tactile maps** and **Braille signboards**.

14.2 Delhi's Connaught Place Redevelopment

- Realigned kerbs, made footpaths continuous, and added auditory signals at major intersections.
- Ongoing audits conducted with NGOs.

14.3 Global Example: London's Inclusive Streets

- Advanced **wayfinding signage**, **hearing loops**, **real-time accessibility data** integrated into apps.
- Enforcement of fines for parking on pedestrian paths.
