Chapter 22: Accessible Indian Cities (Delhi Metro, Bengaluru Airport)

Introduction

Urban infrastructure must serve *all* citizens, including those with disabilities, the elderly, children, and others with limited mobility. The principles of **Universal Design (UD)** aim to make public spaces inclusive, equitable, and usable by everyone. In India, although many urban areas are still catching up in terms of accessibility, cities like **Delhi** and **Bengaluru** have taken significant strides through flagship infrastructural developments like the **Delhi Metro** and the **Kempegowda International Airport** (Bengaluru Airport).

This chapter explores how these two urban infrastructures have incorporated accessible design features, the standards they follow, and how civil engineering plays a pivotal role in achieving these inclusive goals.

22.1 Delhi Metro: A Model of Accessible Mass Transit

The **Delhi Metro Rail Corporation (DMRC)** is among the first Indian urban transit systems to integrate accessibility from its early phases. The system serves over 2 million passengers daily and has set benchmarks for accessibility in public transport.

22.1.1 Accessible Infrastructure Features

a) Station Design

- **Step-free Access**: All stations have ramps, wide entry gates, and elevators to facilitate easy access for wheelchair users and the elderly.
- **Elevators**: Strategically located elevators connect street level to platform level. Buttons are at accessible heights and include Braille markings.
- **Tactile Paths**: Yellow tactile tiles run through station floors, guiding visually impaired users from entrance to ticket counters and platforms.

b) Ticketing & Entry

- **Low-height Ticket Counters**: Special counters are built at lower heights for wheelchair users.
- **Smart Card Readers**: Automatic Fare Collection (AFC) gates include wide gates that open longer and are suitable for users with mobility aids.
- **Help Points**: Intercom and help stations are present at all levels.

c) Platform and Train Access

- **Platform Gap Minimization**: The platform-train interface is designed to be minimal, enabling easier boarding.
- **Wheelchair Spaces in Coaches**: Reserved areas for wheelchairs inside select coaches.
- **Announcements**: Both **audio** and **visual** announcements aid persons with hearing or vision impairments.

22.1.2 Technological Innovations

- **Mobile Apps**: Apps provide route maps, accessible facilities, and elevator status updates.
- **Real-time Information Systems**: Display screens and audio systems are synced for station and train updates.

22.1.3 Maintenance and User Feedback

- **Routine Inspections**: Accessibility features undergo regular maintenance.
- **Grievance Redressal**: DMRC includes feedback mechanisms for users to report issues with accessibility.

22.2 Kempegowda International Airport, Bengaluru: Accessible Air Travel Infrastructure

The **Kempegowda International Airport (BLR Airport)** has set international standards in accessible infrastructure among Indian airports. It is managed by Bangalore International Airport Limited (BIAL), which has adopted a **Barrier-Free Airport Policy**.

22.2.1 Accessible Terminal Design

a) Approach & Entry

- **Drop-off Zones**: Dedicated accessible parking and drop-off areas are located close to terminal entrances.
- **Ramps and Pathways**: Gentle gradient ramps with handrails ensure ease of movement for wheelchairs and assistive walkers.

b) Inside the Terminal

- **Wide Corridors**: All walking paths are sufficiently wide and obstruction-free.
- **Tactile Flooring**: Tactile indicators guide visually impaired persons from entry to check-in counters and boarding gates.

- **Accessible Washrooms**: Special restrooms equipped with handrails, lower sinks, and emergency pull cords are available throughout.

c) Elevators and Escalators

- **Elevators with Braille and Audio Alerts**: Elevators have Braille-marked buttons and voice announcements.
- **Escalator Signage**: Clear pictorial and high-contrast signage informs users of direction and use.

22.2.2 Passenger Services

a) Wheelchair Assistance

- **Pre-Booking & On-Request**: Wheelchair assistance is available for both domestic and international travelers, via pre-booking or on arrival.
- **Trained Staff**: Specially trained personnel assist passengers with mobility needs during boarding, immigration, and baggage collection.

b) Communication Aids

- **Visual Paging**: Displays show real-time flight information and gate changes.
- **Assistive Listening Systems**: Available at select service counters for hearing-impaired passengers.

22.2.3 Inclusive Policies

- **Barrier-Free Policy Implementation**: Ensures all service providers within the airport ecosystem comply with accessibility standards.
- **Feedback Loops**: Accessibility audits are conducted, and feedback from persons with disabilities is integrated into ongoing upgrades.

22.3 Civil Engineering and Accessibility Integration

In both the Delhi Metro and Bengaluru Airport, civil engineers play a foundational role in creating accessible environments. Their responsibilities include:

22.3.1 Planning and Design

- Integrating **Universal Design principles** at the planning stage.
- Ensuring **structural compatibility** with accessibility features (e.g., elevator shafts, non-slippery floor gradients).

22.3.2 Material Selection

- Use of tactile tiles, non-slip floorings, and durable materials that support mobility aids.
- Selection of materials that offer **high contrast and visibility** for better navigation.

22.3.3 Implementation and Construction

- Precise **ramp gradients** (1:12 slope as per CPWD and NBC guidelines).
- **Doorway widths** and passage clearances suitable for wheelchairs (minimum 900 mm).
- Installation of handrails at specified heights and clearances.

22.3.4 Collaboration with Accessibility Experts

- Coordination with **architects, disability consultants**, and end-users during audits and walk-throughs.
- Inclusion of user testing for feedback on facilities before final commissioning.

22.3.5 Compliance with Standards

- Following national standards like the **National Building Code (NBC)** of India, **Rights of Persons with Disabilities Act, 2016**, and international standards such as **ADA (Americans with Disabilities Act)** and **ISO 21542**.

22.4 Challenges and Opportunities

Challenges

- Retrofitting old infrastructure without affecting existing systems.
- Inconsistent implementation across stations/terminals.
- Limited public awareness and usage of accessibility features.

Opportunities

- Replicating these models across Tier 2 and Tier 3 cities.
- Using **smart technology** (e.g., AI-based wayfinding apps) for personalized assistance.
- Training programs for staff in disability etiquette and assistance.

22.5 Case Studies: Real-Life Experiences of Users

Understanding how accessible infrastructure impacts actual users helps reinforce the value of universal design. The following case studies highlight experiences from different user groups.

22.5.1 Case Study 1: Visually Impaired Commuter in Delhi Metro

User: Ramesh Kumar, 27, visually impaired software engineer **Experience:** Ramesh uses the Delhi Metro daily from Rajiv Chowk to Noida Sector 18. He follows the tactile flooring from the entry gate to the train platform with minimal external assistance. The platform-edge warning tiles help him stay safe while waiting for the train. Audio announcements inside the train help him track his journey. **Challenge:** At interchange stations, the absence of continuous tactile paths creates disorientation. **Impact:** Overall, Ramesh feels independent and empowered, with occasional navigational challenges.

22.5.2 Case Study 2: Wheelchair User at Bengaluru Airport

User: Anita Rao, 52, wheelchair user due to arthritis **Experience:** Anita regularly travels for medical tourism coordination. Bengaluru Airport offers pre-booked wheelchair assistance, with priority check-in, security, and boarding. Staff are trained and communicate respectfully. **Challenge:** Crowding near baggage claim areas can make movement difficult. **Impact:** She finds the airport more accommodating than most public spaces in India.

22.6 Guidelines and Standards Followed

Both Delhi Metro and Bengaluru Airport adhere to national and international accessibility standards.

22.6.1 National Standards

- **NBC 2016 (National Building Code)** – Chapter on "Requirements for Accessibility in Built Environment"
- **CPWD Guidelines 2014** – Handbook on barrier-free design
- **RPWD Act 2016** – Legal mandate to provide accessibility to all

22.6.2 International Benchmarks

- **ISO 21542:2011** – Building construction – Accessibility and usability of the built environment
- **ADA Standards (U.S.)** – Influence on tactile systems, ramp slopes, and elevator design

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22.7 Role of Civil Engineers and Planners

Civil engineers act as agents of inclusivity in the built environment. Their involvement spans:

22.7.1 Accessibility Audits

Engineers conduct site surveys to check compliance of ramps, signage, floor surfaces, and toilet facilities with accessibility norms. Audit reports recommend improvements in the built infrastructure.

22.7.2 Inclusive Planning

Collaboration with architects and urban planners is essential to ensure that elements like:

- Signage,
- Corridors and queuing areas,
- Resting spots,
- Emergency evacuation routes . . . are usable by all.

22.7.3 Retrofitting Legacy Infrastructure

Many older buildings/stations/terminals lack accessibility. Engineers need to:

- Add lifts where none exist,
- Create new ramps or modify existing ones,
- Expand restrooms for wheelchair users.

22.8 Innovations in Accessible Design

Urban infrastructure is evolving with technology and smart city concepts. Future-ready accessibility includes:

22.8.1 Smart Navigation Systems

- **Beacons and GPS-based apps** to guide persons with disabilities inside terminals and metro stations.
- **Voice-controlled kiosks** for ticketing or information.

22.8.2 Sensor-based Automation

- **Automatic doors and ramps** using motion detection.
- **Smart elevators** that can recognize visually impaired users through RFID tags or voice commands.

22.8.3 Wearable Accessibility Devices

Collaboration between infrastructure and devices like:

- **Smart glasses** that read signs aloud.
- **Vibrational navigation belts** guiding the visually impaired.

22.9 Comparative Global Practices

To benchmark India's progress, consider the following examples:

City	Infrastructure	Accessibility Features
London	Underground Metro	Platform gap bridges, accessible turnstiles, visual/audio alerts
Tokyo	Narita Airport	Braille maps, multi-sensory guidance, tactile handrails
New York	MTA Subway	Elevator priority system, talking ticket machines, low-floor buses

Takeaway:

While Delhi and Bengaluru are advancing accessibility, full parity with global systems requires:

- Broader implementation,
- Greater user involvement,
- Stronger enforcement of accessibility laws.

22.10 Future Directions for Indian Cities

For future civil engineering and planning projects, some recommendations include:

1. **Accessible-first Urban Policy** – Mandate UD principles in city planning authorities.
2. **Multi-modal Integration** – Seamless accessibility from bus to metro to airport, including footpaths.
3. **Citizen Co-Design** – Include persons with disabilities in design reviews.
4. **Green + Inclusive Design** – Sustainable and accessible features should go hand-in-hand.
