URBAN TRANSPORT INFRASTRUCTURE FOR PEOPLE WITH DISABILITIES IN THE CITY OF TSHWANE, SOUTH AFRICA: AN OBSERVATION AUDIT

BABRA DURI[*] & ROSE LUKE[†]
Department of Transport and Supply Chain Management, University of Johannesburg, South Africa

ABSTRACT

People with disabilities often find it difficult to access public transport. The purpose of this study was to identify issues with urban transport infrastructure in the City of Tshwane that contribute to inaccessible transportation. An observational checklist was prepared to collect data, and the checklist was based on guidelines and best practices for universally accessible transport. The infrastructure elements considered in this study were pavements, street crossings, street furniture, bus stops, bus station, taxi ranks and train stations. To a large extent, the design of transport infrastructure in the City of Tshwane does not comply with universal design principles and, in areas where there was compliance, there was a distinct lack of consistency. The study results revealed that the urban transport infrastructure in the City of Tshwane is not designed to cater to the needs of people with disability. The results also revealed that existing transport infrastructure lacks maintenance. It is recommended that the city train city planners and built environment professionals on disability building regulations. City planners and built environment professionals should be conscious of the needs of different groups of people when planning and designing city infrastructure.
Keywords: transport barriers, people with disability, transport infrastructure, built environment, pedestrian environment, universal access.

1 INTRODUCTION

Urban transport enables city dwellers to access goods, services and opportunities offered by the city. However, the provision of urban transport infrastructure and services is not equal across different groups of transport users [1]. The impact of unequal provision of urban transport infrastructure and services is more pronounced to disadvantaged groups such as people with disability and the elderly. People with disability often encounter numerous barriers in accessing transport infrastructure and services, which may lead to poor quality of life, lack of opportunities, unemployment, poverty [2]–[4]. According to Hernández [1] and Odufuwa [2], transport is one of the essential components of sustainable livelihood which enhances good quality of life. One of the aspirations of the United Nations Sustainable Development Goals (SDG) 11 is that "By 2030, provide access to safe, affordable, accessible and sustainable transport systems for all, improving road safety, notably by expanding public transport, with special attention to the needs of those in vulnerable situations, women, children, persons with disabilities and older persons". South Africa, as one of the countries which ratified the Convention on the Rights of Persons with Disabilities, has the obligation to improve the provision of urban transport infrastructure and services [5].

The South African transport system is shaped by apartheid spatial planning [6]. The legacy of apartheid spatial planning still exists and has a strong effect on the socio-economic activities and arrangement of urban areas [7]. According to Thomas [6] "the provision of safe, accessible, and affordable public transport infrastructure is a fundamental prerequisite for the socio-economic advancement of the South African population". However, some

---

[*] *ORCID: http://orcid.org/0000-0003-2977-4897*

[†] *ORCID: http://orcid.org/0000-0003-1915-6956*

people do not have access to good public transport infrastructure in South Africa. In South Africa, "there is no comprehensive disability legislation that deals exclusively with matters of disability or with people with disabilities" [8]. However, there are pieces of legislation that mention people with disability or deal with matters of disability [8].

The City of Tshwane, which is located in Gauteng province of South Africa, shows an increase in population of people living with some form of disability [7]. According to Stats SA [7], there are approximately 800,000 people living with some form of disability in Gauteng province. Little research has focused on the City of Tshwane, yet there has been an increase in people living with some form of disability. It is inevitable that people with disability will experience transportation problems, given the lack of inclusivity in transport provision in the City of Tshwane. According to Boshoff and Marais [9], the City of Tshwane needs to improve accessibility of its central business district (CBD). The purpose of this study was to identify issues with urban transport infrastructure around the Tshwane CBD that contribute to inaccessible transportation. The secondary objectives formulated to address the main aim of the study are: (1) to establish transport barriers encounters by people with disability; and (2) audit the status quo of the transport infrastructure around the Tshwane CBD.

2 TRANSPORT INFRASTRUCTURE

The infrastructure elements of accessibility considered in this study are pavements, street crossings, street furniture, bus stops, bus station, taxi ranks and train stations. People with visual and mobility disability often encounter many barriers in the road and pedestrian environment [2], [3], [10]–[12]. According to Vanderschuren et al. [13], well-designed pavements should have: "sufficient widths; even surfaces with sufficient friction; sufficient lighting; and appropriate placing of street furniture". Ideally the width of pavements should be at least 2,000 mm wide in areas with heavy pedestrian traffic [14], while pavements around shops or bus stops should be at least 3,000–3,500 mm [15]. Odufuwa [2] found that pavements in Nigeria were in a deplorable state as the pavements were not paved and also crowded with street vendors. Pavements which are characterised by crowded street vendors are common in African countries, for example, Nigeria [2], Ghana [11] and Zimbabwe [12].

Street crossings are form part of road and pedestrian environment which pose danger to people with disability, especially people with mobility, visual and hearing disability [16]–[18]. According to the best practices, street crossing should have a minimum with of 1,200 mm and centre islands are recommended in areas where pedestrian cross many lanes of traffic [14]. In Nigeria, Bombom and Abdullahi [16] found that busy streets are difficult to cross for people with disability, especially those travelling without travel assistants.

Street furniture is defined as "all the setups that are found on the streets that serve many functions related to the usage of the streets in many ways whether directly or indirectly, and that leads to better usage of the streets as an urban space been used by people" [19]. Street furniture includes benches, bins, bus shelters, signboards, water fountains and other elements that make pedestrians comfortable [19], [20]. One of the important factors to consider around street furniture is their placement on the street [21]. Street furniture should not obstruct the flow of pedestrian and objects such as benches should be provided at regular interval of every 50 m [14], [20]. Research done by Lid and Solvang [22] in Norway, reveals that in areas which had benches on the street, people in wheelchairs found it difficult to manoeuvre. Bus stops are vital elements to the pedestrian environment. According to the best practices, bus stops should be close to amenities and transport users should not walk more than 400 m along a route [14], [15]. Bus stop shelters should have sufficient space for wheelchair to enter and manoeuvre [14]. In Stockholm, transport facilities such as bus stops are designed with

universal access features and in urban areas bus stops have elevated kerbs [23]. However, in Chengdu, China, it was observed that the bus stops do not accommodate the needs of people with visual disability [17]. Bjerkan et al. [24] found that one of the main challenge of passengers who use public transport was getting to the bus stop.

Bus and train stations should be designed with accessible features to accommodate different groups transport users, for example, design of entrances, walkways, ticket counters, information, amenities and platforms [14], [15], [25]. According to the best practices, the layout of stations should be simple and compact to reduce walking distances and making navigation easy for everyone [14], [25]. Ideally, all entrances of stations should be fully accessible [14], [25]. Metrorail in South Africa is not designed for people with disability [26]. Similarly, in Pakistan, stations are not universally designed to cater for the needs for all [27]. In Stockholm, Stjernborg [23] found that some lifts at the stations can be out of order for two or three months, thereby making it impossible for people using wheelchairs and others with mobility disabilities to reach platforms.

Taxi ranks in this study, refers to the transport facilities for minibus taxis commonly found in African countries. The mini-bus taxi industry plays a vital role in public transport in South Africa. According to the National Households Travel Survey 2020, about 66% of households in South Africa use mini-bus taxis [28]. The two types of taxi ranks are on-street and off-street taxi ranks. On-street taxi rank can be described as "a place usually within the road reserve at which minibus-taxis are allowed to stop for passengers to board and alight the vehicle" [29], while off street taxi ranks are usually found in a building. Ideally, off-street taxi ranks should have pavements, shelters, waiting areas and amenities such as toilets and shopping facilities [29]. One of the factors considered concerning on-street taxi ranks is width of pavement. Pavements should have sufficient width to avoid obstruction to pedestrians by waiting taxi passengers, especially when located on a busy street.

3 RESEARCH METHOD

This study was conducted in CBD of Tshwane. The City of Tshwane is of the largest metropolitan municipalities in Gauteng province of South Africa. The City of Tshwane has a population of approximately 3,600,000 and area coverage of 6,345 km^2 [30]. Because of spatial planning of the city, many residents of Tshwane spend long time commuting between their homes and places of employment [30]. "The City of Tshwane still resembles the apartheid city form, with most black townships on the outer-skirts of the city, namely, Mamelodi to the east, Atteridgeville to west and Hammanskraal and Soshanguve to the south" [30]. Feature characteristics of Tshwane CBD include main transport terminals, transport arteries, high activity of street vendors, lack of space and the presence of many national government departments [9]. The main streets for public transport in which data were collected were Madiba Street (Vermeulen Street), Pretorius Street; Lilian Ngoyi Street (Van der Walt Street); and Sisulu Street (Prinsloo Street). Data for taxi ranks and bus stations were collected from Marabastad rank.

To address research objectives, qualitative research was adopted, using semi-structured observation. Observation is one of the research techniques widely used for access audit [31], [32]. An observational checklist was prepared to collect data, and the checklist was based on guidelines and best practices for universally accessible transport [14], [15], [20], [25], [33], [34]. The guidelines of accessible design for infrastructure specify the desirable requirements or minimum dimensions of infrastructure elements, for example, width of doors, slope of gradient of ramps, platforms, width of pavement or colour. The infrastructure elements considered in this study are pavements, street crossings, street furniture, bus stops, bus station, taxi ranks and train stations. To capture pictures and videos of the condition of

infrastructure around Tshwane CBD, a mobile phone was used. Field notes concerning the condition of infrastructure were also written.

4   RESULTS

The results are divided into seven themes, namely pavements, street crossings, street furniture, bus stops, taxi ranks, bus stations and train stations.

4.1 Pavements

The variables which were observed on the pavements around the Tshwane CBD are availability, width, type of surface, maintenance, obstructions, resting areas, tactile surfaces, signage, dedicated bicycle lanes, continuity of paths, buffer space, cleanliness, provision of amenities, and speed management. Fig. 1 shows obstructions on pavements around the CBD.
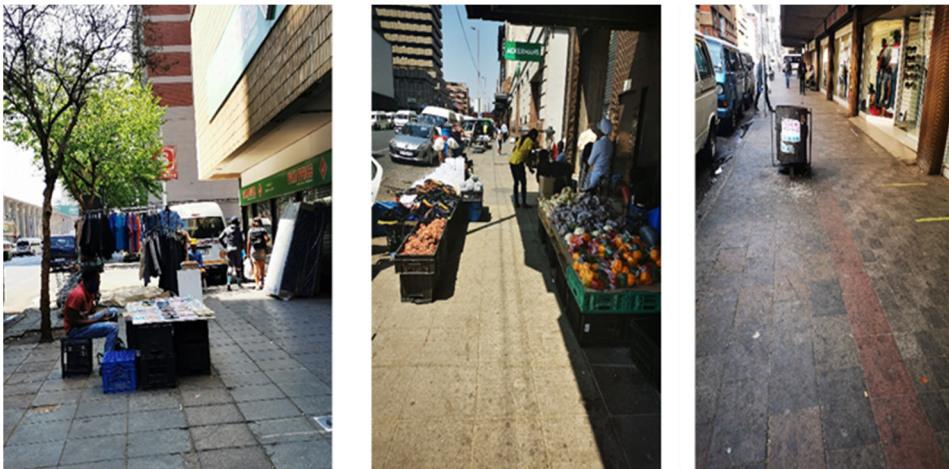

Figure 1: Pavement obstructions.

It was observed that mini-bus taxis, vendors, shop products and bins were obstructing free flow of traffic. The width of some pavements was reduced by street vendors, minibus taxis and shop products which would make it difficult for people with vision and mobility disability to manoeuvre.

Fig. 2 shows broken pavements and incomplete construction of pavements. From the observations it was found that some broken pavements have been in that state for a long time, while some newly constructed pavements were incomplete. Fig. 3 shows the state of tactile surfaces in some areas around the CBD of Tshwane. The findings show that the tactile surfaces around the CBD were mostly in poor condition and lack maintenance. To a large extent, tactile surfaces are not functionally existent around the CBD.

It was observed that some pavements are not kept clean as shown in Fig. 4. The findings also revealed poor spacing of bins around Tshwane CBD. Fig. 5 shows the state of some of the signage around Tshwane CBD. The signage board in Fig. 5 is damaged. From observation, the damaged signage board was in that state for a long time which shows lack of maintenance of infrastructure. The findings also revealed that some signboards are obstructed by street light poles and traffic light poles.

Figure 2: Maintenance of pavements.

Figure 3: Tactile surface.

4.2 Street crossings and street furniture

People with disability often encounter problems when crossing streets. According to the best practices, traffic signal should have push buttons within reach, audible and visual signals and countdown timers [14]. Street crossing should have a minimum with of 1,200 mm and centre islands are recommended in areas where pedestrian cross many lanes of traffic [14]. From observation, the traffic light appeared to be in that state for a long time and it was common

Figure 4: Cleanliness of pavements.

Figure 5: Signage.

around the CBD. The traffic lights around the CBD of Tshwane did not have countdown signals and a few had push buttons that were not functional.

Street furniture includes bins, water fountains, benches and street lights. According to best practices, street furniture should be correctly positioned with a contrasting colour to the surroundings [14]. Fig. 6 shows the state of some of street lights around Tshwane CBD. The light is broken and this was common around the CBD. It was found that street furniture lacked

maintenance. Some of street furniture such as lights and bins were poorly spaced and positioned. It was also observed that some street lights are left on during the day. Some bin containers were full of rubbish and the containers looked dirty. Around the CBD of Tshwane, only a few seating areas were observed.

Figure 6: Traffic light and street light.

4.3 Bus stops

Bus stops should be accessible to everyone with transport information displayed inside and outside the shelter. Bus shelters should have seats and sufficient space for wheelchairs to enter [14]. The findings showed that bus stops are the CBD do not provide any transport information. Only a few bus shelters were identified around the Tshwane CBD

4.4 Bus station

The two types of bus stations audit were the Bus Rapid Transit (BRT), A Re Yeng, bus stations and the stations for conventional buses which are located on the perimeters of the Tshwane CBD. Fig. 7 shows one of the A Re Yeng bus station in the CBD. The findings showed that, to a large extent, the A Re Yeng bus stations were accessible and designed to accommodate different types of transport users, including people with disability. It was observed that starting from the entrance to the exit, the design was fully accessible to people with disability and those with reduced mobility. Although the stations were fully accessible, the outside surrounding environment of some of the stations posed barriers to people who use wheelchairs. It was observed that some pavements leading to the stations did not comply with universally designed principles.

The findings showed significant differences in the level of access of Marabastad bus stations and A Re Yeng bus stations. During the time the observation audit was conducted, the City had done some maintenance work on Marabastad stations (Fig. 8). It was observed that station shelters, pavements and handrails were in good condition. The flow of the station layout was simple and easy to follow. However, it was observed that the station platforms

Figure 7: A Re Yeng bus station.

Figure 8: Marabastad bus station.

did not have ramps and some buses were loading in the middle of a road. Luggage was obstructing the free flow of passengers. There were no ticket counters at Marabastad bus station that were identified.

4.5 Mini-bus taxi ranks

The two types of taxi ranks for mini-buses around Tshwane CBD are off-street and on-street taxi ranks. It was observed that some of the off-street taxi ranks did not have pavements and other amenities such a s toilets and shopping facilities. Off-street taxi ranks had uneven gravel surfaces which was not ideal for people using wheelchairs. One of the basement off-street taxi ranks did not good lighting and ventilation. Fig. 9 shows a taxi loading zone.

Figure 9: Taxi loading zone.

It was observed that street vendors obstruct taxi entrances which was not ideal for people using wheelchairs and people who have visual disability. The vendors' tables were next to the taxi entrance as shown in Fig. 9. The findings also revealed a lack of transport information and signage.

4.6 Train stations

The main types of train stations for passengers in the City of Tshwane are Metrorail stations and Gautrain stations. Metrorail is a division of a state-owned enterprise, Passenger Rail Agency of South Africa (PRASA), which operates commuter rail services in eight metropolitan areas in South Africa [35]. Gautrain is a rapid rail that connects Tshwane, Johannesburg and OR Tambo International Airport in the Gauteng province of South Africa. The study only focused on Metrorail stations as Gautrain stations were newly designed with universal access features. It was observed that some station entrances were fully accessible while some were not accessible. The design of stations lacked consistency. Some stations were step-free while some were not. The floor of some stations was damaged and lacked maintenance. Some handrails outside the stations were broken and posed dangers to everyone. The older rolling stock of Metrorail known as "yellow trains" were found to be non-complaint with universal access principles. The trains floor and platform were not at the same level. There were no tactile surfaces in the station which could endanger people with vision disability.

5 DISCUSSION

The discussion on findings is divided into seven variables namely: pavements, street crossings, street furniture, bus stops, taxi ranks, bus stations and train stations.

5.1 Pavements

The pavements around the Tshwane CBD were of sufficient width and complied with minimum width requirements. However, some pavements were mainly obstructed by street vendors, vehicles parked on pavements, rubbish bins and shop products. Obstructed pavements make mobility and manoeuvring difficult especially for people with vision and mobility disability. The findings are similar to other African countries such as Ghana, Nigeria and Zimbabwe [2], [11], [12], [36]. The pavements generally lacked tactile surfaces which makes mobility of people with vision disability difficulty and constantly depend on travel assistants. Although the surface finish of the pavement was found to be of acceptable quality, some were broken and showed lack of maintenance. In some areas some pavements were not levelled and some manhole covers were missing. The pavements were fairly clean; however, litter was spotted in some areas which could suggest poor spacing of bins. Previous research indicates that uneven surfaces make movement difficult for people with vison disability [3] and people who use wheelchairs [22].

5.2 Street crossing

Overall, the assessment of street crossings around the Tshwane CBD suggests that street crossings are not safe and are relatively inaccessible for people with disability. This finding is in line with research done in Nigeria which reveals that some streets which are difficult to cross for people with disability, especially those without travel assists [16]. The street crossings around Tshwane CBD were not designed for people with disability. The traffic lights around the CBD do not have countdown signals and the few push buttons which were spotted were not functional. The state of traffic lights around the CBD have adverse effect on people with mobility, hearing and vision disability. According to the best practices on street crossings, traffic signals should be accessible to everyone and should have audible and visual signals and countdown timers [14], [20]. There is a high risk for people with disability to collide with fast moving vehicles [16].

5.3 Street furniture

According to Radwan and Morsy [19], variables such as "line, texture, colour and measurement" should be taken into consideration when planning and designing street furniture. Generally, there is limited street furniture around Tshwane CBD and the existing furniture lacks maintenance. Some street furniture was poorly placed and spaced, for example, bin which were in the middle of the pavement and street light poles obstructing signage. Similarly, Lid and Solvang [22], found that benches around seating areas were not properly placed and wheelchairs users found it difficult to manoeuvre around areas where benches were available.

5.4 Bus stops

The design of bus stops around the CBD did not comply with universal design principles. Similarly, in Pakistan, Ahmad [27] indicates that existing bus stops are not universally accessible. Bus stops did not have transport information and timetables were relatively non-

existent. Coxon et al. [18] highlight that availability of bus timetables and routes forms part of small changes which can make significant impact to transport users. Research done in Stockholm reveals that although bus timetables are available, the format of presenting information was not accessible to everyone [23]. There were only few bus shelters around the Tshwane CBD of which, were not designed to accommodate people who use wheelchairs. Some bus stops did not have clear markings showing no-parking zones. Overall, bus stops were fairly clean and bins were placed around the bus stops.

5.5 Bus stations

The two types of bus stations which were audited were for conventional buses and BRT. As expected, the BRT station were found to comply universal design principles while conventional bus stations were not. A Re Yeng buses stations have various feature such information displays, ramps, waiting areas and information announcements. However, the surrounding environment leading to the BRT stations did not comply with universal access principles. Some surfaces had gravel and appeared to be uneven which makes mobility of people who use wheelchairs difficulty. The stations for conventional bus lacked ticket counters of which, is an inconvenience to transport users. However, at time of data collection, the stations for conventional buses had been renovated and showed some improvements in certain areas, for examples, legible signage, handrails and clean seating areas.

5.6 Taxi ranks

The overall assessment on taxi ranks revealed the design of taxi ranks does not comply with universal design principles. Although in South Africa, the National Building Regulations and Building Standards Act (103 of 1977) stipulate that transport infrastructure such as taxi ranks should comply with the building regulations, the design of many taxi ranks is non-compliant. This finding is in line with previous research done in South Africa that reveals that existing transport infrastructure such as taxi ranks are not universally accessible [37]. Some of the off-street taxi ranks had uneven surfaces made of gravel. Basement taxi ranks did not have sufficient lighting and security. The loading zones for taxis were non-compliant with universal design principles. On-street taxi ranks were generally located along busy streets and the taxis obstruct free flow of traffic.

5.7 Train stations

The design of Metrorail stations does not comply with universal design principles. This finding is in line with the research done in Cape Town indicating how inaccessible the Metrorail station were to people who use wheelchairs [26]. The rolling stock which was operating during the time data were collected had floors which were not at the same level with platforms. The platform-to-vehicle gap is one of critical barriers encountered by people with mobility and vision disability [38], [39]. The surfaces around the Metrorail stations and the platforms did not have tactile warning indicators or surfaces which poses high risk of falling of people with vision disability.

6 CONCLUSIONS

The overall assessment of the Tshwane CBD revealed that the design of transport infrastructure does not comply with universal design principles and, in areas where there was compliance, there was a distinct lack of consistency. The urban transport infrastructure around the CBD is not designed to cater to the needs of people with disability. The findings

also revealed that existing transport infrastructure lacks maintenance. The findings suggest that the city does not support independent mobility of people with visual disability as the lack of consistency in the implementation of the tactile surface was consistent throughout the CBD. The study also found that in busy areas, pavements were overcrowded with street vendors, taxis parked on the pavement and shop owners displaying their products on the pavement. However, pavement obstruction does not only affect people with disability but everyone. The city is recommended to train city planners and built environment professionals on disability building regulations. City planners and built environment professionals should be conscious of the needs of different groups of people when planning and designing city infrastructure. The City of Tshwane it is recommended to involve people with disability through participation in planning, designing and implementation of transport infrastructure, transport policies and legislation.

REFERENCES
[1]   Hernández, D., Public transport, well-being and inequality: Coverage and affordability in the city of Montevideo. *CEPAL Review*, **122**, pp. 151–172, 2017.
[2]   Odufuwa, O.B., Towards sustainable public transport for disabled people in Nigerian cities. *Studies on Home and Community Science*, **1**(2), pp. 93–101, 2007.
[3]   Park, J. & Chowdhury, S., Investigating the barriers in a typical journey by public transport users with disabilities. *Journal of Transport and Health,* **10**, pp. 361–368, 2018. DOI: 10.1016/j.jth.2018.05.008.
[4]   Cepeda, E.P., Galilea, P. & Raveau, S., How much do we value improvements on the accessibility to public transport for people with reduced mobility or disability? *Research in Transportation Economics*, **69**, pp. 445–452, 2018.
[5]   Chiwandire, D. & Vincent, L., Wheelchair users, access and exclusion in South Africa higher education. *African Journal of Disability*, **6**(0), a353, 2017.
[6]   Thomas, D.P., Public transportation in South Africa: Challenges and opportunities. *World Journal of Social Science Research*, **3**(3), pp. 352–366, 2016.
[7]   Statistics South Africa (Stats SA), Community survey 2016. Provincial Profile Gauteng. www.statssa.gov.za. Accessed on: 30Jan 2019.
[8]   Grobbelaar-du Plessis, I. & Grobler, C., *South Africa. African Disability Rights Yearbook*, pp. 307–340, 2013. https://home.heinonline.org/. Accessed on: 7 Feb. 2019.
[9]   Boshoff, D.G. & Marais, D., The effects of the expanding outskirts of Tshwane on its CBD and internal structure. *Proceedings in Advanced Research in Scientific Areas* (ARSA), **2**(1), pp. 13–26, 2013.
[10] Wojnowska-Hecial, M., Heciak, J. & Klak, A., Concrete paving slabs for comfort of movement of mobility-impaired pedestrians: A survey. *International Journal of Environmental Research and Public Health*, **19**, p. 3183, 2022.
[11] Owusu-Ansah, J.K., Baisie, A. & Oduro-Ofori, E., The mobility impaired and the built environment in Kumasi: Structural obstacles and individual experiences. *Geography Journal*, **84**, pp. 1003–1020, 2019. DOI: 10.1007/s10708-018-9907-y.
[12] Ndebele, T., Neglect and discrimination: A tale of Zimbabwe inaccessible public transport system. *Journal of African Studies and Development*, **12**(3), pp. 97–103, 2020. DOI: 10.5897/JASD2020.0579.

[13] Vanderschuren, M.J., Baufeldt, J. & Phayane, S., Mobility barriers for older persons and people with universal design needs in South Africa. *14th International Conference on Mobility and Transport for Elderly and Disabled Persons*, 2015.

[14] United Nations Development Programme (UNDP), A review of international best practice in accessible public transportation for persons with disabilities. UNDP: Malaysia, 2010.

[15] Sze, N.N. & Christensen, K.M., Access to urban transportation system for individuals with disabilities. *IATSS Research*, **41**, pp. 66–73, 2017.

[16] Bombom, L.S. & Abdullahi, I., Travel patterns and challenges of physically disabled persons in Nigeria. *Geography Journal,* **81**, pp. 519–533, 2016. DOI: 10.1007/s107 08-015-9629-3.

[17] Wu, C., Li, J. & Li, X., Using community planning method to improve effect of urban barrier-free transportation system. *Transportation Research Procedia*, **25**, pp. 4330–4337, 2017.

[18] Coxon, S., Napper, R. & Richardson, M., *Urban Mobility Design*, Elsevier, 2019.

[19] Radwan, A.H. & Morsy, A.A.G., The importance of integrating street furniture in the visual image of the city. *International Journal of Modern Engineering Research*, **9**(2), pp. 29–53, 2016.

[20] Australian Government, Accessibility design guide: Universal design principles for Australia's aid program. A companion volume to development for all: Towards a disability-inclusive Australian aid program 2009–2014. www.ausaid.gov.au/publications. Accessed on: 28 Mar. 2020.

[21]   Davis, C.J., *Street Design for All: An Update of National Advice and Good Practice*, Public Realm Information and Advice Network, 2014.

[22] Lid, I.M. & Solvang, P.K., (Dis)ability and the experience of accessibility in the urban environment ALTER. *European Journal of Disability Research*, **10**, pp. 181–194, 2016.

[23] Stjernborg, V., Accessibility for all in public transport and the overlooked (social) dimension: A case study of Stockholm. *Sustainability*, **11**(18), p. 4902, 2019. DOI: 10.3390/su11184902.

[24] Bjerkan, K.Y., Nordtømme, M.E. & Kummeneje, A., Transport to employment. *Scandinavian Journal of Disability Research*, **15**(4), pp, 342–360, 2013.

[25] Ahmad, M., Independent-mobility rights and the state of public transport accessibility for disabled people: Evidence from southern Punjab in Pakistan. *Administration and Society*, **2**, pp. 197–213, 2015. DOI: 10.1177/0095399713490691.

[26] Coxon, S., Napper, R. & Richardson, M., *Urban Mobility Design*, Elsevier, 2019.

[27] Ahmad, M., Independent-mobility rights and the state of public transport accessibility for disabled people: Evidence from southern Punjab in Pakistan. *Administration and Society*, **2**, pp. 197–213, 2015. DOI: 10.1177/0095399713490691.

[28] Statistics South Africa (Stats SA). National households travel survey 2020. Statistical release P0320. Accessed on: 14 May 2021.

[29] Wagner, L.P., The siting of public transport facilities in a predominately low to middle-income area, Klapmuts, on the outskirts of a metropolitan city, Cape Town. Masters dissertation, University of Cape Town, 2017.

[30] Cooperative Governance and Traditional Affairs, City of Tshwane Metropolitan GAU. https://www.cogta.gov.za/ddm/wp-content/uploads/2020/11/Tshwane-October-2020.pdf.

[31]   O'Hanlon, J., Scott, M.S. & West, L., Healthy and complete communities in Delaware: The walkability assessment tool. Institute for Public Administration, University of Delaware, 2016.

[32]   Galanis, A. & Eliou, N., Development and implementation of an audit tool for the pedestrian built environment. *Procedia – Social and Behavioral Sciences*, **48**, pp. 3143–3152, 2012.

[33]   European Commission, Best Practice Guide. 20 Best Practice Examples Promoting Sustainable Urban Mobility. https://mobilityweek.eu. Accessed on: 13 Jan. 2020.

[34]   European Conference of Ministers of Transport (ECMT), Improving transport accessibility for all: Guide to good practice. OECD Publications Service: France. 2006.

[35]   Stjernborg, V., Accessibility for all in public transport and the overlooked (social) dimension: A case study of Stockholm. *Sustainability*, **11**(18), p. 4902, 2019.

[36]   Ipingbemi, O., Mobility challenges and transport safety of people with disabilities (PWD) in Ibadan, Nigeria. *African Journal for the Psychological Study of Social Issues*, **18**(3), pp. 15–28, 2015.

[37]   Lister, H.E. & Dhunpath. R., The taxi industry and transportation for people with disabilities: Implications for universal access in a metropolitan municipality. *Transformation*, **90**, 2016. DOI: 10.1353/trn.2016.0009.

[38]   Oksenholt, V.K. & Aarhaug, J., Public transport and people with impairments: Exploring non-use of public transport through the case of Oslo, Norway. *Disability and Society*, **33**(8), pp. 1280–1302, 2018. DOI: 10.1080/09687599.2018.1481015.

[39]   Zajac, A.P., City accessible for everyone: Improving accessibility of public transport using the universal design concept. *Transportation Research Procedia*, **14**, pp. 1270–1276, 2016.