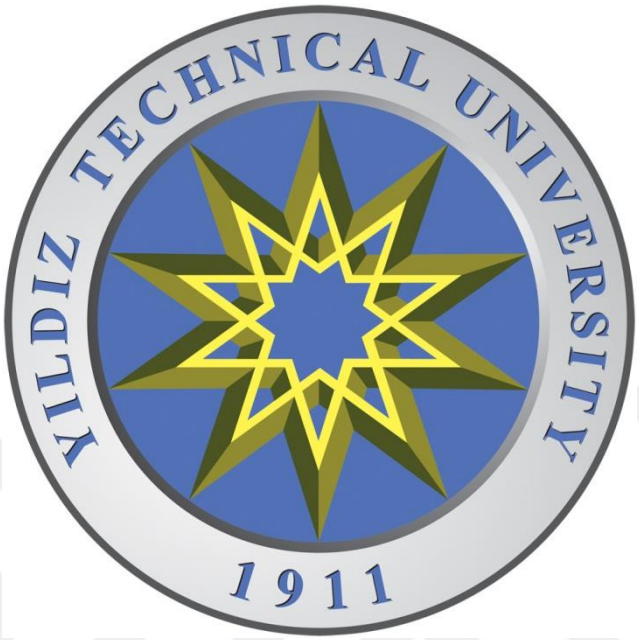


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MONITORING MODEL FOR UNIVERSAL DESIGN

SEYED MOHAMMAD AMIN ALAVI TABRIZI

MSc. THESIS
DEPARTMENT OF ARCHITECTURE
PROGRAM OF ARCHITECTURAL DESIGN

ADVISER
ASSOC. PROF. DR. ASLI SUNGUR ERGENOGLU

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A thesis submitted by Seyed Mohammad Amin ALAVI TABRIZI in partial fulfillment of the requirements for the degree of **MASTER OF SCIENCE** is approved by the committee on 15.04.2016 in Department of Architecture, Architectural Design Program.

Thesis Adviser
Assoc. Prof. Dr. Asli SUNGUR ERGENOGLU
Yıldız Technical University

Approved By the Examining Committee
Assoc. Prof. Dr. Aslı SUNGUR ERGENOGLU
Yıldız Technical University _____

Assoc. Prof. Dr. Çiğdem CANBAY TÜRKYILMAZ
Yıldız Technical University _____

Assoc. Prof. Dr. Göksenin İNALHAN
Istanbul Technical University _____

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LIST OF SYMBOLS

dB	Decibel
Y	Yes
N	No
N/A	Not Available

LIST OF ABBREVIATIONS

ADA	Americans with Disabilities Act
ADAAG	ADA Accessibility Guidelines
ANSI	American National Standard Institute
BREEAM	Building Research Establishments Environmental Assessment Method
CASBEE	Comprehensive Assessment System for Building Environmental Efficiency
GB Tool	Green Building Tool
GSA	US. General Services Administration
LEED	Leadership in Energy and Environmental Des

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ABSTRACT

MONITORING MODEL FOR UNIVERSAL DESIGN

Seyed Mohammad Amin ALAVI TABRIZI

Department of Architecture

MSc. Thesis

Adviser: Assoc. Prof. Dr. Asli SUNGUR ERGENOGLU

In today's world after all the scientific discoveries and revolutions that mankind has faced, having physical barriers for some people and ignoring them seems like a problem that should have been solved centuries ago. However, guidelines such as universal design and inclusive design or legislation such as ADA are made in order to overcome this problem.

In this study, it is aimed to create a monitoring model for universal design in architecture. On the way to reach the proposed model, different architectureal monitoring and rating systems are analized in detail such as, LEED, BREEAM. The frame of the proposed model is obtained from these analyzis.

Afterwards, available and internationally accepted accessibility standards and guidelines are studied in detail in order to acquire the essential needs of everybody in terms of access, and create and use the requisite standards for universal design in architecture. Adapting the standards to the obtained frame, the monitoring model for universal design is created.

In order to examine the created model two cases are chosen from Istanbul. Both the cases are examined and rated with the use of the created model and detailed reports are acquired from this analysis.

Key words: Universal design, inclusive design, LEED, BREEAM

ÖZET

EVRENSEL TASARIM DENETLEME SİSTEMİ

Seyed Mohammad Amin ALAVI TABRIZI

Mimari Tasarım Anabilim Dalı

Yüksek Lisans Tezi

Tez Danışmanı: Doç. Dr. Aslı SUNGUR ERGENOĞLU

Günümüzde Bilim alanındaki gelişmeler ve devrimleri göz önünde bulundurarak, engelli insanlar icin fiziksel bariyerler sorunu yillar once cozulmuş olmasi gerekiyordu. Nitekim ki, ADA gibi evrensel tasarım ve kapsayıcı tasarım veya mevzuat kuralları bu sorunu çözmek icin oluşturulmuştur ama halen bu kuralları göz onunde bulundurmayarak tasarım yapılıyor. Bu sebepten dolayı, bu çalışmadada, mimaride evrensel tasarım için bir izleme modeli oluşturmak hedeflenmiştir. Önerilen modele ulaşmak için, LEED ve BREEM gibi farklı mimari izleme ve değerlendirme sistemleri irdelenmiş ve daha sonra, insanlarin erişim açısından temel ihtiyacları verisine ulaşmak ve mimaride evrensel tasarım için gerekli standartları kullanarak hedeflenen modeli oluşturmak için mevcut ve uluslararası alanda kabul görmüş erişilebilirlik standartları ve ilkeleri, detaylı olarak incelenmiştir.

Bu araştırmada elde edilen veriler ve standartlar bilgilerinden evrensel tasarım izleme modeli oluşturulmuş ve önerilen model çerçevesi bu analizlerden elde edilmiştir.

Oluşturulan modeli incelemek amacıyla, Istanbulda bulunan, Gazi Mustafa Kemal okulu ve Cumhuriyet okulu, örnek olay olarak model üzerinden incelenmiş ve puan verilmiştir.

Anahtar Kelimeler: Evrensel tasarım, kapsayıcı tasarım, LEED, BREEAM

CHAPTER 1

INTRODUCTION

1.1 Literature Review

“We can’t solve problems by using the same kind of thinking we used when we created them.” Albert Einstein.

The perfect form for every design would be human centered design and what is meant by human are all potential users for built environment. For this purpose the concept of universal design is created, to treat everyone equally. In this study the adapted form of the named concept in architecture and design is used to overcome the barriers created by humans. As mentioned this is just a concept and offers options to create an accessible environment. This study has collected different guidelines and standards from these concepts and laws, in order to convert and shape this concept as a rating system that is capable of doing more than suggestions and is possible to even act as a law. This could end up in fully accessible buildings and environments for everyone.

1.2 Objective of the Thesis

We are all physically disabled at some time in our lives. A child, a person with a broken leg, a parent with a pram, an elderly person, etc. are all disabled in one way or another. Those who remain healthy and able-bodied all their lives are few. As far as the built-up environment is concerned, it is important that it should be barrier-free and adapted to fulfill the needs of all people equally. As a matter of fact, the needs of the disabled coincide with the needs of the majority, and all people are at ease with them. As such, planning for the majority implies planning for people with varying abilities and disabilities [1].

The purpose of this thesis is to demonstrate the necessity of accessible societies, environments and buildings and to propose a monitoring model to rate the accessibility level of such environments. Existing rating systems for sustainability are searched to be used as a model to propose a new one about universal design which could measure the accessibility of a building or a neighborhood. It is expected that if the proposed model is implemented the outcome would be the neat determination of accessibility features, identifying the exact points of design issues which are acceptable and which are to be changed or altered, resulting in achieving accessible environments for people with different disabilities.

The structure of this thesis is composed of different steps. First of all generally studies about accessibility and the existing standards and guidelines about this issue. Continuing to that it searches for existing rating systems in different aspects of architecture in order to create the body of a general rating system. Afterwards the main goal is to adapt existing standards and universal design standards to the created model and achieve a monitoring model for universal design.

Accessibility is an issue that should be taken into consideration from the beginning of the design process and then it would end in most effective results. The next step for designing a system that could rate the accessibility level of buildings is to create a general rating system without discriminating any kind of building typologies. Generally at this stage the aim is to create a system that could imply to all kinds of facilities and environments. After making the basis of the system it could be specialized in some parts for different kinds of buildings and these could be added as updates to the system. For the purpose of designing such a system, different rating systems from different continents such as, LEED and BREEAM are studied in detail to be able to create the general chapters of the system.

1.3 Original Contribution

This study contributes in creating fully accessible environments for all users. With the result model of this study, architects and building owners are going to be able to design and build accessible buildings with considering all potential users and assess the accessibility level of the building during its lifetime from design stage to use. Additionaly, this study also helps creating more sustainable environments. The connection between sustainability and the proposed model is that, it creates environments that would be

suitable for a person during every period of its' life, or in better words, it enables aging in place for a user.

Last but not least every facility assessed with the proposed model would have a report showing the accessibility level and whether it is suitable for a user which seeks special details in a facility or not. For instance, the reports are going to help the parents of a child with a physical disability decide which school is more suitable for their kid and will not discriminate it.

CHAPTER 2

GENERAL INFORMATION

Accessible design is a type of design which does not need extra effort or cost to create. Changing the perspective from a able bodied fit person into all possible users for a facility at the stage of design simply solves the problem and at some points creating accessible environments may even cost less. Creating a monitoring model for universal design to assess the accessibility level of built environment helps to achieve this goal and results in more universally designed facilities.

2.1 Excluded from Design

Although in modern world and academic studies, seniors and people with impaired abilities were considered out of the mainstream of life and society, there is a growing trend which considers disability and aging as a stage of every ones life which is unpredictable. Both of these groups have dreamed of being included in the mainstream of the society and considered themselves as an undeniable part of the growing society although it did not accept them at the very beginning. This kind of growing needs brought a new logic to design which instead of being exclusive, was inclusive and was just to every person living in the society inspite of their disabilities [2].

This new logic in design was accompanied by different politics which formed a framework towards an inclusive society by means of increasing accessibility and inclusivity in mainstream design instead of using assistive devices [2].

The feeling of being disabled does not grow inside of people because of physical impairment and is an outcome of the products and designs which fail to be an answer to needs of all potential users. If people could be disabled and excluded by design they can also be enabled and included by thoughtful, user-aware design [2].

2.1.1 People with Different Abilities

Every person experiences different forms of disabilities during their lifespan even though they do not consider themselves disabled or may not see themselves as a disabled person. The reason behind this is that wherever there is speech about disabled people the automatic image that occurs to a person's mind is a man on a wheelchair or a blind person which is incorrect. Disability has different forms, a woman or man with an infant in a pushchair could be discriminated or a senior and etc. Figure 6 shows the universal design pyramid by Selwyn Goldsmith [3] which displays the bottom up methodology of universal design. In which it describes different forms of disabilities according to severity of the physical impairment and how people are discriminated from society even though some do not realize.

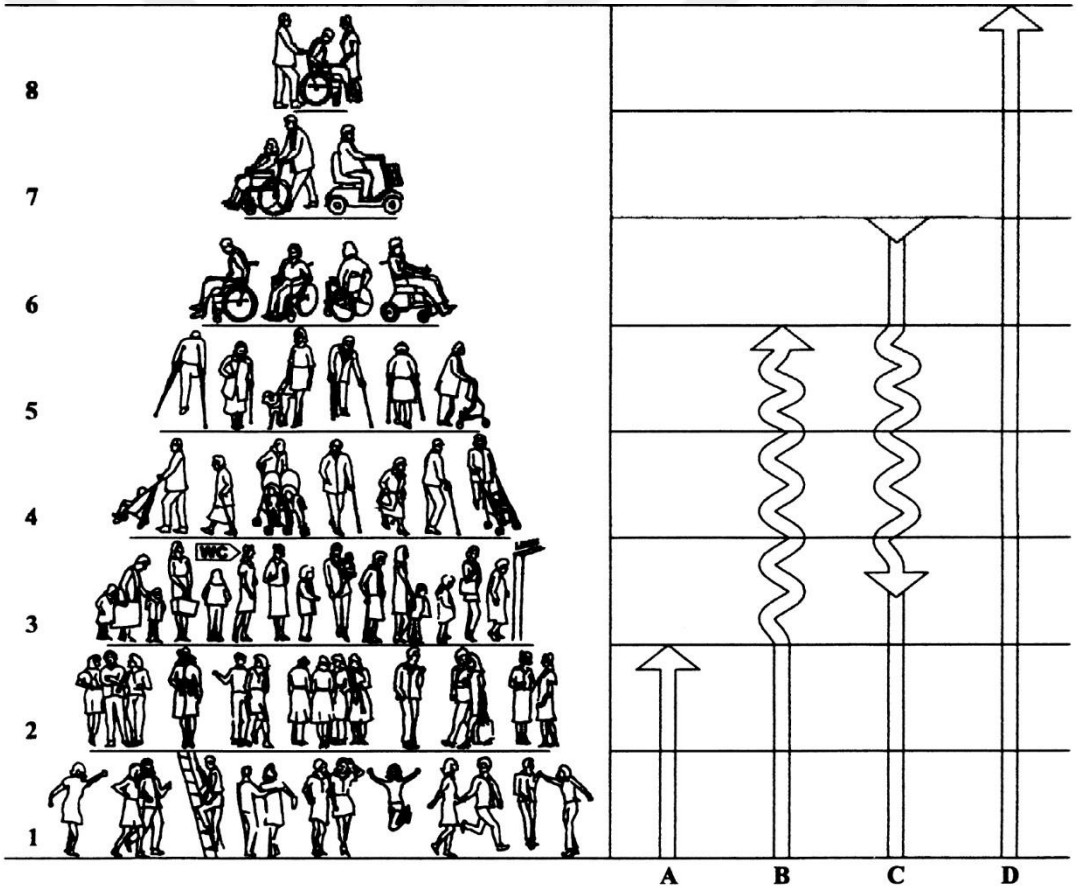


Figure 2.1 Universal design pyramid by Selwyn Goldsmith [3].

Row 4 displays the elderly people and men and women with infants in a pushchair. The elderly people which go around using a stick, do not consider themselves as disabled. Along with the elderly, people who have to carry their infants in a pushchair also do not regard themselves as disabled people. This part in fact are not disabled but are

architecturally discriminated when it comes to for example entering a facility or a part of a facility on account of stairs on the approach to that part or when there is a lack of space for maneuvering easily for instance in public restrooms.

In row 5 there are ambulant people who have physical disabilities. While designing a building or even the built environment, if the architects and designers just aimed all potential users simply by designing the buildings to the precepts of universal design, the people in rows 3, 4 and 5 would automatically be included and would not be considered as disabled in the built environment.

While there is talk about all potential users, the aim is all the people in the pyramid. As noted, designing a building to the precepts of universal design in the best conditions could only be an answer for people till row 5. For the people in rows 6, 7 and 8 there should be more thought in the process of design as an example the entrances must be without stairs or equipped with proper ramps or to give another example for people in rows 7 and 8 there should be at least one unisex bathroom where a man or a woman could help the partner.

The rule is that where normal provision cannot cater for everyone, supplementary special provision may be made [3].

Of the people with disabilities shown in the pyramid, one – in row 5 – is a blind person led by a guide dog. The others, either ambulant disabled or wheelchair users, are all people with locomotor impairments. It is these who when using public buildings are most vulnerable to architectural discrimination, for example on account of steps and stairs, confined circulation spaces, and fixtures, fittings and controls that are too high or too low to reach. And for the architect who is looking to counter architectural discrimination when designing a building on the drawing board or computer screen, it is people with locomotor impairments who can most readily benefit [3].

While there is a talk about accessibility as noted the image that appears in peoples mind is generally persons with mobility disabilities. In recent years there has been some focus and studies about how to address sensory issues such as Deaf or Blind people. In means of autistic spaces there are some guidelines and principles necessary for this situations offered by Mr. Ian Ford. According to Mr. Ford [4] there are 5 levels of accessibility.

1. Movement/getting there,
2. Sense/ being there ,

3. Architecture/orienting oneself,
4. Communication,
5. Agency/autonomy [4].

According to this theory, Ford says that Americans with Disabilities act only refers to the first level of accessibility which is to be able to physically access all necessary parts of a space [4].

The suggestion is that an accessible place has to be free of loud noises, bright lights and bold patterns and textures which could overload and hinder someone's ability to "be there" in the space comfortably. According to this theory architectural spaces could even be designed to support orientation without requiring users to read written language. Communication features can help users understand and make themselves understood in a place [4].

2.2 Accessible Space

There is a design philosophy known as permaculture, which is an approach for one's own habitat, with a presumption that a person can shape their own place to suit them [4]. Following this philosopy and Fords' [4] theory it is understandable that the design approach should be followed with the same logic to suit every person. The only way to discover whether a space is accessible or not is by user experience. Do they feel safe in that space or not, is that space an answer for their needs or not. No other measurments can be as pricise as user experience. Only by designing accessible spaces exclusion as a result of disability is going to fade away.

It is obvious that an accessible space has numerous advantages for disabled people. In addition, able bodied people also benefit from accessible and user-aware design such as:

- An accessible environment increases the pool of potential new workers that an employer can tip into. It also helps organizations retain existing employees who may acquire a disability,
- An accessible building enables more people with disabilities to enter the premises and/or use services,

- Accessibility improves overall safety of buildings, which has a direct impact on the number of accidents taking place and therefore the cost of insurance premiums,
- An accessible environment gives greater customer and staff satisfaction and can improve public perception and recognition of Department or Agency [5].

2.3 Creation History of Inclusive Societies

Civil rights is the result of different events and factors where at the end the society realized that everyone is equal and should have equal rights in their life. It differed from country to country and from culture to culture. For instance, in United Kingdom at the end of World War II, because of the many sacrifices the soldiers made, and the hardships that people had to suffer, there was a growing expectation of social and political justice and the result was the creation of Walfare State. It was the same in Europe and to decrease the tension of the war and to increase peace in Europian countries, came out the Unification. In the United States because of the number of sacrifices that black soldiers made for the freedom of their country and families, there was also a civil right movement that allowed them to have the same rights as their white comrades [2].

Vietnam war was another factor which in many wounded soldiers survived and caused the number of youth which became disabled grow immediately. Most of them became wheelchair users and suddenly found themselves in a world which did not welcome the disabled types. The civil rights following these events acted purposefully and led to emerge products such as racing wheelchairs or paralympics movment and as a final point led to worlds first significant anti-disability discrimination legislation. At this point where access was considered as a right of every person the demands for a barrier-free, environment and universally designed products, where everyone regardless of the impairment could have access. By taking the mentioned trends into consideration, Universal Design movement was created in which that all designs should be universally accessible and usable by all consumers [2].

2.3.1 Accessibility Legislation

The legislation of these theories was followed by the urge of different people and organizations and the mutual aim was to make fundamental changes in equal rights for

disabled people. Table 2.1 demonstrates the different stages of legalizing equal rights for people with disabilities in different countries throughout their history.

Table 2.1 Legislation of Accessibility Theories

Year	Country	Definition
1950-1961	U.S.A	Tim Nugent at University of Illinois writes 1st set of accessibility standards "Barrier Free Architecture" which was instrumental in creation of ANSI A117.1
1981	U.S.A	United States Architectural Barriers Act, a federal law referencing ANSI A117
1988	U.S.A	Fair housing amendment Act
1990	U.S.A	Accessibility guidelines, Americans with Disabilities Act
1996	U.S.A	Telecommunications Act
1963-1987	U.K	Designing for the disabled, Selwyn Goldsmith, underpinned the 1967 British Standard Code of Practice. Revised in 1979 and in 1987, augmented by part M of the UK building regulations
1948	International	United Nations declaration of Human Rights
1982	International	United Nations year for Disabled Persons
1993	International	United Nations standard rules for the equalization of opportunity for persons with disabilities
1999	International	United Nations year of older persons
1991	Australia	Disability Discrimination Act
1995	Australia	Australian Adaptable Housing Standard

What is obvious from Table 3.1, as mentioned before there was a growing attention to people with disabilities which became a trend. It is important to mention that later these trends resulted as laws comprising disabled people and human rights in every field of life such as their habitats. Creating an equal society and environment for people with or with not a disability which does not categorize them by their physical impairments, requires a more human centered design type in architecture. To be an answer for this type of design, different concepts for accessibility is created.

2.3.2 Americans with Disabilities Act

Americans with disabilities act (ADA) is a set of human rights laws which were legislated at 1990 and is being used since then. This series of laws are the most accepted standards for accessibility in architecture all around the world. The aim of these laws is to ban disability based discrimination in different types of activity areas or products. What ADA describes as disabilities are mental, physical, permanent or temporary [6]. These laws are categorized in five titles which are:

Title I – Employment,

Title II - State and Local Government Facilities,

Title III - public accommodations and commercial facilities,

Title IV - telecommunications,

Title V - miscellaneous provisions [6].

Among this five titles the ones that cover most cases are titles 2 and 3. Both of these titles have a series of laws that refer to both new constructions and alterations to existing facilities. According to these five titles, every facility or the necessary part of it must be designed in such manners that would be accessible and useable to people with disabilities. If designing the whole facility to be accessible is impossible or unnecessary, every part of it that is necessary or could be designed to be accessible, must be made this way. If designing a facility to be accessible for a certain type of disabled people is impossible, it should be made accessible for the other types of disabled people. If the function of a facility or a part of it changes to be used by public, the alterations should be made in a manners that the altered portion would be completely accessible to disabled people. Accessible elements are designed in an order in which the priority is with the element that offers the highest level of accessibility and according to ADA standards are:

- An accessible entrance,
- An accessible route to the altered area,
- At least one accessible restroom for each sex or a single unisex restroom,
- Accessible telephones,
- Accessible drinking fountains,
- When possible, additional accessible elements such as parking, storage and alarms [7].

2.4 Design Concepts and Standards for Accessibility

As mentioned, there was a growing attention to subjects such as accessibility and equal rights for all since 1950's all around the world. These trends and legislations were not limited for a single subject and had an impact in almost every field, most importantly in architecture and in this area it varied from product design to built environment. Following these events, came out different design approaches such as Design for all, Universal design, Life span design, Inclusive Design and etc. Generally all of these are different names of methods that largely focus on increasing the accessibility of the interactive system for the widest possible range of use.

2.4.1 Life Span Design

"Architecture should never come between people and the things they want to do" [8] is the slogan for Life Span Design

Most buildings for many years have been designed according to the criterions of a person which according to those standards, they never change. There a clear flaws in this type of design. First, not everyone is in an average condition and secondly, through time every one changes physically [9].

Sometimes objects as simple as a stair in the entrance, a heavy door or even a dim light might be insufficient or in some cases even disabling for the people who do not fit the average image on the designers mind. At one point in every single person's lifetime, they experience these changes. As an example, the average employee is forced to quit his job, or ordinary people being forced to change their habitat and homes just because they cannot act effectively and benefit from the space. Although it seems like having an injury,

physical disability or aging is to blame, but the actual guilt belongs to the constructed environment [9].

For example, the design of a dwelling unit should be made in such manners that in spite of age differences or factors such as size, health or physical impairment, everyone could live in it peacefully. Good design is not only about beautiful decorations and aesthetics, it should also increase the quality of life and create a safe and practical space for every stage of life, it should allow for personal independence and give people the ability to live independently without any help required or without being forced to change their habitat and live there for years even while becoming a senior [9].

2.4.2 Universal Design

The aim of Universal Design concept is to make houses and products useable by everyone or most of the people without having to pay more money. The difference between universal design and accessible or adaptable design concept is that, there are a set of standards in accessible design which only refers to mobility impaired people, but the target in universal design concept is everyone despite of their age, size or abilities. In this concept, there are no specific targets for design, therefore there is no need to design for specific types of disabled people, and they are all included in design.

The notion of universal design was first made by Architect, Ronald L. Mace and has made it as a concept of designing built environment and products in order to be an answer for people's needs despite of their age or disability. Mace believed that if a design could be barrier free for a person, it could also be designed to be barrier free for everyone. Just removing the barriers from the design would not be a complete solution to the problem and the designer most broaden his horizon. In general to make a clear definition about Universal Design, it would be a design of products and built environment which allows everyone to use it equally to its maximum extent without having to make any adaptations or additional designs to the main one. There are seven principles for universal design which was created professionally in North Carolina State University and till today is the most complete definition of universal design

- Equitable Use: The design is usable and marketable to people with diverse abilities,

- Flexibility in Use: The design accommodates a wide range of individual preferences and abilities,
- Simple and Intuitive: Use of the design is easy to understand, regardless of the user's experience, knowledge, language skills, or current concentration level,
- Perceptible Information: The design communicates necessary information to the user effectively, regardless of ambient conditions or the user's sensory abilities,
- Tolerance for Error: The design minimizes hazards and the adverse consequences of accidental or unintended actions,
- Low Physical Effort: The design can be used efficiently and comfortably and with a minimum of fatigue [10].

These principles generally apply to all design types from product to architecture. Table 2.2 demonstrates the connection between these principles and architecture.

Table 2.2 Connection between universal design principles and architecture [11]

Universal Design Principle	Connection with Architecture
Equitable Use	A building should be designed in a manners that everyone could use it equally. As an example making an entrance that works well for everyone. If under any circumstance it is not possible to create a single solution for everyone, each solution should be equivalent in terms of privacy, security, safety, and convenience. The building must not isolate a group of users or privilege one group over another.
Flexibility in Use	The building's design should be flexible, meaning that it has to be able to offer more ways to use its features than one default way. As an example both right handed and left handed people, seated or standing ones must be able to use a feature easily without having to adapt to other conditions.

Table 2.2 (continued)

Simple and Intuitive	The building should make it possible for everyone to understand the purpose of the design features and how to use them easily. As an example, providing lavatory faucets or drinking fountains should be easy to operate.
Perceptible Information	The building must provide all essential information in a variety of modes like written, symbolic or tactile modes to make sure that all users regardless of their disabilities could understand and communicate with the facility.
Tolerance for Error	The building's design should be in a way which to protect and eliminate any features that could cause hazardous situations. In cases such as stairs or any other unavoidable possible dangerous conditions, it should signal and warn the user when they approach that feature.
Low Physical Effort	The buildings should be designed in a way that its features require little or no physical effort. For example, replacing traditional door knobs with a lever handle that does not require to grab and turn the wrist. This way, the design allows the users to engage the features easily.
Size and Space for Approach and Use	A building's design features should provide an adequate amount of space that is appropriately arranged to enable anyone to use them. For instance providing knee space under a washroom lavatory to enable use by someone in a seated position. In addition, the space needs to be arranged to provide a clear path of travel to and from important design features for all users.

2.4.3 Inclusive Design

Inclusive Design is a similar concept to Universal Design and seeks the goal of accessibility and inclusion in design. Although most people use the terms inclusive design

and universal design interchangeably but there are differences between them. Inclusive Design is an alternate formulation emphasizing that Universal Design must be aware of social and economic difference and include the participation of users throughout the design process. The primary differentiation that is evolving has to do with "Inclusive" being interpreted to be broader, to embrace diversity in social and economic circumstances in addition to variation in age and ability. To make a more clear definition, just as other design concepts, inclusive design also has five principles which should be considered in the process of design:

- People: Inclusive design place people at the heart of design process,
- Diversity: Acknowledge diversity and difference,
- Choice: Offer choice where a single design solution could not accommodate all users,
- Flexibility: provides for flexibility in use,
- Convenience**:** Design building and environments that are convenient and enjoyable to use for everyone [12].

A general definition of Inclusive Design would be “The design of mainstream products and/or services that are accessible to, and usable by, as many people as reasonably possible on a global basis, in a wide variety of situations and to the greatest extent possible without the need for special adaptation or specialized design” [11] [13].

2.4.4 Design for All

Design for all is another accessibility seeking design concept. The main goal of this concept is to design products and built environment that could be useable by all or most of the people from every aspect. This does not, however, automatically imply that there is such a thing as a single solution that suits all. There are several definitions of the term design for all. The European Institute for Design and Disability (EIDD), describes the term design for all as “design for human diversity, social inclusion and equality” which could be said that this definition is the most accepted one from this concept. EIDD is a European platform for design for all concept. Members of this organization are national organizations, corporate and individual members now in sixteen European countries.

Another definition of this concept is from European Commission Information Society which defines accessibility as ‘‘this will only come as a result of designing mainstream products and services to be accessible by as broad a range of users as possible. This approach is termed design for all and consists of three principal strategies:

- Design of IST products, services and applications which are demonstrably suitable for most of the potential users without any modifications,
- Design of products which are easily adaptable to different users (e.g. by incorporating adaptable or customizable user interfaces),
- Design of products which have standardized interfaces, capable of being accessed by specialized user interaction devices’’[13].

2.5 Beyond The Requirements

Universal design requires thinking broadly about usability rather than focusing exclusively on the requirements of ADA. Why go beyond the requirements? One reason is to eliminate the stigmatizing effect inadvertently produced by, for example, a separate wheelchair-accessible entrance. While this entrance may comply with ADA guidelines, if it is located at the far end of the building or is difficult to find, anyone who has to use the entrance may feel as if they are being treated differently. A universal design alternative would be wide, automatic sliding doors that accommodate all users and allow groups — including people using wheelchairs, with strollers, or walkers — to enter together. Or in other words what would be beyond the requirements is to be able to erase the word “Disability’ from people’s lives and not labeling people. What should be labeled are the buildings, the environment which is not able to be an answer to the needs of a person with a different type of approaching. Expanding the designers’ vision and not limiting them to simple rules could be an answer to everybody’s needs regardless of age or abilities [14].

2.6 Examples of Universal Design and Inclusive Design in Architecture

For the purpose of designing a monitoring model to rate and see to what extent the built environment and buildings are accessible and designed to be inclusive some examples which are accepted to be accessible and barrier free, are studied. In order to find out what are the primary standards of inclusive and universal design in architecture. What systems

such as ADA or DDA offer are only the standards for accessible design and as mentioned, in order to reach the deep accessible level, there are more to be done than just thinking about physical access. After organizing a deep accessibility standard system the next goal is to create a system to assess facilities with the help of the standards.

2.6.1 The Linburn Centre

From the early stages of design, the main goal in the architect's mind was inclusive design. The reason behind this choice was the future users of the facility, most of them have different kinds of visual impairments and besides of this, they are seniors. The designers of this building had to go far beyond the standards that DDA and ADA offered.

First of all in order to allow wheelchair users complete access, as seen in figure 2.2 all of the objects and building surroundings and the building itself are in a same level. In addition to this, there are almost no thresholds at the entrances and the doors of the facility and at some parts which there are ultra-low-profile thresholds are installed, in order to allow easy access for mobility impaired people [15].

On the other hand, in the interior of the building the main hallway and main circulation parts are wide enough to easily maneuver. On one side of the main hallway there is a continuous handrail to be a support for old people and a guide for visually impaired ones. Where access to rooms occur off this corridor, bold gestures have been made at these locations both in the layout and in terms of the colors used on the walls [15].

By studying the Light Reflectance Values (LRV) of each of the finishes (floors, timber paneling, door laminate, ceiling), this allowed the designers to carefully select the colors of the painted slots at these access points so as to provide sufficient visual contrast [15].



Figure 2.2 Linburn Centre [15]

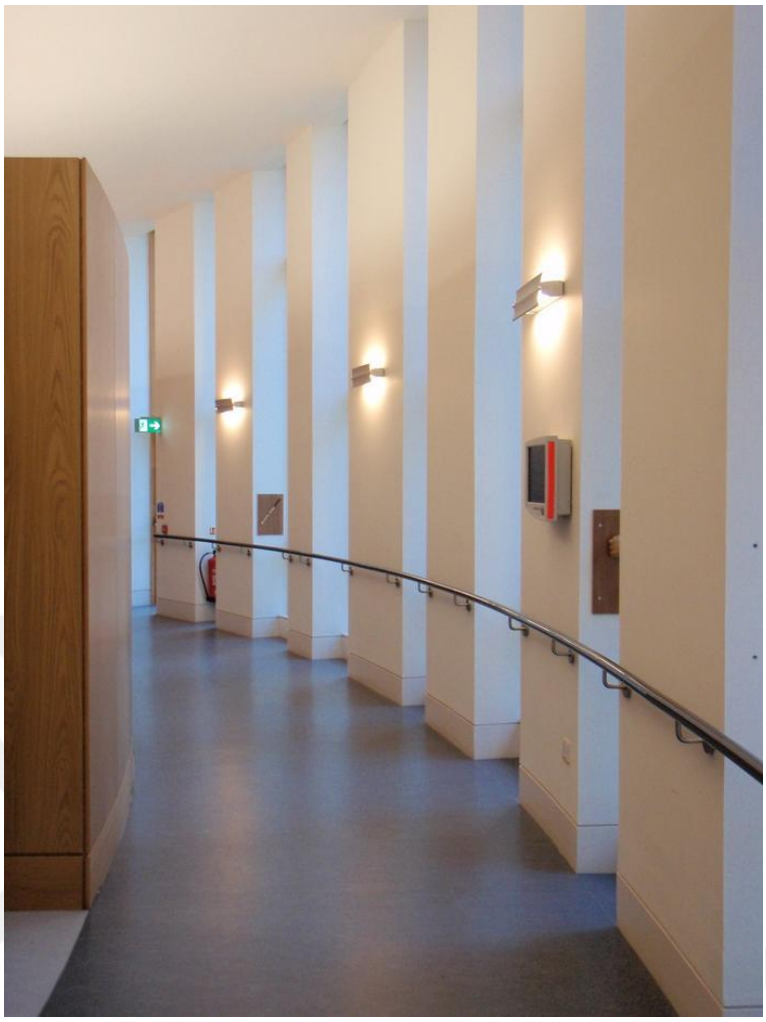


Figure 2.3 Linburn Centre interior main hallway [15]



Figure 2.4 Linburn Centre interior accessibility features [15]

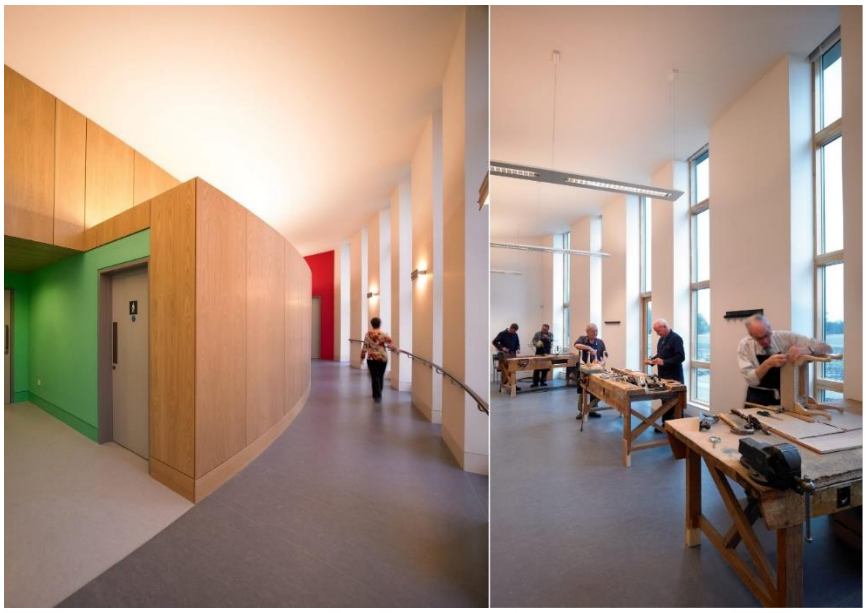


Figure 2.5 Linburn Centre interior accessibility features [15]

2.6.2 Library of Birmingham

The Library of Birmingham has been designed to be as easily accessible as possible for all visitors. At the beginning of the design a committee from The Access Committee for Birmingham supervised the design and step by step approved the accessibility features of the building. This complex is more than just a library and according to Mecanoo the designer group of the project, it is a people's palace, a center for learning, information and culture that unites people of all ages and backgrounds [16].

Visitors could easily change stores by the help of interconnected and overlapping rotundas which also provides natural lighting and ventilation. The building was awarded by different rewards. It is rated as a BREEAM Excellent reward because of its sustainable features. Asides of that one of the other important rewards given to this project was Selwyn Goldsmith Award for Universal Design. This reward was given because of its unique accessibility features and demonstrates that the facility was designed according to Goldsmith's standards for accessibility. This reward is given to projects and spaces that meets the requirements of all people regardless of their disabilities [16].

Some of the accessible features of the facility are as:

Wheelchair and ambulant access

- Car parking for blue badge holders,
- Level access entry to front and back of building,

- Doors open on an automated push button or sensor,
- Lifts located close to the entrance and easily identifiable by the blue lobby walls,
- Automated doors to the lift lobby,
- Mirrors in lifts for wheelchair reversing,
- All manual opening doors meet opening resistance parameters,
- Lower counter provided at Information Points,
- Lower façade benching,
- Platform lift to access Book Browse,
- Studio Theatre has front seats and removable seats to pit to allow wheelchair access,
- Children's steps front row is accessible,
- Amphitheatre has wheelchair viewing on terrace in font of handrail,
- Firefighting evacuation lifts,
- Wheelchair access through the turnstile in our services reception [16].

Visual access

- Color contrast throughout the building has been carefully considered,
- All glass has markings on it so that it is more easily seen,
- Braille and embossed signs are used on toilets and lift lobbies throughout the building,
- Audio information in lifts,
- An audio guide, including a tour, is available for people with visual impairments,
- Braille copies of the visitor guide,
- Supernova is available on every computer,
- Read it touch (a sophisticated desktop reading machine and magnifier),
- Clearview Speech (a table top machine which magnifies and reads aloud),
- Accessible keyboard for people who work better with large keys and bold colors,

- Large trackball mouse (makes controlling the pointer on screen easier) [16].

Hearing access

- Induction loops (for use by people with hearing aids),
- Meeting rooms have infra-red hearing enhancements systems [16].

Also this building is suggested for people with different kinds of disabilities in the website "www.disabledgo.com" which suggests accessible spaces for peoples with disabilities.



Figure 2.6 Library of Birmingham [16]



Figure 2.7 interior of library of Birmingham [16]



Figure 2.8 interior of library of Birmingham [16]

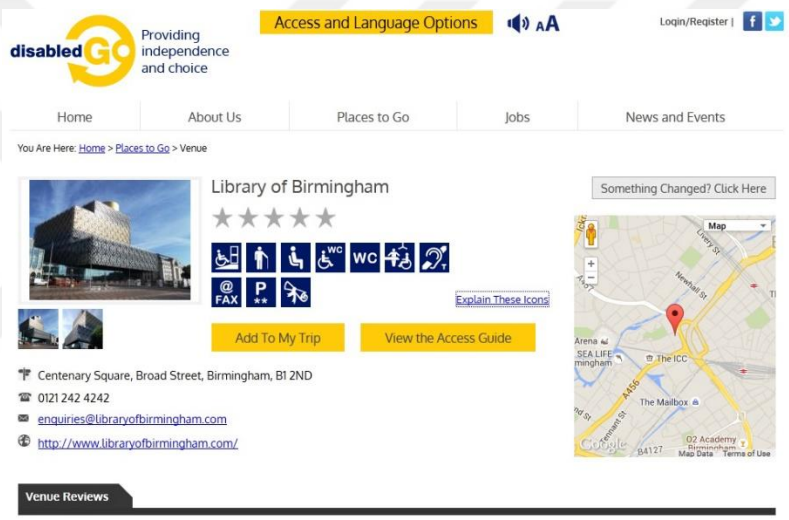


Figure 2.9 Library of Birmingham accessibility features according to www.disabledgo.com

2.6.3 Hazelwood School

The school is situated in a site in Glasgow which before building it there were two schools in the same site. The Hazelwood School is actually the merged form of those previous ones. One of the previous schools was a teaching facility for sightless and hearing impaired children and the other one was special to functional limitations, many children with multiple disabilities including learning disabilities and some with autism. The new facility had to be an answer for all of these requirements so in order to achieve such goal the designers went far beyond the requirements of accessible school design and cooperated with the teachers, parents, children themselves and DDA accessors.

The designers describe their design in these words “The school snakes through the site, curving around existing trees. Its form creates a series of small garden spaces suitable to small class sizes and maximizes the opportunity for more intimate outdoor teaching and learning experiences. Internally, the curved form of the building reduces the visual scale of the main circulation spaces and helps remove the institutional feel that a single long corridor might create. Installation of tactile aids, contrasting colors and materials, and creation of uncluttered readable interior and exterior spaces factored significantly in the design. Specific devices such as the Trail Rail were designed to enable children to safely and independently navigate everywhere in the building” [17].

The choice of materials was of great importance to the creation of a design that was both suitable in the context and exciting to the user. The design team developed a palette of highly textured natural materials that would be stimulating to touch and smell. Naturally weathering timber boarding, reclaimed slate tiles and zinc were chosen for use externally to give variety and contrast [17].

Some of the universal design features of the facility are:

- The unique sensory trail wall weaves throughout the school and enables children to practice mobility and orientation skills, which lead to increased confidence, sense of mastery, and self-esteem,
- The trail rail wall is clad in cork, which has a warm feel and provides signifiers or tactile cues to assist children with orientation and navigation through the school,
- Each bay of sensory trail wall is individually shaped. This helps children orient along the length of the circulation space in the school,
- Corridors are designed as streets, which also assist with orientation and mobility,
- Redundant signage throughout the school, in Braille and pictograph and Moon, caters for the diverse communication abilities of all of the children,
- Large classrooms with ample storage space and adaptable areas between the classrooms,
- The focus-learning rooms offer viewing for staff and visitors without disturbing the children. These areas also offer quiet time as needed,

- The lack of clutter in the classrooms and on the walls generates a calming atmosphere without unnecessary visual confusion,
- The subtle color, contrast, and adaptable lighting elements maximize use of children's residual vision,
- Use of contrasting and neutral color as visual indicators of transitional and storage spaces,
- Classrooms are oriented north facing to take advantage of a more even level of light and open onto the quietist part of the grounds, the classroom garden spaces,
- Storage 'boxes' to the rear of each classroom were designed to provide a solid wall and eliminate visual distraction for the children from outside,
- To reduce the effects of traffic noises proximal to Hazelwood, a majority of classroom spaces are located along the northern, quiet edge of the site and more transient spaces to the south. The 'street' links these areas and guides the building around the existing adjacent trees,
- The curved form means that both internally and externally the building is broken down into manageable spaces. The scale of these is then more appropriate for navigating and also minimizes any visual confusion by reducing the extent of the spaces,
- The building was developed as a series of space groupings for simple orientation,
- Acoustic ceilings are detailed into all teaching spaces to reduce higher volume reverberation,
- The overall roof form results in quiet, sheltered external teaching spaces shared between radial classrooms to the north,
- Naturally weathering larch boarding is used externally for the trail wall and stimulates the sense of smell as well as providing and appealing tactile surface,
- All navigational devices, be it trail rails, window transoms or signage on doors, are set at a consistent height throughout the building so that they can be quickly located by the children,
- Differing tactile floor finishes serve as an alternative or enhancement to the trail walls for navigation and cuing in some locations inside the school,

- The design of the playground and playground equipment allows each child the freedom to play as much as possible at his or her own level,
- Design of the games hall, trampoline area and hydrotherapy pool allow children the opportunity to explore, extend their skills, and gain confidence through engagement in relatively independent activity,
- A high slate exterior wall protects the site from the loud traffic noises,
- The external structure and the cladding were all considered in terms of sensory stimulation. The structural glulam* timber frame casts shadows within the building to establish a clear pattern along the internal street of the school. *[By combining engineered strength with the warmth and beauty of wood, structural glued laminated timber (glulam) offers designers a multitude of options for large, open spaces with a minimum number of columns.],
- Roofing slates define particular areas outside, form a good trailing surface, and the tactile contrast to the timber clearly orients children as to location when outside. The slate also has the advantage on the south elevations of being a heat source for children to use as a navigation device,
- A network of paths around the school and the gardens vary in finish from bound gravel which crunches under foot to recycled bound rubber and timber decking. Each area is defined by separate finishes, which feel and sound different under foot [17].



Figure 2.10 Hazelwood School [17]



Figure 2.11 Hazelwood School Interior [17]



Figure 2.12 Hazelwood School Interior [17]

What is understandable from the studied samples is that, similar to sustainability and sustainable design in architecture, creating a monitoring model for universal design requires standards and step by step evaluation and cooperation of a specialist throughout the design process from the beginning. The other noticeable point in these examples are that they all have considered accessibility in different levels such as site design, landscape and interior design but what is missing is that all have thought of only one aspect of accessibility and creating a fully accessible facility requires more.

2.7 Chapter Conclusion

Disability has different forms, a person using a wheelchair, a senior or even a woman with a child in a pushchair unfortunatelly could be considered as disabled. The reson behind this is, that buildings and facilities are not able to be an answer for some users. If a blind person that is able to walk and circulate independantly, then that person has no barriers such as finding its' way and moving around. It is the built environment that is not able to offer him the option of using it. It is similar to expecting from a middle aged perfectly shaped person to climb a wall and saying this is the path and because you have no disabilities, you should be able to complete the task. There are no such things as fixed and standard barriers, even a single step on an even route could present a barrier for a person in a wheelchair whilst it would not effect a walking person. In order to overcome even the smallest possible barrier, the monitoring model for universal design is proposed and in order to create the model, different kinds of available monitoring systems are studied in the next chapter.

CHAPTER 3

MONITORING SYSTEMS

Monitoring systems are created in order to assess a process or design, in this case the accessibility of built environment. The assessment assissts the designer to create better spaces or better to say more human centered designs. With the help of monitoring models nowadays designers and users are able to understand for instance how much a building is environmental friendly or green. A monitoring model can assisst finding the weak spots of a design before it is built or even after and enables alterations to make an existing one act properly. In this case, a monitoring model is created to assess the accessibility level of facilities and built environment.

The satisfactory form of a building is the one that includes any potential user group without discrimination. Seniors, people with disabilities or children form a huge amount of the society and have the same needs as others. Developed countries have solved some of the fundamental problems such as putting ramps in every route which has a different level or using tactile for sightless people and etc. but all these are just the basics for making an accessible environment for disabled or senior people. Making a barrier free environment or built environment for disabled people are not limited to ramps or tactile warning surfaces. There are, “partial inclusion and full inclusion”. The best and most effective type is full inclusion which the designed building or the environment does not exclude people with special needs from people without special needs or better to say with no architectural discrimination. A building with an entrance using stairs without any ramps and a different entrance with a ramp is accessible for a paraplegic person but the person is excluded socially.

The first thing that should be taken into consideration in every kind of design is to put people in the heart of the design and by saying people it mean’s all of them without any exclusion.

3.1 Monitoring Systems Across the Globe

To be able to achieve a monitoring model that could rate the accessibility level of buildings and accomplish the objective of the thesis, different types of monitoring models under the label of sustainability are studied in detail and compared to each other in order to create the basis of a monitoring model then adapt the accessibility standards with the achieved model. In conclusion two of these models are compared in order to form the background of the proposed monitoring system for accessibility.

3.1.1 Certification Methods

In order to gain information about the principals of every monitoring system, different monitoring models are chosen from sustainability category. Table 3.1 displays the certification methods created around the world by means of sustainability. This chapter examines five chosen methods from 3 different continents mainly U.S.A, Europe and Japan.

Table 3.1 list of environmental assessment methods [18]

NAME	COUNTRY	YEAR STARTED
BREEAM	ENGLAND	1990
BEPAC	CANADA	1993
HK-BEAM	HONG KONG	1996
LEED	USA	1998
EEWH	TAIWAN	1999
GREEN GLOBES	CANADA	2000

Table 3.1 (continued)

GBCS	NORTH KOREA	2002
GREEN STAR	AUSTRALIA	
SB-TOOL	INTERNATIONAL	
PROTOCOLLO ITACA	ITALY	2003
CASBEE	JAPAN	2004
ECO PROFILE	NORWAY	
GREEN MARK	SINGAPORE	2005
HQE	FRANCE	
3-STAR	CHINA	2006
GREEHA	INDIA	
CEPAS	HONG KONG	
DGNB	GERMANY	2008
AQUA	BRASIL	
GBI MALASIYA	MALAYSIA	2009
BERDE	PHILIPPINES	
PEARL/ESTIDAMA	UAE	2010

The reason to choose these five methods among many systems are that they have certified many projects nationally and internationally. The second reason is that they are from different continents and countries and all have one aim with different approaches.

3.1.1.1 Building Research Establishments' Environmental Assessment Method

Building Research Establishment's Environmental Assessment Method (BREEAM) was developed in 1990 in United Kingdom, is the earliest environmental assessment method. BREEAM covers different types of buildings including: offices, homes, industrial units, retail units, and schools. Meanwhile, other types of buildings can be assessed using Bespoke BREEAM.

The assessment process of BREEAM projects consist of different stages including pre-agreement, preparation, design, pre-construction, construction and use. The different stages of the assessment demonstrate that the project is evaluated precisely and has minimum flaws. Figure 3.1 displays BREEAM assessment and certification stages.

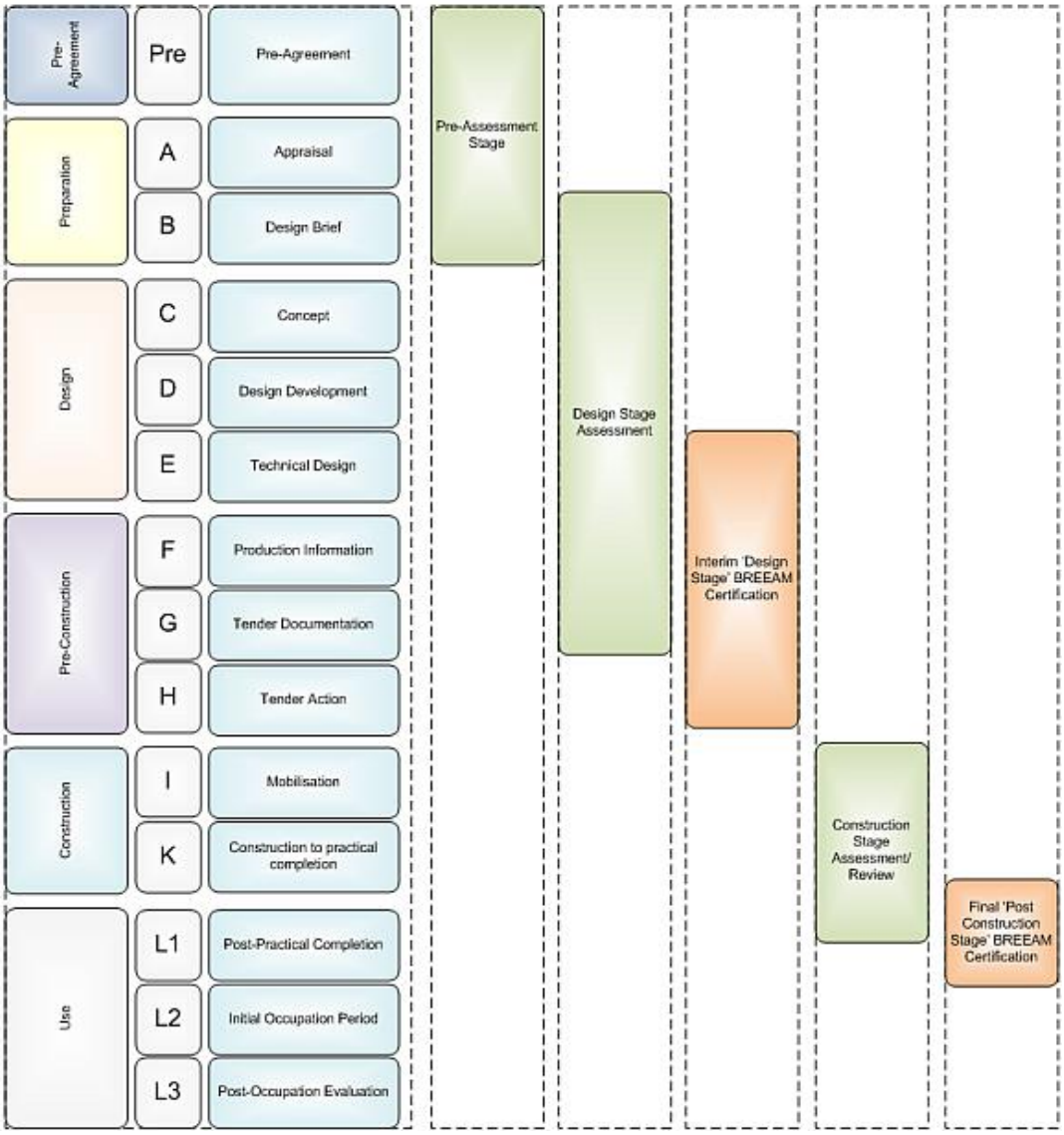


Figure 3.1 BREEAM assessment and certification stages [19]

BREEAM rewards performance above regulation which delivers environmental, comfort or health benefits. BREEAM awards points or credits and groups the environmental impacts as follows:

- Energy: operational energy and carbon dioxide (CO2),
- Management: management policy, commissioning, site management and procurement,
- Health and Wellbeing: indoor and external issues (noise, light, air, quality etc.),
- Transport: transport-related CO2 and location related factors,
- Water consumption and efficiency,
- Materials: embodied impacts of building materials, including lifecycle impacts like embodied carbon dioxide,
- Waste: construction resource efficiency and operational waste management and minimization,
- Pollution: external air and water pollution,
- Land Use: type of site and building footprint,
- Ecology: ecological value, conservation and enhancement of the site [20].

The total number of points or credits gained in each section is multiplied by an environmental weighting factor which takes into account the relative importance of each section. Section scores are then added together to produce a single overall score.

Once the overall score for the building is known this is translated into a rating on a scale of:

- Pass,
- Good,
- Very good,
- Excellent,
- Outstanding [20].

Table 3.2 displays BREEAM rating-benchmark

Table 3.2 BREEAM rating benchmarks [21]

BREEAM Rating	% Score
Unclassified	< 30
Pass	≥ 30
Good	≥ 45
Very Good	≥ 55
Excellent	≥ 70
Outstanding	≥ 85

To ensure that performance against fundamental environmental issues is not overlooked in pursuit of a particular rating, BREEAM sets minimum standards of performance in key areas e.g. energy, water, waste etc. It is important to bear in mind that these are minimum acceptable levels of performance and, in that respect they should not necessarily be viewed as levels that are representative of best practice for a BREEAM rating level. Table 2.3 displays minimum BREEAM standards by rating level [22], [23].

Table 3.3 Minimum BREEAM standards by rating level [22], [23]

Minimum standards by BREEAM rating level					
BREEAM issue	Pass	Good	Very good	Excellent	Outstanding
Man 01: Sustainable procurement	One credit	One credit	One credit	One credit	Two credits
Man 02: Responsible construction practices	None	None	None	One credit	Two credits

Table 3.3 (continued)

Man 04: Stakeholder participation	None	None	None	One credit (Building user information)	One credit (Building user information)
Hea 01: Visual comfort	Criterion 1 only	Criterion 1 only	Criterion 1 only	Criterion 1 only	Criterion 1 only
Hea 04: Water quality	Criterion 1 only	Criterion 1 only	Criterion 1 only	Criterion 1 only	Criterion 1 only
Ene 01: Reduction of CO2 emissions	None	None	None	Six credits	Ten credits
Ene 02: Energy monitoring	None	None	One credit (First sub-metering credit)	One credit (First sub-metering credit)	One credit (First sub-metering credit)
Ene 04: Low or zero carbon technologies	None	None	None	One credit	One credit
Wat 01: Water consumption	None	One credit	One credit	One credit	Two credits
Wat 02: Water monitoring	None	Criterion 1 only	Criterion 1 only	Criterion 1 only	Criterion 1 only
Mat 03: Responsible Sourcing	Criterion 3 only	Criterion 3 only	Criterion 3 only	Criterion 3 only	Criterion 3 only
Wst 01: Construction waste management	None	None	None	None	One credit
Wst 03: Operational waste	None	None	None	One credit	One credit

Table 3.3 (continued)

LE 03: Mitigating eco-logical impact	None	None	One credit	One credit	One credit

Table 3.4 Example of BREEAM score and rating calculation [24]

BREEAM section	Credits achieved	Credits available	% of credits achieved	Section weighting	Section score
Management	10	22	45%	0.12	5.45%
Health & Wellbeing	8	10	80.00%	0.15	12.00%
Energy	16	30	53.33%	0.19	10.13%
Transport	5	9	55.56%	0.08	4.44%
Water	5	9	55.56%	0.06	3.33%
Materials	6	12	50.00%	0.125	6.25%
Waste	3	7	42.86%	0.075	3.21%
Land Use & Ecology	5	10	50.00%	0.10	5.00%
Pollution	5	13	38.50%	0.10	3.85%
Innovation	2	10	20%	0.10	2%
Final BREEAM Score					55.66%
BREEAM Rating					Very Good

3.1.1.2 Comprehensive Assessment System for Building Environmental Efficiency

Beginning in 2001 Comprehensive Assessment System for Building Environmental Efficiency (CASBEE) was developed in Japan and brought a new concept for evaluation which distinguishes environmental load from quality of building performance. By relating these two factors, CASBEE results are presented as a measure of eco-efficiency or BEE (Building Environmental Efficiency). Results are plotted on a graph, with

environmental load on one axis and quality on the other – the best buildings will fall in the section representing lowest environmental load and highest quality. CASBEE major categories of criteria include the following [25]:

1. Building Environmental Quality and Performance

- Indoor environment,
- Quality of services,
- Outdoor environment on site [25].

2. Building Environmental Loadings

- Energy,
- Resources and materials,
- Off-site environment [25].

Each criterion is scored from level 1 to level 5, with level 1 defined as meeting minimum requirements, level 3 defined as meeting typical technical and social levels at the time of the assessment, and level 5 representing a high level of achievement [25].

Figure 3.2 is an example of CASBEE reporting documentation.

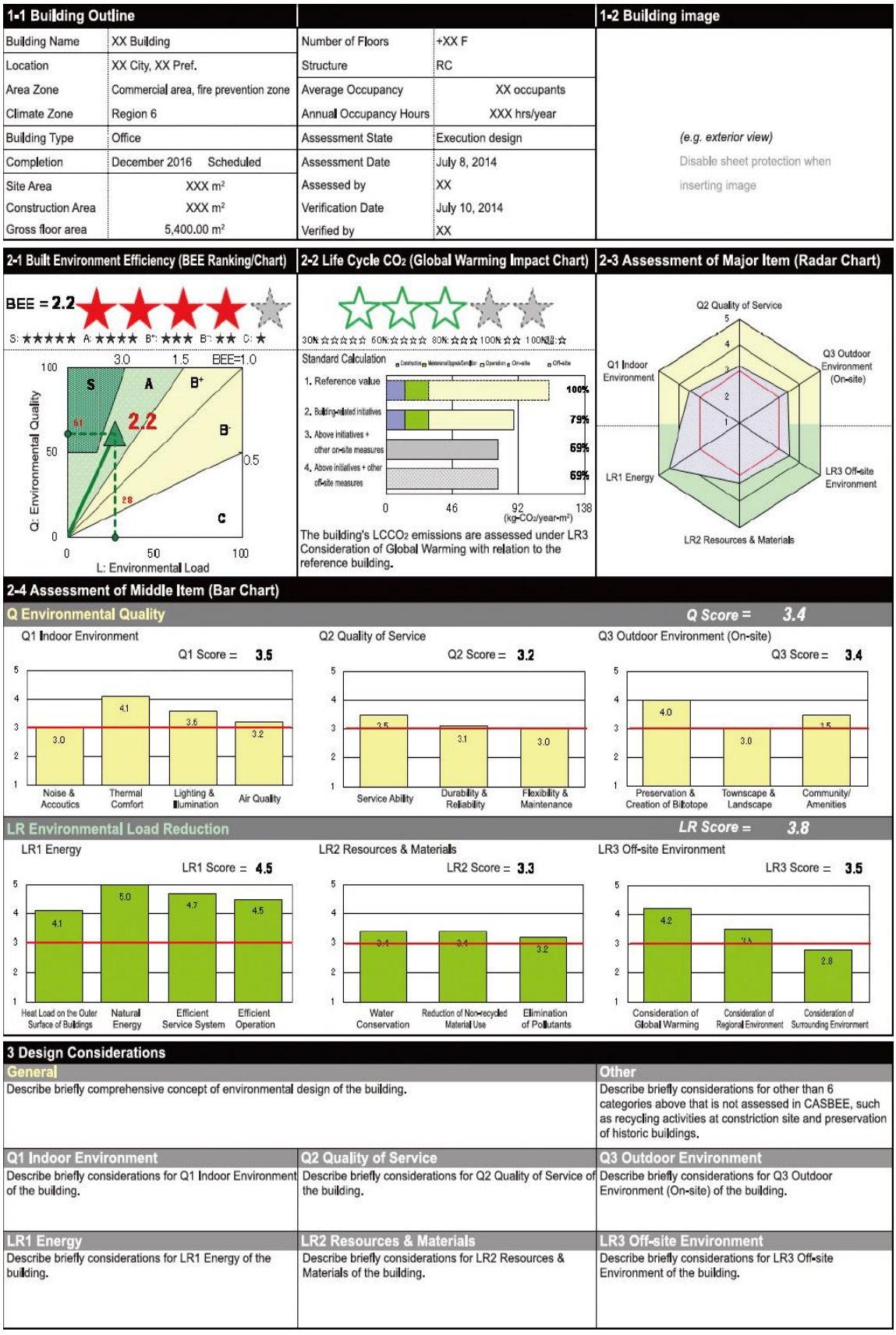


Figure 3.2 an example of CASBEE reporting documentation [26]

3.1.1.3 Green Building Tool

Green Building (GB) Tool was developed by the International Framework Committee for the Green Building Challenge, an international project that has involved more than 25 countries since 1998. GB Tool is designed to be adapted by sponsors to reflect regional conditions and context. It includes criteria in categories such as:

- Site Selection,
- Project Planning and Development,
- Environmental Loadings,
- Energy and Resource Consumption,
- Indoor Environmental Quality,
- Functionality,
- Long-Term Performance,
- Social and Economic Aspects [25].

Originally addressing only an as-designed assessment, GB Tool is developing versions to address pre-design, design, as built, and operations. The tool itself comprises two spreadsheets, one for data entry (to be completed by the project team) and one for establishing weights and benchmarks and completing the assessment (to be completed by third party sponsors or assessors) [25].

Criteria are assessed using scales that are based on local benchmarks of "typical" practice; buildings can score -1 if below typical practice or from +1 to +5, representing good to very high performance. All criteria must be scored, thus providing a complete assessment of the building. Both benchmarks of typical practice and weightings of criteria are established by the sponsoring organization to represent national, regional, or local codes, practice, context, conditions, and priorities [25].

Table 3.3 is an example of GB Tool documentation.

Weighting of Issues and Categories for Toronto, Canada

Design Phase: Generic

Values range from 0 (not applicable) to 5 (most important), with the value 2 representing the normal default or null value, except for Mandatory parameters, which range from 3 to 5.
Click on box at right to select Default or your own weighting values.

Use your values

Instructions:
First decide if you want to use the defaults
If you want to set your own weights
1. First set relative importance for highest level Issues
2. Then set values for Categories within each Issue area
3. To set lowest level weights, go to WtB

	Issues	Suggested nominal default values	Nominal weights adjusted for number of active Categories	Weighted percent	Select your own nominal weighting values	Mandatory
					Active	
A	Site Selection, Project Planning and Development	3	1.3	8.7%	3	
B	Energy and Resource Consumption	5	2.9	19.4%	4	M
C	Environmental Loadings	5	4.3	29.1%	5	M
D	Indoor Environmental Quality	4	2.9	19.4%	4	M
E	Service Quality	3	2.6	17.5%	3	
F	Social and Economic aspects	3	0.6	3.9%	2	
G	Cultural and Perceptual Aspects	3	0.3	1.9%	2	

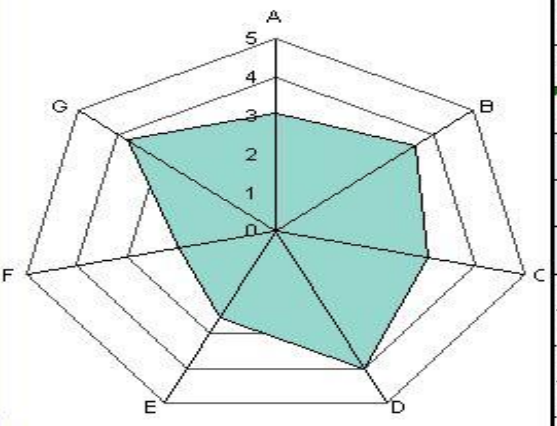
Assessment Scores for Minto Roehampton, Toronto, Canada

Predicted performance results based on information available during Design Phase

Active Phase (set in Region file) | **Design Phase**

Relative Performance Results

0 = Acceptable Practice; 3 = Good Practice; 5 = Best Practice



Performance Issue Areas

Design Phase scores indicate Potential Performance as predicted by an assessment of building features and plans for construction and operation that are developed during the design process.

Project Information

This is a New construction project with a total gross area of 16323 m2. It has an estimated lifespan of 75 years, and contains the following occupancies: Apartment and Indoor parking and is located in Toronto, Canada. The assessment is valid for the Design Phase.

Assumed life span is 75 years, and monetary units are in CAD	Amortization rate for embodied energy of existing materials is set at 0 %
The project contains 148 apartment units	Assessment Scores

With current context and building data, the number of active low-level parameters is:	96	Max. potential low-level parameters:	109
The number of active low-level mandatory parameters with a score of less than 3 is:	0	Active low-level enabling parameters:	7

	Issue	Active Weights	Weighted scores
	To see a full list of Issues, Categories and Criteria, go to the Issues worksheet.		
A	Site Selection, Project Planning and Development	9%	3.1
B	Energy and Resource Consumption	19%	3.5
C	Environmental Loadings	29%	3.1
D	Indoor Environmental Quality	19%	4.0
E	Service Quality	17%	2.5
F	Social and Economic aspects	4%	1.9
G	Cultural and Perceptual Aspects	2%	3.8
	Total weighted building score		3.2

Absolute Performance Results

Relative performance level is Good Practice or better

	These data are based on the Self-Assessment values	By area	By area & occupancy	
1	Total net consumption of primary embodied energy for structure and envelope, GJ/m2	6	3	GJ/m²maph
2	Net annualized consumption of embodied energy for envelope and structure, MJ/m2*yr.	75	42	MJ/m²maph
3	Net annual consumption of delivered energy for building operations, MJ/m2*year	419	237	MJ/m²maph
4	Net annual consumption of primary non-renewable energy for building operations, MJ/m2*yr.	419	237	MJ/m²maph
5	Net annual consumption of primary non-renewable energy per dwelling unit in project, MJ/m2*yr.	3	2	MJ/m²maph
6	Net annual consumption of primary non-renewable energy per dwelling unit in residential element, MJ/m2*yr.	3	2	MJ/m²maph
7	Net annualized primary embodied energy and annual operating primary energy, MJ/m2*yr.	494	279	MJ/m²maph
8	Total on-site renewable energy used for operations, MJ/m2*yr.	51	29	MJ/m²maph
9	Net annual consumption of potable water for building operations, L / m2 * year	784	443	m³/m²maph
10	Annual use of grey water for building operations, L / m2 * year	8	4	m³/m²maph
11	Net annual GHG emissions from building operations, kg. CO2 equivalent per year	23	13	kg/m²maph
12	Total present value of 25-year life-cycle cost fot total project, CAD per m2.	6,712		
13	Proportion of gross area of existing structure(s) re-used in the new project, percent	0%		
14	Proportion of gross area of project provided by re-use of existing structure(s), percent	0%		

Figure 3.3 Example of GB Tool documentation [27]

3.1.1.4 Green Globes U.S.

Green Globes™ US was adapted from the Green Globes Canada rating system in 2004. Green Globes Canada was developed as a web-based version of the combination of BREEAM Canada and Green Leaf. The development of Green Globes™ US is funded by The Green Building Initiative. The Green Globes™ US system is an on-line tool designed for use by architects and builders for any size commercial building. The preliminary assessment occurs after conceptual design and the final assessment occurs after the construction documentation stage. Green Globes major categories of criteria include the following:

- Project Management,
- Site,
- Energy,
- Water,
- Resources,
- Emissions, Effluents and other impacts,
- Indoor Environment [25].

Figure 3.4 displays the major categories and sub-categories for assessment of Green Globe projects.



Percentage Score	Points Score	Areas and Sub-Areas of Assessment
5%	50	A - Project Management
	20	A.1 - Integrated design process
	10	A.2 - Environmental purchasing (including energy efficient products)
	15	A.3 - Commissioning
	5	A.4 - Emergency response plan
11.5%	115	B - Site
	30	B.1 - Development area (site selection, development density, site remediation)
	30	B.2 - Ecological impacts (native planting and vegetation, heat islands, night sky)
	20	B.3 - Watershed features (site grading, stormwater management, pervious cover, rainwater capture)
	35	B.4 - Site ecology enhancement
38%	380	C - Energy
	100	C.1 - Energy performance
	114	C.2 - Reduced energy demand (space optimization, microclimatic response to site, day-lighting, envelope design, metering)
	66	C.3 - Integration of energy efficient systems
	20	C.4 - Renewable energy sources (on-site renewable energy technologies)
	80	C.5 - Energy-efficient transportation (public transportation, cycling facilities)
8.5%	85	D - Water
	30	D.1 - Water performance
	45	D.2 - Water conserving features (sub-metering, devices, cooling towers, landscaping and irrigation strategies)
	10	D.3 - On-site treatment of water (greywater system, on-site wastewater treatment)
10%	100	E - Resources
	40	E.1 - Low impact systems and materials (selection of building materials based on the low environmental impact)
	15	E.2 - Minimal consumption of resources (reused, recycled, local, low-maintenance materials, certified wood)
	15	E.3 - Reuse of existing buildings
	15	E.4 - Building durability, adaptability and disassembly
	5	E.5 - Reduction, reuse and recycling of demolition waste
	10	E.6 - Recycling and composting facilities
7%	70	F - Emissions, Effluents & Other Impacts
	15	F.1 - Air emissions (low emission burners)
	20	F.2 - Ozone depletion
	10	F.3 - Avoiding sewer and waterway contamination
	25	F.4 - Pollution minimization (storage tanks, PCBs, radon, asbestos, pest management, hazardous materials)
20%	200	G - Indoor Environment
	55	G.1 - Ventilation system (intakes, ventilation rates, delivery, CO_2 monitoring, controls, parking areas, ease of maintenance)
	45	G.2 - Control of indoor pollutants (mould, AHU, humidification, Legionella cooling towers/ hot water, building materials, local exhaust)
	50	G.3 - Lighting (visual access, heights & depths of perimeter spaces, daylight factor, ballasts, glare, task lighting, controls)
	20	G.4 - Thermal comfort (thermal conditions meet ASHRAE 55)
	20	G.5 - Acoustic comfort (zoning, transmission, vibration control, acoustic privacy, reverberation, mechanical noise)
100%	1000	TOTAL POINTS AVAILABLE

Figure 3.4 Areas and sub-areas of assessment of Green Globes [28]

The Green Globes is a third party certification system used to certify different types of buildings, constructions or facilities according to the named criteria.

As an example here Green Globes New Construction (NC) is studied. This program is a web application that aids architects, engineers, construction professionals, and owners in evaluating, quantifying and improving the sustainability of new building projects as well as major renovations. Figure 4 displays an example of assessment form of Green Globes New Construction.

GREEN GLOBES

Date:
Project Name: _____

PROJECT MANAGEMENT			Maximum Points: 50	Y	N	?
1.1	**Integrated Design Process (IDP)**		**9**			
	1.1.1	Pre-Design Meetings	3			
	1.1.2	IDP Performance Goals	3			
	1.1.3	IDP Progress Meeting for Design	3			
	1.1.4	Capital Asset Plan & Business Case Summary (Federal only)	0			
1.2	**Environmental Management During Construction**		**12**			
	1.2.1	Environmental Management Systems (EMS)	3			
	1.2.2	Clean Diesel Practices	2			
	1.2.3	Building Materials and Building Envelope	2			
	1.2.4	IAQ During Construction	5			
1.3	**Commissioning**		**29**			
	1.3.1	Pre-Commissioning	3			
	1.3.2	Whole Building Commissioning	19			
	1.3.3	Training	1			
	1.3.4	Operations and Maintenance Manual	6			

SITE			Maximum Points: 115	Y	N	?
2.1	**Development Area**		**30**			
	2.1.1	Urban Infill and Urban Sprawl	10			
	2.1.2	Greenfields, Brownfields and Floodplains	20			
2.2	**Ecological Impacts**		**32**			
	2.2.1	Site Disturbance and Erosion	8			
	2.2.2	Tree Integration	5			
	2.2.3	Tree Preservation	4			
	2.2.4	Heat Island Effect	13			
	2.2.5	Bird Collisions	2			
2.3	**Stormwater Management**		**18**			
2.4	**Landscaping**		**28**			
2.5	**Exterior Light Pollution**		**7**			

ENERGY			Maximum Points: 390	Y	N	?
3.1	**Energy Performance**		**100**			
3.2	**Energy Demand**		**35**			
	3.2.1	Passive Demand Reduction	19			
	3.2.2	Power Demand Reduction	16			

ENERGY (cont'd)			Maximum Points: 390	Y	N	?
3.3	**Metering, Measurement, and Verification**		**12**			
	3.3.1	Metering	8			
	3.3.2	Measurement and Verification	4			
3.4	**Building Opaque Envelope**		**31**			
	3.4.1	Thermal Resistance and Transmittance	10			
	3.4.2	Orientation	5			
	3.4.3	Fenestration Systems	16			
3.5	**Lighting**		**36**			
	3.5.1	Lighting Power Density	10			
	3.5.2	Interior Automatic Light Shut-off Controls	3			
	3.5.3	Light Reduction Controls	4			
	3.5.4	Daylighting	8			
	3.5.5	Controls for Daylighted Zones	6			
	3.5.6	Exterior Luminaires and Controls	5			
3.6	**HVAC Systems and Controls**		**59**			
	3.6.1	Building Automation System	10			
	3.6.2	Cooling Equipment	13			
	3.6.3	Cooling Towers	8			
	3.6.4	Heat Pumps	6			
	3.6.5	Heating Equipment	8			
	3.6.6	Condensate Recovery	3			
	3.6.7	Steam Traps	2			
	3.6.8	Domestic Hot Water Heaters	3			
	3.6.9	Variable Speed Control of Pumps	6			
3.7	**Other HVAC Systems and Controls**		**32**			
	3.7.1	Minimizing Re-heat and Re-cool	6			
	3.7.2	Air Economizers	3			
	3.7.3	Fans and Ductwork	7			
	3.7.4	Demand Controlled Ventilation	10			
	3.7.5	Variable Refrigerant Flow Systems	6			
3.8	**Other Energy Efficient Equipment and Measures**		**11**			
	3.8.1	Elevators and Escalators	5			
	3.8.2	Other Energy Efficient Equipment	6			
3.9	**Renewable Energy**		**50**			
	3.9.1	On-site Renewable Energy	32			
	3.9.2	Off-site Renewable Energy	18			
3.10	**Energy Efficient Transportation**		**24**			

Figure 3.5 Green Globes New Construction Assessment criteria [29]

GREEN GLOBES

Date:
Project Name:

WATER			Maximum Points: 110	Y	N	?
4.1	**Water Consumption**		42			
4.2	**Cooling Towers**		9			
4.3	**Boilers and Water Heaters**		4			
4.4	**Water Intensive Applications**		18			
4.4.1	Commercial Food Service Equipment	6				
4.4.2	Laboratory and Medical Equipment	5				
4.4.3	Laundry Equipment	4				
4.4.4	Special Water Features	3				
4.5	**Water Treatment**		3			
4.6	**Alternate Sources of Water**		5			
4.7	**Metering**		11			
4.8	**Irrigation**		18			

MATERIALS & RESOURCES			Maximum Points: 125	Y	N	?
5.1	**Building Assembly (Core & Shell including Envelope)**		33			
5.2	**Interior Fit-Out (including Finishes and Furnishings)**		16			
5.3	**Reuse of Existing Structures**		26			
5.3.1	Facades	6				
5.3.2	Structural Systems	6				
5.3.3	Non-Structural Elements	14				
5.4	**Waste**		9			
5.4.1	Construction Waste	7				
5.4.2	Operational Waste	2				
5.5	**Building Service Life Plan**		7			
5.6	**Resource Conservation**		6			
5.6.1	Minimized Use of Raw Materials	3				
5.6.2	Multi-Functional Assemblies	1				
5.6.3	Deconstruction and Disassembly	2				
5.7	**Building Envelope - Roofing/Openings**		10			
5.7.1	Roofing Membrane Assemblies and Systems	3				
5.7.2	Flashings	3				
5.7.3	Roof and Wall Openings	4				
5.8	**Envelope - Foundation, Waterproofing**		6			
5.8.1	Foundation Systems	4				
5.8.2	Below Grade Wall Slabs and Above Grade Horizontal Assemblies	2				
5.9	**Envelope - Cladding**		5			
5.9.1	Exterior Wall Cladding Systems	3				
5.9.2	Rainscreen Wall Cladding	2				
5.1	**Envelope - Barriers**		7			
5.10.1	Air Barriers	4				
5.10.2	Vapor Retarders	3				

EMISSIONS			Maximum Points: 50	Y	N	?
6.1	**Heating**		18			
6.2	**Cooling**		29			
6.2.1	Use of New or Existing Cooling Equipment (informational only)	0				
6.2.2	Ozone-Depleting Potential	10				
6.2.3	Global Warming Potential	10				
6.2.4	Leak Detection	9				
6.3	**Janitorial Equipment**		3			

INDOOR ENVIRONMENT			Maximum Points: 160	Y	N	?
7.1	**Ventilation**		37			
7.1.1	Ventilation Air Quantity	11				
7.1.2	Air Exchange	8				
7.1.3	Ventilation Intakes and Exhausts	8				
7.1.4	CO2 Sensing and Ventilation Control Equipment	5				
7.1.5	Air Handling Equipment	5				
7.2	**Source Control and Measurement of Indoor Pollutants**		46			
7.2.1	Volatile Organic Compounds	10				
7.2.2	Leakage, Condensation and Humidity	8				
7.2.3	Access for HVAC Maintenance	4				
7.2.4	Carbon Monoxide Monitoring	4				
7.2.5	Wet Cooling Towers	2				
7.2.6	Domestic Hot Water Systems	2				
7.2.7	Humidification and Dehumidification Systems	3				
7.2.8	Pest and Contamination Control	3				
7.2.9	Other Indoor Pollutants (Tobacco, Radon)	8				
7.2.10	Ventilation and Physical Isolation for Specialized Activities	2				
7.3	**Lighting Design and Systems**		30			
7.3.1	Daylighting	17				
7.3.2	Lighting Design	13				
7.4	**Thermal Comfort**		18			
7.4.1	Thermal Comfort Strategies	12				
7.4.2	Thermal Comfort Design	6				
7.5	**Acoustic Comfort**		29			
7.5.1	Acoustic Comfort Design	18				
7.5.2	Mechanical, Plumbing, and Electrical	11				
	TOTAL:		1000			

Figure 3.5 Green Globes New Construction Assessment criteria [29]

Green Globes allows its users to evaluate their systems based on the amount of applicable available points, having the option of “not applicable” in some categories. Projects that are third-party verified and have achieved over 35% of the points can earn a rating of 1 to 4 Green Globes.

3.1.1.5 Leadership in Energy and Environmental Design

Leadership in Energy and Environmental Design (LEED) was developed in the U.S. in 1998 as a consensus-based building rating system based on the use of existing building technology. Today LEED is considered to be the leading sustainable rating system among others across the world and approximately has certified 1.85 million square feet of construction space. The development of LEED has been through the U.S. Green Building Council member committees. The rating system addresses specific environmental building related impacts using a whole building environmental performance approach. In addition to LEED-NC (for new construction and major renovations), there are versions for existing buildings, commercial interiors, core and shell, homes, and neighborhood development. There are also application guides that can be used to increase the applicability and flexibility of LEED (e.g., multiple buildings and campuses, schools, health care, laboratories, lodging, and retail) [30].

LEED accredits the built environment and buildings according to some major categories that are the same for every type of facilities but the sub-categories vary. The major categories for rating a facility are mentioned below.

- Sustainable Sites,
- Water Efficiency,
- Energy and Atmosphere,
- Materials and Resources,
- Indoor Environmental Quality,
- Innovation and Design Process [30] [31].



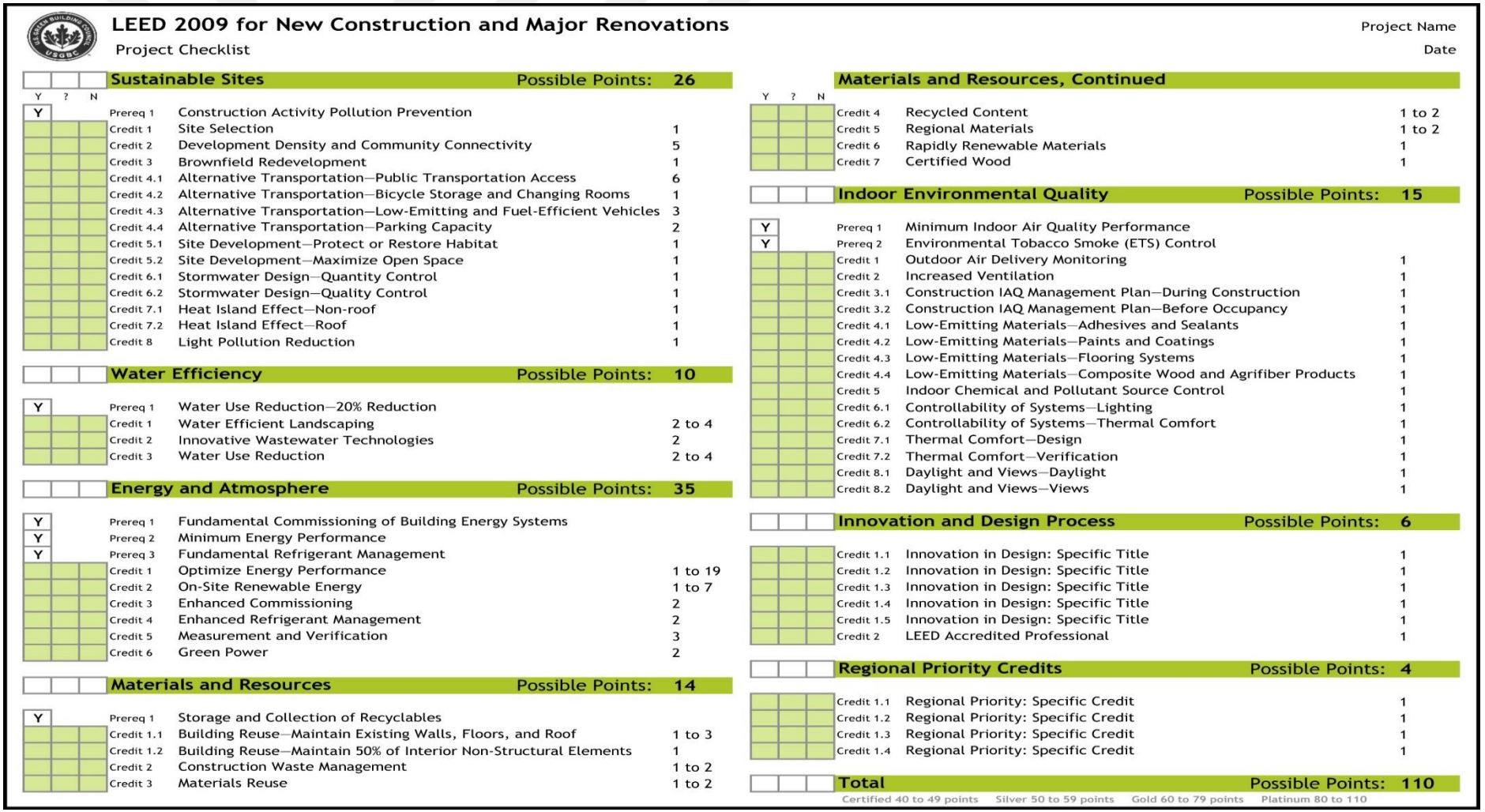
Figure 3.6 LEED Credit Categories

In the result if the project does reach the minimum requirements of LEED checklist, it earns a LEED certification. The certification type changes as the earned points get higher. If a building reaches 40 points it is certified, 50-59 points it gets a silver, 60-79 points a Gold and 80-110 points the project receives a LEED Platinum award. Figure 3.7 displays the type of earned certification according to credits



Figure 3.7 LEED certifications

As mentioned for each type of registered building to receive a LEED certificate there is a checklist that determines the score of that project. Figure 3.8 displays the LEED 2009 for New Construction and Major Renovation checkli



LEED 2009 for New Construction and Major Renovations

Project Checklist

Project Name

Date

Sustainable Sites — Possible Points: 26

Y	?	N			
Y			Prereq 1	Construction Activity Pollution Prevention	
			Credit 1	Site Selection	1
			Credit 2	Development Density and Community Connectivity	5
			Credit 3	Brownfield Redevelopment	1
			Credit 4.1	Alternative Transportation—Public Transportation Access	6
			Credit 4.2	Alternative Transportation—Bicycle Storage and Changing Rooms	1
			Credit 4.3	Alternative Transportation—Low-Emitting and Fuel-Efficient Vehicles	3
			Credit 4.4	Alternative Transportation—Parking Capacity	2
			Credit 5.1	Site Development—Protect or Restore Habitat	1
			Credit 5.2	Site Development—Maximize Open Space	1
			Credit 6.1	Stormwater Design—Quantity Control	1
			Credit 6.2	Stormwater Design—Quality Control	1
			Credit 7.1	Heat Island Effect—Non-roof	1
			Credit 7.2	Heat Island Effect—Roof	1
			Credit 8	Light Pollution Reduction	1

Water Efficiency — Possible Points: 10

Y			Prereq 1	Water Use Reduction—20% Reduction	
			Credit 1	Water Efficient Landscaping	2 to 4
			Credit 2	Innovative Wastewater Technologies	2
			Credit 3	Water Use Reduction	2 to 4

Energy and Atmosphere — Possible Points: 35

Y			Prereq 1	Fundamental Commissioning of Building Energy Systems	
Y			Prereq 2	Minimum Energy Performance	
Y			Prereq 3	Fundamental Refrigerant Management	
			Credit 1	Optimize Energy Performance	1 to 19
			Credit 2	On-Site Renewable Energy	1 to 7
			Credit 3	Enhanced Commissioning	2
			Credit 4	Enhanced Refrigerant Management	2
			Credit 5	Measurement and Verification	3
			Credit 6	Green Power	2

Materials and Resources — Possible Points: 14

Y			Prereq 1	Storage and Collection of Recyclables	
			Credit 1.1	Building Reuse—Maintain Existing Walls, Floors, and Roof	1 to 3
			Credit 1.2	Building Reuse—Maintain 50% of Interior Non-Structural Elements	1
			Credit 2	Construction Waste Management	1 to 2
			Credit 3	Materials Reuse	1 to 2

Materials and Resources, Continued

Y	?	N			
			Credit 4	Recycled Content	1 to 2
			Credit 5	Regional Materials	1 to 2
			Credit 6	Rapidly Renewable Materials	1
			Credit 7	Certified Wood	1

Indoor Environmental Quality — Possible Points: 15

Y			Prereq 1	Minimum Indoor Air Quality Performance	
Y			Prereq 2	Environmental Tobacco Smoke (ETS) Control	
			Credit 1	Outdoor Air Delivery Monitoring	1
			Credit 2	Increased Ventilation	1
			Credit 3.1	Construction IAQ Management Plan—During Construction	1
			Credit 3.2	Construction IAQ Management Plan—Before Occupancy	1
			Credit 4.1	Low-Emitting Materials—Adhesives and Sealants	1
			Credit 4.2	Low-Emitting Materials—Paints and Coatings	1
			Credit 4.3	Low-Emitting Materials—Flooring Systems	1
			Credit 4.4	Low-Emitting Materials—Composite Wood and Agrifiber Products	1
			Credit 5	Indoor Chemical and Pollutant Source Control	1
			Credit 6.1	Controllability of Systems—Lighting	1
			Credit 6.2	Controllability of Systems—Thermal Comfort	1
			Credit 7.1	Thermal Comfort—Design	1
			Credit 7.2	Thermal Comfort—Verification	1
			Credit 8.1	Daylight and Views—Daylight	1
			Credit 8.2	Daylight and Views—Views	1

Innovation and Design Process — Possible Points: 6

			Credit 1.1	Innovation in Design: Specific Title	1
			Credit 1.2	Innovation in Design: Specific Title	1
			Credit 1.3	Innovation in Design: Specific Title	1
			Credit 1.4	Innovation in Design: Specific Title	1
			Credit 1.5	Innovation in Design: Specific Title	1
			Credit 2	LEED Accredited Professional	1

Regional Priority Credits — Possible Points: 4

			Credit 1.1	Regional Priority: Specific Credit	1
			Credit 1.2	Regional Priority: Specific Credit	1
			Credit 1.3	Regional Priority: Specific Credit	1
			Credit 1.4	Regional Priority: Specific Credit	1

Total — Possible Points: 110

Certified 40 to 49 points Silver 50 to 59 points Gold 60 to 79 points Platinum 80 to 110

Figure 3.8 LEED for New Constructions and Major Renovation [32]

3.2 Comparison of Two Chosen Sustainability Method and Their Connection to universal Design

Among these methods, LEED and BREEAM systems are chosen to be examined in detail. The reason to choose LEED and BREEAM among other systems is that they are accepted all around the world and have certified many projects in different countries including Turkey. They both have a section related to inclusivity in architecture. Another reason for this selection is that they are both from a developed country and the most accepted and known sustainability rating system. In other words both LEED and BREEAM are one of the oldest and most famous sustainability rating systems worldwide. The reason behind this comparison is to observe how both systems have created solutions for different situations and how they save their ranking among others.

The differences between the functional bases of these methods are presented in table 3.5:

Table 3.5 comparison of LEED and BREEAM [20] [30]

Name	BREEAM Building Research Establishment Environmental Assessment Method	LEED Leadership in Energy and Environmental Design
Country	England	U.S.A
Release Date	1990	1998
Prevalence of Use	200.000 Certificates – More than 1.000.000 registration	11.082 Certificates – 32.451 registration (Till 2001)
Infrastructure	BRE (Building Research Establishment)	USGBC (United States Green Building Council)
Update to System	Periods of 3 times in a year	As needed

Table 3.5 (continued)

Coverage	BREEAM covers all building types, schools, healthcare buildings, offices, industrial units and more. For the housing sector, there are a number of variants: • The UK Government's Code for Sustainable Homes (CSH) replaced Eco Homes for the assessment of new housing in England, Wales and Northern Ireland • BREEAM Eco Homes for new homes in Scotland BREEAM Multi-Residential covering buildings housing many individuals and offering shared facilities	• New commercial construction and major renovation projects (LEED-NC) • Existing building operations (LEED-EB) • Commercial interiors projects (LEED-CI) • Core and shell projects (LEED-CS) • Homes (LEED-H) Neighborhood • Development (LEED-ND) • Healthcare (LEED-HC)
Requires Assessor	It is mandatory for an assessor to lead the assessment and certification process	It is optional and would be rewarded an extra 1 point if used
Supervisory Authority	BRE	USGBC (till 2008) GBCI (2008 – present day)
Reference Documents	Only assessors have access	Could be purchased
Assessment Criteria	• Energy • Management • Health and Wellbeing • Transport • Water consumption and efficiency • Materials • Waste • Pollution • Land Use • Ecology	• Sustainable Sites • Water Efficiency • Energy and Atmosphere • Materials and Resources • Indoor Environmental Quality • Innovation and Design Process

Table 3.5 (continued)

Prerequisites	Prerequisites change for every level of certification	• Must comply with environmental laws • Must be a complete, permanent building or space • Must use a reasonable site boundary • Must comply with minimum floor area requirements • Must comply with minimum occupancy rates • Must commit to sharing whole-building energy and water usage data • Must comply with a minimum building area to site area ratio
Certification stages	• Design stage • Post-construction stage	Single certification when the project is finished.
Scoring	The total number of points or credits gained in each section is multiplied by an environmental weighting factor which takes into account the relative importance of each section. Section scores are then added together to produce a single overall score.	There are four levels of certification - the number of points a project earns determines the level of LEED certification that the project will receive
Certificates	• Pass 30% • Good 45% • Very Good 55% • Excellent 70% • Outstanding 85% *A star rating from 1 to 5 stars is also provided	• Certified 40-49 points • Silver 50-59 points • Gold 60-89 points • Platinum 80 points and higher
Certification validity	Valid for the lifetime of the structure but, assessed for 60 years of the structure.	Valid for the lifetime of the structure

Besides, LEED and BREEAM both have a section related to inclusivity. LEED gives an option to add an optional 1 point only for dwelling units under the headline of Visitability and Universal Design and BREEAM goes with Inclusivity. There are three options in LEED's Visitability and Universal design that could end up earning 1 point [33] :

Option 1. Universal design features throughout the home (1 point)

Throughout the home, include at least five of the following universal design features:

- easy-to-grip lever door handles,
- easy-to-grip cabinet and drawer loop handles,
- easy-to-grip locking mechanisms on doors and windows,
- easy-to-grip single-lever faucet handles,
- easy-touch rocker or hands-free switches,
- motion-detector lighting at entrance, in hallways and stairwells, and in closets, and motion-detector light switches in garages, utility spaces, and basements,
- large, high-contrast print for controls, signals, and the house or unit numbers,
- a built-in shelf, bench, or table with knee space below, located outside the entry door with weather protection overhead, such as porch or stoop with roof, awning, or other overhead covering,
- a minimum 32-inch (80-centimeter) clear door opening width for all doorways,
- tread at the entrance, on stairs, and other areas where slipping is common, with color contrast difference between stair treads and risers,
- Interior floor surfaces (e.g., low-pile carpets, hard-surface flooring) that provide easy passage for a wheelchair or walker, with color contrast between floor surfaces and trim; no carpet is permitted in a kitchen, bathroom, or other wet areas of the dwelling unit [33].

Option 2. Kitchen features (1 point)

On the main floor of the home (or on another floor, if an elevator or stair lift is provided), provide a kitchen with hard-surface flooring, plumbing with single-lever controls, a 5-

foot (1.5-meter) turning radius, and at least four of the following universal design features [33]:

- variable-height (28- to 42-inch [70- to 110-centimeter]) or adjustable work surfaces, such as countertops, sinks, and cooktops,
- clear knee space under sink and cooktops (this requirement can be met by installing removable base cabinets or fold-back or self-storing doors), cooktops and ranges with front or side-mounted controls, and wall-mounted ovens at a height to accommodate a seated adult,
- a toe kick area at the base of lower cabinets with a minimum height of 9 inches (23 centimeters), and full-extension drawers and shelves in at least half (by volume) of the cabinets,
- contrasting color treatment between countertops, front edges, and floor,
- adjustable-height shelves in wall cabinets,
- Glare-free task lighting [33].

Option 3. Bedroom and bathroom features (1 point)

On the main floor of the building (or on another floor, if an elevator or stair lift is provided), include all of the following in at least one accessible bedroom [33]:

- Size the room to accommodate a twin bed with a 5-foot (1.5-meter) turning radius around the bed,
- Install a clothes closet with a 32-inch (80-centimeter) clear opening with adjustable-height closet rods and shelves,
- In at least one full bathroom on the same floor as the bedroom,
- Provide adequate maneuvering space with a 30-by-48-inch (75-by-120 centimeter) clear floor space at each fixture,
- Center the toilet 18 inches (45 centimeters) from any side wall, cabinet, or tub, and allow a 3-foot (90-centimeter) clear space in front,
- Install broad blocking in walls around toilet, tub, and/or shower for future placement and relocation of grab bars,

- Provide knee space under the lavatory (this requirement may be met by installing removable base cabinets or fold-back or self-storing doors),
- Install a long mirror whose bottom is no more than 36 inches (90 centimeters) above the finished floor and whose top is at least 72 inches (180 centimeters) high [33].

Also BREEAM has Inclusive and Accessible design headline which are not mandatory in order to gain a certificate but could lead to earning 3 extra points. The aim is to create an inclusive community for all possible users. The required criteria according to Breeam are as stated below [34]:

One credit

1. An inclusive design and management strategy is produced at the outset of the development including issues of accessibility, inclusion and emergency egress for all occupants and visitors, with specific consideration to people's wellbeing and age, gender, ethnicity, beliefs and/or disability related needs,
2. Community engagement is used to develop the inclusive design strategy through the processin issue 'GO02 - Consultation and engagement',
3. Where available, national and local authority guidance on procurement of inclusive communities and design has been followed [34].

Two credits

4. Criteria 1 to 3 are achieved,
5. A person isidentified or appointed within the design team to champion and provide oversight on inclusive design and management within the project team, during the outline formulation and ongoing development of the masterplan [34].

Three credits

6. Criteria 1 to 5 are achieved,
7. An appropriately qualified independent access consultant is commissioned to provide advice on the both strategic and detailed design proposals.
8. Deliberations and decisionstakenwithin the project team are tracked by the project manager based on documentation and preliminary advice obtained from the access consultant. The views of organisational duty holders(such asthe champion for

inclusive design and management) and of third-party stakeholders are also accounted, recorded and considered,

9. There is evidence within the decisionstaken that design implications are anticipated and that plans are made to develop operational management strategies. These decisions are recorded and communicated to inform those who will use and manage the environment [34].

Checking out the features of all three options in LEED, it seems like the only disabled people are the paraplegic ones with a wheelchair according to LEED. These are only options that could lead to a partial inclusive dwelling unit design with a special target of people. On the other hand although it seems like BREEAM is a step ahead of LEED because it designs for all potential users but unfortunately there are no details in the system. This also could only result in a partial inclusive facility. In both systems the outcome is going to be similar to each other and at the finest situation it only gives away 3 extra point and that would not be sufficient to rate such a huge issue with diverse problems.

In addition, these systems are flexible and make changes to their models. BREEAM updates its existing system 3 times a year in the same periods and LEED makes updates to its current version as needed and there are no specific periods of time for it. For both systems the flexibility results in more improved versions to their system. These two systems almost cover every type of facilities.

3.3 Chapter Conclusion

Any proposed rating model should be able to cover areas on an international level, as well as regional context in case that some cultures could have different norms about some of the options. For instance, in some Islamic cultures blind people do not prefer to use guide dogs which in that case there should be other options for recovery. Additionally they should have a vast coverage of different types of buildings such as dwelling units or educational facilities etc., periodic updates to the development of the system, an infrastructure in order to be able to make the system mandatory for designers to design barrier free structures etc. Most importantly, any type of proposed model should have assessment criteria that would avoid architectural discrimination. Last but not least the most important prerequisite for fully inclusive design is to put the people with all types of abilities in the heart of the design process. Moreover, different standards are collected

for universal and accessible design and all together have shaped the proposed model in the next chapter

CHAPTER 4

MONITORING MODEL FOR UNIVERSAL DESIGN

As mentioned earlier, the purpose of the monitoring model is to find out to what extent a particular building acts in terms of access and universal design. Does it allow each user to use the facility easily and evenly or are some discriminated. At last the aim of this model is to make recommendations for building owners to improve the accessibility of the facility. The model rates the building with specific points according to the access level, find out the weak spots of it, recommend alterations, assess only a specific part of the building if needed and is where the proccess of universal design actualy comes to life in architecture and built environment.

4.1 The Basis of a Monitoring Model for Universal Design

Earlier in the thesis it is discussed that, although there are different systems such as ADA which offer standards for creating accessible spaces, why there is need for a monitoring model for universal design. Also it was mentioned that this set of guidelines and standards should be created according to the principles of universal design. According to universal design criteria for architecture created by North Carolina State University and criteria from other accessibility standards such as ADA there are some differences between these systems with universal design. As an example, ADA requires for an accessible entrance and hands out detailed information about the dimensions and other criteria for that entrance. On the other hand universal design requires all entrances to be accessible and be an answer for all potential users and has a less detailed information about the construction part. For instance according to universal design criteria all hallways must be wide enough to be an answer for the traffic flow but how much? ADA is the answer for that. The proposed model for universal design is a combination of these two meaning it includes the most accepted set of standards for accessibility and applies those standards to seven principles of universal design.

The first step to design such system would be the determination of the general categories of evaluation. In order to find out the general categories for this rating system some checklists created about universal design are studied. For instance, in previous years based on Britain's accessibility standards a rating system was developed in Scotland for the purpose of creating accessible and universally designed healthcare centers. The current system in Scotland is named "Access Audit Checklist" by "National Health Service". According to this system there is an order for categorizing the assessment of a health care center which divides the evaluation into major different parts. Table 4.1 displays the categories of the access audit checklist by National Health Service of Scotland [35].

Table 4.1 Access Audit Checklist for Healthcare Centers in Scotland [35]

Access Audit Checklist	
External Approach	External Approach
	External Change in Level: Ramp
	External Change in level: Steps
Entrance and Reception	Entrance
	Reception
Horizontal and Vertical Circulation	Corridor
	Internal Ramp
	Internal Staircase
	Lift
	Platform Stair climber Lift
	Vertical Platform Lift

Table 4.1 (continued)

Internal Spaces	Internal Door
	Internal Space
	Wards and Treatment Areas
	Catering and Refreshment Areas
Sanitary Facilities	Accessible WC – Ambulant
	Accessible WC – Standard Layout
	Accessible WC – Peninsular Layout
	Changing Facilities – Cubicle
	Accessible Shower
	Accessible Bathroom
Signage and Information	Signage
Evacuation and Management	Means of Escape
Customer Care	Customer Care
Implementation	Implementation Considerations

Studying this table it is understandable that the evaluation should be based on either the function or the space. If the evaluation is based on function, the general categories of assessment would be based on the functioning of the spaces and would apply to all spaces. As an example there would be criteria for lighting and the sub criteria for that should apply to all lights in all spaces. The other type of evaluation which is based on space, is chosen for the creation of the system. The reason behind this selection is that each space requires different criteria for every part of a facility. For instance on this type of assessment the materials or illumination differs in the interior and exterior of the facility.

The main areas of audit which should be taken into consideration on the assessment stage of a project are listed below:

- Access to site,
- Landscape,
- Parking lot,
- Entrance of the facility and reception,
- Ground floor and horizontal circulation,
- Vertical circulation,
- Innovation in design.

As mentioned these criteria are general categories that would apply to all facilities. What is comprehensible is that for this model to be inclusive for all types of facilities, similar to sustainability rating systems, for different types of facilities there should be different rating standards. As an example, what applies to a dwelling unit cannot be the same as a learning institution or a healthcare center. But the fundamental parts, meaning the general categories as stated are mostly the same. Fig4.1 displays the coverage of the universal design audit checklist for different types of facilities.

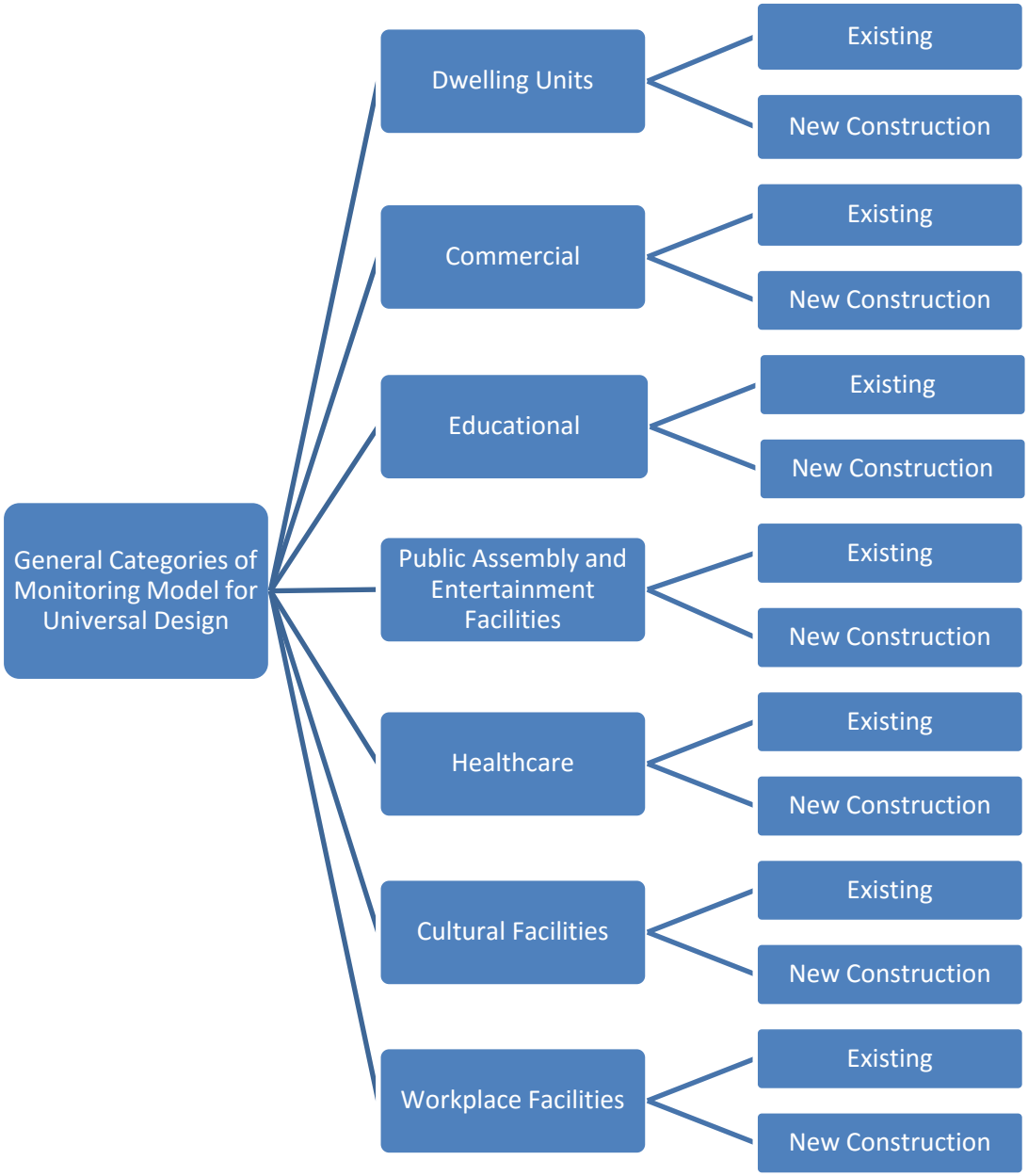


Figure 4.1 Coverage of universal design audit checklist

Generally these types of systems have different prerequisites for facilities with various functions. With the collected data from sustainability rating systems especially BREEAM and LEED it is obvious that these types of rating systems, are not comprehensive and for the improvement of them, by emergence of new demands and solutions they should be updated in a specific period of time. Another approach that could lead in more precise results could be including a professional in the process of design as the named models do.

Awarding a design does not mean that it is going to be an answer for the needs of all times. New needs demand new and better solutions and it is better to reevaluate a project in specific periods of time or update a project and the certificate as the same time the

system updates. The aim here is not certifying buildings and creating better markets for labeled facilities. It is to create an environment where anyone despite of disabilities could benefit equally. In this order it is important to reevaluate certified projects as there are updates to the main system to keep them flawless and accessible for their life cycle.

One of the goals of creating such a checklist is to hand information for both the provider of a service and the receiver. This is important in order to increase awareness about the accessibility features of a space and encourage creating universally built environments. For instance creating a social website or an application where people with disabilities could easily seek about the features of a facility is beneficial for both sides. It automatically creates a competition between service providers because they would get more credit in the marketing of their service.

Another subject here is that the only barrier for seniors or disabled community are not future buildings and environments. As same as sustainable rating systems, alterations to existing buildings should be possible. For instance in a historical site the only solution is to add universal design features to the existing facility. In developed countries some of these problems are solved but in developing countries disabled people face a lot of barriers that most of young and able bodied people cannot see or understand. In order to understand and see the flaws in built environment it is best to see the world from their perspective. For instance if there was a social media that people could instantly take pictures of the obstacles they or others face and upload it so the authorities could see, it would bring more and more attention to all the obstacles and highlight all the flaws that is missed in the process of design.

The main difference between new design and existing systems is that this system should track a person's movements from approaching to the facility, entrance, circulation, exploring the space, to exiting the facility safely. Denying one part of this chain, automatically disables the other parts and unlike LEED or BREEAM, a designer does not have the freedom of selection in the design process. It is similar to a basic software algorithm, if there is a flaw on the process the whole system would disfunction.

4.2 Monitoring Model for Universal Design

Unlike accessibility which only seeks to eliminate physical barriers for the users, universal design not only aims to eliminate physical access but also creates an environment where there are no labeled and discriminated people because of their disabilities. Universal design creates environments and facilities that treat its users equally, and everyone despite of their condition are able to use the built environment evenly. There are a number of definitions available for access audits. These include:

- An access audit rates an existing building against given criteria for usability and accessibility. It involves not only the issue of ready movement to and around the building, but also the use by people with sensory or intellectual disabilities of the services, which the building provides [36].
- The purpose of an access audit is to establish how well a particular building or environment performs in terms of access and ease of use by a wide range of potential users, including people with disabilities, and to recommend access improvements [37].
- The access audit of a building and its setting is the starting point for a planned program of access improvements. Access auditing involves an inspection of a building or environment to appraise its accessibility - judged against predetermined criteria [5].
- Access audits give a snapshot of an existing building at a point in time. They are a useful starting point in assessing the current state of accessibility and usability of existing buildings [36].
- An access audit will give a picture of the level of accessibility in a building, identify points of good or bad access, identify areas of need that are not catered for and is a first step in the process of improving accessibility [37].

Before starting the audit and rating process of an existing or new construction, in order to make the correct judgment and rating the facility some data such as the occupier, the services provided, the life cycle of building, the budget and future plans for alterations should be collected [36]. Collecting these data helps the assessor to make reletive and

effective recommendations for the users of that facility. For instance what is required for a public facility may not be needed to provide in a private one with limited users.

Assessment of the design is only one part of the total appraisal. As stated earlier in thesis the assessor has to be involved in all stages of construction in order to make a correct and complete evaluation and rating. The assessment includes three stages for the assessor:

- The design process,
- The construction level,
- And last but not least, the post-occupancy evaluation or POE.

The criteria should be assessed in the same order such as an algorithm. Meaning that each step is a prerequisite for the other step and without passing the minimum requirements of one main criteria, the assessor is not able to continue on the checklist. Figure 4.2 displays the order for the main criteria required for the assessment

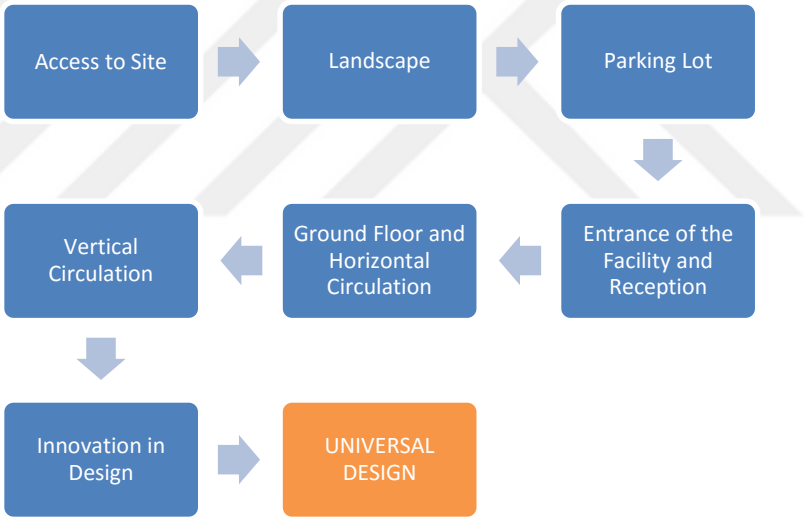


Figure 4.2 universal design assessment procedure

For all these main criteria there are some sub categories of assessment based on created standards by authentic organizations. In order to pass a step of the main criteria, the design must meet the minimum requirements of each sub category. The requirements for these sub criteria are mostly collected from Universal design standards, Accessibility standards such as ADA or DDA and etc. Altogether, the merged form of standards with suggested guidelines and created system, the moditoring model for universal design is created. Table 4.2 demonstrates the general model of assessment for the named system.

Table 4.2 Universal Design monitoring model

1	2	3	4	5	N/A	Criteria	Score
						1. Access to Site	
						• Path of travel	
						• Materials	
						• Illumination	
						• Wayfinding	
						• Safety and warning systems	
						• Public transportation	
						• Comfort	
						• Innovation in design	
						2. Landscape	
						• Path of travel	
						• Materials	
						• Illumination	
						• Wayfinding	
						• Safety and warning systems	
						• Public amenities	
						• Comfort	
						• Innovation in design	
						3. Parking Lot	
						A- Outdoor parking	
						• Path of travel	
						• Materials	
						• Illumination	
						• Wayfinding	
						• Safety and warning systems	
						• Comfort	
						• Innovation in design	
						B- Multistory and Indoor Parking	
						• Path of travel	
						• Materials	
						• Illumination	
						• Wayfinding	
						• Safety and warning systems	
						• Comfort	
						• Innovation in design	
						4. Entrance of Facility and Reception Area	
						A- Entrance of facility	
						• Materials	
						• Illumination	
						• Safety and warning systems	
						• Door design	
						• Entrance design	
						B- Reception area of facility	
						• Path of travel	

Table 4.2 (continued)

	• Illumination
	• Wayfinding
	• Comfort
	• Reception desk
	5. Ground Floor and Horizontal Circulation
	• Path of travel
	• Materials
	• Illumination
	• Wayfinding
	• Safety and warning systems
	• Communication
	• Public amenities
	• Comfort
	• Openings
	• Innovation in design
	6. Vertical Circulation
	A- Stairs
	• Path of travel
	• Materials
	• Illumination
	• Wayfinding
	• Safety and warning systems
	• Comfort
	• Innovation in design
	B- Ramps
	• Path of travel
	• Materials
	• Illumination
	• Wayfinding
	• Safety and warning systems
	• Comfort
	• İnnovation in design
	C- Lifts
	• Path of travel
	• Materials
	• Illumination
	• Wayfinding
	• Safety and warning systems
	• Comfort
	• Innovation in design
	TOTAL SCORE

As stated before one of the reasons for this assessment is to find out the weak spots for each facility in order to create better environments for all users. It is also possible to rate only a specific part of the facility to find the weak points about that part. For instance with the suggested monitoring system it is possible to say that a facility is not accessible in terms of access to site – path of travel but according to the standards dedicated for each part it would be possible to say the exact part which makes the facility unaccessible.

Table 4.3 demonstrates the criteria of evaluation for each sub category. For each standard there is a dedicated point which at the end the total precentage dedicates the score earned by that category, for instance if a category meets the minimum requirements it earns 1 point. For each 20 percent of points earned it gets points from level 1 to 5 as represented in table 4.2. Each standard either is a prerequisite or offers 1 point for each offered standards. For instance access to site – path of travel number 1 is a prerequisite, number 3 offers one point. Additionally access to site – materials number 2 offers two points because it has 2 offered standards and for each there is 1 dedicated point. The evaluation is done by only calculating the score for available criteria. As an example, if a project has no landscape then there are no dedicated scores for that part and the score is not calculated as 0. The prerequisites are not calculated on the scoring process but in order to start the process, the project has to meet all of the prerequisites. Table 4.3 demonstrates the dedicated scores for each available standard. Additionally related figures are presented in appendix A. All the standards and data are collected from existing and accepted organizations [38], [39], [40], [41], [42], [43], [44], [45], [46], [47], [48].

Table 4.3 universal design criteria of evaluation

	Standards	Points
Access to Site	**7. Path of Travel**	
	• Minimum Clear width 2000mm. if less, passing places provided	P
	• Minimum 2300mm overhead clearance	P
	• Widen pavements in front of shops and bus stops	1
	• Inclined routes with a gradient between 3% and 4%	P
	• Gradient greater than 4%, is ramp	P
	• Ramps should be designed according to figure 4.3	P
	• steps should be provided in conjunction with a ramp and designed according to figure 4.4	P
	• Level or flush crossing points with a dropped curb	P
	• Min. 1200 mm width of level surface to rear of pavement at a crossing point	1
	• Avoid single steps on access routes	1
	• Direct access from all access points to all facilities and building entrances	1
	• All pathways accessible unless there are alternative pathways that begin and end in the same location	1
	• Reduce pedestrian crossing distance on major crossing routes by providing expanded corners or safety islands	1
	• Storm drains located outside marked crossings	1
	8. Materials	
	• Firm, smooth, even and slip-resistant	P
	• Strong patterns and contrasting lines should be avoided on a surface	2
	• Non-reflective materials are better to be used on surfaces or materials that minimize reflection and glare.	1
	• Light colors such as bright clear white should be avoided on floor finishes to minimize sun reflection and also to not fade the contrasting alerting colors away	1
	• Clearly mark boundaries of crossings using permanent materials	1
	9. Illumination	
	• Illuminate steps and ramp surfaces with 150 lux	P
	• Highlight location of building entrance with lighting	1
	• External lighting should illuminate steps and ramps without causing shadows	1
	• Avoid glare with low-level recessed lights	1
	• Avoid floodlights	P
	• Higher illumination levels in the safe crossing area	1
	• Light pedestrian access routes and walkways to 30 lux	1
	10. Wayfinding	
	• Access routes should be understandable, easy to use, and offer choice	P
	• Highlight location of building entrance with lighting	1
	• Ramped and stepped routes are clearly visible or well signed	2
	• Ticket machines and ATMs should be clearly signed and signage should be clearly visible from front and side	1
	• Tactile paving should be used strictly and consistently	2
	• Highlight location of key facilities using clear signage	P
	• Plan overall should be designed to be logical and direct as possible	2

Table 4.3 (continued)

Access to Site1	• Doors should contrast visually with adjacent wall surfaces	1
	• Changes in color or textures could be used to contribute to a system of wayfinding	1
	• Landmarks such as statues could incorporate to a system of wayfinding	1
	• Incorporate visual, audible and tactile information in signage	P
	• All signage should be clear, consistent and easy to understand	P
	• Maps, plans and models with tactile and audible information included should be used	2
	• Wording should be aligned to the left. In countries with right to left language the opposite in addition	1
	• Suitable letter size for distance viewing	1
	• Arrows should be used to indicate direction	1
	• Enable reading by touch with embossed signs	1
	• Embossed letters should be between 16 mm and 50 mm height	1
	• Braille should be positioned below related text	1
	• Locate braille signs on inclined surfaces	1
	• Signs should be positioned in manners that people reading them would not cause an obstruction	1
	11. Safety and Warning Systems	
	• Maximum cross-fall gradient 2% on all access routes	P
	• Dished gullies, grills and manhole covers should be avoided	P
	• Avoid vertical deviations and gaps greater than 5mm	P
	• Prevent accidents to side of access routes with curb upstands, barriers or guardrails	P
	• Surfaces should drain water effectively	1
	• Highlight step edges	P
	• Tactile warning surfaces at top and bottom of flight figure 4.4	P
	• Continuous handrails on both sides of ramps and stairs. If width more than 2000 mm an additional handrail in center	P
	• Headroom area below steps less than 2100 mm, should be protected	1
	• Wherever post-mounted items present a hazard, tapping rail should be provided	1
	• Avoid links using chains and ropes	P
	• Crossings should be located where they are safe for all users	1
	• Use blister tactile surfacing in absence of a curb	P
	• Red blister at controlled, buff blister at uncontrolled crossings	P
	• Corduroy hazard warning system on top and bottom of steps	P
	• External lighting should illuminate steps and ramps without causing shadows	1
	• Communication equipment on path of travel wherever potential security or safety threats may exist	1
	• Security cameras on path	1
	• Clearly mark boundaries of crossings using permanent materials	1
	• Pedestrian crossing signals provide enough time for slower moving people to cross	1
	12. Public Transportation	
	• Taxi ranks in appropriate locations	1
	• Orientate taxi ranks to enable passengers to alight and board on the nearside of a taxi	1
	• Min. pavement width 4040 mm for wheelchair ramp and maneuvering, in taxi ranks	1

Table 4.3 (continued)

Access to Site	• At least one public transportation system within 50 m of reach	P
	• All public transportation waiting areas should provide seating appropriate for all possible users	1
	13. Comfort	
	• Resting places on long routes	1
	• Undercover queuing areas with seating	1
	• Easy to operate gates	P
	• Drinking fountains appropriate for standing and seating use	1
	• Locate card operated machines such as ATMs where they are readily apparent	1
	• Orientate ATMs to minimize the glare on the screen	1
	• Provide a clear knee space for ATMs to facilitate frontal approach for wheelchair users	P
	• Choice of language should be available for all machines with on-screen instructions	1
Landscape	**1. Path of Travel**	
	• Minimum Clear width 2000mm. if less, passing places provided	P
	• Minimum 2300mm overhead clearance	P
	• All routes between site entrance and building entrances are accessible	1
	• If overall rise of a ramp exceeds 2000 mm, an alternative means of access provided	P
	• Inclined routes with a gradient between 3% and 4%	P
	• Gradient greater than 4%, is ramp	P
	• Ramps should be designed according to figure 4.3	P
	• steps should be provided in conjunction with a ramp and designed according to figure 4.4	P
	• Avoid single steps on access routes	1
	• Direct access from all access points to all facilities and building entrances	1
	• All pathways accessible unless there are alternative pathways that begin and end in the same location	1
	• The path should be able to allow emergency vehicles circulate	1
	2. Materials	
	• Firm, smooth, even and slip-resistant	P
	• Strong patterns and contrasting lines should be avoided on a surface	2
	• Non-reflective materials are better to be used on surfaces or materials that minimize reflection and glare.	1
	• Light colors such as bright clear white should be avoided on floor finishes to minimize sun reflection and also to not fade the contrasting alerting colors away	1
	3. Illumination	
	• Illuminate steps and ramp surfaces with 150 lux	P
	• Highlight location of building entrance with lighting	1
	• A gradual transition between external and internal lighting levels should be provided around an entrance	1
	• External lighting should illuminate steps and ramps without causing shadows	1
	• Avoid glare with low-level recessed lights	1
	• Avoid floodlights	P
	• Illuminate external signage	1
	• Illuminate approach area to ATMs with min of 200 lux	1

Table 4.3 (continued)

Landscape	**4. Wayfinding**	
	• Access routes should be understandable, easy to use, and offer choice	P
	• Highlight location of building entrance with lighting	1
	• Ramped and stepped routes are clearly visible or well signed	2
	• Ticket machines and ATMs should be clearly signed and signage should be clearly visible from front and side	1
	• Highlight location of key facilities using clear signage	P
	• Plan overall should be designed to be logical and direct as possible	1
	• Doors should contrast visually with adjacent wall surfaces	1
	• Changes in color or textures could be used to contribute to a system of wayfinding	1
	• Landmarks such as statues or entrances could incorporate to a system of wayfinding	1
	• Incorporate visual, audible and tactile information in signage	P
	• Tactile paving should be used strictly and consistently	P
	• All signage should be clear, consistent and easy to understand	P
	• Maps, plans and models with tactile and audible information included should be used	1
	• Wording should be aligned to the left. In countries with right to left language the opposite in addition	1
	• Suitable letter size for distance viewing	1
	• Arrows should be used to indicate direction	1
	• Enable reading by touch with embossed signs	1
	• Embossed letters should be between 16 mm and 50 mm height	1
	• Braille should be positioned below related text	1
	• Locate braille signs on inclined surfaces	1
	• Signs should be positioned in manners that people reading them would not cause an obstruction	1
	5. Safety and Warning Systems	
	• Maximum cross-fall gradient 2% on all access routes	P
	• Dished gullies, grilles and manhole covers should be avoided	P
	• Avoid vertical deviations and gaps greater than 5mm	P
	• Prevent accidents to side of access routes with curb upstands, barriers or guardrails	P
	• Surfaces should drain water effectively	1
	• Highlight step edges	P
	• Tactile warning surfaces at top and bottom of flight figure 4.4	P
	• Continuous handrails on both sides of ramps and stairs. If width more than 2000 mm an additional handrail in center	P
	• Headroom area below steps less than 2100 mm, should be protected	1
	• Wherever post-mounted items present a hazard, tapping rail should be provided	1
	• Avoid links using chains and ropes	P
	• Tactile paving should be used strictly and consistently	P
	• Use blister tactile surfacing in absence of a curb	1
	• Corduroy hazard warning system on top and bottom of steps	P
	• External lighting should illuminate steps and ramps without causing shadows	1

Table 4.3 (continued)

Landscape	• Communication equipment on path of travel wherever potential security or safety threats may exist	1
	• Security cameras on path	1
	6. Public Amenities	
	• Overall provision for all building occupants	P
	• Toilets are easily accessed	P
	• Sanitary facilities on accessible routes	1
	• Provide toilets at regular intervals	1
	• Temporary sanitary facilities are as accessible as permanent ones	1
	• Logical and accessible urinals, cubicles and hand washing facilities	1
	• Enlarged cubicle for people who need extra space	1
	• Washbasins at different heights	P
	• Lever or automatic taps and plugs in washbasins	P
	• One in six urinals at lower heights	P
	• Fitting grab rails between urinals	1
	• Unisex toilet suitable for all building users	P
	• Room dimensions min 2700 mm wide x 2500 mm long	P
	• An additional standing-height washbasin, rim height 780 to 800 mm	1
	• Incorporate unisex baby-changing facilities	1
	• Changing tables at two heights	1
	• Separate facility for breast feeding Washbasin with clear knee space	1
	7. Comfort	
	• Resting places on long routes	1
	• Setting-down point close to building entrance	1
	• A canopy with minimum height of 2600 mm to be provided	1
	• Undercover queuing areas with seating	1
	• Easy to operate gates	P
	• Drinking fountains appropriate for standing and seating use	1
	• Locate card operated machines such as ATMs where they are readily apparent	1
	• Orientate ATMs to minimize the glare on the screen	1
	• Provide a clear knee space for ATMs to facilitate frontal approach for wheelchair users	P
	• Choice of language should be available for all machines with on-screen instructions	1
Outdoor Parking	**1. Path of Travel**	
	• Easy to understand and logical route between each parking spot and parking exit	P
	• Accessible and easy to understand route between car park and facility	P
	• No obstructions on pavement side	1
	2. Materials	
	• Firm, smooth, even and slip-resistant	P
	• Strong patterns and contrasting lines should be avoided on a surface	2
	• Non reflective material on ground pavement	P

Table 4.3 (continued)

Outdoor Parking	**3. Illumination**	
	• Highlight location of parking entrance with lighting	1
	• Highlight location of building entrance with lighting	1
	• Avoid glare with low-level recessed lights	1
	• Each spot should be illuminated in manners that would not cause reflection or glare	1
	• Each empty spot should be signed with illumination that is visible from parking entrance	1
	• Signage should be illuminated evenly	1
	4. Wayfinding	
	• Each parking spot should be clearly signed with universal numbers	P
	• The path between parking spot with building entrance and parking exit should be clearly signed	P
	• The location of each spot should be logical and easy to find	1
	• Clear, wall or post mounted signage to highlight location of designated parking spot	P
	• Each empty spot should be signed with illumination that is visible from parking entrance	1
	5. Safety and Warning Systems	
	• Level or flush access routes away from vehicles	P
	• Firm and level surface with maximum cross-fall gradient of 2% on access routes between parking and facility	1
	6. Comfort	
	• Each spot covered with simple shading to avoid direct sunshine reflection, glare and heat	1
	• Parent and child, handicapped parking spaces, near the entrance	P
	• Off street and on street spaces should be designed according to figure 4.5	1
Multistory and Indoor Parking	**1. Path of Travel**	
	• Easy to understand and logical route between each parking spot and parking exit	P
	• Accessible and easy to understand route between car park and facility	P
	• Parking levels served by lifts in addition to stairs providing access to all floors	1
	• Minimum vertical clearance of 2600 mm	P
	2. Materials	
	• Firm, smooth, even and slip-resistant	P
	• Strong patterns and contrasting lines should be avoided on a surface	2
	• Non reflective material on ground pavement	1
	3. Illumination	
	• Highlight location of parking entrance with lighting	1
	• Highlight location of building entrance with lighting	1
	• Illuminate all spaces evenly with blurry lighting to avoid direct reflections and glare	1
	• Each spot should be illuminated in manners that would not cause reflection or glare	1
	• Each empty spot should be signed with illumination that is visible from parking entrance	1
	• Signage should be illuminated evenly	1
	4. Wayfinding	
	• Each parking spot should be clearly signed with universal numbers	P
	• The path between parking spot with building entrance and parking exit should be clearly signed	P

Table 4.3 (continued)

Multistory and Indoor Parking	• The location of each spot should be logical and easy to find	1
	• Clear, wall or post mounted signage to highlight location of designated parking spot	P
	• Each empty spot should be signed with illumination that is visible from parking entrance	1
	5. Safety and Warning Systems	
	• Each spot should be designed according to figure 4.6 to create maximum safety for people passing from spot to building or the opposite	P
	6. Comfort	
	• Parent and child, handicapped parking spaces, near the entrance	P
	• Ticket dispensers are conveniently located, accessible, understandable and usable by all users	1
	• Ventilation should be considered to overcome the heat and odor of cars	P
	• Acoustics should be considered to minimize the reflection of car engine noises	P
Entrance of Facility	**1. Materials**	
	• Firm, smooth, even, slip-resistant and non-directional floor materials	P
	• Easy to clean	1
	• Visually contrasting materials on floor with walls	1
	2. Illumination	
	• Lighting should ease the transition between external and internal environment	1
	• Glazed screens and doors highlighted effectively	P
	• Recommended level of 150 lux illumination	1
	3. Safety and Warning Systems	
	• Outward-opening doors should be arranged so that they are recessed or guarded	1
	• Entrance thresholds level or maximum 10 mm with chamfered, pencil-rounded or ramped profile	P
	• All accessible entrances designed to serve as emergency exit routs as well	P
	• Visually contrasting markings at two levels on all glazed doors and screens	1
	• Door protection provided to the lower 400 mm of glass doors	1
	4. Door Design	
	• Minimum opening of 1000 mm in new and 850 mm in existing buildings	P
	• Adequate space be provided on both sides of door figure 4.7	1
	• Minimum 600 mm clear space adjacent to handle-side	1
	• Entrance thresholds level or maximum 10 mm with chamfered, pencil-rounded or ramped profile	P
	• Vision panels on all entrance and entrance lobby doors	1
	• Visually contrasting markings at two levels on all glazed doors and screens	1
	• Entrance doors should contrast visually with adjacent walls or screens	1
	• A highly contrasting strip on all edges of frameless glass doors	P
	• Door protection provided to the lower 400 mm of glass doors	1
	• Avoid revolving doors. If not possible, sliding or hinged doors should be installed either	1
	• Accessible gates with width of 950 mm provided in addition to turnstiles	P
	• Accessible gates should contrast with surroundings and be clearly signed	1
	5. Entrance Design	
	• Clearly visible, prominent and universally designed	P

Table 4.3 (continued)

Entrance of Facility	• For existing buildings, an alternative universally designed entrance	1
	• Min 2400 mm x 2400 mm landing space outside of entrance	P
	• Canopy or door recess for weather protection	1
	• Firm and flush mats adjacent with floor surface	P
Reception Area of Facility	**1. Path of Travel**	
	• Should be located logically to arrange circulation routes and facilities with a direct access from main entrance	1
	• Clear space of min 2440 mm x 2440 mm provided for approach	P
	2. Illumination	
	• Well-designed lighting to optimize visual communication and lip reading	P
	• Avoid glare by using controllable light sources	1
	• Adequate illumination at counter level	1
	3. Wayfinding	
	• Should be clearly visible	P
	4. Comfort	
	• Comfortable seating and free space for all possible users	1
	• All seating is readily apparent and clearly signed	1
	• Seating in all reception and waiting areas provided	1
	• Seating close to toilet facilities and a reception or information point	1
	• Access to seating is unobstructed	1
	• Seats of different styles to suit different people	1
	• Seats should visually contrast with surrounding surfaces	1
	5. Desk Design	
	• Desk and counters should be understandable on both costumer and staff side	P
	• Must have knee recess for people in seated position	P
	• Include counters at different heights as figure 4.8	P
	• The counter must have a visually-contrasting, upward-sloping leading edge	1
	• Voice augmentation system used in conjunction with glazed screens	1
	• A hearing enhancement system should be provided and clearly signed	1
	• Induction loop system should be provided	1
Ground Floor and Horizontal Circulation	**1. Path of Travel**	
	• Avoid changes in level in a floor	P
	• Access routes should be maintained carefully and kept clear of obstructions	1
	• Min 2000 mm width for corridors in public and 1500 mm for other buildings	P
	• Min 2000 mm long x 1800 mm wide passing places in corridors less than 1800 mm wide	P
	• Lobby or internal lobbies should not be provided unless necessary and kept clear of obstructions	1
	• Changing areas on accessible routes	1
	• Kitchen should be located close to dining or seating areas	1
	• Consider open-plan arrangements for kitchen to facilitate easier circulation between kitchen and dining areas	1

Table 4.3 (continued)

Ground Floor and Horizontal Circulation	**2. Materials**	
	• Firm, even, securely fixed, non-directional, durable and well maintained floor surfaces should be installed	P
	• Slip-resistant finishing on floors when it is wet and dry	P
	• Avoid deep pile carpets and coir matting	P
	• Visual contrast should be optimized between floor and wall finishes and other features such as obstructions	P
	• Avoid shiny and reflective surfaces	1
	• Avoid large and bold patterns	1
	• Wherever there is infrared transmission, glazed partitions, large windows and dark surfaces should be avoided	1
	• Signs should have a matt or satin finish	1
	• Letters and symbols of a sign should contrast visually with sign board	1
	• Sign boards should visually contrast with background	1
	• When color coding is used easy to differentiate colors should be used	1
	• Paths of travel distinguished with material, floor textures or color differences to assist in orientation	1
	3. Illumination	
	• The placement of natural and artificial light sources should be considered to provide an even level of illumination	P
	• Placement of windows and artificial lighting should minimize reflection and glare	P
	• Positioning windows or lights at the end of corridors and behind a person at reception desk should be avoided	1
	• Avoid creating strong shadows on walls and floors	1
	• All rooms and space should benefit from natural light if possible	1
	• Use sun-shading devices or blinds to reduce glare from direct sun light	1
	• All rooms and surfaces should be evenly illuminated	1
	• Lighting design should be flexible so people can control individual lighting levels	P
	• Avoid strobe lighting	1
	• Use down lighters that incorporate diffusers	1
	• Avoid uplighters positioned at floor level	1
	• All signs illuminated evenly to 200 lux	1
	• Adequate lighting levels in all bathrooms	1
	• Backup lighting source to supplement automatic lights	1
	• Adequate timing on automatic lights	1
	• Avoid ultra violet light in accessible bathrooms	1
	• Gradual transitions from dark to bright spaces	1
	• Recommended level of 150 lux illumination in corridors, passages and walkways	1
	• Toilets, showers and bathrooms lit up to 200-300 lux	1
	• Offices lit up to 300 lux	1
	• Switches and controls lit up to 100 lux	1
	• Directional signs, maps and information displays lit up to 200 lux	1

Table 4.3 (continued)

Ground Floor and Horizontal Circulation	**4. Wayfinding**	
	• Highlight location of key facilities using clear signage	P
	• Plan overall should be designed to be logical and direct as possible	P
	• Access routes of open-plan areas should be well defined	1
	• Provide handrails on both sides of walkways	1
	• Doors should contrast visually with adjacent wall surfaces	1
	• Changes in color, texture, acoustic characteristics of floor finishes could be used to contribute to a system of wayfinding	1
	• Incorporate visual, audible and tactile information in signage	P
	• All signage should be clear, consistent and easy to understand	P
	• Maps, plans and models with tactile and audible information included should be used for large buildings	1
	• A clear and consistent, sans serif typeface with no complex, italicized or too bold characters should be used throughout a site or building	1
	• Wording should be aligned to the left. In countries with right to left language the opposite in addition	1
	• Suitable letter size for distance viewing	1
	• Symbols should be used in place of text or to supplement it	1
	• Arrows should be used to indicate direction	1
	• Enable reading by touch with embossed signs	1
	• Embossed letters should be between 16 mm and 50 mm height	1
	• Braille should be positioned below related text	1
	• Locate braille signs on inclined surfaces	1
	• Public address system should be clearly audible in all relevant areas of a building	1
	• Signs should be positioned in manners that people reading them would not cause an obstruction	1
	• Changing facilities should be clearly identified	1
	• Sanitary facilities are clearly identified	P
	• Handed layouts can be identified by touch-legible pictograms	1
	• Paths of travel distinguished with material, floor textures or color differences to assist in orientation	1
	• Directional signage when the direction of emergency egress is not easy to understand	P
	• When color coding is used easy to differentiate colors should be used	1
	5. Safety and Warning Systems	
	• Fix junctions with threshold plates between different floor finishes	P
	• Outward-opening doors should be protected by a guardrail	P
	• Emergency exit door ironmongery should be accessible	P
	• Activation and safety systems should protect people who are slow-moving or fallen in doorway	1
	• Guard all potential body and finger traps in automatic opening doors	P
	• Guard all swing doors that can be approached from side by barriers	P
	• Tactile warning surfaces with 3 mm ridges should be used indoors	P
	• If tactile warning surfaces are not suitable, visually contrasting floor finishes should be used	P
	• Safety information and warning signs should follow the universally established color code	1

Table 4.3 (continued)

Ground Floor and Horizontal Circulation	• Alarm systems should be effective in alerting all building occupants	P
	• Audible, visual and tactile devices should be incorporated	1
	• The sound level of an alarm should be limited to 120 dB	1
	• Visual alarms should be located to be seen from all areas of a facility	1
	• Manual call points should be within reach of all building users and must be simple to operate	1
	• Provide visible and audible indicator in all sanitary facilities	1
	• Total building sprinkler system	P
	• Two-way emergency communications in all remote areas	1
	6. Communication	
	• The use of infrared and radio systems should be considered where multi-channel communication is required	1
	• Radio and sound field systems should be taken into consideration where people with hearing difficulty who do not wear a hearing aid, may benefit	1
	• Provide assistance alarms in all accessible toilets, bathrooms, shower rooms, and changing rooms designed for independent use	P
	• Visible and audible indication within the room that alarm has been raised in independent accessible bathrooms	1
	• Provide public telephones that are accessible, useable, understandable to everyone	P
	7. Public Amenities	
	• Toilet facilities should be located adjacent to reception area	1
	• Overall provision for all building occupants	P
	• Toilets are easily accessed	P
	• Sanitary facilities on accessible routes	1
	• Provide toilets at regular intervals	1
	• Temporary sanitary facilities are as accessible as permanent ones	1
	• Logical and accessible urinals, cubicles and hand washing facilities	1
	• Enlarged cubicle for people who need extra space	1
	• Washbasins at different heights	P
	• Lever or automatic taps and plugs in washbasins	P
	• One in six urinals at lower heights	P
	• Fitting grab rails between urinals	1
	• Unisex toilet suitable for all building users	P
	• Room dimensions min 2700 mm wide x 2500 mm long	P
	• An additional standing-height washbasin, rim height 780 to 800 mm	1
	• Incorporate unisex baby-changing facilities	1
	• Changing tables at two heights	1
	• Separate facility for breast feeding	1
	• Washbasin with clear knee space	P
	• Min room dimension of 3000 mm x 2500 mm for shower and bathroom	P
	• Level-access shower tray	P
	• Use adjustable height, detachable shower head	1
	• Temperature controls are easy to identify	1

Table 4.3 (continued)

Ground Floor and Horizontal Circulation	• Fold-down plastic seat in shower area	1
	• Position grab rails and drop-down rails correctly	P
	• Corner arrangement WC as figure 4.9	1
	• Recommend 2500 mm x 2300 mm for accessible changing areas	1
	• Accessible poolside shower	1
	• Shower controls within reach of all users	1
	• Accessible shower and changing areas in single-sex facilities in addition to unisex facilities	1
	• Domestic bathrooms should be designed according to figure 4.10	1
	• Use tubular grab rails with a 32 to 35 mm diameter and a suitable surface to provide a good grip when wet	1
	8. Comfort	
	• Adequate ventilation to all rooms and spaces should be provided	P
	• Mechanical ventilation and air-conditioning systems should be well maintained	1
	• Avoid the use of doors where other solutions are possible	1
	• Seating should be provided at regular intervals of walkways	1
	• The direction of door openings should be consistent throughout the building	P
	• All outlets, switches and controls should be clearly visible, easy to reach and operate	1
	• Light switches should be located logically and avoided within 500 mm of the corner of any room	1
	• Two or three-way switching should be used for lights where flexibility is required	P
	• Switch background should contrast visually with mounted surface	1
	• Avoid switches which require turning or gripping	P
	• Acoustic requirements should be taken into consideration at earliest stage of design	1
	• Quiet rooms should be located away from external noise resources	1
	• Using a buffer zone such as a lobby or foyer as a separation between quiet and noisy rooms are preferred	1
	• The acoustic characteristics of a room should be in reference with its' function	1
	• Ventilation systems with minimal noise should be used	1
	• Bathroom heaters should be positioned away from transfer and maneuvering space	1
	• Surface temperature of heaters should not exceed 40 degrees (centigrade)	1
	• Standing height work surfaces should be 900 mm and seated approach should be 760 mm high	P
	• Clear knee space provided for lower work surfaces	P
	• Adjustable height units should be used in work surfaces	1
	• A clear area of 2400 mm diameter between units in L or U shaped and 1100 mm between parallel work surfaces should be arranged	P
	• Clearly visible switches and sockets no higher than 1000 mm above floor level	P
	• Switch and sockets should be positioned towards the front of work surface or on return wall where there is no knee space	1
	9. Openings	
	• All doors should be accessible, understandable and usable	P
	• Min 1600 mm between door swings	P
	• Doors should be easy to identify, sufficiently wide, and easy to operate	P
	• Sufficient space should be provided on both sides of doors	1

Table 4.3 (continued)

Ground Floor and Horizontal Circulation	• Clear width of 850 mm for internal doors	P
	• Inward opening doors should open against a sidewall	P
	• Double swing doors should be provided with pull handles	1
	• Horizontal rails should be provided on closing face of outward opening doors	1
	• Use door closing devices only where necessary	1
	• Letter plates positioned 900 mm above ground	1
	• Activation system should open door at min 1400 mm of a person	1
	• Opening time should be sufficient for slow moving people	1
	• Controls of manually – activated automatic doors should be within reach and clear of door swing, visible and with clear signage	1
	• Fail-safe systems provided on all automatic doors	1
	• Door entry systems located within reach of all users on handle side of door	1
	• Windows that open should be accessible to all users	P
	• Window provision should balance environmental performance with safety, security, privacy and visual comfort	P
	• Transoms between 900 mm and 1200 mm above floor level should be avoided	P
	• Accessible, useable, understandable and positioned window controls between 800 mm and 1000 mm	P
	• Lever handles should be installed which require minimum force to operate	1
	• While opening, windows should not create a hazard or obstruct	1
	• Windows of first floor and upper levels should not open more than 100 mm	P
	• For out of reach windows the use of easy to operate remotes are recommended	1
	• Inward opening doors for easy reversal	1
	• Bathroom clear door opening of 950 mm	P
	• Outward-opening doors to accessible facilities that do not obstruct emergency escape routes	1
	• Horizontal rails on outward-opening doors	1
	• Fit inward-opening doors with emergency-release catches	1
	• Lever-style door handles	P
Vertical Circulation, Stairs	**1. Path of Travel**	
	• Min 1200 mm clear width of steps and suit expected level of use	P
	• Max. total rise of flights between landings 1800 mm or 12 steps	P
	• Consistent number of steps in consecutive flights	1
	• Clear landing at top and bottom with the length equivalent to step width	1
	• Handrails on both sides and continuous around intermediate landings	P
	• Width more than 2000 mm central handrail should be installed	P
	• Maximum depth of 355 mm on treads of stairways and risers between 100 mm and 180 mm	P
	• Escalator steps should be minimum 580 mm and maximum 1100 mm wide with maximum 240 mm or 210 mm height	1
	• Min 2300 mm vertical clearance required for an escalator	1
	• Min 1500 mm wide walkway and 2300 mm vertical clearance provided for a travellator	1
	• Stairways kept out of the direct path of travel	1

Table 4.3 (continued)

Vertical Circulation, Stairs	**2. Materials**	
	• Visually contrasting handrails should be installed	1
	• Slip resistant traveling surfaces without impeding the mobility of wheelchairs	P
	• Firm, even and securely fixed floor surfaces	P
	• Top and bottom of flight should visually contrast with the tread and riser surfaces	1
	• Step nosing should be firmly fixed, highlighted and extend the full width of each step	P
	• Avoid shiny and polished surfaces that create glare and reflection	1
	3. Illumination	
	• Step and landing surfaces should be lit to 150 lux	P
	• Time – delay timings should accommodate the needs of all users	1
	• Gradual transitions from dark to bright spaces	1
	• Avoid lighting that casts shadow obscuring the step edge	1
	4. Wayfinding	
	• Clearly-signed or readily apparent alternative means of access for escalators and travellators	1
	• Direction of travel to stairs, escalators and travellators should be clearly signed	P
	• Directional signage when the direction of emergency egress is not easy to understand	1
	5. Safety and Warning Systems	
	• Area below stairs with a headroom less than 2200 mm should be protected	P
	• Edges of steps should be visually highlighted	P
	• Tactile hazard warning system on top and bottom of flight	P
	• Handrails on both sides of steps and continuous around intermediate landings	P
	• Footway to each end in an escalator and travellator should contrast visually and a change in floor finish should be installed	1
	• Moving handrails should extend minimum 300 mm beyond the start and end of escalator	P
	• A 55 mm wide contrasting band should be installed to full width of each step edge in an escalator	P
	• Max speed for an escalator 0.75 m per second. For travellator 0.5 m per second	P
	• Visible and accessible emergency stop controls in an escalator and travellator	P
	• Moving handrails should extend min 700 mm beyond the start and end of travellators' walkway	P
	• Max gradient for an inclined travellator is 5%	P
	• Fixed and contrasting guarding at entry and exit points alongside adjacent access routes should be installed	1
	• Reserved stairway for the fire service	1
	• Total building sprinkler system	1
	• Two-way emergency communications in all remote areas	1
	6. Comfort	
	• Seating at landings of long stairways	1

Table 4.3 (continued)

Vertical Circulation, Ramps	**1. Path of Travel**	
	• Max gradient 5%, max rise 450 mm and max length 9000 mm in an internal ramp	P
	• Gradient of a ramp slope should be constant and consistent throughout and between consecutive ramp slopes	P
	• Min width of ramp 1300 mm and suitable for expected level of use	P
	• 2440 mm x 2440 mm top and bottom landings, 2000 mm x ramp width intermediate landings	P
	• Ramps running in the direction of normal travel	1
	2. Materials	
	• Visually contrasting handrails should be installed	1
	• Slip resistant traveling surfaces without impeding the mobility of wheelchairs	P
	• Visually contrasting slope finish with landings	1
	3. Illumination	
	• Ramp and landing surfaces should be lit with 150 lux	P
	• Gradual transitions from dark to bright spaces	1
	4. Wayfinding	
	• Directional signage when the direction of emergency egress is not easy to understand	P
	5. Safety and Warning Systems	
	• A curb upstand or guarding should be provided on side of ramp	P
	• Handrails should be provided on both sides of ramp and continuous around intermediate landings	P
	• Total building sprinkler system	P
	• Two-way emergency communications in all remote areas	1
	6. Comfort	
	• Seating at landings of long stairways	1
Vertical Circulation, Ramps	**1. Path of Travel**	
	• Provide passenger lifts in preference to platform lifts	1
	• Elevator lobby within short distance from main entrance and other main function facilities	1
	• Passenger lifts should be located adjacent to an accessible flight of stairs	1
	• Clear floor area of the lobby wide enough to allow people to assemble without obstructing the circulation flow	1
	• Clear floor surface of the landing area wide enough for all users to approach and use from a forward or a parallel direction	1
	• Clear floor surface of the elevator car to allow people in wheelchairs or with pushchairs to make 180 degree turn	P
	• Lift size suitable to building type and occupancy	1
	• Min internal dimension 1800 mm x 1800 mm	P
	• Min clear door opening 950 mm	P
	• For min 8 seconds doors should remain open	P
	• Min 1800 mm x 1800 mm clear landing space should be provided	P
	• Controls within reach of all users and easy to operate	P
	• If passenger lifts cannot be installed, platform lifts and inclined platform lifts should be installed on existing buildings	P
	• Min platform size 1100 mm x 1400 mm	P
	• Solid barriers on non-access sides of platform	P

Table 4.3 (continued)

Vertical Circulation, Ramps	• Clear landing space of 2440 mm x 2440 mm provided for a platform	P
	• Inclined platform lifts and stair lifts should be avoided if the device encroaches into the recommended clear width of stairs	1
	• Recommended size of 890 mm wide x 1525 mm long should be considered for inclined platform lift	1
	• Platform lifts should be easy to use with clear instructions	1
	• Inclined platform lifts should have 1100 mm – high solid side nearest to wall or support rails	1
	2. Materials	
	• Interior should minimize glare and reflection	1
	• Half-height mirror should be provided on rear wall	1
	• Firm, level and securely fixed floor materials both in wet and dry conditions	P
	• Slip-resistant characteristics similar to landing floor finishes	P
	• Light color or tone	1
	3. Illumination	
	• An even level of illumination of 200 lux should be used for lift landings and lift cars	1
	• Lift control panels should be lit up to 100 lux	1
	4. Wayfinding	
	• Lifts should be clearly signed from building entrances and other key areas	P
	• Visual and tactile floor numbers should be provided at each landing	P
	• Lift signaling system should be both visual and audible	P
	5. Safety and Warning Systems	
	• An emergency communication system suitable for all users be provided	1
	• Evacuation lifts should be located in fire-resisting enclosure with independent electrical supply and additional controls	P
	• Equip elevator car with a mirror so that wheelchair users could exit easily	P
	• Elevators designed to be safe for emergency egress	1
	6. Comfort	
	• Conventional enclosed lifts should be provided as an alternative to glass walled lifts	1
	• Handrails should be installed on all walls without doors	P
	• A tip-up seat should be provided	1
	• Voice synthesis or recorded announcements to describe the floor reached and its contents	1
	• Operable parts of all calling buttons and control panels between 890mm and 1220mm	1

4.3 Case Studies

Alongside the criteria there are two studied cases in order to examine the proposed model to see how it reacts in built environment. Both cases are chosen from istanbul and are public schools. The comparison also between these two cases demonstrates what are the criteria that are usually missed or are met or can be altered easily to meet the requirements. Both schools are from Besiktas strict of Istanbul, Gazi Mustafa Kemal elementary school that is reffered as school A and the second one is Cumhuriyet elementary school which is reffered as school B. The results and images of both studies are represented below on

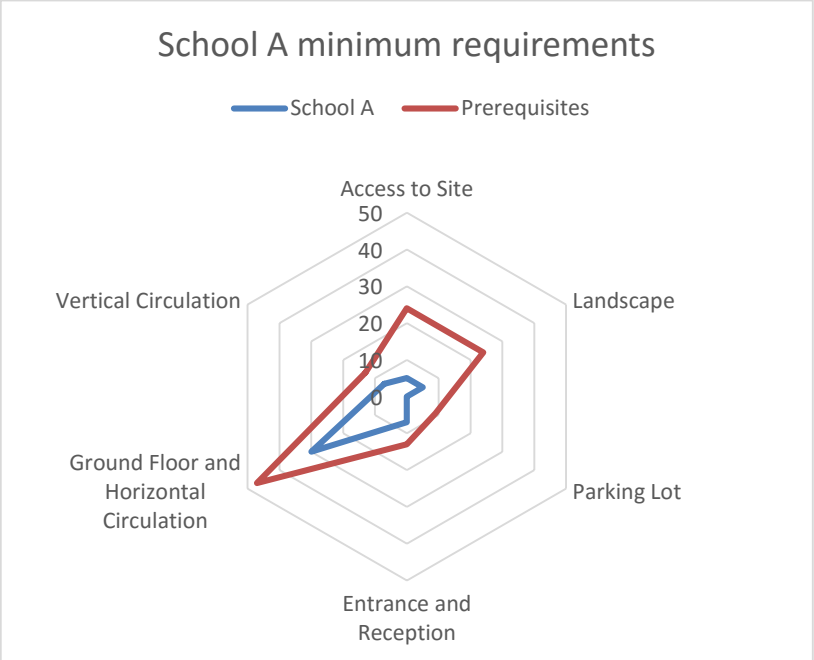
table 4.4 and 4.5, figure 4.3 and 4.4 and the detailed scoring system is available at appendix B

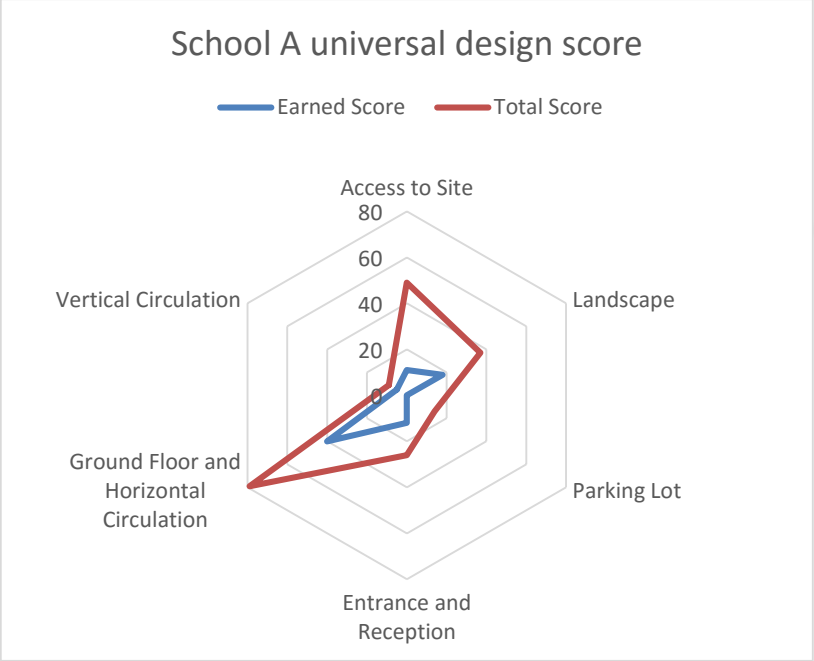
Table 4.4 universal design monitoring model for school A

1	2	3	4	5	N/A	Criteria	Score
						1. Access to Site	11/49
					N	• Path of travel	1/6
			✓			• Materials	4/5
					N	• Illumination	0/4
					N	• Wayfinding	4/19
					N	• Safety and warning systems	2/9
					N	• Public transportation	0/4
					N	• Comfort	0/2
					N/A	• Innovation in design	-
						2. Landscape	18/37
					N	• Path of travel	3/5
				✓		• Materials	4/4
					N	• Illumination	1/5
					N	• Wayfinding	7/15
					N	• Safety and warning systems	2/4
					N/A	• Public amenities	-
					N	• Comfort	1/4
					N/A	• Innovation in design	-
						3. Parking Lot	0/14
						A- Outdoor parking	
					N	• Path of travel	0/1
					N	• Materials	0/2
					N	• Illumination	0/6
					N	• Wayfinding	0/2
					N	• Safety and warning systems	0/1
					N	• Comfort	0/2
					N/A	• Innovation in design	-
						B- Multistory and Indoor Parking	
					N/A	• Path of travel	-
					N/A	• Materials	-
					N/A	• Illumination	-
					N/A	• Wayfinding	-
					N/A	• Safety and warning systems	-
					N/A	• Comfort	-
					N/A	• Innovation in design	-
						4. Entrance of Facility and Reception Area	12/26
						A- Entrance of facility	
				✓		• Materials	2/2
				✓		• Illumination	2/2
				✓		• Safety and warning systems	2/2
				✓		• Door design	5/5
				✓		• Entrance design	1/1

Table 4.4 (continued)

						B- Reception area of facility	
					N	• Path of travel	0/1
					N	• Illumination	0/2
					N	• Wayfinding	0
					N	• Comfort	0/7
					N	• Reception desk	0/4
						5. Ground Floor and Horizontal Circulation	40/79
				✓		• Path of travel	4/4
					N	• Materials	4/7
		✓				• Illumination	12/18
					N	• Wayfinding	3/18
					N	• Safety and warning systems	3/6
					P	• Communication	-
					N	• Public amenities	4/6
		✓				• Comfort	4/9
					N	• Openings	6/11
					N/A	• Innovation in design	-
						6. Vertical Circulation	5/9
						A- Stairs	
					N	• Path of travel	2/3
					P	• Materials	-
					N	• Illumination	2/2
					N	• Wayfinding	0/2
					N	• Safety and warning systems	1/2
					N/A	• Comfort	-
					N/A	• Innovation in design	-
						B- Ramps	
					N/A	• Path of travel	-
					N/A	• Materials	-
					N/A	• Illumination	-
					N/A	• Wayfinding	-
					N/A	• Safety and warning systems	-
					N/A	• Comfort	-
					N/A	• İnnovation in design	-
						C- Lifts	
					N/A	• Path of travel	-
					N/A	• Materials	-
					N/A	• Illumination	-
					N/A	• Wayfinding	-
					N/A	• Safety and warning systems	-
					N/A	• Comfort	-
					N/A	• Innovation in design	-
						TOTAL SCORE	86/214





Category	Score	Accessibility Level
Access to Site	11	22.44%
Landscape	18	48.64%
Parking Lot	0	0%
Entrance and Reception Area	12	46.15%
Ground Floor and Horizontal Circulation	40	50.63%
Vertical Circulation	5	55.55%
Total	86	40.18%

Figure 4.1 Gazi Mustafa Kemal elementary school score card



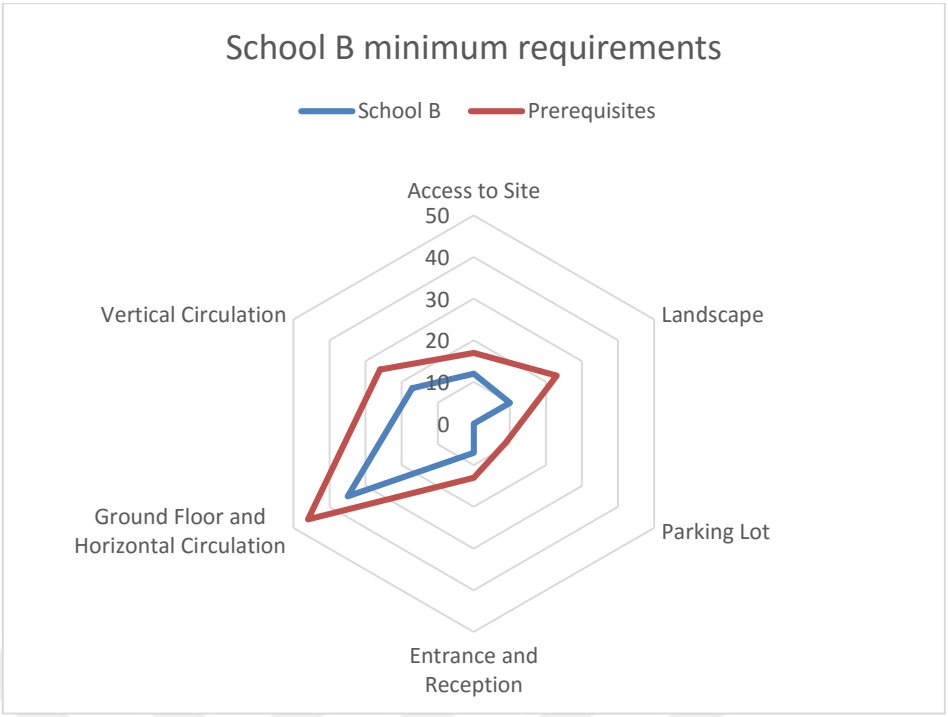
Figure 4.2 Gazi Mustafa Kemal elementary school

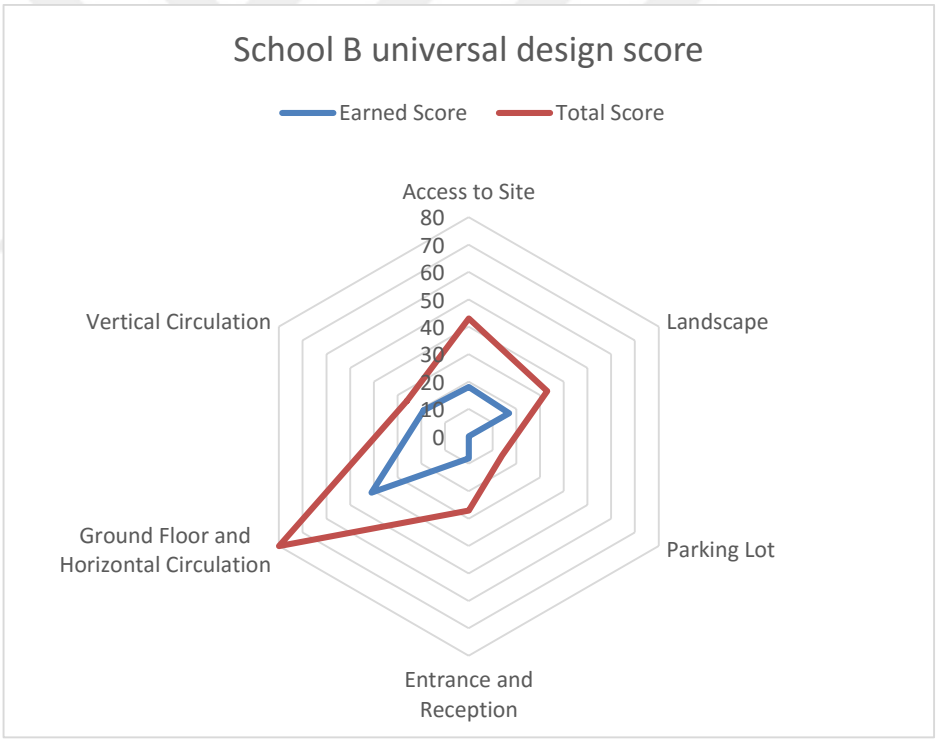
Table 4.5 universal design monitoring model for school B

1	2	3	4	5	N/A	Criteria	Score
						1. Access to Site	18/43
					N	• Path of travel	4/5
			✓			• Materials	4/5
	✓					• Illumination	1/3
					N	• Wayfinding	3/17
	✓					• Safety and warning systems	3/7
			✓			• Public transportation	3/4
					N	• Comfort	0/2
					N/A	• Innovation in design	-
						2. Landscape	17/33
					N	• Path of travel	3/5
				✓		• Materials	4/4
					P	• Illumination	-
					N	• Wayfinding	6/16
					N	• Safety and warning systems	2/4
					N/A	• Public amenities	-
					N	• Comfort	2/4
					N/A	• Innovation in design	-
						3. Parking Lot	0/14
						A- Outdoor parking	
					N	• Path of travel	0/1
					N	• Materials	0/2
					N	• Illumination	0/6
					N	• Wayfinding	0/2
					N	• Safety and warning systems	0/1
					N	• Comfort	0/2
					N/A	• Innovation in design	-
						B- Multistory and Indoor Parking	
					N/A	• Path of travel	-
					N/A	• Materials	-
					N/A	• Illumination	-
					N/A	• Wayfinding	-
					N/A	• Safety and warning systems	-
					N/A	• Comfort	-
					N/A	• Innovation in design	-
						4. Entrance of Facility and Reception Area	8/27
						A- Entrance of facility	
		✓				• Materials	1/2
				✓		• Illumination	2/2
					P	• Safety and warning systems	0/1
			✓			• Door design	4/5
				✓		• Entrance design	1/1

Table 4.5 (continued)

						B- Reception area of facility	
					N	• Path of travel	0/1
					N	• Illumination	0/2
					N	• Wayfinding	0
					N	• Comfort	0/7
					N	• Reception desk	0/4
						5. Ground Floor and Horizontal Circulation	41/80
				✓		• Path of travel	4/4
	✓					• Materials	3/7
		✓				• Illumination	12/18
					N	• Wayfinding	3/18
					N	• Safety and warning systems	3/6
					P	• Communication	-
					N	• Public amenities	4/6
		✓				• Comfort	7/12
					N	• Openings	5/9
					N/A	• Innovation in design	-
						6. Vertical Circulation	19/26
						A- Stairs	
					N	• Path of travel	3/3
	✓					• Materials	1/3
					N	• Illumination	2/2
					N	• Wayfinding	0
					N	• Safety and warning systems	2/2
					N/A	• Comfort	-
					N/A	• Innovation in design	-
						B- Ramps	
					N/A	• Path of travel	-
					N/A	• Materials	-
					N/A	• Illumination	-
					N/A	• Wayfinding	-
					N/A	• Safety and warning systems	-
					N/A	• Comfort	-
					N/A	• İnnovation in design	-
						C- Lifts	
				✓		• Path of travel	6/6
			✓			• Materials	2/3
				✓		• Illumination	2/2
					N	• Wayfinding	0
✓					P	• Safety and warning systems	0/2
	✓					• Comfort	1/3
					N/A	• Innovation in design	-
						TOTAL SCORE	103/220





Category	Score	Accessibility Level
Access to Site	18	41.86%
Landscape	17	51.51%
Parking Lot	0	0%
Entrance and Reception Area	8	29.62%
Ground Floor and Horizontal Circulation	41	51.25%
Vertical Circulation	19	73.07%
Total	103	46.81%

Figure 4.3 Cumhuriyet elementary school score card

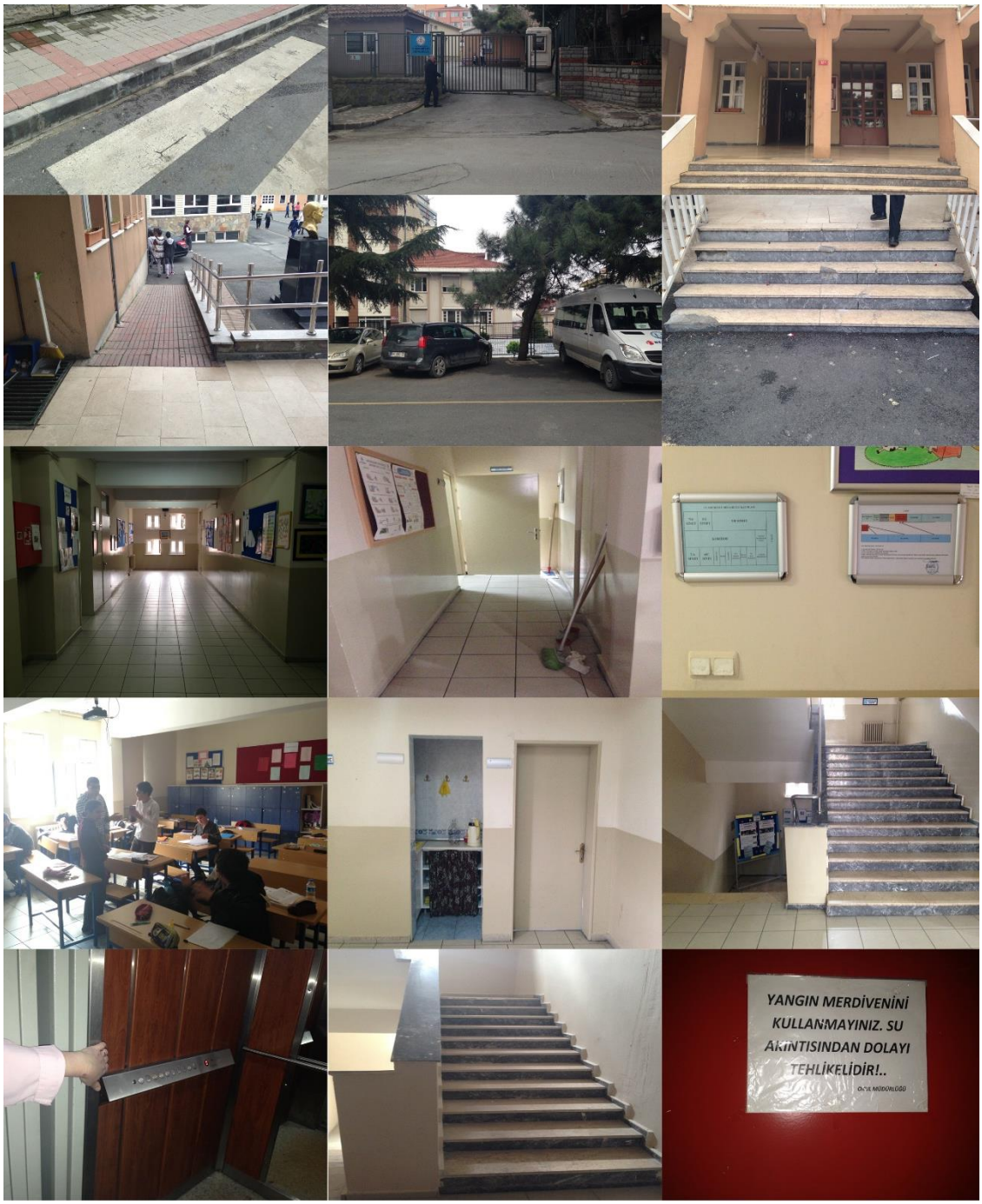


Figure 4.4 Cumhuriyet elementary school

CHAPTER 5

DISCUSSION AND CONCLUSION

5.1 Discussion

At the end it is worth mentioning that all the criteria was checked by the researchers own examinations such as using a wheelchair and etc. studying both cases, it is observable that most criteria for both of the cases do not meet the required prerequisites in order to be accessible. For each case there is a report showing to what extent the facility is accessible. Additionally it demonstrates the limit required for each facility to meet the minimum requirements in order to considered as accessible.

The result reports give all the information required to find out whether the facility is accessible or not, if it is, to what extent it meets the needs of the users and if it is not what could be done in which part to make it useable for everyone. For instance, examining the result reports for school A it is comprehensible that this facility has a fully accessible entrance but in terms of parking lot or landscape it is not accessible at all. Although it earned almost half of the dedicated points under landscape category, because it did not meet the prerequisites, it is not considered as accessible.

On the other hand, school B has features that allows access only to paraplegic persons aside of persons who do not face disabilities. While school A has insufficient access issues in almost every criteria and does not allow access to any kind of disabled person at all. Although both the managements claim that the reason behind this fault was budget. But as mentioned in this paper, universal design concept enables access with no extra cost. It is advisable for both building managements to plan and provide more human centered solutions in order to alter their facilities to be more accessible and universally designed for all current and future potential users.

5.2 Conclusion

In this thesis a general form of a universal design monitoring system is developed, that is able to rate different kind of facilities and offer more accessible solutions with no exrta cost. Not everyone is in the same physical condition and this should be kept in mind before designing a facility or a building.

It is possible to use the created system in rating, benchmarking, diagnosing the problem area, and defining the exact deficiencies and insuficiencies, and according to these criteria it is possible to:

- Evaluate any existing or future building precisely
- To solve the problems in a more specific way
- Last but not least, the access audit could result in benchmarking which would automatically create a competition and a market place for building constructors, architects and real estates

Last but not least, by examining facilities with such model and getting the result reports for each one of them, the users will be able to see if a facility is suitable for them, they are going to be able to make themselves understood in there, easily and independently access and use it or not. The created model has to be revisioned in future as new needs occur, in order to create new and better solutions

The absence of such a system is sensible because, there are a lot of facilities that are in same condition as these two buildings. The most effective way to make universally designed, sustainable environments is applying the monitoring model. An accessible or universally rated facility would be a more pleasant environment even for the able bodied.

As mentioned before, this study presents a core monitoring model for universal design. In future studies, adapting it to different typologies and making them more precise has to be done. In addition, it is also possible to create a digital program to show and tell the accessibility features of a facility by making user surveys that advance by entering the data. This also is another area of research for future studies.

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APPENDIX-A

UNIVERSAL DESIGN STANDARD FIGURES

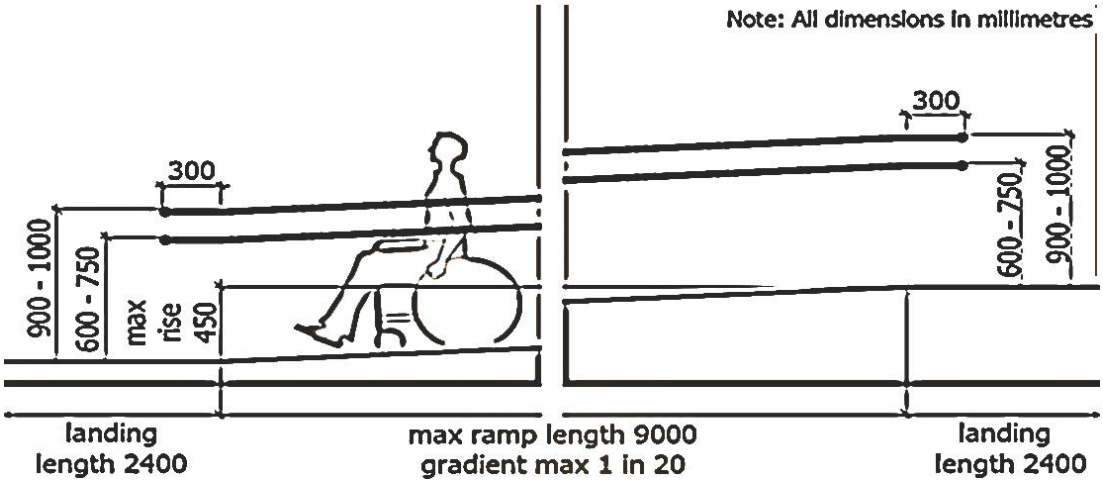


Figure 4.5 ramp standards [38]

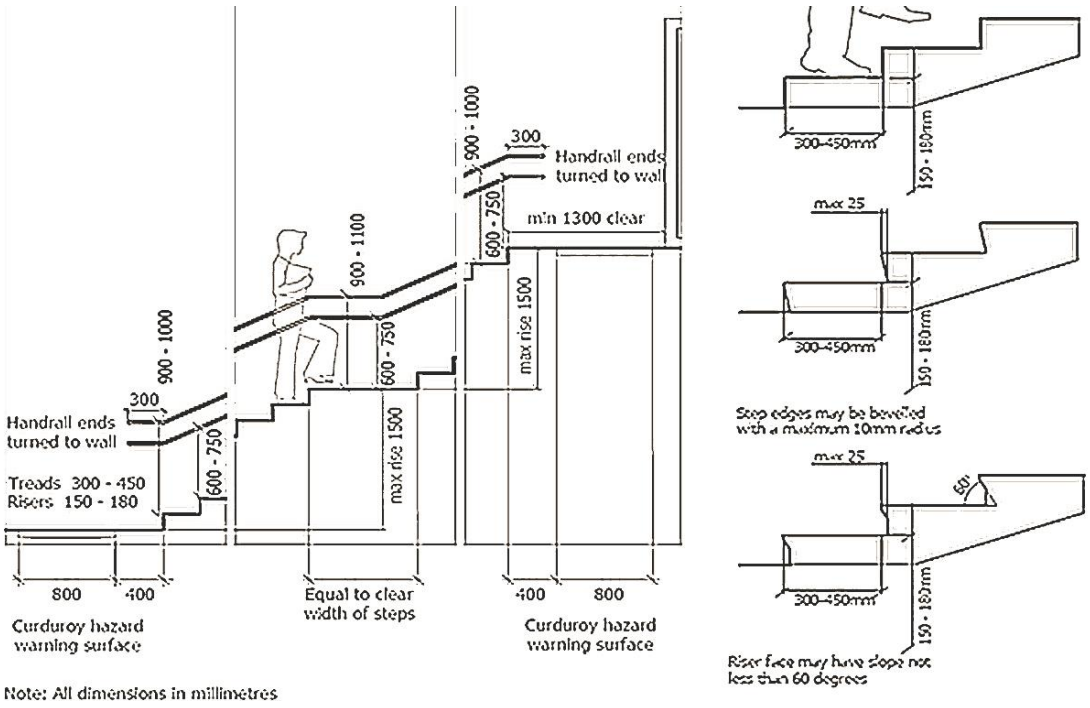


Figure 4.6 step standards [38]

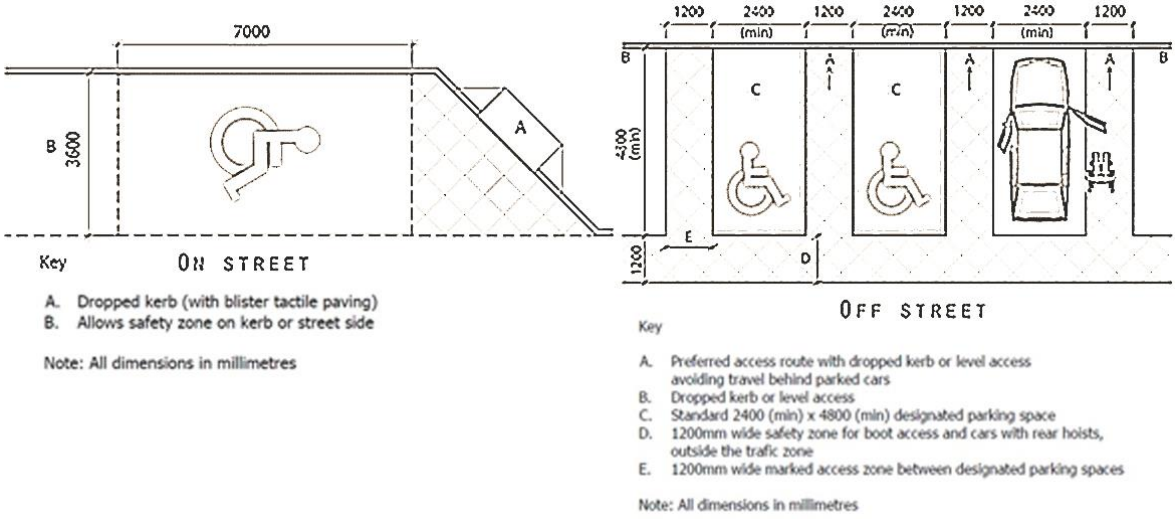
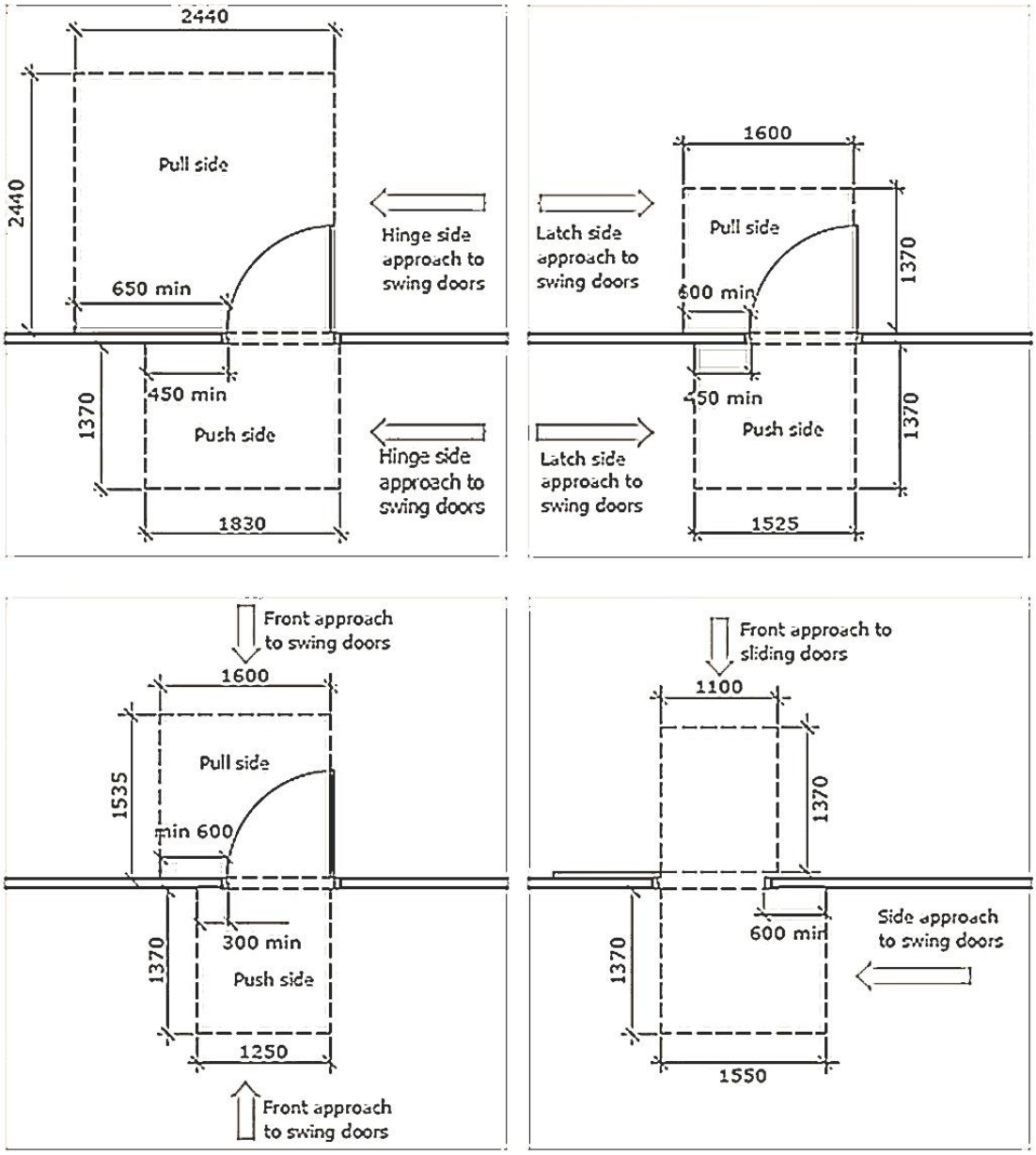


Figure 4.7 off street and on street parking standards [38]



Figure 4.8 underground accessible parking [38]



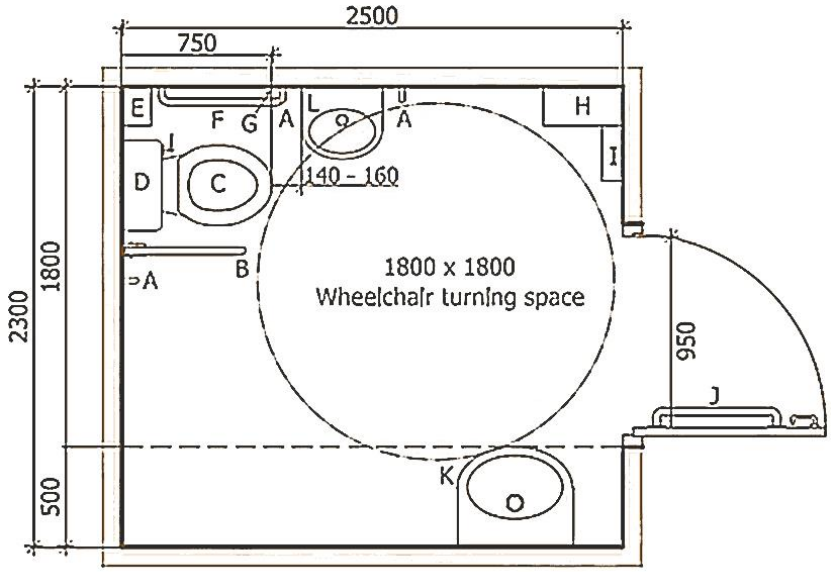
Note: All dimensions in millimetres

Door widths may vary – the important dimensions to refer to are the unobstructed spaces.

Figure 4.9 door approach standards [39]



Figure 4.10 reception desk [39]

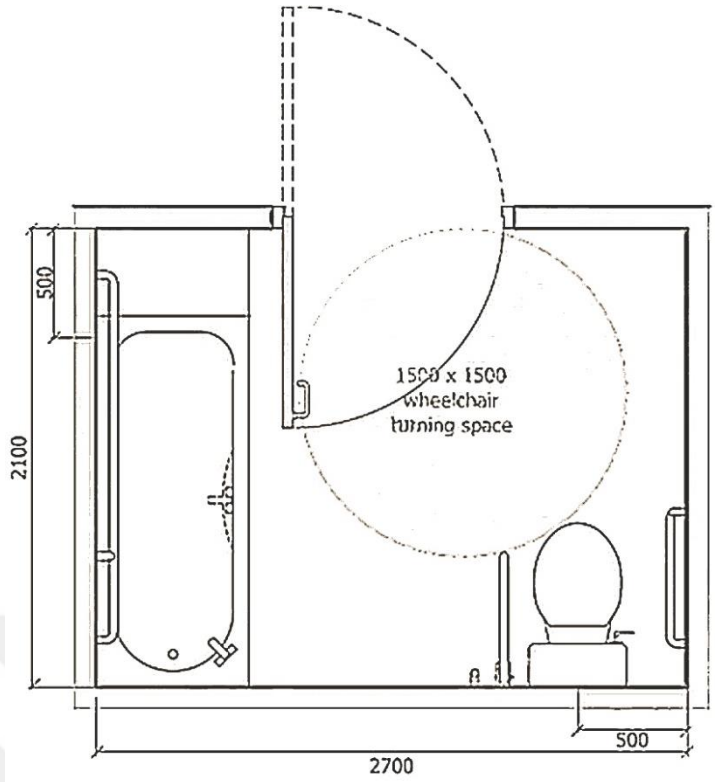


Key

A. Vertical grabrail ⊘ diameter 35mm
B. Drop down rail ⊘ diameter 35mm
C. Special WC pan
D. Flat-topped close-coupled cistern providing a back rest
E. 950 high shelf for colostomy bags
F. Horizontal grabrail ⊘ diameter 35mm
G. Alarm pull-cord o
H. Shelf for personal use
I. Sanitary dispenser with controls between 750 - 1200
J. Horizontal rail to assist door closing
K. Additional standing height washbasin with rim 680 - 700 high and clear knee space
L. Washbasin

Note: All dimensions in millimetres

Figure 4.11 unisex accessible toilet [42]



Note: All dimensions in millimetres

Figure 4.12 domestic bathroom standard [42]

APPENDIX-B

DETAILED ASSESSMENT OF CASE STUDIES

Table 4.6 case studies evaluation

	Standards	Points	School A	School B
Access to Site	**14. Path of Travel**			
	• Minimum Clear width 2000mm. if less, passing places provided	P	N	Y
	• Minimum 2300mm overhead clearance	P	Y	Y
	• Widen pavements in front of shops and bus stops	1	0	0
	• Inclined routes with a gradient between 3% and 4%	P	N	Y
	• Gradient greater than 4%, is ramp	P	N	N/A
	• Ramps should be designed according to figure 4.3	P	N/A	N/A
	• steps should be provided in conjunction with a ramp and designed according to figure 4.4	P	N	N/A
	• Level or flush crossing points with a dropped curb	P	N	N
	• Min. 1200 mm width of level surface to rear of pavement at a crossing point	1	0	1
	• Avoid single steps on access routes	1	1	1
	• Direct access from all access points to all facilities and building entrances	1	0	1
	• All pathways accessible unless there are alternative pathways that begin and end in the same location	1	0	1
	• Reduce pedestrian crossing distance on major crossing routes by providing expanded corners or safety islands	1	N/A	N/A
	• Storm drains located outside marked crossings	1	0	N/A
	15. Materials			
	• Firm, smooth, even and slip-resistant	P	Y	Y
	• Strong patterns and contrasting lines should be avoided on a surface	2	1	1
	• Non-reflective materials are better to be used on surfaces or materials that minimize reflection and glare.	1	1	1
	• Light colors such as bright clear white should be avoided on floor finishes to minimize sun reflection and also to not fade the contrasting alerting colors away	1	1	1
	• Clearly mark boundaries of crossings using permanent materials	1	0	0
	16. Illumination			
	• Illuminate steps and ramp surfaces with 150 lux	P	N	N/A
	• Highlight location of building entrance with lighting	1	N/A	N/A
	• External lighting should illuminate steps and ramps without causing shadows	1	0	N/A
	• Avoid glare with low-level recessed lights	1	0	0
	• Avoid floodlights	P	Y	Y
	• Higher illumination levels in the safe crossing area	1	0	1
	• Light pedestrian access routes and walkways to 30 lux	1	0	0
	17. Wayfinding			
	• Access routes should be understandable, easy to use, and offer choice	P	N	Y
	• Highlight location of building entrance with lighting	1	N/A	N/A
	• Ramped and stepped routes are clearly visible or well signed	2	0	N/A
	• Ticket machines and ATMs should be clearly signed and signage should be clearly visible from front and side	1	N/A	N/A
	• Tactile paving should be used strictly and consistently	2	0	0
	• Highlight location of key facilities using clear signage	P	N	N
	• Plan overall should be designed to be logical and direct as possible	2	1	1

Table 4.6 (continued)

Access to Site1	• Doors should contrast visually with adjacent wall surfaces	1	1	0
	• Changes in color or textures could be used to contribute to a system of wayfinding	1	0	0
	• Landmarks such as statues could incorporate to a system of wayfinding	1	0	0
	• Incorporate visual, audible and tactile information in signage	P	N	N
	• All signage should be clear, consistent and easy to understand	P	N	N
	• Maps, plans and models with tactile and audible information included should be used	2	0	0
	• Wording should be aligned to the left. In countries with right to left language the opposite in addition	1	1	1
	• Suitable letter size for distance viewing	1	1	1
	• Arrows should be used to indicate direction	1	0	0
	• Enable reading by touch with embossed signs	1	0	0
	• Embossed letters should be between 16 mm and 50 mm height	1	0	0
	• Braille should be positioned below related text	1	0	0
	• Locate braille signs on inclined surfaces	1	0	0
	• Signs should be positioned in manners that people reading them would not cause an obstruction	1	0	0
	18. Safety and Warning Systems			
	• Maximum cross-fall gradient 2% on all access routes	P	N	Y
	• Dished gullies, grills and manhole covers should be avoided	P	N	Y
	• Avoid vertical deviations and gaps greater than 5mm	P	N	Y
	• Prevent accidents to side of access routes with curb upstands, barriers or guardrails	P	Y	Y
	• Surfaces should drain water effectively	1	1	1
	• Highlight step edges	P	N	N/A
	• Tactile warning surfaces at top and bottom of flight figure 4.4	P	N	N/A
	• Continuous handrails on both sides of ramps and stairs. If width more than 2000 mm an additional handrail in center	P	N	N/A
	• Headroom area below steps less than 2100 mm, should be protected	1	1	N/A
	• Wherever post-mounted items present a hazard, tapping rail should be provided	1	0	0
	• Avoid links using chains and ropes	P	Y	Y
	• Crossings should be located where they are safe for all users	1	0	1
	• Use blister tactile surfacing in absence of a curb	P	N/A	N/A
	• Red blister at controlled, buff blister at uncontrolled crossings	P	N/A	N/A
	• Corduroy hazard warning system on top and bottom of steps	P	N	N/A
	• External lighting should illuminate steps and ramps without causing shadows	1	0	N/A
	• Communication equipment on path of travel wherever potential security or safety threats may exist	1	0	0
	• Security cameras on path	1	0	1
	• Clearly mark boundaries of crossings using permanent materials	1	0	0
	• Pedestrian crossing signals provide enough time for slower moving people to cross	1	0	0
	19. Public Transportation			
	• Taxi ranks in appropriate locations	1	0	1
	• Orientate taxi ranks to enable passengers to alight and board on the nearside of a taxi	1	0	1
	• Min. pavement width 4040 mm for wheelchair ramp and maneuvering, in taxi ranks	1	0	1

Table 4.6 (continued)

Access to Site	• At least one public transportation system within 50 m of reach	P	N	Y
	• All public transportation waiting areas should provide seating appropriate for all possible users	1	0	0
	20. Comfort			
	• Resting places on long routes	1	0	0
	• Undercover queuing areas with seating	1	0	0
	• Easy to operate gates	P	N	N
	• Drinking fountains appropriate for standing and seating use	1	N/A	N/A
	• Locate card operated machines such as ATMs where they are readily apparent	1	N/A	N/A
	• Orientate ATMs to minimize the glare on the screen	1	N/A	N/A
	• Provide a clear knee space for ATMs to facilitate frontal approach for wheelchair users	P	N/A	N/A
	• Choice of language should be available for all machines with on-screen instructions	1	N/A	N/A
Landscape	**8. Path of Travel**			
	• Minimum Clear width 2000mm. if less, passing places provided	P	N	Y
	• Minimum 2300mm overhead clearance	P	Y	Y
	• All routes between site entrance and building entrances are accessible	1	0	1
	• If overall rise of a ramp exceeds 2000 mm, an alternative means of access provided	P	N/A	N/A
	• Inclined routes with a gradient between 3% and 4%	P	N	Y
	• Gradient greater than 4%, is ramp	P	N	N/A
	• Ramps should be designed according to figure 4.3	P	N	N
	• steps should be provided in conjunction with a ramp and designed according to figure 4.4	P	N	N
	• Avoid single steps on access routes	1	1	1
	• Direct access from all access points to all facilities and building entrances	1	1	1
	• All pathways accessible unless there are alternative pathways that begin and end in the same location	1	0	0
	• The path should be able to allow emergency vehicles circulate	1	1	0
	9. Materials			
	• Firm, smooth, even and slip-resistant	P	Y	Y
	• Strong patterns and contrasting lines should be avoided on a surface	2	1	1
	• Non-reflective materials are better to be used on surfaces or materials that minimize reflection and glare.	1	1	1
	• Light colors such as bright clear white should be avoided on floor finishes to minimize sun reflection and also to not fade the contrasting alerting colors away	1	1	1
	10. Illumination			
	• Illuminate steps and ramp surfaces with 150 lux	P	N/A	N/A
	• Highlight location of building entrance with lighting	1	0	0
	• A gradual transition between external and internal lighting levels should be provided around an entrance	1	1	0
	• External lighting should illuminate steps and ramps without causing shadows	1	0	0
	• Avoid glare with low-level recessed lights	1	0	0
	• Avoid floodlights	P	N	Y
	• Illuminate external signage	1	0	0
	• Illuminate approach area to ATMs with min of 200 lux	1	N/A	N/A

Table 4.6 (continued)

Landscape	**11. Wayfinding**			
	• Access routes should be understandable, easy to use, and offer choice	P	N	Y
	• Highlight location of building entrance with lighting	1	0	0
	• Ramped and stepped routes are clearly visible or well signed	2	1	1
	• Ticket machines and ATMs should be clearly signed and signage should be clearly visible from front and side	1	N/A	N/A
	• Highlight location of key facilities using clear signage	P	N	N
	• Plan overall should be designed to be logical and direct as possible	1	1	1
	• Doors should contrast visually with adjacent wall surfaces	1	1	0
	• Changes in color or textures could be used to contribute to a system of wayfinding	1	1	1
	• Landmarks such as statues or entrances could incorporate to a system of wayfinding	1	1	1
	• Incorporate visual, audible and tactile information in signage	P	N	N
	• Tactile paving should be used strictly and consistently	P	N	N
	• All signage should be clear, consistent and easy to understand	P	N	N
	• Maps, plans and models with tactile and audible information included should be used	1	0	0
	• Wording should be aligned to the left. In countries with right to left language the opposite in addition	1	1	1
	• Suitable letter size for distance viewing	1	1	1
	• Arrows should be used to indicate direction	1	0	0
	• Enable reading by touch with embossed signs	1	0	0
	• Embossed letters should be between 16 mm and 50 mm height	1	0	0
	• Braille should be positioned below related text	1	0	0
	• Locate braille signs on inclined surfaces	1	0	0
	• Signs should be positioned in manners that people reading them would not cause an obstruction	1	0	0
	12. Safety and Warning Systems			
	• Maximum cross-fall gradient 2% on all access routes	P	N	Y
	• Dished gullies, grilles and manhole covers should be avoided	P	N	N
	• Avoid vertical deviations and gaps greater than 5mm	P	Y	Y
	• Prevent accidents to side of access routes with curb upstands, barriers or guardrails	P	Y	Y
	• Surfaces should drain water effectively	1	1	1
	• Highlight step edges	P	N	N
	• Tactile warning surfaces at top and bottom of flight figure 4.4	P	N	N
	• Continuous handrails on both sides of ramps and stairs. If width more than 2000 mm an additional handrail in center	P	N	N
	• Headroom area below steps less than 2100 mm, should be protected	1	N/A	N/A
	• Wherever post-mounted items present a hazard, tapping rail should be provided	1	0	0
	• Avoid links using chains and ropes	P	Y	Y
	• Tactile paving should be used strictly and consistently	P	N	N
	• Use blister tactile surfacing in absence of a curb	1	N/A	N/A
	• Corduroy hazard warning system on top and bottom of steps	P	N	N
	• External lighting should illuminate steps and ramps without causing shadows	1	0	0

Table 4.6 (continued)

Landscape	• Communication equipment on path of travel wherever potential security or safety threats may exist	1	N/A	N/A
	• Security cameras on path	1	1	1
	13. Public Amenities			
	• Overall provision for all building occupants	P	N/A	N/A
	• Toilets are easily accessed	P	N/A	N/A
	• Sanitary facilities on accessible routes	1	N/A	N/A
	• Provide toilets at regular intervals	1	N/A	N/A
	• Temporary sanitary facilities are as accessible as permanent ones	1	N/A	N/A
	• Logical and accessible urinals, cubicles and hand washing facilities	1	N/A	N/A
	• Enlarged cubicle for people who need extra space	1	N/A	N/A
	• Washbasins at different heights	P	N/A	N/A
	• Lever or automatic taps and plugs in washbasins	P	N/A	N/A
	• One in six urinals at lower heights	P	N/A	N/A
	• Fitting grab rails between urinals	1	N/A	N/A
	• Unisex toilet suitable for all building users	P	N/A	N/A
	• Room dimensions min 2700 mm wide x 2500 mm long	P	N/A	N/A
	• An additional standing-height washbasin, rim height 780 to 800 mm	1	N/A	N/A
	• Incorporate unisex baby-changing facilities	1	N/A	N/A
	• Changing tables at two heights	1	N/A	N/A
	• Separate facility for breast feeding Washbasin with clear knee space	1	N/A	N/A
	14. Comfort			
	• Resting places on long routes	1	0	1
	• Setting-down point close to building entrance	1	1	1
	• A canopy with minimum height of 2600 mm to be provided	1	0	0
	• Undercover queuing areas with seating	1	0	0
	• Easy to operate gates	P	N	N
	• Drinking fountains appropriate for standing and seating use	1	N/A	N/A
	• Locate card operated machines such as ATMs where they are readily apparent	1	N/A	N/A
	• Orientate ATMs to minimize the glare on the screen	1	N/A	N/A
	• Provide a clear knee space for ATMs to facilitate frontal approach for wheelchair users	P	N/A	N/A
	• Choice of language should be available for all machines with on-screen instructions	1	N/A	N/A
Outdoor Parking	**7. Path of Travel**			
	• Easy to understand and logical route between each parking spot and parking exit	P	N	N
	• Accessible and easy to understand route between car park and facility	P	N	N
	• No obstructions on pavement side	1	N	N
	8. Materials			
	• Firm, smooth, even and slip-resistant	P	N	N
	• Strong patterns and contrasting lines should be avoided on a surface	2	N	N
	• Non reflective material on ground pavement	P	N	N

Table 4.6 (continued)

Outdoor Parking	**9. Illumination**			
	• Highlight location of parking entrance with lighting	1	N	N
	• Highlight location of building entrance with lighting	1	N	N
	• Avoid glare with low-level recessed lights	1	N	N
	• Each spot should be illuminated in manners that would not cause reflection or glare	1	N	N
	• Each empty spot should be signed with illumination that is visible from parking entrance	1	N	N
	• Signage should be illuminated evenly	1	N	N
	10. Wayfinding			
	• Each parking spot should be clearly signed with universal numbers	P	N	N
	• The path between parking spot with building entrance and parking exit should be clearly signed	P	N	N
	• The location of each spot should be logical and easy to find	1	N	N
	• Clear, wall or post mounted signage to highlight location of designated parking spot	P	N	N
	• Each empty spot should be signed with illumination that is visible from parking entrance	1	N	N
	11. Safety and Warning Systems			
	• Level or flush access routes away from vehicles	P	N	N
	• Firm and level surface with maximum cross-fall gradient of 2% on access routes between parking and facility	1	N	N
	12. Comfort			
	• Each spot covered with simple shading to avoid direct sunshine reflection, glare and heat	1	N	N
	• Parent and child, handicapped parking spaces, near the entrance	P	N	N
	• Off street and on street spaces should be designed according to figure 4.5	1	N	N
Multistory and Indoor Parking	**7. Path of Travel**			
	• Easy to understand and logical route between each parking spot and parking exit	P	N/A	N/A
	• Accessible and easy to understand route between car park and facility	P	N/A	N/A
	• Parking levels served by lifts in addition to stairs providing access to all floors	1	N/A	N/A
	• Minimum vertical clearance of 2600 mm	P	N/A	N/A
	8. Materials			
	• Firm, smooth, even and slip-resistant	P	N/A	N/A
	• Strong patterns and contrasting lines should be avoided on a surface	2	N/A	N/A
	• Non reflective material on ground pavement	1	N/A	N/A
	9. Illumination			
	• Highlight location of parking entrance with lighting	1	N/A	N/A
	• Highlight location of building entrance with lighting	1	N/A	N/A
	• Illuminate all spaces evenly with blurry lighting to avoid direct reflections and glare	1	N/A	N/A
	• Each spot should be illuminated in manners that would not cause reflection or glare	1	N/A	N/A
	• Each empty spot should be signed with illumination that is visible from parking entrance	1	N/A	N/A
	• Signage should be illuminated evenly	1	N/A	N/A
	10. Wayfinding			
	• Each parking spot should be clearly signed with universal numbers	P	N/A	N/A
	• The path between parking spot with building entrance and parking exit should be clearly signed	P	N/A	N/A

Table 4.6 (continued)

Multistory and Indoor Parking	• The location of each spot should be logical and easy to find	1	N/A	N/A
	• Clear, wall or post mounted signage to highlight location of designated parking spot	P	N/A	N/A
	• Each empty spot should be signed with illumination that is visible from parking entrance	1	N/A	N/A
	11. Safety and Warning Systems			
	• Each spot should be designed according to figure 4.6 to create maximum safety for people passing from spot to building or the opposite	P	N/A	N/A
	12. Comfort			
	• Parent and child, handicapped parking spaces, near the entrance	P	N/A	N/A
	• Ticket dispensers are conveniently located, accessible, understandable and usable by all users	1	N/A	N/A
	• Ventilation should be considered to overcome the heat and odor of cars	P	N/A	N/A
	• Acoustics should be considered to minimize the reflection of car engine noises	P	N/A	N/A
Entrance of Facility	**6. Materials**			
	• Firm, smooth, even, slip-resistant and non-directional floor materials	P	Y	Y
	• Easy to clean	1	1	1
	• Visually contrasting materials on floor with walls	1	1	0
	7. Illumination			
	• Lighting should ease the transition between external and internal environment	1	1	1
	• Glazed screens and doors highlighted effectively	P	N/A	N/A
	• Recommended level of 150 lux illumination	1	1	1
	8. Safety and Warning Systems			
	• Outward-opening doors should be arranged so that they are recessed or guarded	1	N/A	1
	• Entrance thresholds level or maximum 10 mm with chamfered, pencil-rounded or ramped profile	P	Y	Y
	• All accessible entrances designed to serve as emergency exit routs as well	P	Y	Y
	• Visually contrasting markings at two levels on all glazed doors and screens	1	N/A	N/A
	• Door protection provided to the lower 400 mm of glass doors	1	1	1
	9. Door Design			
	• Minimum opening of 1000 mm in new and 850 mm in existing buildings	P	Y	Y
	• Adequate space be provided on both sides of door figure 4.7	1	1	1
	• Minimum 600 mm clear space adjacent to handle-side	1	1	1
	• Entrance thresholds level or maximum 10 mm with chamfered, pencil-rounded or ramped profile	P	Y	Y
	• Vision panels on all entrance and entrance lobby doors	1	1	1
	• Visually contrasting markings at two levels on all glazed doors and screens	1	N/A	N/A
	• Entrance doors should contrast visually with adjacent walls or screens	1	1	0
	• A highly contrasting strip on all edges of frameless glass doors	P	N/A	N/A
	• Door protection provided to the lower 400 mm of glass doors	1	N/A	N/A
	• Avoid revolving doors. If not possible, sliding or hinged doors should be installed either	1	1	1
	• Accessible gates with width of 950 mm provided in addition to turnstiles	P	N/A	N/A
	• Accessible gates should contrast with surroundings and be clearly signed	1	N/A	N/A
	10. Entrance Design			
	• Clearly visible, prominent and universally designed	P	Y	Y

Table 4.6 (continued)

Entrance of Facility	• For existing buildings, an alternative universally designed entrance	1	N/A	N/A
	• Min 2400 mm x 2400 mm landing space outside of entrance	P	Y	Y
	• Canopy or door recess for weather protection	1	1	1
	• Firm and flush mats adjacent with floor surface	P	N/A	N/A
Reception Area of Facility	**6. Path of Travel**			
	• Should be located logically to arrange circulation routes and facilities with a direct access from main entrance	1	N/A	N/A
	• Clear space of min 2440 mm x 2440 mm provided for approach	P	N/A	N/A
	7. Illumination			
	• Well-designed lighting to optimize visual communication and lip reading	P	Y	N/A
	• Avoid glare by using controllable light sources	1	1	N/A
	• Adequate illumination at counter level	1	1	N/A
	8. Wayfinding			
	• Should be clearly visible	P	N/A	N/A
	9. Comfort			
	• Comfortable seating and free space for all possible users	1	N/A	N/A
	• All seating is readily apparent and clearly signed	1	N/A	N/A
	• Seating in all reception and waiting areas provided	1	N/A	N/A
	• Seating close to toilet facilities and a reception or information point	1	N/A	N/A
	• Access to seating is unobstructed	1	N/A	N/A
	• Seats of different styles to suit different people	1	N/A	N/A
	• Seats should visually contrast with surrounding surfaces	1	N/A	N/A
	10. Desk Design			
	• Desk and counters should be understandable on both costumer and staff side	P	N/A	N/A
	• Must have knee recess for people in seated position	P	N/A	N/A
	• Include counters at different heights as figure 4.8	P	N/A	N/A
	• The counter must have a visually-contrasting, upward-sloping leading edge	1	N/A	N/A
	• Voice augmentation system used in conjunction with glazed screens	1	N/A	N/A
	• A hearing enhancement system should be provided and clearly signed	1	N/A	N/A
	• Induction loop system should be provided	1	N/A	N/A
Ground Floor and Horizontal Circulation	**10. Path of Travel**			
	• Avoid changes in level in a floor	P	Y	Y
	• Access routes should be maintained carefully and kept clear of obstructions	1	1	1
	• Min 2000 mm width for corridors in public and 1500 mm for other buildings	P	Y	Y
	• Min 2000 mm long x 1800 mm wide passing places in corridors less than 1800 mm wide	P	N/A	N/A
	• Lobby or internal lobbies should not be provided unless necessary and kept clear of obstructions	1	1	1
	• Changing areas on accessible routes	1	N/A	N/A
	• Kitchen should be located close to dining or seating areas	1	1	1
	• Consider open-plan arrangements for kitchen to facilitate easier circulation between kitchen and dining areas	1	1	1

Table 4.6 (continued)

Ground Floor and Horizontal Circulation	**11. Materials**			
	• Firm, even, securely fixed, non-directional, durable and well maintained floor surfaces should be installed	P	Y	Y
	• Slip-resistant finishing on floors when it is wet and dry	P	N	Y
	• Avoid deep pile carpets and coir matting	P	Y	Y
	• Visual contrast should be optimized between floor and wall finishes and other features such as obstructions	P	Y	Y
	• Avoid shiny and reflective surfaces	1	0	0
	• Avoid large and bold patterns	1	1	1
	• Wherever there is infrared transmission, glazed partitions, large windows and dark surfaces should be avoided	1	N/A	N/A
	• Signs should have a matt or satin finish	1	0	0
	• Letters and symbols of a sign should contrast visually with sign board	1	1	1
	• Sign boards should visually contrast with background	1	1	1
	• When color coding is used easy to differentiate colors should be used	1	0	0
	• Paths of travel distinguished with material, floor textures or color differences to assist in orientation	1	1	0
	12. Illumination			
	• The placement of natural and artificial light sources should be considered to provide an even level of illumination	P	Y	Y
	• Placement of windows and artificial lighting should minimize reflection and glare	P	Y	Y
	• Positioning windows or lights at the end of corridors and behind a person at reception desk should be avoided	1	0	0
	• Avoid creating strong shadows on walls and floors	1	1	1
	• All rooms and space should benefit from natural light if possible	1	1	1
	• Use sun-shading devices or blinds to reduce glare from direct sun light	1	1	1
	• All rooms and surfaces should be evenly illuminated	1	1	1
	• Lighting design should be flexible so people can control individual lighting levels	P	Y	Y
	• Avoid strobe lighting	1	1	1
	• Use down lighters that incorporate diffusers	1	0	0
	• Avoid uplighters positioned at floor level	1	1	1
	• All signs illuminated evenly to 200 lux	1	0	0
	• Adequate lighting levels in all bathrooms	1	1	1
	• Backup lighting source to supplement automatic lights	1	0	0
	• Adequate timing on automatic lights	1	N/A	N/A
	• Avoid ultra violet light in accessible bathrooms	1	1	1
	• Gradual transitions from dark to bright spaces	1	1	1
	• Recommended level of 150 lux illumination in corridors, passages and walkways	1	1	1
	• Toilets, showers and bathrooms lit up to 200-300 lux	1	1	1
	• Offices lit up to 300 lux	1	1	1
	• Switches and controls lit up to 100 lux	1	0	0
	• Directional signs, maps and information displays lit up to 200 lux	1	0	0

Table 4.6 (continued)

Ground Floor and Horizontal Circulation	**13. Wayfinding**			
	• Highlight location of key facilities using clear signage	P	N	N
	• Plan overall should be designed to be logical and direct as possible	P	Y	Y
	• Access routes of open-plan areas should be well defined	1	1	1
	• Provide handrails on both sides of walkways	1	0	0
	• Doors should contrast visually with adjacent wall surfaces	1	1	0
	• Changes in color, texture, acoustic characteristics of floor finishes could be used to contribute to a system of wayfinding	1	0	1
	• Incorporate visual, audible and tactile information in signage	P	N	N
	• All signage should be clear, consistent and easy to understand	P	N	N
	• Maps, plans and models with tactile and audible information included should be used for large buildings	1	0	0
	• A clear and consistent, sans serif typeface with no complex, italicized or too bold characters should be used throughout a site or building	1	0	0
	• Wording should be aligned to the left. In countries with right to left language the opposite in addition	1	0	0
	• Suitable letter size for distance viewing	1	0	0
	• Symbols should be used in place of text or to supplement it	1	0	0
	• Arrows should be used to indicate direction	1	0	0
	• Enable reading by touch with embossed signs	1	0	0
	• Embossed letters should be between 16 mm and 50 mm height	1	0	0
	• Braille should be positioned below related text	1	0	0
	• Locate braille signs on inclined surfaces	1	0	0
	• Public address system should be clearly audible in all relevant areas of a building	1	1	1
	• Signs should be positioned in manners that people reading them would not cause an obstruction	1	0	0
	• Changing facilities should be clearly identified	1	N/A	N/A
	• Sanitary facilities are clearly identified	P	N	N
	• Handed layouts can be identified by touch-legible pictograms	1	0	0
	• Paths of travel distinguished with material, floor textures or color differences to assist in orientation	1	0	0
	• Directional signage when the direction of emergency egress is not easy to understand	P	N	N
	• When color coding is used easy to differentiate colors should be used	1	N/A	N/A
	14. Safety and Warning Systems			
	• Fix junctions with threshold plates between different floor finishes	P	N/A	N/A
	• Outward-opening doors should be protected by a guardrail	P	Y	N
	• Emergency exit door ironmongery should be accessible	P	N	Y
	• Activation and safety systems should protect people who are slow-moving or fallen in doorway	1	N/A	N/A
	• Guard all potential body and finger traps in automatic opening doors	P	N/A	N/A
	• Guard all swing doors that can be approached from side by barriers	P	N	N/A
	• Tactile warning surfaces with 3 mm ridges should be used indoors	P	N	N
	• If tactile warning surfaces are not suitable, visually contrasting floor finishes should be used	P	N	N
	• Safety information and warning signs should follow the universally established color code	1	1	1

Table 4.6 (continued)

Ground Floor and Horizontal Circulation	• Alarm systems should be effective in alerting all building occupants	P	Y	Y
	• Audible, visual and tactile devices should be incorporated	1	0	0
	• The sound level of an alarm should be limited to 120 dB	1	1	1
	• Visual alarms should be located to be seen from all areas of a facility	1	0	0
	• Manual call points should be within reach of all building users and must be simple to operate	1	1	1
	• Provide visible and audible indicator in all sanitary facilities	1	0	0
	• Total building sprinkler system	P	N	Y
	• Two-way emergency communications in all remote areas	1	N/A	N/A
	15. Communication			
	• The use of infrared and radio systems should be considered where multi-channel communication is required	1	N/A	N/A
	• Radio and sound field systems should be taken into consideration where people with hearing difficulty who do not wear a hearing aid, may benefit	1	N/A	N/A
	• Provide assistance alarms in all accessible toilets, bathrooms, shower rooms, and changing rooms designed for independent use	P	N/A	N/A
	• Visible and audible indication within the room that alarm has been raised in independent accessible bathrooms	1	N/A	N/A
	• Provide public telephones that are accessible, useable, understandable to everyone	P	Y	Y
	16. Public Amenities			
	• Toilet facilities should be located adjacent to reception area	1	1	1
	• Overall provision for all building occupants	P	N	Y
	• Toilets are easily accessed	P	N	N
	• Sanitary facilities on accessible routes	1	1	1
	• Provide toilets at regular intervals	1	1	1
	• Temporary sanitary facilities are as accessible as permanent ones	1	N/A	N/A
	• Logical and accessible urinals, cubicles and hand washing facilities	1	1	1
	• Enlarged cubicle for people who need extra space	1	0	0
	• Washbasins at different heights	P	Y	Y
	• Lever or automatic taps and plugs in washbasins	P	Y	Y
	• One in six urinals at lower heights	P	N/A	N/A
	• Fitting grab rails between urinals	1	0	0
	• Unisex toilet suitable for all building users	P	N/A	N/A
	• Room dimensions min 2700 mm wide x 2500 mm long	P	N/A	N/A
	• An additional standing-height washbasin, rim height 780 to 800 mm	1	N/A	N/A
	• Incorporate unisex baby-changing facilities	1	N/A	N/A
	• Changing tables at two heights	1	N/A	N/A
	• Separate facility for breast feeding	1	N/A	N/A
	• Washbasin with clear knee space	P	Y	Y
	• Min room dimension of 3000 mm x 2500 mm for shower and bathroom	P	N/A	N/A
	• Level-access shower tray	P	N/A	N/A
	• Use adjustable height, detachable shower head	1	N/A	N/A
	• Temperature controls are easy to identify	1	N/A	N/A

Table 4.6 (continued)

Ground Floor and Horizontal Circulation	• Fold-down plastic seat in shower area	1	N/A	N/A
	• Position grab rails and drop-down rails correctly	P	N/A	N/A
	• Corner arrangement WC as figure 4.9	1	N/A	N/A
	• Recommend 2500 mm x 2300 mm for accessible changing areas	1	N/A	N/A
	• Accessible poolside shower	1	N/A	N/A
	• Shower controls within reach of all users	1	N/A	N/A
	• Accessible shower and changing areas in single-sex facilities in addition to unisex facilities	1	N/A	N/A
	• Domestic bathrooms should be designed according to figure 4.10	1	N/A	N/A
	• Use tubular grab rails with a 32 to 35 mm diameter and a suitable surface to provide a good grip when wet	1	N/A	N/A
	17. Comfort			
	• Adequate ventilation to all rooms and spaces should be provided	P	Y	Y
	• Mechanical ventilation and air-conditioning systems should be well maintained	1	1	0
	• Avoid the use of doors where other solutions are possible	1	N/A	N/A
	• Seating should be provided at regular intervals of walkways	1	0	0
	• The direction of door openings should be consistent throughout the building	P	N	N
	• All outlets, switches and controls should be clearly visible, easy to reach and operate	1	0	1
	• Light switches should be located logically and avoided within 500 mm of the corner of any room	1	1	1
	• Two or three-way switching should be used for lights where flexibility is required	P	Y	Y
	• Switch background should contrast visually with mounted surface	1	0	0
	• Avoid switches which require turning or gripping	P	Y	Y
	• Acoustic requirements should be taken into consideration at earliest stage of design	1	N/A	N/A
	• Quiet rooms should be located away from external noise resources	1	N/A	1
	• Using a buffer zone such as a lobby or foyer as a separation between quiet and noisy rooms are preferred	1	N/A	1
	• The acoustic characteristics of a room should be in reference with its' function	1	N/A	1
	• Ventilation systems with minimal noise should be used	1	1	1
	• Bathroom heaters should be positioned away from transfer and maneuvering space	1	N/A	N/A
	• Surface temperature of heaters should not exceed 40 degrees (centigrade)	1	1	1
	• Standing height work surfaces should be 900 mm and seated approach should be 760 mm high	P	N/A	Y
	• Clear knee space provided for lower work surfaces	P	Y	Y
	• Adjustable height units should be used in work surfaces	1	0	0
	• A clear area of 2400 mm diameter between units in L or U shaped and 1100 mm between parallel work surfaces should be arranged	P	Y	Y
	• Clearly visible switches and sockets no higher than 1000 mm above floor level	P	N	Y
	• Switch and sockets should be positioned towards the front of work surface or on return wall where there is no knee space	1	0	0
	18. Openings			
	• All doors should be accessible, understandable and usable	P	Y	Y
	• Min 1600 mm between door swings	P	Y	N/A
	• Doors should be easy to identify, sufficiently wide, and easy to operate	P	Y	N
	• Sufficient space should be provided on both sides of doors	1	1	1

Table 4.6 (continued)

Ground Floor and Horizontal Circulation	• Clear width of 850 mm for internal doors	P	Y	Y
	• Inward opening doors should open against a sidewall	P	Y	Y
	• Double swing doors should be provided with pull handles	1	1	N/A
	• Horizontal rails should be provided on closing face of outward opening doors	1	0	N/A
	• Use door closing devices only where necessary	1	1	1
	• Letter plates positioned 900 mm above ground	1	0	0
	• Activation system should open door at min 1400 mm of a person	1	N/A	N/A
	• Opening time should be sufficient for slow moving people	1	N/A	N/A
	• Controls of manually – activated automatic doors should be within reach and clear of door swing, visible and with clear signage	1	N/A	N/A
	• Fail-safe systems provided on all automatic doors	1	N/A	N/A
	• Door entry systems located within reach of all users on handle side of door	1	N/A	N/A
	• Windows that open should be accessible to all users	P	Y	Y
	• Window provision should balance environmental performance with safety, security, privacy and visual comfort	P	Y	Y
	• Transoms between 900 mm and 1200 mm above floor level should be avoided	P	Y	Y
	• Accessible, useable, understandable and positioned window controls between 800 mm and 1000 mm	P	Y	Y
	• Lever handles should be installed which require minimum force to operate	1	1	1
	• While opening, windows should not create a hazard or obstruct	1	1	1
	• Windows of first floor and upper levels should not open more than 100 mm	P	N	N
	• For out of reach windows the use of easy to operate remotes are recommended	1	N/A	N/A
	• Inward opening doors for easy reversal	1	0	0
	• Bathroom clear door opening of 950 mm	P	N	Y
	• Outward-opening doors to accessible facilities that do not obstruct emergency escape routes	1	0	0
	• Horizontal rails on outward-opening doors	1	1	1
	• Fit inward-opening doors with emergency-release catches	1	0	0
	• Lever-style door handles	P	Y	Y
Vertical Circulation, Stairs	**7. Path of Travel**			
	• Min 1200 mm clear width of steps and suit expected level of use	P	Y	Y
	• Max. total rise of flights between landings 1800 mm or 12 steps	P	Y	N
	• Consistent number of steps in consecutive flights	1	0	1
	• Clear landing at top and bottom with the length equivalent to step width	1	1	1
	• Handrails on both sides and continuous around intermediate landings	P	N	N
	• Width more than 2000 mm central handrail should be installed	P	N/A	N/A
	• Maximum depth of 355 mm on treads of stairways and risers between 100 mm and 180 mm	P	Y	Y
	• Escalator steps should be minimum 580 mm and maximum 1100 mm wide with maximum 240 mm or 210 mm height	1	N/A	N/A
	• Min 2300 mm vertical clearance required for an escalator	1	N/A	N/A
	• Min 1500 mm wide walkway and 2300 mm vertical clearance provided for a travellator	1	N/A	N/A
	• Stairways kept out of the direct path of travel	1	1	1

Table 4.6 (continued)

Vertical Circulation, Stairs	**8. Materials**			
	• Visually contrasting handrails should be installed	1	0	1
	• Slip resistant traveling surfaces without impeding the mobility of wheelchairs	P	Y	Y
	• Firm, even and securely fixed floor surfaces	P	Y	Y
	• Top and bottom of flight should visually contrast with the tread and riser surfaces	1	0	0
	• Step nosing should be firmly fixed, highlighted and extend the full width of each step	P	Y	Y
	• Avoid shiny and polished surfaces that create glare and reflection	1	0	0
	9. Illumination			
	• Step and landing surfaces should be lit to 150 lux	P	N	N
	• Time – delay timings should accommodate the needs of all users	1	N/A	N/A
	• Gradual transitions from dark to bright spaces	1	1	1
	• Avoid lighting that casts shadow obscuring the step edge	1	1	1
	10. Wayfinding			
	• Clearly-signed or readily apparent alternative means of access for escalators and travellators	1	N/A	N/A
	• Direction of travel to stairs, escalators and travellators should be clearly signed	P	N	N
	• Directional signage when the direction of emergency egress is not easy to understand	1	N/A	N/A
	11. Safety and Warning Systems			
	• Area below stairs with a headroom less than 2200 mm should be protected	P	N	Y
	• Edges of steps should be visually highlighted	P	Y	N
	• Tactile hazard warning system on top and bottom of flight	P	N	N
	• Handrails on both sides of steps and continuous around intermediate landings	P	N	N
	• Footway to each end in an escalator and travellator should contrast visually and a change in floor finish should be installed	1	N/A	N/A
	• Moving handrails should extend minimum 300 mm beyond the start and end of escalator	P	N/A	N/A
	• A 55 mm wide contrasting band should be installed to full width of each step edge in an escalator	P	N/A	N/A
	• Max speed for an escalator 0.75 m per second. For travellator 0.5 m per second	P	N/A	N/A
	• Visible and accessible emergency stop controls in an escalator and travellator	P	N/A	N/A
	• Moving handrails should extend min 700 mm beyond the start and end of travellators' walkway	P	N/A	N/A
	• Max gradient for an inclined travellator is 5%	P	N/A	N/A
	• Fixed and contrasting guarding at entry and exit points alongside adjacent access routes should be installed	1	N/A	N/A
	• Reserved stairway for the fire service	1	1	1
	• Total building sprinkler system	1	0	1
	• Two-way emergency communications in all remote areas	1	N/A	N/A
	12. Comfort			
	• Seating at landings of long stairways	1	N/A	N/A

Table 4.6 (continued)

Vertical Circulation, Ramps	**7. Path of Travel**			
	• Max gradient 5%, max rise 450 mm and max length 9000 mm in an internal ramp	P	N/A	N/A
	• Gradient of a ramp slope should be constant and consistent throughout and between consecutive ramp slopes	P	N/A	N/A
	• Min width of ramp 1300 mm and suitable for expected level of use	P	N/A	N/A
	• 2440 mm x 2440 mm top and bottom landings, 2000 mm x ramp width intermediate landings	P	N/A	N/A
	• Ramps running in the direction of normal travel	1	N/A	N/A
	8. Materials			
	• Visually contrasting handrails should be installed	1	N/A	N/A
	• Slip resistant traveling surfaces without impeding the mobility of wheelchairs	P	N/A	N/A
	• Visually contrasting slope finish with landings	1	N/A	N/A
	9. Illumination			
	• Ramp and landing surfaces should be lit with 150 lux	P	N/A	N/A
	• Gradual transitions from dark to bright spaces	1	N/A	N/A
	10. Wayfinding			
	• Directional signage when the direction of emergency egress is not easy to understand	P	N/A	N/A
	11. Safety and Warning Systems			
	• A curb upstand or guarding should be provided on side of ramp	P	N/A	N/A
	• Handrails should be provided on both sides of ramp and continuous around intermediate landings	P	N/A	N/A
	• Total building sprinkler system	P	N/A	N/A
	• Two-way emergency communications in all remote areas	1	N/A	N/A
	12. Comfort			
	• Seating at landings of long stairways	1	N/A	N/A
Vertical Circulation, Ramps	**7. Path of Travel**			
	• Provide passenger lifts in preference to platform lifts	1	N/A	1
	• Elevator lobby within short distance from main entrance and other main function facilities	1	N/A	1
	• Passenger lifts should be located adjacent to an accessible flight of stairs	1	N/A	1
	• Clear floor area of the lobby wide enough to allow people to assemble without obstructing the circulation flow	1	N/A	1
	• Clear floor surface of the landing area wide enough for all users to approach and use from a forward or a parallel direction	1	N/A	1
	• Clear floor surface of the elevator car to allow people in wheelchairs or with pushchairs to make 180 degree turn	P	N/A	Y
	• Lift size suitable to building type and occupancy	1	N/A	1
	• Min internal dimension 1800 mm x 1800 mm	P	N/A	Y
	• Min clear door opening 950 mm	P	N/A	Y
	• For min 8 seconds doors should remain open	P	N/A	Y
	• Min 1800 mm x 1800 mm clear landing space should be provided	P	N/A	Y
	• Controls within reach of all users and easy to operate	P	N/A	Y
	• If passenger lifts cannot be installed, platform lifts and inclined platform lifts should be installed on existing buildings	P	N/A	N/A
	• Min platform size 1100 mm x 1400 mm	P	N/A	N/A
	• Solid barriers on non-access sides of platform	P	N/A	N/A

Table 4.6 (continued)

Vertical Circulation, Ramps	• Clear landing space of 2440 mm x 2440 mm provided for a platform	P	N/A	N/A
	• Inclined platform lifts and stair lifts should be avoided if the device encroaches into the recommended clear width of stairs	1	N/A	N/A
	• Recommended size of 890 mm wide x 1525 mm long should be considered for inclined platform lift	1	N/A	N/A
	• Platform lifts should be easy to use with clear instructions	1	N/A	N/A
	• Inclined platform lifts should have 1100 mm – high solid side nearest to wall or support rails	1	N/A	N/A
	8. Materials			
	• Interior should minimize glare and reflection	1	N/A	1
	• Half-height mirror should be provided on rear wall	1	N/A	1
	• Firm, level and securely fixed floor materials both in wet and dry conditions	P	N/A	Y
	• Slip-resistant characteristics similar to landing floor finishes	P	N/A	Y
	• Light color or tone	1	N/A	0
	9. Illumination			
	• An even level of illumination of 200 lux should be used for lift landings and lift cars	1	N/A	1
	• Lift control panels should be lit up to 100 lux	1	N/A	1
	10. Wayfinding			
	• Lifts should be clearly signed from building entrances and other key areas	P	N/A	N
	• Visual and tactile floor numbers should be provided at each landing	P	N/A	N
	• Lift signaling system should be both visual and audible	P	N/A	Y
	11. Safety and Warning Systems			
	• An emergency communication system suitable for all users be provided	1	N/A	0
	• Evacuation lifts should be located in fire-resisting enclosure with independent electrical supply and additional controls	P	N/A	N/A
	• Equip elevator car with a mirror so that wheelchair users could exit easily	P	N/A	Y
	• Elevators designed to be safe for emergency egress	1	N/A	0
	12. Comfort			
	• Conventional enclosed lifts should be provided as an alternative to glass walled lifts	1	N/A	N/A
	• Handrails should be installed on all walls without doors	P	N/A	Y
	• A tip-up seat should be provided	1	N/A	0
	• Voice synthesis or recorded announcements to describe the floor reached and its contents	1	N/A	0
	• Operable parts of all calling buttons and control panels between 890mm and 1220mm	1	N/A	1

CURRICULUM VITAE

PERSONAL INFORMATION

Name Surname : Seyed Mohammad Amin Alavi Tabrizi

Date of birth and place : 07/10/1989 – Iran – Tabriz

Foreign Languages : Persian – English

E-mail : amin.alavi.t@gmail.com

EDUCATION

Degree	**Department**	**University**	**Date of Graduation**
Master			
Undergraduate	Architecture	Islamic Azad University	2012
High School	Mathematics and physics	Azadegan High school	2008

WORK EXPERIENCE

Year	**Corporation/Institute**	**Enrollment**
2010	Diba Naqsh Aria	Architect
2015	teamFORES	Architect

PUBLISHMENTS

Conference Papers

1. Monitoring Model for Universal Design in Educational Facilities