Investigating the Level of Attention to the Principles of Accessibility of People with Disabilities of Public Buildings

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Abstract. Providing an appropriate platform for the active presence of all community members is regarded as one of the approaches of community growth and development. Physically disabled persons should access their environmental requirements in the activities of daily living as much as possible without the assistance of others. Tailoring results in removing current physical and architectural barriers and modifying environment for moving all people such as physically disabled persons in their surroundings including public places freely and safely. The public buildings of city are considered as one of the important buildings which should be publicly accessible. Regarding the overview of public buildings, little attention has been paid to the presence of physically disabled persons in designing and implementing these buildings, leading to their minimum use of these public buildings. The present study aimed to assess the public buildings of Babol with respect to tailoring principles for physically disabled persons. The American with Disabilities Act Accessibility Guidelines (ADAAG) standards were used in the present study to derive the rules and instructions of tailoring architecture for disabled persons and their matching was measured through field study. Twenty public buildings were randomly selected among busy ones in Babol as the samples under field study. Regarding each variable under study including accessible parking, entrance doors, inclined surfaces, corridors, interior doors, elevators and restroom, a checklist was created by using micro questions based on above-mentioned standard and assessed through measurement tool and field observation in each building. Based on the results, the amount of following the standards of variables in buildings were as interior doors, main building entry, interior access routes, elevators, ramps and inclined surfaces, restroom and parking, respectively.

Introduction

Applying the capabilities of all community members is considered as one of the approaches of community growth and development, which is achieved by providing appropriate platform and adequate facilities for presenting all people in community actively and using current facilities publicly. Despite the limitations of physically disabled persons, they possess a lot of physical and mental competences which can be used to advance community objectives if their active presence in community becomes possible. They should be able to do the activities of daily living and meet routine requirements as much as possible without the assistance of others. Since everyone has the right to access his environmental requirements in the activities of daily living without the help of others, physically disabled persons should not be forced to use the assistance of others in their daily commutes in order to preserve individual independence.

Based on the 12th part of the world programme of action concerning disabled persons approved by United Nations General Assembly (UNGA) resolution in 3 December 1982, the equalization of opportunities in developing countries is considered as a process for accessing the general system of society such as physical, cultural, housing, transportation, social and health services, and employment, life, social and cultural opportunities including sport and recreational facilities by community members especially disabled persons. The rules and instructions of urbanization and architecture for physically disabled persons in Iran which was approved by Supreme council of urbanization and architecture in 1989 and edited for the second time in 1999 are regarded as first serious action for codifying the laws supporting physically disabled persons in the field of tailoring

urban environment. Considering article 2 of the act of the comprehensive protection of disable people approved by lawmakers in 2004, all ministries, institutions and governmental and private organizations and companies should consider the possibility of the accessibility and utilization of public buildings and areas, passages and service devices for disabled persons along with normal persons during their designing and constructing. This article is dedicated to the tailor of buildings and urban spaces for accessing and utilizing by disabled persons. Further, it forces municipalities to avoid issuing completion certificate to the public buildings and areas and passages which did not follow the professional standards related to disabled persons.

Based on the world health report 2012, almost 15% of world population possesses a type of disability. Considering 2011 census in Iran, 1017659 persons were recognized with at least one physical disability. Mazandaran province is regarded as one of the most populous provinces of Iran and located in the southern margin of Caspian Sea. Babol as the most populous city of Mazandaran possesses 3678 physically disabled persons (1.56% of population) based on the results of 2011 population and housing census. Further, the persons having temporary physical mobility limitation due to various reasons and temporary physical mobility limitation and weakness in their organs, suffering from acute or chronic low back pain or osteoarthritis (knee osteoarthritis) and carrying heavy loads, mothers who carry their children in a carriage, elderlies, children and pregnant should be added into this population with permanent physical disability, leading to an increase in the percentage of the persons facing movement problems for accessing public buildings due to different reasons. Further, the impossibility of movement freely in all urban facilities results in depriving the possibility of their continuous and normal presence in community. Rattray (2013) assessed the disabled person's experience regarding facing inaccessible urban spaces in Ecuador and found that the existence of the urban public spaces which are inappropriate for disabled persons led to their lower use from urban public spaces, loneliness and seclusion and increase in their social exclusion.

Tailoring current status means the modification of pre-created conditions, which results in removing physical and architectural barriers and reforming environment to moving all people such as those having physical mobility limitation in their surroundings including public places freely and safely. Providing the possibility of returning disabled persons to normal life such others and entering them into community is regarded as the objective of making environment accessible. The accessibility of public buildings is considered as the main issue in tailoring urban environment after passages and urban equipment. Disabled person and elderly should be able to use all urban public areas and this issue should be considered in both of the plan related to the interior architecture of building and building access. The building access connects building to urban environment, which is regarded as an interface between urban environment and interior space of public buildings. The overview of public buildings indicates that little attention has been paid to the presence of physically disabled persons during designing and implementing these buildings, leading to their minimum use of these buildings and induction of the feeling of disability. The present study sought to evaluate the public buildings of Babol with respect to tailoring principles for physically disabled persons.

Literature review

Welage and Liu reviewed the previous studies conducted on assessing public buildings with respect to accessibility principles for disabled persons (2011). Further, they evaluated 12 studies among 85 ones more accurately, among which seven studies were performed in United State and others were conducted in Mexico, Nigeria (West Africa), Turkey, the United Arab Emirate (Middle East) and Zimbabwe (Africa). Furthermore, the American with Disabilities Act Accessibility Guidelines (ADAAG) was used as tool to assess the accessibility of disabled persons to public buildings in these 12 studies. Based on the results of their study, no study reported the possibility of the accessibility of wheelchair users to public buildings as 100%. Additionally, appropriate parking and entry were obtained as the variables which were followed minimally and maximally, respectively (Welage & Liu, 2011). The present study tried to create a checklist by using the standard tool of ADAAG for evaluating intended public buildings by considering the lack of using this tool in the few

studies conducted in Iran on assessing public buildings with respect to tailoring principles for physically disabled persons.

Numerous studies were conducted in different countries to evaluate public buildings with respect to accessibility principles for physically disabled persons. For example, Rivano (2004) assessed the accessibility of public buildings among 17 buildings in the United Arab Emirate based on ADAAG standard and reported that maximum and minimum followed factor were obtained as access routes (76%) and parking (19%), respectively. Further, the items related to mentioned standard was not followed as 100% in any building (Rivano, 2004). Based on the results of the study of Hamzat and Dada regarding the evaluation of public buildings with respect to tailoring principles for disabled persons by using ADAAG in 38 public buildings of Nigeria, only 18.4 (7), 45.1 and 19.4% of buildings, entries and access routes were tailored for wheelchair, respectively. Additionally, hospital buildings attained the maximum percentage of tailoring and 66.7% of accessible buildings, while no social and recreational one was accessible (Hamzat & Dada, 2005). Keerthirathna et al. mentioned the unsatisfactory of the accessibility of public buildings for disabled persons in Sri Lanka by assessing public buildings with respect to accessibility for disabled persons (2010). Based on the results of the study of Yarfi et al. (2017) on the accessibility of wheelchair to 84 public buildings in Ghana, only 40.5 (34), 52.3 and 87.4% of buildings, entries and access routes can be used by wheelchair. Further, 13 buildings (25%) of 52 ones having more than one story were tailored for accessing upper stories by elevators. Al Shahri et al. (2018) assessed the architectural access to buildings in King Abdul-Aziz Medical City in two phases of implementing questionnaire among disabled people and evaluating buildings with respect to tailoring principles based on the standard questionnaire of ADA. The results of their study indicated that the architectural access to buildings were determined as waiting area and registration counters (46.5%), signage (45%) parking (36%), toilets (34.75%), exterior access (32.5%), patient sleeping rooms (29.5%) and interior access (11.75%) (Al Shahri et al., 2018). Yilmaz reported the results of the study conducted on the principles of appropriate mobility circulation for physically disabled persons in Selçuk University (2018). The public and private buildings located in the center of Harare were evaluated by Munemo in 2018. In this regard, 40 physically disabled persons were questioned in the field of building access in this urban area. The results indicated that the maximum discomfort of disabled persons was related to the lack of ramp, insanitary restroom, problem of moving in parking and the like. Further, he provided some solutions for improving the current status of buildings (Munemo, 2018). Ulvi (2019) assessed the commercial buildings of Ankara with respect to accessibility principles for physically disabled persons. Based on the results of the study of Farzana regarding the evaluation of accessibility to 75 public buildings with respect to accessibility principles for wheelchair users, only 6.7% of the buildings under study were appropriate with respect to accessibility for disabled persons and 28% of them (25 buildings) can be modified to tailor accessibility (2019).

Method

A combination of library and field methods was used to collect data in the present study. Further, ADAAG standards were applied to derive the rules and instructions of tailoring architecture for disabled persons in the present study by considering its use as more common tool in the previous studies conducted on assessing public buildings with respect to accessibility principle for disabled persons as Welage and Liu (2011) reported in their review. Furthermore, field study was applied to measure matching the rules and instructions of tailoring architecture environments for physically disabled persons. Formulated tables and checklists were completed by using observation tools and assessment of the details of architectural elements such as stair, entrance door and ramp in field study. The different variables which affect tailoring architecture for disabled persons were evaluated through quantitative methods in the public buildings under study summarily and categorized to obtain an desirable conclusion regarding the amount of compatibility between the architecture of public buildings in Babol and rules and instructions in order to pose some suggestions in future to improve current status based on variable prioritization and current status of buildings for attaining appropriate status in different executive phases. Twenty public buildings were randomly selected among busy

ones in Babol as the samples under field study. The variables assessed based on ADAAG standards were as follows:

- Accessible parking
- Accessible entrance doors
- Accessible inclined surfaces
- Accessible corridors
- Accessible interior doors
- Accessible elevators
- Accessible restroom

Further, following micro-variables were evaluated in each above-mentioned variable.
The micro-variables assessed in the parking of public buildings were as follows:

- Is there public parking space on site?
- Is parking intended for disabled persons?
- Is the width of determined space four meters?
- Is this space considered as the closest one to building entry?
- Is there an accessible route from parking to building entry for disabled persons?

The micro-variables evaluated in the ramp of public buildings were as follows:

- Is building entry accessible without ramp?
- Is there a ramp if building entry is inaccessible?
- Is ramp slope 1:12 or 8% or less?
- Is ramp height 76cm or less?
- Is the useful width of ramp at least 91.4 or more?
- Is ramp surface non-slider, hard, and firm?
- Is there a landing with minimum width and length of 150cm at the top and bottom of ramp?
- Is there a landing with the dimensions of at least 150× 150cm if ramp redirects?
- Is there a handrail in the both sides of ramp if ramp covers more than 15cm level difference?
- Is the height of the upper part of handrail between 86 and 96cm?
- Is handrail continuing 30cm in the top and bottom of ramp?

The micro-variables assessed regarding the main entry of public buildings were as follows:

- Is main entry accessible (with revolving door or swing, ….)?
- Is there a replacement option for entrance if main entry is inaccessible?
- Is the splay angle of door at least 90º?
- Does full opening entrance door result in creating at least 81.5cm open area?
- Regarding sliding doors with threshold as entrance door, is its maximum height more than 1.9cm?
- Regarding non-sliding doors with threshold as entrance door, is its maximum height more than 1.3cm?
- Can all equipment on door such as lock and handle be used by one hand without turning wrist?
- Is equipment on door placed in the height between 86 and 120cm from floor?
- Is there at least five seconds for closing door from 90 to 120º in the doors having automatic door closer?
- Is there at least 120cm distance between doors and walls during opening fully double entry doors?

The micro-variables evaluated in the interior access routes of public buildings were as follows:

- Is there at least one accessible access route in all public land uses?
- Is the flooring of routes non-slider, firm, and devoid of long pile?
- If there is carpet or mats no higher than 1.2cm thick?
- Are carpet and flooring edges safe and firm?
- Is minimum route width 91.4cm?

- Is maximum splay size more than 1.27cm if network or splay or seam surface is available in route?
- Is the slope of the inclined surfaces located in access routes more than 1:20 by considering that higher slopes are observed in ramp in which the standards of ramp should be followed?
- Is there transverse slope in inclined surface?
- Are the land uses of access route such as fire extinguisher, drinking fountain and signs interred into the route more than 10cm?
- Is their minimum height from ground level 68.5cm or less if the leading edge of each land use is more than 10cm?
- Is the minimum height of each leading edge in the route 2m or more from floor?

The micro-variables which were evaluated in the interior doors of public buildings were similar to the standards assessed regarding their main entrance door.

The micro-variables assessed in the elevators of public buildings were as follows:

- Is the public space of this building located in more than one story?
- Is there elevator to access higher public stories?
- Is elevator hall call button mounted in the height less than 137cm?
- Is elevator door automatically reopened by impacting a barrier?
- Is the minimum useful dimensions of car 91.4× 137?
- Is the minimum useful width of elevation door 81cm?
- Is elevator door at the level of hallway floor?
- Is minimum waiting space in the front of the elevator related to each story 150× 150cm?

The micro-variables assessed regarding the restrooms of public buildings were as follows:

- Is there public restroom in complex?
- Is there a special restroom designed for disabled persons?
- All standards mentioned in entrance door.
- Is the height of toilet seat between 43 and 48.5?
- Is a handle bar with the minimum length of 106.5cm mounted in a side of toilet on wall?
- Is the height of bar between 83 and 92cm?
- Does the remaining space of restroom become 142×152.5 by opening door completely?
- Is there at least a mirror which the height of its downer edge is maximally 101.6 from floor?
- Is there at least a sink with the accessibility dimensions of 76×122cm?
- Is there dent under sink that possesses wheelchair close to under sink?
- Is the distance between sink surface and floor higher than 86.5cm?
- Is the height of the topmost part of dryer, Kleenex, and all equipment more than 122cm?

Results

The section of field study involved referring and assessing the standards mentioned in public buildings. Regarding 20 public buildings under study, public parking was observed only in two buildings in which no special parking was considered for disabled persons. Thus, the item of accessible route from parking to main building entry was not evaluated. The results of this section are summarized in Table 1.

Table 1. Results of the evaluation of buildings with respect to the standards related to accessible parking

	Parking	Parking for people with disability
Yes N(%)	2 (10%)	-
No	18	20

The presence or absence of level difference in building entry was assessed as the first item of the standards related to inclined surfaces. Building floor in Babol is usually implemented above ground level due to its location in moderate and humid climate and presence of humidity in ground surface.

Thus, 19 buildings were implemented with the tangible level difference relative ground level and only one building possessed an inconsiderable level difference (7cm) because of this climatic issue. As mentioned in Table 2, nine buildings had stair to access persons along with ramp by regarding 20 buildings with level difference in their entry. Further, all nine ramps possessed standard non-slider surface, among which standard length, width and area were not followed in three cases and the standard slope of ramp was only followed in two ones of which one had a 8cm threshold in its beginning despite the possession of standard slope. There was no sample in which the standards related to the handrail of inclined surface were correctly followed and standard handrails were mounted in both sides of inclined surface. Table 2 represents the results of this section.

Table 2. Results of assessing buildings with respect to the standards related to accessible ramps

	Different level in entrance	There is ramp	Accessible slope	Suitable surface	Accessible area	Accessible hand railing
Yes N(%)	20 (100%)	9 (45%)	2 (22% of 45%) 10% of All	9 (100% of 45%) 45% of All	6 (66% of 45%) 30% of All	0
No	0	11	7	0	3	9

Based on the results, the main entrance door of two buildings was swing door and others could be used by disabled persons. Further, the standards of entrance door were followed in 19 buildings, while the dimensions of one door was less than standard and two consecutive doors without following standard distance between them were observed in its entry. Furthermore, the main entrance doors of four buildings were opened hardly by applying high force and devoid of the standard handle and equipment which need the minimum pressure of hand for opening. Finally, the threshold of four entrance doors was more than standard, while 16 cases were devoid of threshold. The findings related to this section are presented in Table 3.

Table 3. Results of assessing buildings with respect to the standards related to accessible Entrance

	Suitable entrance for people with disability	Accessible area	Suitable accessories	Standard vertical threshold
Yes N(%)	18 (90%)	19 (95%)	16 (80%)	16 (80%)
No	2	1	4	4

Regarding the assessment of the standards related to the interior access routes of building, the dimensions related to the access routes of two buildings were less than standard, while those were followed in 18 buildings. Leading edges such as flower pot, chair, table, banner advertising, dustbin and drinking fountain were observed in the interior routes of 19 buildings. The presence of leading edges in route resulted in reducing the dimensions of routes from standard in six buildings, while those of 14 buildings did not decrease to below standard. Additionally, the floor slope of routes in one building was more than standard and one sample possessed very slider surface, while the surface of the interior routes of 19 buildings was non-inclined and had standard material. Table 4 indicates the results of this section.

Table 4. Results of assessing buildings with respect to the standards related to accessible Routs

	Suitable area	Standard protruded objects on circulation	Suitable area with fix furniture	Suitable slope	Suitable surface
Yes N(%)	18 (90%)	1 (5%)	14 (70%)	19 (95%)	19 (95%)
No	2	19	6	1	1

The results of evaluating interior doors in 20 buildings (Table 5) represented that two buildings were devoid of interior doors. Considering 18 buildings with interior doors, two cases possessed non-standard handle and required high force for opening and two ones had threshold in their interior doors. Further, the interior doors of 16 buildings were without threshold and had standard handle.

Table 5. Results of assessing buildings with respect to the standards related to accessible Interior Doors

Suitable area	Accessible hand railing	Standard vertical threshold	Suitable area
Yes N(%)	17 (94%)	16 (89%)	16 (89%)
No	1	2	2

Four buildings possessed only one story as public space, while more than one story as public space were observed in others among which only six buildings had elevator. Regarding six buildings having elevator, five cases possessed standard internal dimensions and that of other was less than standard. Further, the standards related to the external dimensions and front of elevator were followed in all six samples and the quality and height of their equipment was standard. Furthermore, two elevators could not be automatically opened because of impacting with an object and others could be opened. The results related to this section are summarized in Table 6.

Table 6. Results of assessing buildings with respect to the standards related to accessible Elevators

More than one floor	There is elevator	Suitable area in	Suitable area out	Suitable accessories	Automatic door	More than one floor
Yes N(%)	16 (80%)	6 (37.5%)	5 (83% of 37.5%) 31.2 of all	6 (100% of 37.5%) 37.5 of all	6 (100% of 37.5%) 37.5 of all	4 (66.6% of 37.5%) 25% of all
No	4	10	1	0	0	2

Based on the results of the evaluation of restroom (Table 7), public restroom was reported in 15 buildings among which only two buildings possessed toilets which the dimensions of their interior space were non-standard for disabled persons and the dimensions of the entrance door of one toilet and equipment and furniture in the seating toilet of both were non-standard.

Table 7. Results of assessing buildings with respect to the standards related to accessible restrooms

	Toilet	Seating toilet	Suitable area	Suitable furniture
Yes N(%)	15 (75%)	2 (13% of 75%) 10% of all	0	0
No	5	13	2	2

Data analysis and conclusion

ADAAG was used in the present study to derive the rules and instructions of tailoring architecture for physically disabled persons and their matching was measured through field study. The variables assessed by using ADAAG involved accessible parking, entrance doors, inclined surfaces, corridors, interior doors, elevators and restroom and results of matching the buildings under study and standards mentioned in the present study are summarized in Tables 1-7.

The results of evaluating public parking (Table 1) indicated that only 10% of buildings possessed public parking in which no special parking was considered for disabled persons. All public buildings under study had level difference relative to the street due to the climatic conditions of Babol. Accordingly, accessibility to the height level of public buildings is regarded as the most important problem of disabled persons to building access. The results provided in Table 2 represented that inclined surface was observed in nine buildings, while accessibility to others could be through stairs. Regarding nine existing ramps, the standard of the necessity of using non-slider and safe surfaces was followed in all samples (the maximum standard followed). Although the dimensions of inclined surfaces were standard in 66% of ramps, high and non-standard slopes were observed in ramps, so that the slope of 22% of ramps was standard. Handrails were not used correctly based on mentioned standards in no inclined surface, which this item was less followed in inclined surface.

In fact, adequate attention is not paid to follow the standards required for the usage of disabled persons despite the aware of the necessity of modifying current status. For example, using added inclined surface for solving the problem of accessibility to one of the public buildings under study

became a new barrier for disabled persons because of disregarding the follow of intended standards. Further, due to non-level access route to ramp, a threshold was created in the beginning of the ramp related to one building in which ramp slope was appropriately implemented, thus high force is needed for passing wheelchair. The maintenance of continuity from origin to destination would be highlighted to design appropriately for physically disabled persons. In fact, individual independence is preserved when access route be not cut in no point from origin to destination.

Based on the results of Table 3, standards were mostly followed in entrance doors. 90% of buildings were devoid of swing and revolving doors as main accessibility to building, among which relevant standard dimensions were followed in 95%. Further, two factors of the existence of threshold with the height more than standard and requirement to high force for turning handles and opening doors were followed less (80%) compared to the other items related to main entrance doors. Regarding interior doors in public buildings, two cases were devoid of public interior doors, relevant dimensions were not followed only in 6% of samples and 11% of doors possessed threshold with the height more than standard and needed to turn handle with high force.

As shown in Table 4, the dimensions related to interior access routes were followed in 90% of buildings. Further, 95% of interior access routes were devoid of slope and safe non-pile and non-slider materials were used in 95% of routes. The leading edges of different equipment and furniture in interior access routes were observed in 95% of buildings, which results in creating barriers for safe movement in routes. Although the dimensions of 70% of routes were standard despite the presence of these leading edges, safe movement in one direction in route was impossible by considering the existence of different barriers.

The results of assessing the standards related to elevator in public buildings (Table 6) indicated that 37.5% of 16 public buildings having more than one story as public space possessed elevator and others devoid of elevator or electric lift. The standards were followed in existing elevators to acceptable level. Thus, the dimensions related to the entrance space in the front of 16 elevators were standard, their equipment were mounted in appropriate height, the internal dimensions of 17% of elevators were less than standard. Further, because of impacting objects, 24% of elevator doors were non-automatically opened which is dangerous and unsafe for physically disabled persons.

Based on the results of Table 7, public restroom was available in 75% of public buildings among which only 13% possessed toilet which were devoid of appropriate dimensions and equipment required for using physically disabled persons. Accordingly, the amount of following standards in public buildings are as interior doors, main building entry, interior access routes, elevators, ramp and inclined surfaces, restroom and parking, respectively.

Environment determines the amount of disability in persons. The presence of the urban public spaces which cannot be used by physically disabled persons without the assistance of others results in forming the sense of disability and secluding from society. Since the removal of barriers in designing phase is more simple and cheap than tailoring constructed spaces in utilizing phase, executive approach should focus on the areas under design which did not built. Implementing the rules and instructions of urbanization and architecture for physically disabled persons correctly needs the technical knowledge, awareness and compassion of the human forces of designing and implementing process instead of special equipment, machinery and material.

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