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Accessibility and Inclusivity in Railway Station Design

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Abstract- **Public transport infrastructure access and inclusion are essential components of permanent urban development. Being a railway station, high-traffic public interfaces, all users must be designed to meet the needs, including people with disabilities, elderly, children and temporarily injured persons. This paper examines the inclusive design principles in railway stations, evaluates national and international standards, and presents two case studies - Gandhinagar Capital Railway Station (India) and London Kings Cross Station (UK) - describes the best practices. The paper ends with practical recommendations and a counseling structure to guide the development and retrofitting of universally accessible stations.**

I. INTRODUCTION

Railways make the backbone of public transport networks. While their primary purpose is to support efficient transit, they also reflect the inclusion of a city or nation. In fact, Sulabh railway station ensures that every passenger can move through space independently, safely and with dignity regardless of physical or cognitive ability. Historically, many railway stations were built without considering the diverse requirements of users. Modern inclusive design is beyond basic legal compliance, which aims to remove obstacles and create environment that are usable by all. This paper focuses on understanding challenges, evaluating current practices and providing actionable solutions for inclusive railway station design.

- *EXAMPLES*

1. Pedestrians reach Site 2. Parking vehicle parking near the main entrance gate 3. Desk, lift and toilet compartment 13 for persons with disabilities. Easy, clear and accessible means of Ingress 14. Huge lift 15. Safe stairs that are easy to use, and provide safe aided withdrawal/ rescue in emergency. Maneuvering Space 19. Easy operation of sufficient height, location and control and switch 20. Good light 21. Good views of walls, floors, doors and signage 22 opposite. Good signage 23. Important information is transmitted through two senses or more (touch, audible and visual). 24. Good sounds 25. Hearing Enhancement System 26. Management and maintenance of maintenance.

II. RULES AND REGULATION

- *SITE PLANNING*

The Neberhood Site Planning Walk will ensure the location of features within competent distance or create a specified route to reach various features for all. In addition to ensuring access to all the premises, railway stations, roads or large -scale urban development with various disability, there is a need to consider the special needs of children, women, families, elderly. Attempts should be made to reduce the level of ambient sound/ noise to create sound evidence as possible to sites or complexes. This enhances communication possibilities for people with hearing and speech loss with other diverse user groups such as elderly, etc.

- *SITE ENTRANCE*

Each manufactured environment is usually approached by an outer site entrance, before reaching a building entrance. It is important to design for universal access on each site, considering the width of the gate, safety counter heights, shelter drop of spaces, clearly demarcated waiting areas, adequate lights, adequate lights and connectivity with walking routes. The needs of individuals with disabled and other diverse user groups should be considered, while as the plan and design plan is shown in fig: 1 and fig: 2.

Fig: 1

Fig: 2

This includes the presence of various characteristics such as:1. Site map with braille / tactile features along with appropriate wayfinding signage shall be part of the site entrance to aid ease of mobility for all. 2. Clear pedestrian access with inclusive features for wheeling devices such as wheelchairs, rollators, baby strollers, baggage trolleys, etc. 3. TGSIs from the point of entrance independently and safe access to the site. 4. Low height counter windows for interaction with security personnel 5. Site entrances must be designed with adequate color contrast for legibility in context with the surrounding environment. For e.g., Mentioning Gate nos. on a site with multiple entries aids people to minimize effort and provides access. 6. Safe parking and waiting zones with adequate street furniture must be an integral part of site entrances to ensure safety for women, children, elderly, and persons with disabilities.

Fig :3 Parking space requirements for adapted shooter

- *PARKING*

Sulabh parking refers to adequate parking for individuals with in-built environment on all scales, etc. various disabled and weak user groups, such as elderly, etc. Relevant, it will include parking for customized scooters, tricycles, cars or any other individual vehicle system, which is adopted by a person with disabilities to reach the building premises.

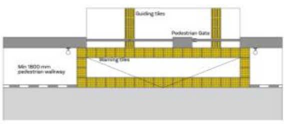

Fig: 4

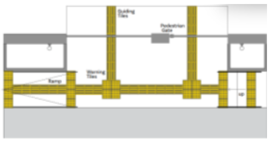

Fig: 5

Parking for customized scooters, tricycles or other individual dynamics devices (in two-wheeler) should be adopted by the following access measures for reserved parking bay, with a minimum bay size of 3000 mm x 2400 mm. 2. Sulabh car parking bay will have a minimum size of 5000 mm × 3600 mm, which is an inclusive of 1200 mm wide side transfer zone. This will also ensure enough space for rear transfer of persons with disabilities especially with wheelchair users. 3. When two accessible bezes are adjacent to each other, the 1200 mm side transfer bay can be shared by two parking bays.

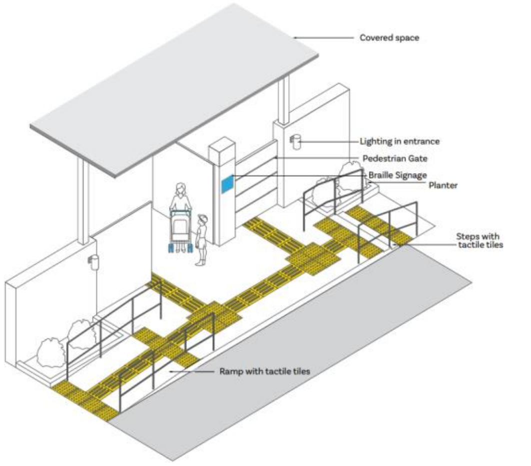

Fig:6 3D view of entrance point with ramp and tactile tiles

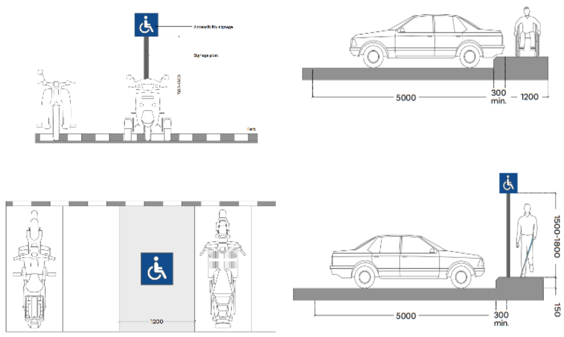

Fig :7 parking for all types of groups and proper dimensions with singes for easy to accessible.

- *ACCESS ROUTES / WALKWAYS*

Access root and walkway define the dynamics of a site or manufactured environment. In simple terms, walking passage or passage is one of the important elements that allow diverse user groups to reach them to make sites socially inclusive. To make them universally accessible, the following recommendations will need to be followed.

Fig:8 &9 Accesses route in outdoor landscape

- *WIDTHS AND HEIGHTS*

1. Minimum Walkway width will be 1200 mm. However, they should be 1800 mm wide for two-way traffic. In extraordinary cases (such as around trees/poles etc.); The recommended clear width can

be 1500 mm. 2. The walkway should not have a shield of more than 1:20. It also refers to crossing the slope. 3. For walking more than 60 meters in length, the locations that relax with road furniture will be provided in each 30 meters length. The seating height should be between 450 mm -500 mm, a backrest and hand rests at a height of 700 mm. 4. The minimum clear height of the covered walkway will be 2200 mm. 5. Grab rail from both sides will be provided with access routes or walking trails, where the area of the land is slope or uncontrolled. Grab rail in opposite colors will be fixed at two levels between 700 and 900 mm.

- *LIGHTING, ILLUMINATION AND SIGNAGE*

1.Walkways should be well enlightened to ensure sufficient visual opposite and uninterrupted routes for all. Light fixtures should be provided not exceeding the height of 4 meters from the ground level. This will increase access to low vision persons. 2. If the intensity of light of light stability increases, the height of increasing stability from the ground level can also be increased, to provide optimal light level 3. The light pole can be preferably located within the tree-plateful area. 4. Light poles of the lower level are preferred to avoid shade where there are high trees. 5. Universally accessible Synthes will be provided with access routes for ease of navigation using pictograms for various public facilities in the environment created. 6. For access routes over 60 meters, the direction signal with distance will also be first provided to visitors or individuals to enable individuals with diverse capabilities and better oriented their dynamics.

- *LEVELS, GROOVES AND GRATINGS*

Level changes in built environments, grooves in construction systems and gratings as drain covers, etc. form an integral part of infrastructure systems. The role of such elements is crucial for functional purposes, such as segregating functional areas, covering undulating terrains, accommodating material changes, responding to drainage or other underground services, etc. It is however expected that they should not become access barriers to persons with special needs, wheeling devices or with diverse abilities.

1.1 Levels

Vertical level changes up to 6 mm may not need edge treatment to pass over them using wheeling devices like wheelchairs, baby prams, etc. 2. Level changes between 6 mm and 15 mm should be levelled off with a slope no greater than 1:2. Other details for level changes and gradient shall be as per Table 3.2 given below. 3. People with low vision, the elderly, expectant mothers or walking individuals on their mobile phone, may trip over level changes if not legibly contrasted and well illuminated. 4. Level changes shall have to be marked with a contrasting color strip, preferably through a contrasting flooring material itself. However, as a retrofitting measure contrasting color strips may be installed over the edges.

1.2 Grooves

Grooves in flooring either as expansion or construction joints or for other purposes of retrofitting need to be well covered to ensure that either they are well covered to ensure smooth access for all. 2. If not well identified, they may cause people to trip over. It is therefore recommended to provide adequate visual contrast for the same. 3. In case the grooves are temporary and cannot be covered for the entire length, an access path should be created to manage the same.

1.3 Gratings

Gaps in gratings and walking surfaces should not be more than 12mm in width and be placed such that their length is perpendicular to the dominant direction of travel. This will help prevent wheels (of wheelchairs, baby prams, baggage trolleys, etc.), walking sticks and heels from getting caught in the gaps. 2. Alternately, perforated gratings in stone or steel finish could be installed. 3. Manholes, gratings and drains should preferably be located to the side of the walkway and levelled with the ground surface. They should not be located at the center of the path as they may become tripping hazards. 4. Grating should be flushed with finished ground or floor level. 5. Drain covers should be made of materials that are non-slip in both wet and dry conditions. Metal chequeen plates, which tend to be slippery when wet, should be avoided. 6. Where possible, gratings should be located outside the minimum clear width of the outdoor recreation access route.

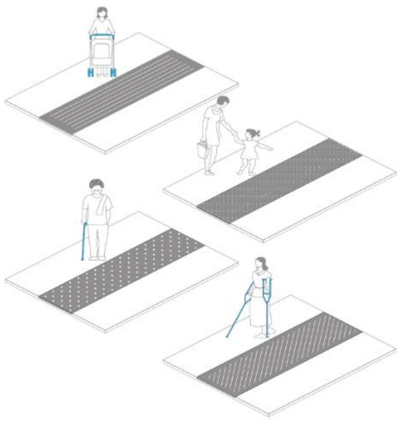

Fig:10Accessible street grating typology

Fig:11 Accessible grating details

1.4 Kerb ramps

1. can typically be of four types viz. a. With flared sides b. With returned or continuous kerbs c. With built up or extended kerbs and d. With parallel kerbs. 2. Are provided preferably for kerb heights up to 200 mm. Kerbs higher than 200 mm may pose challenges to safe slopes for persons using wheelchairs, etc. 3. The surface finish should be slip resistant 4. Should be designed not to allow water accumulate on the walking surface; 5. Do not require handrails 6. Should not project into the road surface as they may pose a danger to users and an obstruction to vehicles 7. Edge surfaces have to be completely level with the road. 8. Should be located or protected to prevent obstruction by parked vehicles; 9. Should be free from any obstruction such as signposts, traffic lights, etc.

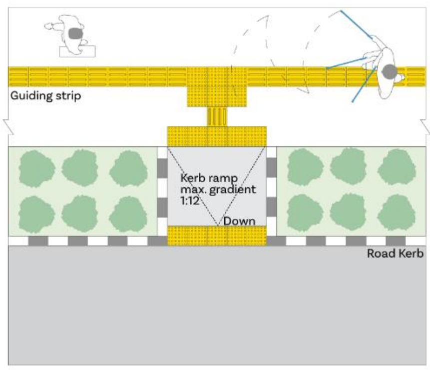

Fig :12 Accessible kerb ramp

III. CASE STUDIES

1. Gandhinagar Capital Railway Station, Gujarat, India

Opened again in 2021, the Gandhinagar capital station was designed as a model for modern, inclusive and green public infrastructure. Major inclusive features: - Barrier-free access: lifts, ramps, and escalators connect all levels. - touch flooring: Percey indicators for visually impaired travelers throughout the station. -Adio-Visual AIDS: Real-time digital signboard and announcements in many languages. - Wheelchair-accessible features: Toilets, counters and ticketing systems were designed at optimal altitudes for easy use. - Wide Corridor: Designed to facilitate smooth wheelchairs and stretcher movement.

Impact:

- The station has set a benchmark for future developments across India.
- Accessibility features have significantly improved user satisfaction and reduced dependence on support staff.

2. London King's Cross Station, United Kingdom

As one of the busiest railway hubs in the UK, Kings Cross renewed a major renewal between 2007 and 2012, including universal design principles. Major inclusive features: - Step-free access: All platforms are accessible through lift and ramp. - Hearing Loops: Installed at ticket counters and help the desk for hearing-baby users. -Rial-time digital signage: Displays on strategic points with high-opposite audio alerts. - Sulabh Toilet: Located at the station with child care and adult changing features. - Staff Training: The from line staff is trained in the use of accessibility assistance and mobility AIDS. Effect: - Recognized as one of the most accessible railway stations in Europe. - Strong integration of technology with human-centric design has determined global design standards.

3. Consultation & Design Recommendations

User-Centered Approach:

- Engage stakeholders such as disability rights groups, elderly communities, and transport planners during the design phase.
- Conduct accessibility audits and user testing before and after construction.

Design Recommendations:

- Minimum 1:12 gradient ramps and wide corridors (min. 1.8m).

- Tactile paving leading from entrance to platforms and key facilities.
- Visual contrast in floors and walls for low-vision users.
- Real-time information with voice and visual prompts.
- Provision of quiet rooms and sensory-friendly zones.
- Emergency systems with visual and auditory alarms.

Policy & Regulation Alignment:
- Follow national standards like India's Harmonized Guidelines (2021) or international ones like ADA (USA) and BS 8300 (UK).

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