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Design and Implementation Guide

People with Disability Inclusive Urban Transport Infrastructure | Summary

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HVT055-SE012 – Mekelle University

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1. Introduction

1.1 General

Mekelle, which is the capital city of Tigray, is the second largest city in Ethiopia after Addis Ababa. In Mekelle, urban planners, designers and administrators tend to prioritise vehicular traffic. This means the needs of pedestrians, especially those with disabilities, are neglected. Current law enforcement and design guidelines are insufficient to address the barriers people with disabilities face in the transport system. These challenges include difficulties for wheelchair users in accessing public transport, non-existent, narrow or poorly designed and managed sidewalks, missing or inadequate curb ramps, inaccessible buildings and a lack of signage and information.

Limited research works on the safety and mobility of people with disabilities in the city is making it difficult to identify challenges and develop suitable, inclusive, and sustainable transport solutions. To address this gap, Mekelle University - as part of UK AID's High Volume Transport Applied Research Programme (HVT) - has conducted research to explore the challenges of the existing transport system for people with disabilities and propose possible solutions.

This document is a summary of a full guide, which can be accessed at transport-links.com. It outlines the safety and mobility challenges for people with disabilities in Mekelle city, highlighting the research findings and providing design and management guidelines for urban transport infrastructure based on the research findings and international best practices.

1.2 What is the purpose of this guide?

This document – and the detailed guidelines – provide a guide for developing disability inclusive urban transport infrastructure in cities of low income countries (LICs). While this document does not provide all design approaches and principles for disability inclusion in the transport sector, urban planners and designers in LICs can use the design principles and recommendations to create more accessible urban transport infrastructure for people with disabilities.

1.3 What is this guide based on?

This guide is based on the inputs obtained from the research work undertaken in Mekelle city by Mekelle University. It incorporates best practices on pedestrian accessibility and disability inclusion from other countries.

1.4 Who should use this guide?

This guide is for use by anyone who is involved in planning, designing, and installing or improving public transport and building infrastructure. This includes policy makers, city authorities, road and transport agencies, urban planners, contractors, consultants, and practitioners in civil works. The design principles incorporated here in this guide apply to both new and retrofitting urban transport infrastructure works.

2. Highlights to research findings

2.1 Introduction

People with disabilities have the right to inclusive, integrated and accessible transport infrastructure and services that meet their needs. However, in urban areas, these people usually face a number of barriers that affect their safe mobility to opportunities and enjoy their lives. Challenges of people with disabilities in urban areas should be assessed and tailor-made or city-specific solutions need to be proposed. To this end, in Mekelle city, a research was carried out by Mekelle University to assess the safety and mobility challenges of people with disabilities and propose solutions that incorporate best practices from other countries.

The study consists of a review of both scientific and grey literature and primary data collection. Available policy documents, directives and guidelines in the transport sector were reviewed. Quantitative data was collected through digital questionnaire-based face-to-face interviews and on-site assessments of transport infrastructure, public buildings, transport services and stops. Qualitative data was also collected using in-depth interviews of key-informants, such as disability associations and government institutions, interviews with people with disabilities, and focus group discussions. Research findings were discussed among the various stakeholders in workshops and consultative meetings.

The study revealed that the issue of people with disabilities inclusive urban transport system in Mekelle is far from what it should be. The attitude of government bodies, policy makers, urban planners, and engineers in this case is low. Directives and guidelines in the transport sector were inadequate to remove the barriers for people with disabilities. Despite their availability, the implementation or enforcement of these directives and guidelines was poor in the building sector. The available policies, directives, and implementation guidelines were not clearly communicated resulting in confusion for the administrators, urban planners, engineers, and people with disabilities.

The results from the interviews, focus group discussions, and on ground assessments showed that poor accessibility of the transport infrastructure, especially problems with sidewalk designs and management and inadequate ramps to access buildings, was found the main issue that negatively affect the livelihood of people with disabilities in Mekelle city. The main streets in the city had poor walkability and the sidewalks are narrow and obstructed by roadside obstacles. The sidewalks are unclean and found in an unusable condition for people with disabilities. Entrance and exit ramps to public buildings were constructed with inappropriate slopes, inadequate landings and widths, or were poorly located making them unsafe or inaccessible for people with disabilities. Public transport vehicles were also found inaccessible for wheelchair users and they lacked any facility to aid people with visual impairments.

To play a role in removing the barriers for people with disabilities in the transport system of Mekelle and other cities of LICs, a policy brief document and this urban transport infrastructure design and implementation summary guide are prepared. These documents incorporate solutions and recommendations, including best practices of other countries, to improve the safety and mobility of people with disabilities.

2.2 Assessment on roads and public transport stops

2.2.1 Street sidewalks

In the study, Relative Importance Index (RII), a non-parametric technique was used to analyse people with disabilities structured questionnaire responses on how problems with eleven selected transport infrastructure or facilities in Mekelle city had negatively affected their urban livelihood. For this purpose, a Likert scale from 1 (very low) to 5 (extremely high) was used and RII analysis results are presented from a value of 1% (the negative effect of the issue on the livelihood of the people with disabilities had been very low) to 100% (the effect is extremely high). Based on the attitudes of these respondents, the top three issues with Mekelle city's urban transport system that negatively affect the livelihoods of people with disabilities are the lack of or poor accessibility of public transport infrastructure and facilities, as well as design and management problems with sidewalks, with relative importance index (RII) values of 90.1%, 89.6% and 88.8%, respectively. The study found that sidewalks in Mekelle were unsuitable for people with disabilities.

Additionally, on ground assessment of the existing transport infrastructure or facilities and services was carried out. The walkability of the main streets in Mekelle city were evaluated using nine parameters. The walkability

index of these streets was determined with a scale from 1 (least or poorly walkable) to 100 (most walkable). This study revealed that the main streets in Mekelle city had below average walkability, with Walkability Index (WI) of 46.5. There are sidewalks in the main streets of the city but they are obstructed by roadside static obstacles and encroachments, poorly managed, and unclean. The availability of infrastructure for people was found to be limited, indicating that and the streets are unsafe and in an unusable condition.

Most of the streets in the study had an overall sidewalk width of below 3.5 m. Only 19.2% of the assessed sidewalks were found to meet the recommended width of 2.4 m, which is needed to allow two wheelchair users to pass each other. For 46.2% of sidewalks, the width available for pedestrian movement was less than 1.2 m, which is below the minimum width needed to allow two non-disabled pedestrians to pass each other.

2.2.2 Street crossings

The walkability analysis result showed that the availability score for safe and convenient pedestrian crossings in the main streets of Mekelle is below 50. Pedestrian crossings should be spaced in the range from 100 m to 200 m. However, the average distance of pedestrian crossings in the main streets was found to be between 300 m to 500 m.

2.2.3 Public transport stops

All of the public transport vehicles operating in the city were found to be inaccessible for wheelchair users and they lacked any facility to aid people with visual impairments. Some vehicles did not even have space to carry wheelchairs. Public transport stops in the city are limited. No defined stops were observed in the streets of the city, with the only facilities being shades with seating, but they lacked access ramps, tactile guidance, and other supporting facilities for people with disabilities.

2.3 Public buildings

Among the assessed hotels and educational centres, 80% and 90% respectively had ramps at entrances and exits. However, only 14.3%, 40%, and 42.9% of the commercial buildings, health centres, and government offices respectively were found to be accessible. Additionally, more than 75% of the available entrance and exit ramps on hotels and commercial centres were constructed with inappropriate slopes, inadequate landing widths, or were poorly located. Less than half of these ramps had supportive infrastructure, such as handrails and other features for people with disabilities. The results of the survey also indicated that accessibility within the buildings themselves was limited.

3. Pedestrian infrastructure design and management guidelines

3.1 Introduction

The needs of people with disabilities is usually over-looked in planning and designing of transport infrastructure in urban areas of LICs. Pedestrians, especially people with disabilities, usually face challenges in the transport sector with inadequate policy issues, unavailable or poorly implemented directives and guidelines. Pedestrian facilities in the urban environment should be designed or constructed and managed properly so that the safety and mobility of pedestrians of all groups can get improved. To this end, developing supportive design and implementation guidelines for pedestrian infrastructures is important. Therefore, aiming at improving the pedestrian infrastructures in LICs, this summary of guidelines is prepared incorporating the findings of the research by Mekelle University and best practices from other countries. It consists basic pedestrian infrastructure design considerations, and summarised guidelines for design and management of these infrastructure in the urban environment.

3.2 Basic design considerations

The inclusion of people with disabilities during the design process benefits all pedestrians, such as people with disabilities, the elderly, young children, and people carrying luggage. Similar to the principles governing the development of infrastructures for vehicular traffic, a multitude of factors is taken into account when designing for the diverse range of pedestrian groups within the transport environment.

3.2.1 People without impairment

Body depth and shoulder breadth of a pedestrian should be used to specify the minimum space requirements for pedestrian facilities. A shoulder breadth of 600 mm, including lateral clearance, is considered to specify the minimum sidewalk width to be used by non-disabled people. Two people moving side by side or in opposite directions need a minimum width of 1.2 m while a minimum width of 1.5 m is needed for a non-disabled person and a wheelchair user to pass each other.

3.2.2 People with mobility and vision impairments

A person who does not use a walking aid has the ability to navigate a passageway that measures less than 700 mm in width. However, someone using a walking stick for support needs an additional 50 mm. Someone who relies on two sticks or crutches, or uses a walking frame, needs a minimum width of 900 mm. In contrast, a visually impaired person who employs a long cane needs a width of 1.1 m. Anyone who requires guidance from other non-disabled person necessitates a width of 1.2 m. The minimum width needed to accommodate a solitary, stationary wheelchair and its occupant is 900 mm. Taking into consideration the clearance required on both sides during movement, a width of 1.2 m is essential for a wheelchair user. In the event that two wheelchair users need to pass each other, the recommended minimum width required is 2.4 m, which includes the shy widths or additional clearances necessary on both sides. In situations where it is challenging to provide this width, an absolute minimum width of 1.5 m could be employed to enable a wheelchair user and a non-disabled person to pass each other.

The unobstructed height above a pathway designated for pedestrians is very important, particularly for people with visual impairments who may not be able to detect obstacles or who could encounter difficulty in manoeuvring beneath them. This means walkways and other pedestrian paths should provide a minimum clear height of 2.3 m. In instances where a sign is suspended above a pedestrian walkway, a minimum clearance of 2.1 m is deemed acceptable.

3.2.3 Walking distances of people with disabilities

Basic household and communal services and facilities should be located close to residential areas of urban dwellers. However, pedestrians sometimes have to walk long distances to get services and enjoy their life. In such cases, considering the varying mobility abilities of pedestrians, a place to rest on their way should be included. The maximum distance that people with disabilities and older people can walk without a rest depends

on many factors, including the slope and evenness of the footpath. The recommended limit without rest for wheelchair users and visually impaired people is 150 m, while for walking stick and cane users it is 50 m.

3.3 Pedestrian ways and crossing facilities design guidelines

The main factors that should be considered when designing pedestrian walkways include, ease of access and safety, directness and choice of routes for different modes of travel, suitability of the route with respect to widths and gradients, distances between resting places and seating, lighting, shelter and shade.

3.3.1 Pedestrian ways

In the realm of urban planning and street design, pedestrians should be regarded with equal importance as car drivers. Consequently, roads should be crafted in a manner that offers pedestrians and motorists a comparable level of service. The appropriate design of sidewalks not only yields safety advantages for pedestrians, but also gives supplementary comfort to motorists. When the sidewalk is unsafe or less conducive to walking, pedestrians have a tendency to alter their walking paths and move to carriageways, exposing themselves to a higher risk of accident from motor vehicles. Once a road has been constructed in urban areas, altering its width becomes a challenging task due to the increased cost of using adjacent land and the construction of costly structures along the roadside.

The sidewalk environment

Sidewalks are commonly regarded as areas designated solely for pedestrian traffic. However, they possess a diverse range of functions, including designated areas for urban furniture placement, spaces where the interaction between private and public domains takes place, as well as zones for recreation, rest, dining, and sightseeing. The sidewalk environment is typically divided into frontage, pedestrian, and furniture zones. The frontage zone serves as an extension of the building, while the furniture and curb zone functions act as a buffer between pedestrians and cycle lanes, and parked or moving vehicles.

They provide space for greenery and various amenities such as benches, traffic signs, street lighting, cycle parking, and kiosks. The pedestrian zone is a dedicated space exclusively reserved for pedestrian travel, and it should be direct and free of any obstacle. Delineating of the three pedestrian zones with different colours helps for anyone to easily differentiate the boundaries among them.

Minimum width and height clearance

It is advisable to make sidewalks and footpaths as wide as possible. In typical situations, a width of 2.4 m should be used to allow for the free passage of two wheelchair users. When the available space is limited, a minimum width of 1.5 m could be considered to enable a non-disabled pedestrian and a wheelchair user to pass each other. It is important to note that the minimum width described here refers specifically to the space dedicated to pedestrians. Additional widths for road-side activities, furniture zones, and curb zones should be provided when considering the total width of the sidewalk.

If the sidewalk is directly adjacent to the curb, the minimum width should be increased by approximately 500 mm, measured from the edge of the curb. When it is anticipated that trees and other greenery will be present in the furniture zone, a width of 500 mm to 1 m, measured from the edge of the curb, should be provided. If the building face is a fence or wall, a width of 500 mm in the frontage zone is required, while a width of 1 m is necessary for window display building face conditions.

Generally, the minimum sidewalk width that must be provided on sub-arterial and arterial roads is 4 m. On collector roads, a minimum width of 3.5 m is recommended. When there are right-of-way problems, a sidewalk width as narrow as 2.5 m can sometimes be adopted. Generally, considering its various functionalities, a sidewalk shall have an overall minimum width of 3 m in residential areas, 4 m in commercial areas, and 7 m in high-intensity commercial areas. A minimum clear height of 2.3 m, except in sub-surface station platforms, where it must be 3 m, shall be considered in pedestrian routes.

Gradients

It is advisable that pedestrian areas possess a flat surface, with no gradient greater than a ratio of 1.5%. In situations where a level surface is not attainable, it is crucial that any inclines do not surpass a ratio of 5%.

Even if a pedestrian route does not contain slopes exceeding a ratio of 5%, it is imperative that there are level portions, or 'landings', at regular intervals. The purpose of these landings is to give people an opportunity to rest; ideally, accessible seating should also be made available on these landings. The maximum gradient employed for pedestrians should not exceed 10%. Should a crossfall be necessary for drainage, then it is preferable to have a crossfall between 1% and 2%.

Surface condition

Sidewalk surfaces should be durable and slip resistant in both wet and dry conditions. When possible, the sidewalk paving materials should be concrete or asphalt, however, tile and stone are also frequently used. Although the use of tile, stone or brick have aesthetic benefit, they can lead to grooves or odd spacing. These can catch wheelchair castors or create a tripping hazard for pedestrians, especially those with visual or mobility impairments. It is recommended that the joints between flags and pavers be no less than 2 mm and no more than 5 mm in width. However, for footpaths exclusively intended for pedestrians, the joints between flags may be in the range from 6 mm to 10 mm, when filled with compacted mortar. The maximum deviation of the footpath surface, when measured with a 1 m straight edge, should not exceed 5 mm. In the context of new environments, the use of cobbled surfaces is not suitable to all pedestrian groups, so other alternative options should be explored. To guide visually impaired people, tactile pavers should be used along the pedestrian zone, at direction changes, and intersections or curb cuts.

Drainage covers and slots should be situated as far away as possible from the main streams of pedestrian traffic. Inspection chambers and their covers should be flush with the surface and have a non-slip texture.

Street furniture

Street furniture is positioned in areas that do not compromise the pedestrian safety of all groups. These objects should be placed in a manner that leaves a minimum width as recommended for pedestrian pathways. Ideally, streetlights and signs should be fixed to buildings or walls. If this is not feasible, then placing them at the furniture zone, near to the edge of the carriageway or rear of the sidewalk, as close to the property line as possible, is considered acceptable.

To aid people with visual impairments, it is advantageous if the positioning of posts and other freestanding items on the sidewalk adhere to a consistent pattern. Street furniture should be aligned parallel to the path of travel, ensuring a predictable and easily comprehensible layout to prevent collisions. In cases where a sidewalk adjoins a road used by motor vehicles, any post placed on the road-side of the sidewalk should be at least 500 mm from the edge of the road.

Street furniture, such as planters, litter bins, and signposts, ought to have smooth rounded edges and be devoid of sharp or protruding elements to minimise the risk of injury in the event of impact. Any item of street furniture should be colour contrasted with its surroundings in order to maximise visibility.

3.3.2 Pedestrian crossings

Crossing should be clear for all users of the road, including those with visual impairments. They ought to be have contrasting strips and incorporate a detectable warning surface on the pavement. The implementation of tactile and traffic light systems with audible signals at controlled crossings, which convey the same information as the 'green walking symbol', are particularly helpful for people with vision impairments, while also aiding other pedestrians. Crossings and curb ramps must be free of any obstacles and should have a detectable warning surface that tonally contrasts with the surrounding pavement surface.

Location of crossings

Crossings should follow the natural paths that pedestrians prefer to take and be located near key points of interest, such as bus stops, mass transit stations, parks, plazas, monuments, and entrances to public buildings. Crossings are recommended at intervals of 80 m to 100 m. At junctions, crossings should be placed as close as possible to the corners of intersections.

Curb ramps

Flush dropped curbs with appropriate tactile paving must be consistently provided at crossings to ensure accessibility for people with mobility impairments. The maximum gradient on the direct approach to the dropped curb should not exceed 8%, with a gradient of 5% if space allows. For transition to a dropped curb, the gradient should be no steeper than 10%. The flush portion of the dropped curb should have a minimum width of 1.5 m, excluding the flared sides and transitions.

A level space of at least 1.2 m the curb is recommended, allowing wheelchair users to pass easily without crossing the road. At marked crossings, curb ramps must be contained within the crosswalk.

Corner radii

Reducing corner radius helps create more compact junctions, shortens pedestrian crossing distances and significantly improves safety for both pedestrians and cyclists. Depending on the road type and expected vehicles, corner radius on streets usually range from 4 m to 9 m. To improve visibility between drivers and pedestrians, tall, bushy plants should be avoided near refuge islands, median ends, and intersection corners.

3.4 Pedestrian infrastructure management

Sidewalk must be designed and managed to be level, step-free and free of protruding, standing, or overhanging obstacles. The location of fixed objects on sidewalks should be coordinated with existing or planned pedestrian facilities. This can be achieved through the drafting and application of appropriate policies and procedures.

Drainage structures should be regularly inspected and maintained. Legislation should prohibit vehicles either fully or partially, on the sidewalks. Where trees overhang a sidewalk, they must be managed to maintain a minimum of 2.3 m unobstructed height above the pedestrian path. Street corners and pedestrian crossings should be properly monitored to ensure safe pedestrian movement.

Street works must be carefully managed to avoid hazards and obstruction for pedestrians. A continuous barrier with tonal and colour contrast should surround street works, including materials and equipment. If street works are being carried out on pedestrian walkways, suitable barriers should be erected to protect pedestrians from traffic and other hazards. The route provided should have a minimum width of 1.2 m. Slip-resistant curb ramps or raised temporary footways should be installed to assist wheelchair users and others. Where scaffolding is erected on or over a footway, there must be minimum height clearance of 2.1 m.

3.5 Design guidelines to public transport stops

Public transport hubs, stops, and stations should be spread across the city to ensure equal accessibility for all districts. Access to these stops should be step-free, with elevators or ramps provided where necessary to ensure pedestrians reach their destination. Pedestrian routes to the stops should be free from barriers.

Shelters and seating

Shelters provide protection from weather and should have enough space for waiting passengers including benches or seats to rest. Benches should provide both backrests and armrests to give additional support to people who need it.

Bus boarding and alighting

Bus stop boarding and alighting areas must be connected to streets, sidewalks, or pedestrian paths by accessible routes. These areas should have a minimum of 1.5 m clear width and a transverse slope no greater than 2%.

Information and signage

Information and signage about stations, routes, and destinations must be provided in clearly legible characters. Lists of stations, routes, and destinations served by the station, platforms, or stops must be marked with visual characters for easy identification.

3.6 Access ramps to public buildings

Access ramps to buildings should be universally accessible, smooth, and wide enough to accommodate wheelchairs, with adequate turning space. Ramps should be direct to the entrances and exit of buildings and be easily accessible. The minimum clear width of these should be 900 mm. Ramps should have a maximum slope of 8% and a transverse slope no greater than 2%. The surface material of the ramp should be smooth, non-slip, and visually contrasting. Ramps must include supportive handrails and handrail fittings along the ramp run for added safety and accessibility.

4. Conclusion

The study's overall assessment reveals that Mekelle city's built urban environment is not inclusive for people with disabilities. Building entrances and transport infrastructure are unsuitable for these people. Among the various problems with urban transport infrastructure and facilities in the city, poor accessibility of the infrastructure or facility, flawed design and the inadequate management of sidewalks were found to be the major issues that negatively affect the safety and mobility of people with disabilities. Road sidewalks and entrance ramps to public buildings were found to be particularly problematic.

The existing sidewalks are narrow, full of roadside static obstacles and encroachments and are poorly managed and unclean. They often feature rough, inconsistent paving materials and obstructions that reduce useable space and pose safety hazards, especially for visually impaired people. Accessible infrastructure for people with disabilities is limited, unsafe and often in an unusable condition. Entrance and exit ramps at public buildings are poorly designed in terms of location, slope, landing, and width. Public transport vehicles and stops in the city were limited with no ramps, and tactile guidance and other supporting features for people with disabilities.

Although policies and proclamations exist, there were no disability inclusive directives or guidelines road infrastructure and transport services in Mekelle city. The available directives and guidelines for buildings were also poorly communicated and enforced. Moreover, the awareness of the government bodies, urban planners, and engineers towards disability inclusive urban transport development was low. To this end, it should be noted that transport policies should be supported with clear, well communicated, and disability inclusive directives and implementation guidelines. In developing such directives and guidelines, consultation with people with disabilities associations should be considered mandatory.

Continuous awareness creation programmes need to be arranged for government personnel, policy makers, urban planners, engineers, and disability associations together with stronger law enforcement work. Adherence to these directives and guidelines should also be timely monitored and evaluated. It is important for everyone to know that people with disabilities have the right to inclusive, integrated, and accessible urban transport system so that they can have equal access to opportunities and enjoy their life. Ignoring this issue not only affect the livelihood of these disadvantaged groups but also directly or indirectly affect the wider community too. Therefore, the study urges prompt action on this regard to ensure no one is left behind.

4.1 Acknowledgments

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4.2 Data Availability

This document consists the highlights of the research work and full details can be obtained from the final project report available on HVT website at transport-links.com or from the project coordinator in Mekelle University upon request.

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