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E-mail: chsud@futminna.edu.ng

ASSESSMENT OF RAMP DESIGNS AS ACCESSES IN PUBLIC BUIL ABUJA, NIGERIA

ANUNOBI, A. I.[1], ADEDAYO, O. F.[1], AYUBA P.[1], OYETOLA, S. A.[1], and OTIJELE, G. O.[1]
[1] Department of Architecture, Federal University of Technology, Minna, Niger State, Nigeria
Corresponding Author: arctonnie2000@yahoo.com

Abstract

Increasingly, concerns about the need to improve the level of accessibility of buildings for the aged and the physically challenged in the built environment especially in public buildings have been raised. This study is aimed at assessing the effectiveness of ramp designs in the Federal Capital Territory Area of Abuja, Nigeria. An adaptive survey was deployed to selected public buildings to generate recommendations for change and improvement. The findings indicate that there are several shortcomings associated with ramp characteristics, landing and handrail provisions in the public buildings studied. The study recommends redesigning of existing ramps to achieve desired standards, and the adherence of prospective designs to desired needs of users to ensure ease of accessibility within the built environment. When implemented, it will eventually allow the elderly and physically challenged move easily, safely and enjoy the great variety of opportunities and experiences existing in the City.

Keywords: Accessibility, Barrier-Free, City, Public Buildings, Ramp Design

Introduction

For many city-dwellers, today's modern cities and towns may be convenient and fascinating places for working and living, offering a great variety of opportunities and experiences (UNESCAP, 2011). However, nearly everyone will experience functional limitations at one time or another and consequently be restricted by barriers resulting from design standardization. According to the Federal Highway Administration [FHWA] (2007), the groups that face the most limitations are the aged; who have problem with balance, strength, or stamina; children and shoppers with trolleys; and the physically challenged. This is because they find environments of public buildings entrances with difficult ramps and unsafe stairs, unable to conveniently access them. For disabled persons, such built environments are full of uncertainties, anxieties and dangers as they encounter many obstacles that prevent them from moving about freely and safely. The obstacles are mainly as a result of differences in height between indoor and outdoor levels at entrances or routes of public and residential buildings, community centers, parks and places of worship, municipal and communication services, and entertainment as well as to various modern facilities (Romanyuta, 2011).

Many disabled persons live in poverty and thus require improvement in their livelihood through the provision and utilization of social facilities such as schools and hospitals Funk, Drew, & Knapp, (2012).. However, most of these facilities are often located in places where access is difficult for them. The inclusion of persons with disabilities in development is pertinent to improving their welfare and that of their immediate family and also has important ramifications for the achievement of international sustainable development goals, such as the Millennium Development Goals (MDGs). Reaching the MDGs is unlikely to be achieved unless the rights and needs of person with disabilities (PWD) are considered in the process of development (World Bank, 2009). Improving the accessibility of the built environment for disabled people is critical to their being able to live independent lives on an equal basis with others (Office for Disability Issues, 2011).

Traditionally, in Nigeria, the aged and the physically challenged have been regarded as a group that should be dependent on the extended family, being passive recipients of services and charity (Wellington, 1992). Over the years, demographic changes have resulted in an upsurge in the number of physically challenged and the aged who are leading active public lives, and have become part of the group patronizing buildings either for recreation, commerce, education. In addition, more people are now living with disability, as medical advances have also enabled people to survive illness and accidents, which were previously considered fatal. The life expectancy in Abuja, Nigeria is expected to increase largely due to healthier living, and better medical care associated with projected economic growth (World Bank, 2010).

In Nigeria, the welfare and interest of the physically challenged and the aged population are administratively a responsibility of the Ministry of Employment and Social Development. However, the planning for and development of public and communal physical facilities that fulfill their existential needs generally fall within the ambit of the Town and Country Planning Department and the various areas and districts under the Ministry of Local Government. These bodies by virtue of their administrative responsibilities are directly charged with ensuring standards in the quality of the Nigerian public built environment. However, they have not confronted the issue of accessibility due to lack of governmental policy objectives (Hagan and Wellington, 1992; Aderinoye, Ojokheta, &Olojede,2007).

Until the passage of the Disability Law in Nigeria the pursuit of institutional framework for legislation towards the development of facilities to meet the needs of the physically challenged had not been a prime consideration. This is in spite of the fact that the provision of special accesses and rails were made mandatory for all public buildings as part of the law. Consequently, there are *physical barriers restricting* movement and utilization of public, social and communal facilities. Though there are a number of multi-storey buildings which have incorporated elevators to aid movement from one floor to the other, the entrances have a flight of stairs thus hindering access from the forecourt to the ground floor as shown in Figure 1.

Handicap ramps are an essential part of any building where access by people with disabilities or those who need the use of a wheelchair is needed. This includes homes, public buildings, public walkways where there are steps up or down to a higher or lower level, specialized motor vehicles, public transportation access points, train stations and indeed anywhere else that wheelchair access may otherwise be limited or even made impossible by the lack thereof (Prose, 2009). An estimated 75% of public buildings in Abuja, Nigeria are inaccessible freely to the physically challenged without assistance due to a lack of or improper design of ramps (Hamzat & Dada, 2005). Existing ramps for public buildings are not well designed and have steep inclinations, slippery surfaces, with inadequate railings, inappropriate locations and are too long with no landing(s). In many instances the physically challenged find the use of such poorly designed ramps inconvenient or difficult, and prefer to use stairs despite the challenges that come with it, when available.

Accumulated evidence by Gitlin et al (2001) shows that inaccessible buildings substantially impact on individuals' independent functioning and health. Many poorly designed ramps are unattractive, detract from a building's appearance and discourage prospective developers from having such a useful addition in their projects. The objective of this study is to bring to the fore the technicalities involved in the design of the elements of a ramp to guide their provision in public buildings which will substantially impact on individuals' independent functioning and health. Also this study will bring to the fore deeper perspectives in the design and deployment of ramps in public buildings to make their use smart, safe, and attractive in Nigerian cities. The study intends to assist building designers (architects and interior designers) and building managers (facilities managers) to provide design sustainability in terms of accessibility to meet the needs of persons with disabilities both today and in the future.

Figure 1: Entrance of a public building with no ramp provided
Source: Authors Field Survey, 2014.

Accessibility and Disability

According to the International Standards Organization (2009), accessibility includes ease of independent approach, entry, evacuation, and or use of a building and its services and facilities by all of the building's potential users with an assurance of individual health, safety, and welfare during the course of those activities. The main public entrance or route to a building should be accessible to all persons, regardless of disability. Accessibility to buildings or part of buildings, into them, within them and exits from them should be a prime consideration in the design and construction of a building. An accessible barrier-free environment is the first step towards fulfilling the right of People with Disability (PWD) to participate in all areas of community life. Article 9 of the UN convention on the rights of PWD on accessibility notes that, to enable persons with disabilities to live independently and participate fully in all aspects of life, appropriate measures should be taken to ensure persons with disabilities have access, on an equal basis with others, to the physical environment, transportation· systems, and other facilities and services open to or provided for the public, both in urban and in rural areas (UN Enable, 2004).

Sustainability and Design for disabled persons

Sustainable design involves the consideration for both social contribution and ecologically acceptable solutions in the design process, (International Design Society of America [IDSA], 2005), includes an interaction between social, economic and environmental values. This means that sustainable design can be considered completed only when these three values are satisfied (Lee et al, 2009). The environmental aspect embraces an ecological approach that pursues environmental conservation and use of regenerative energy. The economical aspect seeks efficiency of resource utilization and system flexibility. The social perspective however is relatively ambiguously valued. In an account of sustainability, Mckenzie (2004) identified four characteristics of social sustainability; 'need-sufficient', 'reliable', 'adequate', 'equal'. The term 'need-sufficient' suggests every development has to provide physical and psychological satisfaction to humans. 'Reliable' suggests that final deliverable has to be conveyed in a stable way and users also have to perceive this reliability. 'Adequate' is the property that consider user context such as culture, geography, economic situation and other user appropriate needs in the development process. 'Equal' has close relationship with universal design. It aims to enable every user to consume the resource or product equally and in this way, the basic user-ability has to be secured thus giving the user a feeling of 'convenience'.

According to the United Nations Economic and Social Commission for Asia and the Pacific [UNESCAP] (2011), persons with disabilities include those who have long-term physical, mental, intellectual or sensory impairments, which their interaction with various barriers may hinder their full and effective participation in the society on an equal basis with others. The term disability is conventionally used to refer to attributes that are severe enough to interfere with, or prevent, normal day-to-day activities and can be permanent, temporary, or episodic. They can affect people from birth, or be acquired later in life through injury or illness (Right to Play, 2010). On the other hand, the wheelchair-bound handicapped, is a person who cannot walk on his feet but must be transported with the aid of a wheelchair for a limited time or for all his life (Hacihasanoglu and Hacihasanoglu, 2001).

The Design of Ramps

The Americans with Disabilities Act [ADA] (2002), defines ramp as an accessible route for walking or wheeling in the form of an inclined plane with a slope greater than or equal to 1:12 from the horizontal. The Canada Mortgage and Housing Corporation [CMHC] (2011), asserts that a ramp is ideal for people who are having difficulty negotiating stairs for various reasons, be it the need to carry heavy objects between levels, move a child in a stroller, or because of a disabling condition. Providing both stairs and a ramp at changes in level will allow people to choose the option that best suits their needs, resulting in a flexible and more universally accessible design (CMHC, 2011). According to the Centre for Accessible Environments [CAE] (2011), ramps, both external and internal, connecting different levels need to be designed and detailed with care if they are to have real practical value. When the topography or the configuration of an existing building is restrictive, variations may be done to the gradient as a function of the ramp length (United Nations, 2003). Slopes beyond 1:10 become hazardous even for people who are physically fit. Recommended minimum and maximum ramp slopes by the United Nations are shown in Figure 2.

The United Nations Manual on Accessibility recommends that ramps be provided wherever stairs obstruct the free passage of pedestrians, mainly wheelchair users and people with mobility problems (United Nations, 2003). Much as the desirability of ramps are obvious, there are also potent arguments against them. Mace (1991), though highly in favor of the universal design, however recommends the avoidance of ramps as much as possible for reasons such as difficulty to incorporate sloping handrails into the design of a house as well as conflict of interest arising when ramps with their handrails become very notable elements. This, according to Mace, tends to label a residence as 'accessible' or as a house for people with disabilities, such that able-bodied people might prefer not to live in such a house. In tropical parts of the world such as Nigeria, accidental slips caused by accumulation of dry sand on ramps and wet ramps during rainy seasons are problems associated with ramps. This is aggravated by smooth surface finish of steep ramp gradients. It is in this direction that stairs with proper handrails are recommended alongside with ramps so that people are not compelled to use ramps (United Nations, 2003).

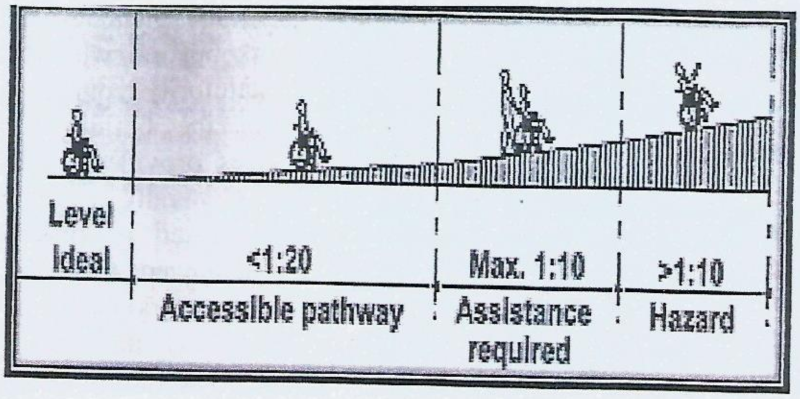

Figure 2: Minimum and Maximum Ramp Slopes
Source: United Nations, 2003.

Study Approach and Data Collection Methods

The study was carried out employing adaptive survey to gather data that were analyzed to generate recommendations for change and improvement. Methods of data collection predominantly employed were access audit. Holmes-Siedle (1996) asserts that access audit gives a "snapshot" of an existing building at a given point in time. The snapshots are a useful starting point in assessing the current state of accessibility and inaccessibility of existing buildings. An access audit examines an existing building against predetermined criteria designed to measure the "inability" of the building for disabled people. Access audit is a structured approach to accessibility that results in collecting information that can lead to improvements (which would not have occurred by using an ad-hoc approach) and opportunities that reduce overall cost improvements (which causes them to be more affordable).

Holmes-Siedle (1996) adds that, in audits carried out for adaptive survey, the surveying and reporting team should be experienced in the design of buildings for disabled people and the process required for their implementation. For this research, two graduate research assistants were taken through training and tutorials to serve as field assistants. They used a checklist to assess the accessibility of selected case study buildings over a two-week period in August, 2014. The study was conducted on selected buildings with ramps at their main entrance. A total of sixteen buildings with ramps were studied, out of which five are single storey and eleven were multi-storey. A purposive sampling was employed to achieve two strata of buildings based on the following criteria: (i) buildings with ramps designed and provided during the construction of the buildings: and (ii) buildings with ramps that were added on to an existing building. The buildings under criteria (ii) are such buildings that had existed without a ramp, but a need had been realized over time to incorporate a ramp. Twelve out of the sixteen buildings studied (75%) had ramps designed and provided during the construction, with the rest (25%) having the ramps constructed later in the course of use of the buildings.

Measuring tapes were used to determine the existing dimensions of the ramps. The data obtained from the measuring tapes were used for a comparison between the required measurement and the observed measurement to determine whether or not it complies with the standard. Sketchbooks were used to record data manually by drawing the conceptual diagram of movement as well as recording measurements and problems that were identified through observations. Data collected on ramps included total horizontal running distance, total vertical rising height, materials used, characteristics of landings and handrails, location, slip resistance, presence of curbs, and compliance to codes. These data were gathered and analyzed using four broad categories regarding their specific characteristics namely Ramp, Landing, handrail, and Entrance Door. A digital camera was used to take photographs of the entrances with ramps and analyzed within the context of the study objectives. Slope of ramp were obtained by taking the ratio of the effective height to the total horizontal running distance from one level to the other. The data for this study are presented in narratives and in table formats. The responses were coded and inputted for analysis using the Statistical Package for the Social Scientists (SPSS).

Findings and Discussion

All the building entrances studied had ramps connecting the foreground to the ground floor. There was no building with ramp connecting to an upper floor. Only 11% of the buildings had an elevator in place to aid movement to the upper floors. This is because 80% of the buildings do not exceed four floors, which is the mandatory minimum number of floors beyond which the Nigeria Building code statutorily requires an elevator. Only two of the buildings surveyed had parking spaces provided for the physically challenged. Generally, most buildings do not have dedicated parking spaces for the physically challenged; hence, such users depend on off-street parking and pockets of parking spaces that are not designed to function as such. The ramps are generally of a straight run, with the exception of two of which one is an L-shaped and the other curved as a result of limitation on space and constrained starting and ending points of the buildings in questions. Based on the checklists for access audits for ramps identified, the frequency of occurrence of observed characteristics of ramps at entrances studied are presented in Table 1 and Table 2. The observations were mainly associated with: (a) ramp characteristics; (b) Landing provision and characteristics (c) handrail provision and characteristics; and (d) entrance • door characteristics.

Table 1: Frequency of observed ramp characteristics

Ramp Characteristics:	%
Construction Material:	
Concrete	100
Material of surface:	
Tiles (ceramic porcelain)	67
Cement and screed	22
Terrazzo	11
Texture of surface:	
Smooth	22
Rough	88
Clear width:	
>1050mm	67
<1050mm	22
>or=3000mm	11
Slope:	
<1:12	88
>1:12	12
Horizontal running distance:	
>9700mm	11(NL)
<9700mm	89
Vertical rising distance:	
>760mm	44
>500mm	67 (NL)

Source: Field Survey, September, 2014.

Table 2: Frequency of Associated features with Ramp

Landing Characteristics:	%
Size:	
<1500x1500	11
>1500x1500	89
Handrail Characteristics:	
Location:	
Both sides	20
One side	80
Height:	
<or=950	100
Material:	
Metal	60
Concrete	40
Door Characteristics:	
Door width:	
<1000mm	100
Door material:	
Glass	67
Metal	33
Door handle position:	
>970mm	100
Threshold Height:	
>25mm	33
None	67

Ramp Characteristics

All the ramps audited were made of concrete, which is one of the most commonly used construction materials for buildings in Nigeria. Hacihasanoglu and Hacihasanoglu (2001) recommend that a ramp connecting a change in level of more than 500mm should always have an associated flight of steps in close proximity, which should also be carefully designed. The audit revealed that entrances of about 89% of the buildings studied had a staircase alongside the ramps, even though not all of them have the change in level of up to 500mm minimum rise, required for ramps to have a flight of steps in close proximity. This fosters movement since the physically challenged who are not wheelchair users find ramps, especially steep and long ones, inconvenient or difficult to use and prefer to use stairs. Thirty-five percent (35%) had a clear width of less than the recommended minimum of 1050mm to enable a wheelchair to turn or at least 1500mm to allow 2 wheelchairs to pass-by. This does not enhance movement and maneuvering of wheelchair users. It was also observed that the ramp of one building had a width of 1200mm at the starting point but reduced towards the ending point to 900mm, making its use inconvenient for users.

An assessment of the slopes revealed that about 85% of ramps studied had slopes of greater than the recommended value of 1:12 or 8.3% to the horizontal. This could be attributed to limitation of space and constraints at the starting and ending points largely because the provision of ramps are treated as afterthought. For some of the buildings, the ramps could not be used because of inappropriate gradients. Fifty percent (50%) of the ramps have gradients as high as 1:5.4 making persons with disability, particularly those using clutches, to find them inconvenient and difficult to negotiate. This range of slope is hazardous even for people without disabilities.

The UN Enable (2004) recommends that ramp surface should be hard and non-slip. Data from the field survey revealed that 60% of the ramps studied had porcelain or ceramic floor tiles finish, 38% had unpolished terrazzo finish, and 2% had cement sand screed finish. Though the use of unpolished tiles provides a firm surface for users, there are some with relatively smooth surfaces while the polished tiles do not provide a non-slip surface for users hence posing a hazard of slipping off, especially in times of rain as most of the ramps are neither covered nor protected. ADA (2002) indicates that, thresholds should not be placed at the doors and that if there is a requirement for making thresholds, then its height should not exceed 25mm. Thresholds obtained from the field ranged between 50mm and 100mm and were not leveled to facilitate passage of wheelchairs. The accessibility of about 80% of buildings with ramps in place is limited due to barriers posed by relatively high thresholds at the doorway. Figures 3 and 5 show the entrance of a public building with a relatively high door threshold that confronts users after ascending a ramp.

Figure 3: High thresholds at a main entrance doorway
Source: Field Survey, 2014.

Landing Provision and Characteristics

The study revealed that most of the ramps have long and stressful climbs, with no periodic level areas or landing between slopes that will allow for resting, safe and easy maneuvering. Landing is an essential element towards maintaining an aggregate slope of a ramp (ADA, 2002). Evidence from the field survey indicated that 95% of the ramps had landings both at the starting and ending points and were all made of the same material as the ramp. The ability to manage an inclination is related to both its slope and its length. ADA (2002) further states that, a ramp should have a landing provided at either every total vertical rising of 760mm; or a total horizontal running distance of 9120mm; or at every change in direction or at the top or bottom of the ramp. In addition, Hacihasanoglu and Hacihasanoglu (2001), have argued that landings shall have the following features; (1) The landing shall be at least as wide as the ramp run leading to it; (2) The landing length shall be a minimum of 1,525 mm clear; and (3) If ramps change direction at landings, the minimum landing size shall be 1,525mm by 1,525mm.

Majority of the landings have the same width as the ramp; however, the lengths are shorter than the recommended size of 1,525mm. Data from the field survey revealed that 25% of the buildings studied had no landing before the entrance as the ramps run directly to the threshold at the door. Even though these ramps did not need to have a landing because the total vertical rise of 440mm was less than the recommended value, the absence of the landing before the door caused wheelchair users and ambulant persons to tip backwards as they stop on the sloping surface of the ramp to open the door (Figure 4).

About 95% had a total vertical distance of less than the recommended 760mm (see Table 2) for which no intermediate landing is required. It was further observed that about 20% of the landings were less than the recommended dimension of 1,525mm by 1,525mm to allow for maneuvering and turning by users. Only one building had an intermediate landing as a result of the use of an L-shaped ramp design arising from restricted space. All the landings had the same surface finish as the ramps. Forty-four percent (44%) of the ramps of buildings studied have a maximum rise of between 800 to 2200mm, as compared to the recommended maximum of 760mm. Some ramps run on horizontal distance of more than 9700mm or vertical distance of more than 760mm but have no intermediate landing to provide wheelchair users a convenient level surface to rest.

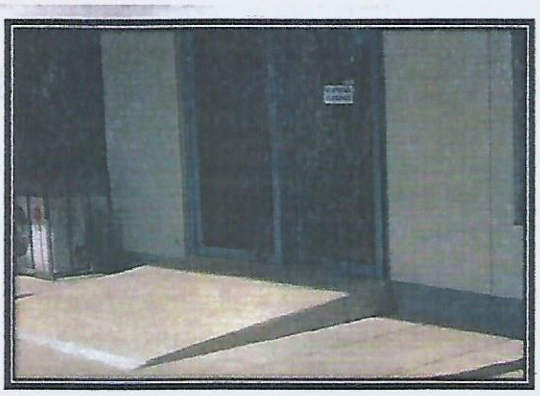

Figure 4: Ramp running directly to threshold of door with no landing
Source: Field Survey, 2014.

Handrail Provision and Characteristics

If a ramp has a rise greater than 150mm or a horizontal projection greater than 1,830mm, then it shall have a handrail on both sides (ADA, 2002). The handrails should be firmly fixed with the top properly shaped and placed safely to provide guidance, balance and support to users. About 45% of the ramps surveyed had handrails on either the left or the right side only; with 10% having handrails on both sides of the ramp, and 45% of the ramps had no handrails at all though their vertical rising height is greater than 150mm and the horizontal projection is greater than 1,830mm (Figure 5).

Reviewed literature (Gitlin*et al, 2001;* Hacihasanoglu & Hacihasanoglu 2001; Hamzat, & Dada, 2005), indicates that the top of handrail gripping surfaces should be mounted between 865mm and 965mm above ramp. An evaluation of the handrails provided for ramps studied shows that heights of all handrails, fell within the recommended range of 865mm and 965mm above the ramp surface. Further literature study Lee, *et al,* 2009; Mace, 1991; Romanyuta, 2011). also indicates that ramps with width of more than 3,000mm should have an intermediate handrail. One building had a ramp of width of 3,600mm, but it had no handrail at all even though it had a total rise of 2,200mm, which is by far greater than the recommended minimum of 150mm to have a handrail provided. This could make the use of the ramp dangerous for users. By virtue of the fact that children also use public buildings, a second set of handrails at an appropriate height can assist them and aid in preventing accidents. None of the ramps with handrails had a provision made for children at an approximate height to aid them and prevent accidents.

Figure 5: Ramp with no guiding handrails for users
Source: Field Survey, 2014.

Grasp ability is recommended on a handrail that does not require significant hand and finger joint movement. For this reason, an elliptical or a circular profile of not less than 45mm and not more than 60mm in diameter is recommended (Hacihasanoglu and Hacihasanoglu, 2001). For the buildings surveyed, among the 45% that had handrails, half of them had metal pipe rails with diameter between 50mm and 60mm. The rest had concrete or cement-sand block walls of between 200mm and 300mm thick, which do not provide a firm grip for users. An examination of the handrails revealed that some do not have good grasp ability because they have diameters that are bigger and beyond the recommended 60mm diameter.

Conclusion and Recommendations

Among the objectives of this study is to bring to the fore the technicalities involved in the design of elements of ramps to guide their provision in public buildings and make their use smart, safe and attractive in Nigeria's Federal Capital Territory, Abuja. Data from sixteen public buildings with ramps at their entrances in Abuja were analyzed using descriptive analysis based on access audits, observations, plan analysis, photographs and questionnaires. The findings show several shortcomings associated with ramp characteristics, landing provision and characteristics, and handrail provision and characteristics that subtract from their usefulness in providing design sustainability in terms of accessibility at entrance of public buildings. Several challenges were observed with a few of them here-under highlighted:

Challenges with ramp characteristics related to inadequate width, steep slopes, use of inappropriate surface materials. Relatively high and non-leveled thresholds impeded the use of wheelchairs while challenges with landing provision and the absence of landing at the middle, end of ramps and before entrances, create huge difficulties for wheel chair users. Short lengths and widths of ramps hinder maneuvering of wheelchair while horizontal running distance higher than the recommended distance and inappropriate surface finish affect the use of ramps in public buildings. Challenges with handrail provision and characteristics indicated that though the appropriate height of handrails was used for most of the ramps, the provision of handrails on both sides of the ramp, intermediary handrail, grasp ability, and secondary handrail for children were not considered for all ramps. Ramp design at building entrance should ensure ease of maneuvering to achieve a more sustainable access to meet needs of both current and future users. Besides the statutory requirement for provision of ramps for ease of accessibility, should be seen as an important element of sustainability.

Based on the above conclusions, the following have been recommended to make the design of ramps suitable for the use of the physically challenged to access public buildings:

- Existing ramps that have inappropriate slopes, widths and surfaces should be redesigned and reconstructed with appropriate response to spatial constrains to achieve a gradient ratio of 1:12 and provisions must be made for handrails on both sides of the ramp. Non-slip surfaces should be provided for users to achieve a firm grip during the use of the ramps.
- Finished floor levels at entrances should be increased to either remove thresholds or reduce them to the recommended maximum height of 25mm.
- The Ministries, Departments and Agencies responsible for the built environment should initiate measures to remove obstacles to participation in the physical environment by persons with disabilities. Such measures should lead to the development of standards and guidelines and also include enforcing laws to ensure accessibility to various areas in the society, such as housing, commercial buildings, and other outdoor environment.
- Organizations of persons with disabilities should be involved in the development of standards and norms for accessibility. They should also be involved locally from the initial planning stage when public construction projects are being designed, thus ensuring maximum accessibility.
- Professionals such as architects, construction engineers, planners, building inspectors and others who are professionally involved in the design and construction of the physical environment should be provided with continual training and have access to adequate information on disability policy and measures to achieve accessibility.

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