ACCESSIBILITY OF DISABLED TOILET FOR WHEELCHAIR USER IN PUBLIC BUILDINGS IN KUALA LUMPUR

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FACULTY OF ENGINEERING
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RESEARCH PROJECT SUBMITTED IN FULFILMENT OF THE REQUIREMENTS FOR THE DEGREE OF MASTER OF ENGINEERING (SAFETY, HEALTH AND ENVIRONMENT)

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ACCESSIBILITY OF DISABLED TOILET FOR WHEELCHAIR USER IN PUBLIC BUILDINGS IN KUALA LUMPUR

ABSTRACT

According to Department of Statistics Malaysia, the highest number of People with Disabilities (PWD) registered have physical disabilities where this group of people face difficulties in moving and executing task. As the population of PWDs in Malaysia is increasing, the demand for the right to access public buildings such as government institutions, transportations, tourist attractions and healthcare also has been rising especially in Kuala Lumpur. In this research, disabled toilet has been selected as the main facility to be assessed. Therefore, the two objectives for this study are to assess the accessibility of disabled toilet in public buildings in Kuala Lumpur and to evaluate the compliance or applicability of Malaysian Standard in the design of the disabled toilet. In order to measure the accessibility of disabled toilet, questionnaire survey is conducted where respondent's view and opinion on current condition of disabled toilet are collected. Next, two public building of four sectors which are healthcare, tourism, business or retails and transportation been chosen and access audit are been done by comparing the measurement with guidelines provided in Malaysian Standard (MS 1184:2014): Universal Design And Accessibility In The Built Environment. Based on the result obtained, it can be observed that Transportation sector received the lowest score for both in term of accessibility and applicability of Malaysian Standard while Healthcare and Business or Retails has the highest score which indicated that these two sectors had done a great job providing a barrier free facility. Items that need improvements are the height of toilet paper and installing an emergency alarm inside every disabled toilet.

Keywords: People with disabilities, ergonomic, disabled toilet, Malaysian Standard

KEBOLEHCAPAIAN KEMUDAHAN TANDAS ORANG KURANG UPAYA (OKU) UNTUK PENGGUNA KERUSI RODA DI BANGUNAN AWAM KUALA LUMPUR

ABSTRAK

Menurut Jabatan Perangkaan Malaysia, bilangan Orang Kurang Upaya (OKU) tertinggi yang mendaftar mempunyai kecacatan fizikal di mana kumpulan orang ini menghadapi kesukaran dalam mobiliti dan melaksanakan tugas. Seiring dengan meningkatnya jumlah penduduk OKU, permintaan akan hak untuk mengakses bangunan awam seperti institusi pemerintah, pengangkutan, tempat-tempat pelancongan dan penjagaan kesihatan juga meningkat terutama di Kuala Lumpur. Dalam penyelidikan ini, tandas kurang upaya telah dipilih sebagai kemudahan utama untuk dinilai. Oleh itu, dua objektif kajian ini adalah untuk menilai kebolehcapaian tandas kurang upaya di bangunan awam terutama di Kuala Lumpur dan untuk menilai kepatuhan atau perlaksanaan Piawaian Malaysia dalam reka bentuk tandas kurang upaya. Untuk mengukur kebolehcapaian tandas kurang upaya, tinjauan soal selidik dilakukan di mana pandangan dan pendapat responden mengenai keadaan tandas kurang upaya semasa dikumpulkan. Seterusnya, dua bangunan awam dari empat sektor iaitu penjagaan kesihatan, pelancongan, perniagaan atau runcit dan pengangkutan telah dipilih dan audit akses dilakukan dengan membandingkan ukuran berdasarkan panduan yang disediakan dalam Piawaian Malaysia (MS 1184: 2014): Reka Bentuk Universal dan Akses Persekitaran binaan. Berdasarkan hasil yang diperoleh, dapat diperhatikan bahawa sektor Pengangkutan memperoleh skor terendah baik dari segi kebolehcapaian dan penerapan Piawaian Malaysia. Bagaimanapun, Penjagaan Kesihatan dan Perniagaan atau Peruncitan mendapat skor tertinggi yang menunjukkan bahawa kedua-dua sektor ini telah memberikan kemudahan yang baik dan bebas halangan kepada pengguna. Tandas kurang upaya di kedua-dua sektor ini telah memenuhi sebahagian besar syarat yang

dinyatakan dalam standard dan yang kemudian menyumbang untuk menjadi contoh tandas orang kurang upaya yang boleh diakses. Item yang memerlukan penambahbaikan adalah ketinggian kertas tandas dan memasang penggera kecemasan di dalam setiap tandas yang kurang upaya.

Kata kunci: Orang kurang upaya, ergonomik, tandas kurang upaya, Standard Malaysia

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LIST OF SYMBOLS AND ABBREVIATIONS

PWD	Person/people with disabilities
MS 1184:2014	Malaysian Standard, Design and Accessibility In The Built Environment 2014
TBS	Terminal Bersepadu Selatan
CVS	Cardiac Vascular Sentral
KL Sentral	Kuala Lumpur Sentral
KLCC	Kuala Lumpur City Centre
WHO	World Health Organization
ICF	International Classification of Functioning, Disability and Health
SEA Games	Southeast Asian Games
PPKRM	Persatuan Pengguna Kerusi Roda Malaysia
EPPs	Entry Point Projects

CHAPTER 1

INTRODUCTION

1.1 Research Background

According to Malaysia's Vision 2020, there are nine strategic challenges had been highlighted in order for Malaysia to overcome and achieve and one of it is to establish a fully caring society. A fully caring society also includes the welfare of people with disabilities (PWD) where PWD shall have the same right to access public facilities located across the country (Rahim & Samad, 2010). According to Department of Statistics Malaysia, 453,258 persons across the country has been registered as PWD in 2017 under Department of Social Welfare. According to the statistical result shown, physical disabilities have the highest number and percentage compare to the other types of physical disabilities such as hearing and visually impaired and this numbers are predicted to keep increasing in future. Along this decade, Malaysia has proved great improvements in providing facilities to the people especially to PWDs community like wheelchair user. This include providing access ramps, wide parking spaces to move freely and suitable width length at the entrance of the buildings to accommodate wheelchair and also providing at least one disabled toilet at each of the toilet in the buildings (Jing, 2019). This is very important as where PWDs are entitled to be given equal opportunities to use facilities and to be in the public places.

Hence, all public buildings should provide facilities for PWD such as disabled toilet, ramps and many more. However, the design for the facilities must follow or obey the requirements outlined by the Malaysian Standard (MS 1184:2014): Universal Design and Accessibility In The Built Environment. In MS 1184:2014, its been highlighted and specifies

the range of provision and recommendation for the design that comprises construction and assemblies that related to accessibility aspect of buildings (Kamarudin, Hashim, Mahmood, Ariff, & Ismail, 2012). In addition, universal design refers to the holistic approach by the government for designing product, services and also environment that can be accessed to all including PWDs (Ezanee et al., 2011).

In this research, disabled toilet has been selected as the main focus subject where the accessibility of disabled toilet in public buildings in Kuala Lumpur are being evaluated. The Federal Territory Kuala Lumpur is the Malaysia's national capital where also been known as the nation most populous urban region according to the Bunnell, Barter, & Morshidi (2002). As the center of the country, people from all over the country emigrated to Kuala Lumpur to find jobs opportunity or to do businesses. Besides, people from all over the world also consider as a place that must be visited in Malaysia as the city has numerous attractions. In addition, travel and opportunities for PWDs in many countries are highly limited and usually been neglected as it usually is inaccessible (Zahari, N., Che-Ani, A., Abdul Rashid, R., Mohd Tahir, M. and Amat, 2019).

Therefore, as the heart of Malaysia, wide range of facilities should be given and provided in all sectors to accommodate all people without discrimination according to the guidelines by the Malaysian Standard. Moving towards a new era, this research may help to promote awareness regarding the right of PWDs and further improvement in designing can be made in future.

1.2 Problem statement

According to the World Health Organization (WHO) disabilities can be defined as an impairment in body function and limitation of activities which can be hindrance for the individual to execute task. There are over 1 billion people globally experience disabilities and 80% of the billion live in the Developing countries like Malaysia. In addition, previous research also highlighted the constant struggle faced by PWDs in the society due to inaccessible infrastructure at public buildings such as healthcare, transportation, business and tourism settings. This discriminations towards disabled people can lead to unbearable physical and emotional distress (Amin, 2016). Besides, there are 70 million of people reported needed a wheelchair where the key of wheelchair user effectiveness is the mobility or the ability to move in daily lives activities (Rispin, Hamm, & Wee, 2017). With of spaces needed and the limitations to move freely in different surfaces, PWD has faced this difficulties therefore wheelchair user has been an important key in designing.

As the population of PWDs is increasing, the demand for the right to access public buildings such as healthcare, transportations, tourist attractions and also shopping mall has been rising especially in city called Kuala Lumpur. Being one of the popular spotlights and high-tech city of the country, the need for the complete and perfect facilities is increasing (Yau et al., 2016). It is mandatory for all public buildings in Malaysia to provide an equal facility especially for PWDs which had been govern in Person with Disabilities Act 2008 (Isa, Zanol, Alauddin, & Nawi, 2016). However, although there have been some improvements had been made throughout this decades, it can be seen that Malaysia is still lacking term of designing and has a long way to go in providing facilities for PWDs especially for the disabled toilet. The inaccessible environment will limit the opportunity of

PWDs to get involve in many activities (Isa et al., 2016) Although some of the buildings has been implemented a user-friendly environment, the guidelines provided by Malaysian Standard for design has not been fully followed which can cause discomfort to the users.

1.3 Objectives

The aim for this study is to investigate the range of disabled toilet provided for PWD in public buildings. Generally, it can be seen that there are attempt made in designing and providing accessibility for the PWDs which giving barrier free environment where it gives PWDs the right to fully used the public facility just like others. This research also aiming to promote awareness about PWD and give professionals a full picture in current situation which can be as a push for improvement and future design. Therefore, there are two main objectives for this research which are:

1. To assess the accessibility of disabled toilet in public buildings in Kuala Lumpur.

2. To evaluate the compliance or applicability of Malaysian Standard in the design of the disabled toilet specifically located in Kuala Lumpur.

3. To highlight specific area or items that can be improved from current disabled toilet located in Kuala Lumpur.

1.4 Scope of study

This study main focus is to study the current disabled toilet facility in public buildings specifically located in Kuala Lumpur. In order to do that, two public buildings of each sector will be chosen for this purpose. The main sectors are transportation, healthcare, business or retails, and tourism. For transportation, Kuala Lumpur Sentral or KL Sentral and also

Terminal Bersepadu Selatan (TBS) are selected as it serves as the integrated transportation center which serve high number of users. Next, both Cardiac Vascular Sentral (CVS) and Sunway Medical center Velocity will be fall under healthcare sector for the investigation. To cater with business and retail sector, two shopping malls will be selected for this research study which are Midvalley Megamall and Sunway Velocity Mall. Last but not least, other places are KLCC and National Museum of Malaysia disabled toilet are chosen to represent tourism sector. Although PWD are fall under many categories, only wheelchair user will be the main topic of this study.

The public building chosen above are according to their significance and the regularity of public visiting in daily basis which the facility is supposed to be accessible and follow the standard requirement set by the Malaysian Standard

CHAPTER 2

LITERATURE REVIEW

2.1 Person with Disability (PWD)

World Health Organization (WHO) defined disabilities as in blanket term that covers any limitation, impairment and also restrictions of participation in any activities including with and without mobility. The term impairment is also can be considered as a problem which associated with body structure and its function while limitation is referring to difficulty that been faced by a person to execute a task. Last but not least, a restriction is a reduction of activities that a person can experienced in daily or life situations. In other words, person with disabilities or PWD is a special group of person that consist of various types of impairment such as physical, mental, sensory and intellectual which interaction with external factor can limit the involvement of the person in socials and activities. The classification of disabilities has been outlined by WHO in International Classification of Functioning, Disability and Health or also known as (ICF) where it use as a framework for measuring and describing individual's disabilities (Ezanee et al., 2011). The model or framework can be seen in the figure 2.1 below where it describes four domains which are body functions and structures, activities and participations, environmental factors and lastly personal factors (Deramore Denver, Adolfsson, Froude, Rosenbaum, & Imms, 2017).

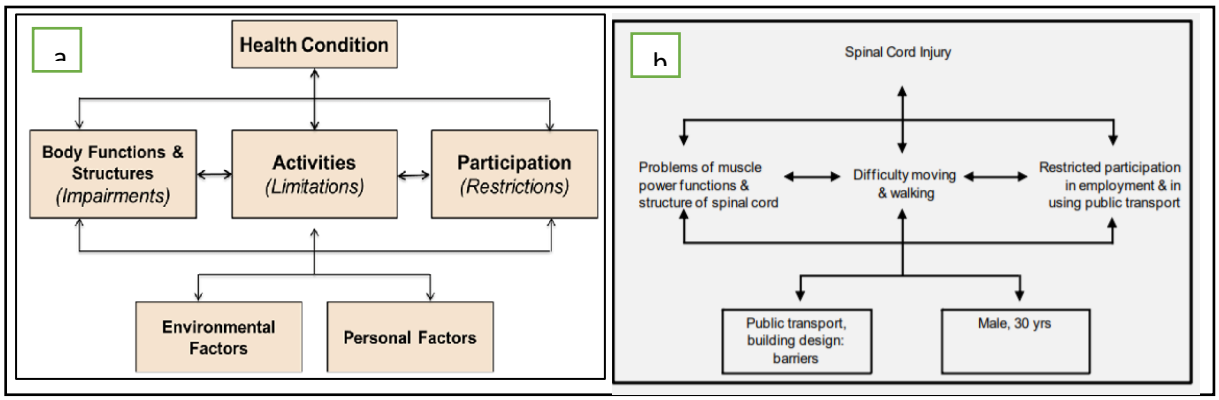

Figure 2.1 (a) ICF Model ; (b) Example of ICF model (Deramore Denver et al., 2017). .

For the body functions and structures, it describes the physiological and anatomical parts of body systems such as limbs and its functions while the impairment is subjected to the deterioration of body function. The activities and limitation highlight the difficulties faced by the PWDs to execute task. Next, the restriction of participation covers the inability of person to involve in many situations and activities and lastly the environmental factors and personal factors are defined as the environment on which people live and conduct their lives. The examples of ICF can be seen in figure 1(b) where it covers an individual with spinal cord injury that cause difficulties to move and walk and lead to restriction to participate in employment and in using facilities like public transport. In addition, the design of public transport which consider as environmental factors can also affect the person's involvement and participant. If the design of the public transport is barrier free, that person can access to the facilities provided.

2.1.1 Categories of PWDs

There are seven categories of PWDs that been outlined by the Malaysia Department of Social Welfare. There are PWDs that suffers disabilities in hearing, visual, speech, physical, learning, metal and multiple impairments in one body. Based on the statistic

detailed out by WHO, there are over one billion people that categorized as PWD and 360 million from the one billions are people diagnose with hearing impairment, 200 million for visual impairment and more than 70 million with physical disabilities and need a wheelchair to move and execute tasks (Mohd Noor, Abd Manaf, & Mohd Isa, 2018). A person is categorized under hearing impairment can be classified into two which are peripheral hearing loss and sensorineural hearing loss. Peripheral hearing loss refers as a conductive where it caused by the damage of the outer or middle ear. While for sensorineural hearing loss is a dysfunction that located in the spiral ganglion or in the cochlea. This type of impairment is divided into four levels which are minimum, medium, severe and profound (Quispe-Tintaya, 2017).

Next, a person is considered as visually impaired if both or one eye are unable to see or has limited view (Abdullah & Mey, 2011). Like hearing impairment, this type of disability also can be divided into categories which are low vision and blind where low vision people have eyesight less than 6/18 and for blind categories less than 3/60. If the person has inability to have a proper communication and interaction with surround people as the speech cannot be understand, it can be considered as speech impairment. Speech or language impairment consist of three basic types which are fluency disorder, articulation disorder and also voice disorder. For fluency disorder, the person may experience difficulties with timing and rhythm of speech which followed by repetition and prolongations of words and phrases. Articulation disorders is defined as errors in the speech production that may be related or due to the limitation of physiological or anatomical. Lastly, for voice disorders are considered as problem associated by disorders in larynx affected the voice quality. For children to be

diagnosed, assessment must be done at early age of five years old or older (Taylor & Zubrick, 2009).

Learning disabilities can be seen in person with intellectual capabilities is lower than the supposed to be based on the biological age. Learning disabilities can be due to neurobiological factors that alter the brain function which affect a person's ability to process problems and learn basic skills like writing and reading. This can be seen when a person cannot keep up with other person with others same age. Learning disabilities includes in an umbrella of Dyslexia, Dyscalculia, Dysgraphia, Non-verbal Learning disabilities and Central Auditory Processing Disabilities (Kulkarni, Karande, Thadhani, Maru, & Sholapurwala, 2006). A person who diagnosed with Dyslexia experienced a learning disability that affects reading and other related language-based processing skills such as unable to decode words especially in order of the letter. While for Dyscalculia affect one's mathematical skills where the person had trouble in learning mathematical facts like symbols and time. For Dysgraphia, the affected area are motor skills and handwriting. This can be seen when a person diagnosed with Dysgraphia has difficulty to write a consistent letter like using lowercase or capital in words and sentences. For Non-Verbal Learning Disabilities and Central Auditory Processing Disabilities comprises of difficulties in understanding language and difficulties in processing language related tasks.

For mental disability, the person has inability to fully or partly function in maters that related to his or her own and with community due to severe mental illness such as Schizophrenia, Delusional Disorder, Paranoia and many more (Kumar, 2018). While Multiple disabilities refer to an individual that diagnosed with more than one disability and last but least physical disability.

2.1.2 Physical Disability

Physical disability or physical impairment is defined as a limitation or an inability on one's physical mobility, functioning, stamina and also dexterity. Dexterity is fine motor skill which includes small muscle's coordination movement usually focusing on hand movement. For instance, a good dexterity can be described as a person who has an ability to use hand skillfully, coordinated and in precise way. A physical disability can be classified as temporary, short term, long term or permanent. A physical disabilities condition can be due to several causes or occasion like disease which develops throughout the body systems like neuromuscular for system involving cardiovascular and nervous and orthopedic for musculoskeletal system. Examples of physical disabilities are amputation, arthritis cerebral palsy, spinal cord injury and brain injury. Majority of person with physical disabilities listed before requires a tools or mobility aid to move and continue the daily lives routine independently without other people. The most common mobility aid are crutches and wheelchair. Crutches is a common mobility aids or walking aid which the purpose is to provide a base support. Basically, crutches function is to transfer weight from legs to upper body and usually been used by person who had limitation in using their one leg. While wheelchair is basically a chair that been mounted with wheels which serve the purpose as mobility aid or device for person that had mobility disability.

Based on the annual report produced by Department of Statistics Malaysia, among the 453,258 PWDs registered, 35.2% of the community suffered physical disabilities and depending on mobility aids to move and to do daily routine activities. this can be seen in table 2.1 below where it shows that there are many types of disabilities and it can be varying for different age group from child as early as age five years old to grown adult and elderly.

It also can be seen from the table that wheelchair user amount is significantly increase as age of the human increase. This is because, a grown adult or elderly have high chance to suffer chronic disease where it will gradually affect the body systems and subsequently reduce the quality of life(Requejo, Furumasu, & Mulroy, 2015). Therefore, an appropriate design must be done in build environment so that it can be access by all including PWDs of difference age group (Rahim & Samad, 2010)

Table 2.1: Category of PWD by age group and gender

Kumpulan Umur / *Age Group*	Penglihatan *Vison Impair*		Pendengaran *Hearing*		Fizikal *Physical*		Masalah Pembelajaran *Learning Disabilities*		Pertuturan *Speech*		Mental *Mental*		Pelbagai *Others*		Jumlah *Total*	
	L *M*	P *F*	L *M*	P *F*	L *M*	P *F*	L *M*	P *F*	L *M*	P *F*	L *M*	P *F*	L *M*	P *F*	L *M*	P *F*
Kurang dari 6 tahun / *Below 5 years*	82	71	119	101	420	320	957	608	14	11	6	2	239	168	1,837	1,281
7 - 12 tahun / *years*	173	116	171	144	424	316	1,788	1,085	53	29	9	4	289	177	2,907	1,871
13 - 18 tahun / *years*	181	117	192	134	539	343	1,128	702	12	6	42	35	128	91	2,222	1,428
Jumlah / *Total* (a)	**436**	**304**	**482**	**379**	**1,383**	**979**	**3,873**	**2,395**	**79**	**46**	**57**	**41**	**656**	**436**	**6,966**	**4,580**
19 - 21 tahun / *years*	105	49	92	72	395	206	522	304	6	4	86	48	70	42	1,276	725
22 - 35 tahun / *years*	465	277	371	298	1,418	761	884	704	33	34	707	462	253	174	4,131	2,710
36 - 45 tahun / *years*	418	257	217	191	1,321	746	412	351	36	14	801	515	196	111	3,401	2,185
46 - 59 tahun / *years*	752	451	377	329	1,809	1,156	294	245	19	18	682	556	231	147	4,164	2,902
60 tahun ke atas / *60 years and above*	627	379	400	239	1,450	956	60	67	17	5	218	176	155	99	2,927	1,921
Jumlah / *Total* (b)	**2,367**	**1,413**	**1,457**	**1,129**	**6,393**	**3,825**	**2,172**	**1,671**	**111**	**75**	**2,494**	**1,757**	**905**	**573**	**15,899**	**10,443**
Jumlah / *Total* (a + b)	**2,803**	**1,717**	**1,939**	**1,508**	**7,776**	**4,804**	**6,045**	**4,066**	**190**	**121**	**2,551**	**1,798**	**1,561**	**1,009**	**22,865**	**15,023**

2.1.3 Anthropometric Measurement for Wheelchair user.

Anthropometric data or measurement can be defined as a measurement on the physical properties of human body quantitively and systematically (Bragança, Castellucci, & Arezes, 2018). The function of anthropometric data is to optimize the use, fit and also function of a design or product. There are basically three general and basic choices for anthropometric data which are design for the average, design for adjustability and also design for extremes. Next, the relevant body dimension and a specific task must be determined and proceed with deciding the percentile of the population. The common percentile used in

ergonomic measurement are fifth percentile, 95th percentile and 50th percentile. The fifth percentile will represent a population of small body figure while 95th percentile will accommodate a big and taller body. For the 50th percentile, the average body figure will be represented. (Mohamad, Deros, Ismail, Darina, & Daruis, 2010).

The main elements for anthropometric measurements are the person's weight, height, circumferences of the body that include hip, waist, limbs and thickness of skinfold. The importance of this measurement are to have a diverse range of optimize dimensions (Pomohaci & Sopa, 2017). According to Adnan & Dawal (2019), an anthropometric data that inclusive must consist of able-bodied and disabled-bodied of adults, children from primary to secondary and elderly. Besides that, different countries tend to have difference in anthropometric measurement for the people due to several reasons such as genetic and climate.

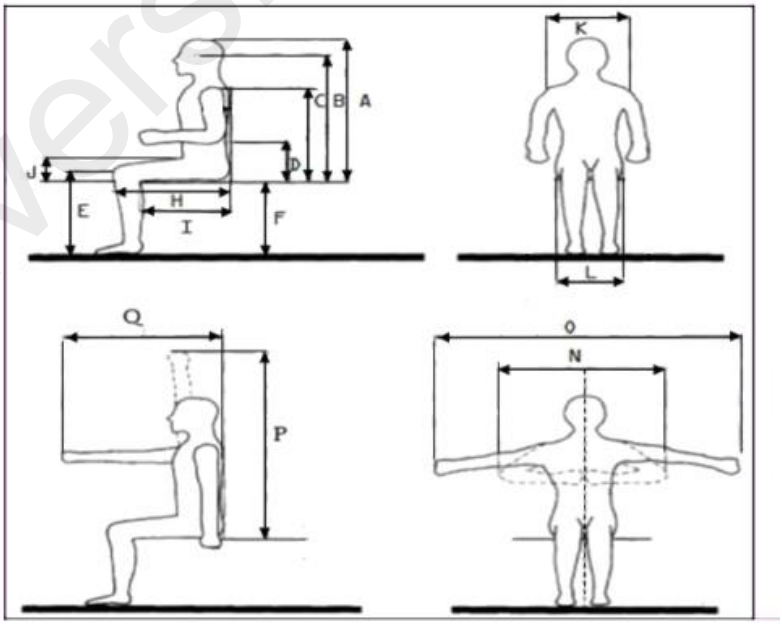

Figure 2.2: Measurement on subject's body

Table 2.2: Anthropometric Dimension Description

Symbol	Measurement	Description
A	Sitting Height	Vertical distance from the sitting surface to the vertex
B	Sitting Eye Height	Vertical distance from the sitting surface to see an outer corner of the eye
C	Sitting Shoulder Height	Vertical distance from the sitting surface to acromion (a landmark on the tip of the shoulder)
D	Sitting Elbow Height	Vertical distance from the sitting surface To the underside of the elbow.
E	Sitting Knee Height	Vertical distance from the foot surface to the upper knee
F	Sitting Popliteal Height	Vertical distance from the foot surface To the bottom of the thigh just behind the knee.
H	Buttock Knee Length	Horizontal distance from the back of the uncompressed buttock to the front of the kneecap
I	Buttock Popliteal Length	Horizontal distance from the back of the uncompressed buttock To the popliteal angle, at the back of the knee.
J	Thigh Clearance	Vertical distance from the sitting surface To the highest point on the top of the thigh.
K	Shoulder Breadth	Distance across the Maximum lateral protrusions of the right and left Deltoid muscles.
L	Hip Breadth, sitting	Maximum horizontal distance across the hips of a seated subject
N	Elbow Span	Lateral maximum elbows (Distance between left and right elbow when elbow in horizontal position)
O	Span	Widest distance across the arm (Distance between the tips of the third fingers when the arms are stretched out horizontally)
P	Arm Reach Upward	Highest Distance when arm doing overhead reach during sitting, Vertical Distance from the sitting surface to longest fingertips.
Q	Arm Reach Forward	Horizontal Distance between back of shoulder to longest finger tips (when hand is extended horizontally)

Table 2.2 and figure 2.2 above shows the required measurements needed, its descriptions and the measurements on the subject's body for reference. The measurement must be done when the person is sitting with thigh and surface are parallel to each other and 90 degrees flexed 90 degrees. The data collected can be used for designing product which inclusive and can be used for all including wheelchair user. Usually, the tools that been used for these measurements are anthropometer, measuring tape, stadiometer and also caliper (Goher, 2016).

2.2 Wheelchair

Wheelchair is a tools or device that move when propelled by the user or by another person. As mentioned before, wheelchair users are usually having limitation in movement and it has been used by all from children to adults and also elderly. Wheelchair not only specific for people with permanent impairment but also for those in needs such as pregnant women, and elderly that have difficulties walking in long distance. Wheelchair is considered as an importance device as it gives benefits to many especially for PWDs where it gives hope and opportunities to conduct daily routine like others. It also convenient for other group of people such as health care workers, carer or individuals that need to look after sick family members where it can be used transfer and move the person from one place to another (Requejo et al., 2015).

2.2.1 Wheelchair's Types and Design

According to WHO, the design for wheelchair is based on several factors which are the physical requirement of the users, the environment and how it will be used and also the material, current technology that available in the market and where it is produced. It comprises of different method of propulsion, the control mechanism and the technology. There are currently consist of wide varieties of wheelchair around the world. As mentioned above, the varieties depend on the needs of the user itself.

For example, for user that need to travel or spend more time outdoor are recommended to have a portable or folding wheelchair with lightweight materials such as titanium, carbon and aluminum. This is because, this type of wheelchair is easy to bring, occupy less space and convenient to use. Although folding wheelchair is easier to be used

and travelled compared to the rigid frame wheelchair, this type of wheelchair is considered as nondurable because of the frame itself easier to be damaged especially by wear and tear process. however, maintenance can be done to ensure the wheelchair's parts in good condition.

Other examples of wheelchair are for those that need for postural support and usually this type of wheelchair is custom made to made fit the requirements of users. This condition required for wheelchair design specifically to support the back of the user so that user can be comfortably using it. In addition, development of technology also contribute to the design of wheelchair where latest technology such as motion controlled electrical wheelchair been produced which can be beneficial to the user to be independent and practical (Eu et al., 2014). As wheelchair takes up plenty of spaces, universal design of places and buildings need to be done for wheelchair user to be given equal right especially in public building and services (Giesbrecht, Miller, Mitchell, & Woodgate, 2014). Figure 2.3 below are the examples of wheelchair that available in current market.

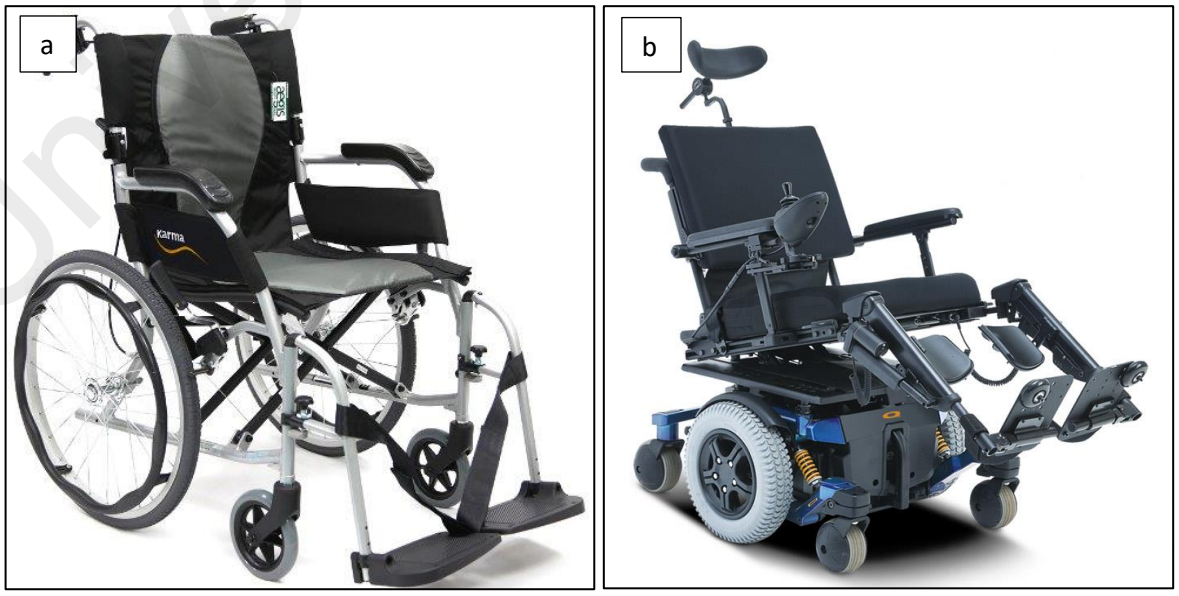

Figure 2.3 Types of wheelchair (a) Manual foldable wheelchair (b)Automated custom-made wheelchair

2.3 Current Accessibility of Public Buildings

In 1991, Malaysian fourth and seventh prime minister had introduced Vision 2020 or widely known as “Wawasan 2020” where the objective of it is for nation to achieve a self-sufficiency in many aspects by the year 2020. This vision comprises every aspects of life such as education, economic, politics, psychological and also social well-being. There are nine strategic challenges outline at that time by Tun Mahathir Muhamad and one of them is challenge 7 where it is focusing on establishing a fully caring society. This challenge focusing on to establish a fully caring society and also inside a social system which also can be described as a society that care to each other before self. This includes the welfare of all people without discriminate any age, gender, race and religion. By referring to this challenge, it can be related to the right of PWD to get equal access to the facilities especially in public buildings. If comparison been made throughout the years, it can be seen that there are plenty of improvements had been made especially in term of accessibility to accommodate the increment of PWDs year by year.

. According to Kadir & Jamaludin (2012), The improvements that had been showed is a result of establishing regulations which known as Code of Practice of Employment of Disabled Person in Private Sector and Persons With Disabilities Act In 2008. The aim of establishing this act is to taking care of PWD’s welfare and to give an equal right and access to facilities and services provided in the any buildings throughout the country. By having this act, people had to be responsible and alert in designing and providing public facilities for all range of people. However, all professional people including enforcer need to come together as a team to make it happen. For instance, a developer and architect designer need to plan beforehand and revise all the plan and design to make sure there are area specifically provided

to accommodate this community. Besides that, enforcer also had to take initiative to revise the current act and revise whenever it is relevant. A stricter law or act also recommended such as incentives and compound in order to encourage people to follow the act outlines by the.

Some of the sectors that had took the initiative to include PWDs facilities such as disabled toilet and ramps in the buildings are healthcare sectors which is hotel, shopping malls , transportation and also tourism sectors like tourist attractions and accommodation like hotel. However, although a planning had been done, one study had found that the current hotel provided to accommodate all person is inaccessible for wheelchair user. This is due to a narrow door and spaces of the disabled toilet.

(Isa, Zanol, Alauddin, & Nawi, 2016).

Furthermore, although facilities for PWD are presence, the design and measurement must follow the guidelines that has been outline by the government stated in Malaysian Standard for the facilities to be labeled as accessible (Niya, 2015). Nevertheless, although the current level of accessibility to facilities are increases day by day, it is noticeable that only few that fully follow the requirement which approved by the Malaysian Standard. and also for tourist attraction (Rashid, Hussain, Yusuff, & Norazizan Syed Abd Rashid, 2008). Table 2.3 below shows the current condition of a hotel room where it is inaccessible for wheelchair user and the recommendation proposed for the situation.

Table 2.3: Access audit element in Hotel

ELEMENT	DESCRIPTION OF EXISTING FEATURES	PROPOSAL / RECOMMENDATION
HOTEL ROOM  Figure 13. Wheelchair users entering the room.	**Wheelchair Users** - The room is accessible. Unfortunately, the door width at the toilet is too narrow for wheelchair users. There is a threshold of 1 inch before entering the toilet. Circulation area is acceptable. However, it is difficult to obtain access for wheelchairs and is impossible to enter the shower. The bath tub is also inaccessible. - Toilet door is too narrow (750 mm)	- Increase the door width at the toilet from 760 mm to 1000 mm. - Remove the threshold at the main entrance door for wheelchairs. - Remove the glass door, provide a curtain and remove the threshold at the shower area. - Shower door opening should be 1000 mm wide.

2.4 Malaysian Standard.

In Malaysia, government had established a standard in order to ensure PWDs can access to facilities like able person. Malaysian Standard or MS 1184:2002 Code of Practice on Access for Disabled Persons to Public Building (First Revision) and MS1184:2014 Universal Design and Accessibility In The Built Environment (second revision) are developed by Department of Standard Malaysia to be used as a guideline where it provide all the requirement needed for may elements in built environment such as construction, components, assemblies and fittings.

These requirements can also be used for designing facilities of structural building where it covers all groups of people and every aspect such as the access and circulations to and into the buildings and also for normal situation or events and evacuation in the case of emergency. These standard are applies to all public buildings including landed properties, administrative and commercials buildings like hotels, shops and banks, transportation, health services such as clinics and hospitals, recreation and entertainment building such as cinemas and stadium for sport, religious buildings, tourist attraction building and also in education sector like school and university (Chuong, 2007). According to Kamarudin, Hashim, Mahmood, Ariff, & Ismail (2012), both standard outlined the requirements based on the human abilities principal where need to be adhered upon designing. The design requirement needs to be inclusive and benefit to all including people with many impairments and also for people with all age range and status.

2.4.1 Design for Disabled Toilet according to Malaysian Standard (MS)

A disabled toilet or accessible toilet is one of the facilities provided specifically design to accommodate PWDs that face difficulties in accessing a regular toilet facility located in a public building. The design of disabled toilet can be explained in term of ergonomic study (Tee et al., 2017). Ergonomic or also known as human factor can be defined as a scientific discipline which concerned about human interactions and other elements or external factors. This implies to optimize an overall human being and system performance. In other words, ergonomic study focusses on giving comfort to the user in specific environment such as working environment. therefore, it can be said that ergonomic designs are needed for disabled toilet specifically for PWDs so that the facility can be accessed.

There are several differences between regular toilet and disabled toilet such as the equipment provided, space, the overall layout and even lighting. This is because, PWDs requires much more space to move and additional equipment like grab rails and emergency button for safety purpose. The function of grab rail if for the wheelchair user to hold during the transfer process from wheelchair to wash or toilet basin. In addition, the measurement for the general equipment such as sink, and toilet paper roller also need to be accordance to the anthropometric measurements which had been summarized in the guidelines provided by Malaysia Standard.

There are several items in guidelines provided by Malaysian Standard focusses on the disabled toilet and the item listed must be followed or implemented in every disabled toilet located in Malaysia. the general requirement stated is that the toilet facilities must can be used by all group of people which include all gender and all age group. besides that, at least one disabled toilet should be provided and the disabled toilet's signage or symbols showing the location of the facility need to be displayed and can be seen clearly. The general layout and design of the disabled toilet can be seen below in figure 2.4. based on the measurement given and stated in the MS1184:2014, checklist or access audit can be done to assess the applicability of Malaysian Standard in designing specifically for disabled toilet.

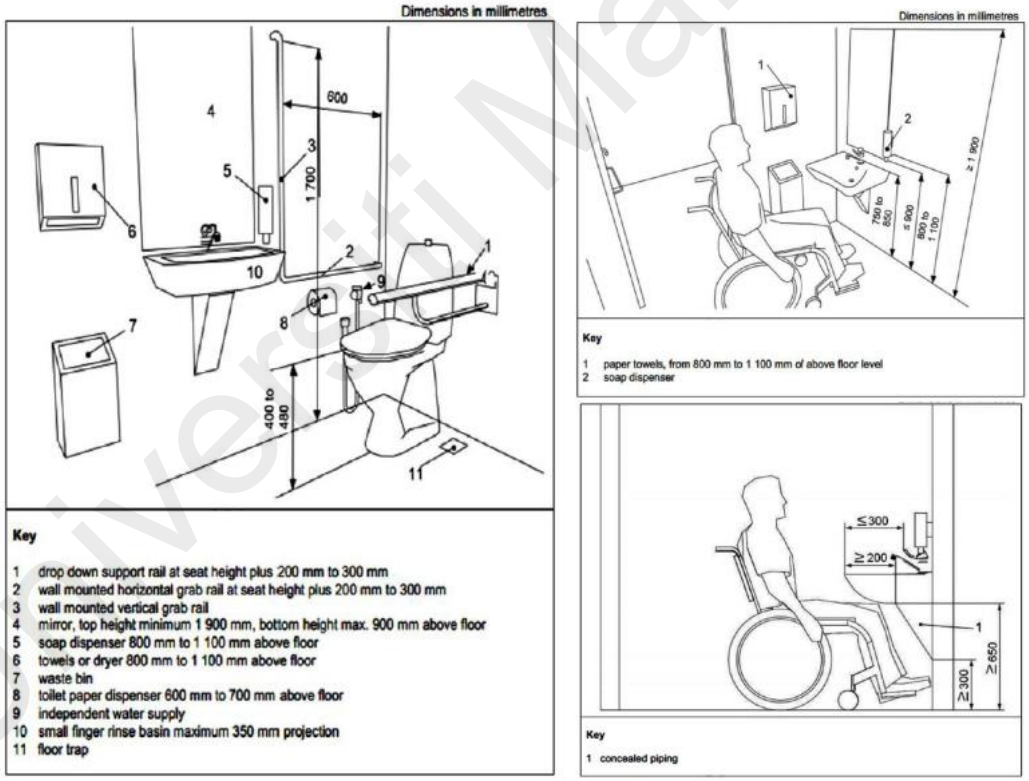

Figure 2.4: Measurement for disabled toilet stated in MS1184:2014

2.5 Importance of Kuala Lumpur as subject matter

The capital city of Malaysia, Kuala Lumpur had been widely known as one of the important and busiest cities in Asian. This city also considers as the largest city in Malaysia where Kuala Lumpur has always been recognized as the center for many sectors and activities like cultural, financial and also economic. Besides that, Kuala Lumpur also consist of administrative buildings where it can be shown that Parliament Malaysia and Istana Negara also located in this big city. The Importance of Kuala Lumpur can be proved since long time ago when Kuala Lumpur had been chosen to conduct and host many major international events in both political and sports. For instance, on 1998, the XVI Commonwealth Games event was been held in Kuala Lumpur Malaysia which it was the first time been conducted in Asian country. Besides that, the 2017 Southeast Asian Games (SEA Games) also known as Kuala Lumpur 2017 is also major sports event that took place in Kuala Lumpur. the sport event comprised of participant from 11 countries around Southeast Asia. Therefore, it can be said that Kuala Lumpur is widely known and can be consider as an important city in Malaysia(Yau et al., 2016). In addition, as the one of the leading cities in the world where Kuala Lumpur has been recognized for tourism and shopping, this city has been ranked 10th for most visited city in 2017. According to Bunnell, Barter, & Morshidi (2002), Kuala Lumpur has been emerge as an urban region where recognized as ‘all happens in Kuala Lumpur’ by Malaysian. This is because most of the people from around the country migrate to Kuala Lumpur to start a better life where this city promises higher amount of job opportunities and demand for business to happen. As the population in Kuala Lumpur is expected to increase, the facilities provided must be improved in order to cope with the

demand. This include all sectors, both government and private to cooperate and deliver a conducive environment.

In Entry Point Projects (EPPs), there are nine goals that supposedly to be achieved by 2020 for Greater KL project. One of the projects is EPP number eight which it highlights a comprehensiveness of pedestrian network that covers the accessibility for all including for the elderly and for disabled community (Yau et al., 2016). This shows the governments see the importance of disabled communities where improvement of facilities for disabled can contribute to the nation's economy especially on the heart of country's Kuala Lumpur. Furthermore, according to Sanmargaraja, Tunku, & Rahman (2015), tourism sector also contribute largely to the economy. Because of that, all tourism sectors must have initiative to take actions such as providing barrier free environment to attract all tourists including disabled tourist. An accessible tourist attraction not only beneficial for PWDs community but also for elderly, pregnant ladies and also parents with child gear such as baby pram or stroller (Sanmargaraja, Tunku, & Rahman, 2015). Therefore, it can be said that Kuala Lumpur is a crucial part of the country where the design and the facilities need to be comparable with the reputation and importance in world's eye. Public buildings in various sectors such as administrations, health, educations, and tourism need to be seen and improve so that not only the facilities can be access by able person, but also for disable person or PWDs.

CHAPTER 3

METHODOLOGY

3.1 Introduction

In this chapter, the methods will be explained and discussed throughout this project. This chapter will be described in various sections to fulfill the objectives of this study. The first section of the methodology is the questionnaire survey to wheelchair user about the current condition and level of accessibility of disabled toilet in Kuala Lumpur. This section will give the general view and opinions regarding the current condition of disabled toilet and improvements that can be made in future. Next, the second part of this chapter is about the applicability of Malaysian Standard or MS1184:2014 Code of Practice on Access for Disabled People to Public Buildings. In the guidelines, all the minimum requirement for disabled toilet has been outlined such the measurement where it is based on the anthropometric measurement of Malaysian people which the purpose is to provide comfortability to the user. Therefore, the access audit will be based on the checklist and documented result be analyzed qualitatively. Besides, photographic documentation also will be taken for further analysis and arguments of the current disabled toilet in public building in Kuala Lumpur.

3.2 Questionnaire Survey

For this section of methodology, data was collected by using questionnaire survey which been conducted through online survey forms, phone calls and emails which been distributed for about 2 weeks. The survey questionnaire consists of two parts namely as Part

A and Part B. For Part A of this survey questionnaire, it required information of respondents' background which included the age, gender and occupation. For part B, is concerning about respondent's view and experiences on using disabled toilet located in Kuala Lumpur's public building. this part emphasized the level of accessibility of the current disabled toilet that existed in Kuala Lumpur.

The samples are wheelchair user that lived in Kuala Lumpur. Therefore, the population of wheelchair user selected as the target group for this survey study are from registered member of Persatuan Pengguna Kerusi Roda Malaysia (PPKRM) that lived in Kuala Lumpur. The questionnaire has been distributed for the data collection. The total wheelchair user that lived in Kuala Lumpur registered under PPKRM are about 26 persons. However, the samples collected is only 24 persons which covered 92.31% from the total of community. The calculation for the sample size is shown below:

$$\textit{Sample size (\%)} = \frac{N}{n}\ x\ 100$$

Therefore,

N= 24, n = 26,

$= \frac{24}{26} \times 100$

= 92.31%

The collected data will be analyzed by using SPSS software. Various statistical analysis will be done such as bar graph and pie chart for data presentation. The SPSS software is widely been used for data analysis when the population and the sample size is big as the result will be relatively more precise and accurate. In addition, by using this software, frequency and mean analysis can be calculated to obtain the general condition of the current disabled toilet

in public buildings located in Kuala Lumpur. The frequencies of the data collected will be calculated by using the scoring formula shown below:

Score (x) = f × score (1,2,3,4 or 5)

Furthermore, respondents' opinion or data index for each question can be identified by calculation the average through mean formula shown below:

$$\overline{X} = \frac{\sum X}{N}$$

Mean= [(f × score 1) + (f × score 2) + (f × score 3) + (f × score 4) + (f × score 5)]

The scoring index is based on the level of respondents' satisfaction regarding accessibility of disabled toilet located in various sectors of public buildings in Kuala Lumpur. The scoring index is translated as below:

Table 3.1: Scoring index

Index	**1.0**	**2.0**	**3.0**	**4.0**	**5.0**
Description	Strongly disagree	Tend to disagree	Neutral	Tend to agree	Strongly agree

3.3 Access Audit

In this section of methodology, eight public buildings from various sectors being assessed in this research study. Four sectors consist of Health Sector, Tourism Sector, Transportation Sector and Shopping Centre Sector been selected and two public building from each sector is been chosen for this assessment. These buildings are Cardiac Vascular Sentral Kuala Lumpur (CVSKL), Sunway Medical Centre Velocity, Kuala Lumpur City Centre (KLCC), National Museum Malaysia, Kuala Lumpur Sentral (KL Sentral), Terminal Bersepadu Selatan (TBS), Midvalley Megamall and Sunway Velocity Mall.

This data collection involved site observation of the eight selected public buildings specifically for the disabled toilet. Next, measurement is taken inside the disabled toilet and compared with the guidelines provided inside the Malaysian Standard or MS1184:2014 Code of Practice on Access for Disabled People to Public Building. The checklist used for the access audit are based on the guidelines stated. The table below is the checklist used for the access audit conducted.

Table 3.2: Checklist for access audit

No	Standards	Applicability	Remarks
1	At least one disabled toilet must be provided for wheelchair user.		
2	Clearly shown disabled toilet signage		
3	Emergency alarm including reset control must be install at 800mm-1100mm height from floor		
4	The entrance must be minimum of 900mm x 900		
5	The door must be opened to outside direction with width of at least 800mm.		
6	The floor must not be slippery		
7	The size of the toilet must at least 1700mm x 2200mm for wheelchair user		
8	Requirements for wash basin: I. Height 400mm-480mm II. Minimum distance from the wash basin to the back wall is between 650mm to 800mm III. Minimum distance from the wash basin to the side wall must be 250mm.		
9	Grab rails must be placed at both sides at distance of 300mm to 350mm from the wash basin and the minimum distance to wall must be 40mm. If there is wall besides, the rails must have height of 200mm to 300mm from the wash basin and 1700mm from the floor.		
10	Requirements for the equipment in the disabled toilet I. Soap dispenser, tower or dryer must be 800mm-1100mm height from the floor II. Toilet paper dispenser: 600-700mm height from the floor III. Mirror: not more than 900mm height from the floor.		
11	Sink must be provided in the toilet		

12	The height of the sink should be between 750mm to 850mm from the floor.		
13	Distance to the sink's pipe must not exceed 300mm		

3.4 Summary

It can be summarized that there are two different method been used in this research project which served for two different objectives. The first method which are the questionnaire survey is to collect data which focused on the accessibility of the current disabled toilet provided inside the public buildings in Kuala Lumpur. this can be proved by gathering user's experiences and opinions. The questionnaire also focused on the 4 different sectors to reflect with the second objective. next, the second method been used is the access audit where two public buildings from four sector are selected and been assessed. The assessment is by using access audit checklist where the items been highlighted are referring to the guidelines by Malaysian Standard MS1184:2014.

CHAPTER 4

RESULT AND DISCUSSION

4.1 Introduction

This study had been conducted to achieve the two main objectives stated in chapter 1. In this section, the collected data or result will be presented and discussed to serves the purpose of this project. The first part of this section will be mainly focus on the accessibility level of disabled toilet which located in Kuala Lumpur specifically for wheelchair user. The second part of this section will be focus on the applicability level of current disabled toilet in Kuala Lumpur's public buildings. The data collected by using access audit or checklist is analyzed and will be presented in this section. The results for each section will be further discussed throughout this chapter.

4.2 Demographic Data

The demographic data for this study showed and recorded the respondent's background which included gender, age, occupation, categories of wheelchair user and types of wheelchair used. As mentioned in previous chapter, the target population is registered member of Persatuan Pengguna Kerusi Roda Malaysia (PPKRM) that lived in Kuala Lumpur. Table below shows the descriptive analysis of the demographic data of this study.

Table 4.1: The Demographic data collected

Variables	Frequency	Percentage
Age		
18-25 Years Old	7	29.2%
26-40 Years Old	9	37.5%
41-55 Years Old	7	29.2%
> 55 Years Old	1	4.2%
Gender		
Male	15	62.5%
Female	9	37.5%
Occupation		
Student	4	16.7%
Worker	17	70.8%
Retiree	3	12.5%
Categories of Wheelchair User		
Independent wheelchair user	24	100%
Dependent wheelchair user	0	0%
Types of wheelchair use		
Manual wheelchair	12	50%
Automated wheelchair	12	50%

Based on the data collected from the part A of questionnaire survey, 37.5% of the registered PPKRM member that lived in Kuala Lumpur age are ranges from 26-40 years old. Both age ranges 18-25 years old and 41-55 years old have equal portion with 29.2% from the total number of sample size. The general condition to be a registered member of PPKRM is to be above 18 years old. Thus, the sample size ages variation starts from the age of 18 up to above. Only 1 person from the group of age above 55 years old with 4.2% is presented in this study. 62.5% of the data collected was represented by the male respondents and balance of 37.5% was female respondents. Referring to the occupation, majority of respondent are worker and 16.7% and 12.5% are student and retiree respectively. In the table above showed that 100% of the respondents are independent wheelchair user. this indicates that all the

respondents have freedom in terms of mobilization and does not requires any assistance to perform their daily routine and task. Next, the types of wheelchair use by the respondents are subjected two which are manual wheelchair and automated wheelchair. There is equal number of respondents that use manual wheelchair and automated wheelchair.

4.3 Views and Experiences of wheelchair user

In this section, data collected in part B of the questionnaire survey is analyzed. Respondent is given nine questions regarding their views and experiences of using disabled toilet in public buildings at Kuala Lumpur. This questionnaire also includes specific questions in respects to current accessibility of disabled toilet for four different sectors to compare in next section. The data is been analyzed by comparing the mean differences between the score given for each question. The mean score for the nine questions given is been highlighted in the table below.

Table 4.2: Mean score for each survey questionnaire's survey

Item	Descriptions	Mean score
Q1	There are enough disabled toilets in public buildings in Kuala Lumpur to allow me to leave home without significant worry or concern about needing to use the toilet	2.625
Q2	There is enough information about the location of the disabled toilets and facilities their offer	3.750
Q3	There are sufficient disabled toilets for me to be able to meet family or friends in public buildings	2.833
Q4	There are sufficient disabled toilets for me to be physically active as I would like to be	1.750
Q5	Disabled toilet located in public building in Kuala Lumpur are accessible and comfortable to be used	2.500
Q6	Tourist attraction places have sufficient disabled toilet facilities	3.250
Q7	Hospitals located in Kuala Lumpur have an accessible disabled toilet facility	4.625
Q8	Transportation Hub in Kuala Lumpur have sufficient disabled toilet facilities to enable us to travel easily	2.042

Q9	Shopping Mall have sufficient disabled toilet facilities to enable me to shop there	4.458

In summary, the data above was been analyzed to get a mean value for each question regarding respondents' experiences and views. The highest mean score reflected as the most satisfaction regarding experiences, accessibility and overall view on the current condition of disabled toilet rated by respondents which comprises of wheelchair user. The lowest mean score indicates that the respondents view in the accessibility of the disabled toilet located in Kuala Lumpur need more improvements.

For question 1, the mean score is 2.625 which is relatively low where it indicates that respondents still have worries to go out due to the low availability and accessibility of disabled toilets. For the next question, the mean score is 3.75 which it considered as neutral where it shows that respondents in view that there is enough information about the location of the disabled toilets and facilities in Kuala Lumpur and signage is one of the indicators that usually been put to show the location of the disabled toilet in public buildings. Next, with mean score of 2.833, it can be observed that there are insufficient number of disabled toilets in public buildings in Kuala Lumpur based on respondents' experiences. Question 4 has the lowest value of mean score compare to others with 1.750. Most of the respondents agreed that insufficient number of disabled toilets had restricted respondents' desire to be physically active. For question 5, the mean score is 2.50 where respondents tend to disagree that the current disabled toilet in Kuala Lumpur are accessible and comfortable to use.

Question 6 to question 9 reflects the accessibility of disabled toilet in four different sectors. The four different sectors described in this part are business or retail sectors, tourism sector, transportation sectors and last but not least healthcare sector. The questionnaire given

to respondent are regarding the level of accessibility of current disabled toilet located in public building in Kuala Lumpur. Lowest mean score indicates that the sectors has lower in term of accessibility rated by respondents while higher mean score indicates that the current facility are good and accessible by wheelchair user. Table and bar chart below describe the analysis for this part. Healthcare sectors score the highest mean value of 4.625 with 62.50% respondents strongly agree that public building under healthcare sectors such as hospital has a sufficient amount of disabled toilet and can easily be accessed by wheelchair user.

Business or retail sector score second place with mean score of 4.458 where half of the respondent strongly agree that retail and business sectors provide an accessible disabled toilet especially in shopping mall. Next, tourism sector achieves mean score of 3.250 and it can be observed that there are portion of 16.67% respondent in view that this sector is not fully accessible by wheelchair user. Last but not least, the least mean score receives by transportation sector. For this sector, the focus is on the transportation hub or also known as transport interchange where passengers can exchange the mode of transport. This sector receives 2.042 mean score where 25% of the respondents had experience difficulties to travel due to the inaccessible of disabled toilet in transportation hub located in Kuala Lumpur.

Table 4.3: Mean score table

Sectors	Mean Score (highest to lowest)
Healthcare	4.625
Business/Retail	4.458
Tourism	3.250
Transportation	2.042

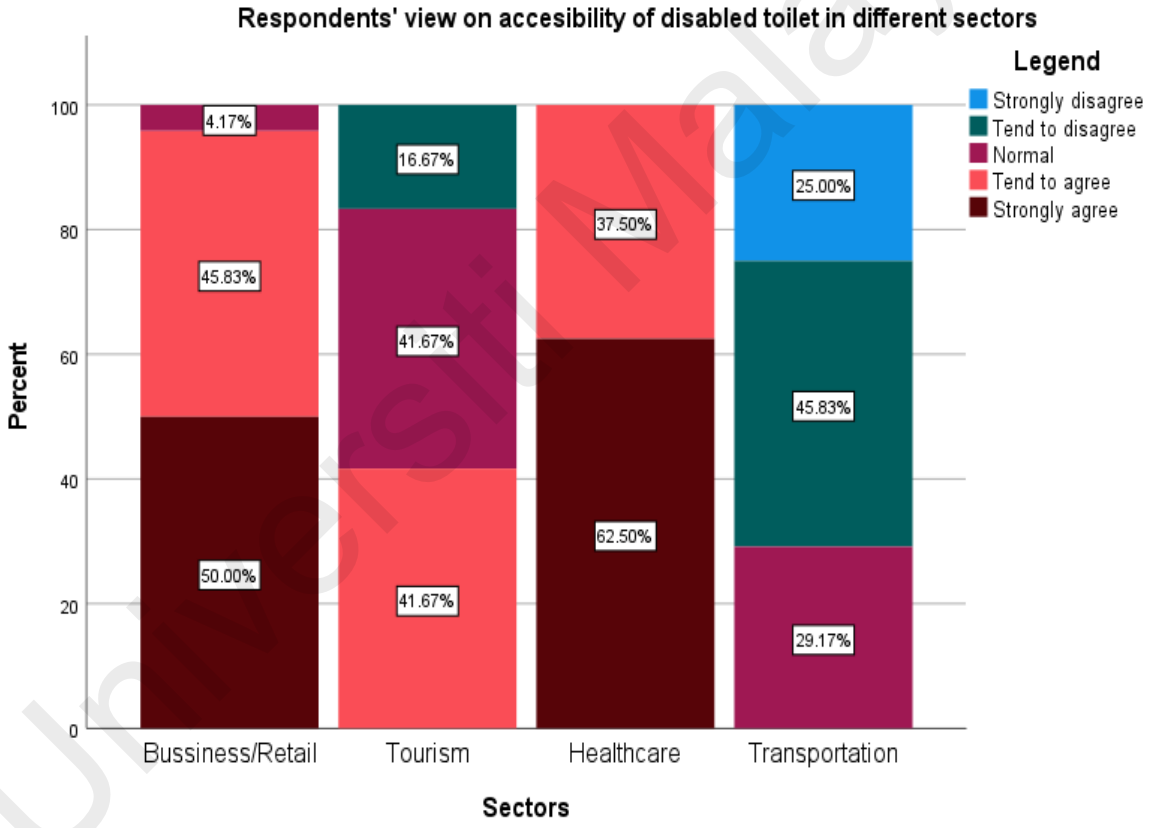

Figure 4.1: Bar chart representing the percentage of opinions for each types

4.4 Applicability of disabled toilet in Public Buildings in Kuala Lumpur

On this part of result and discussion, the data collected from the checklist or access audit is analyzed. The applicability of disabled toilet according to the guidelines by Malaysian Standard was summarized in the table below.

Table 4.4: The disabled toilet's evaluation based on MS1184:2014

No	Buildings	(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(i)	(j)	(k)	(l)	(m)	(n)	(o)	(p)	(q)	Score (%)
1	Cardiac Vascular Sentral (CVS)	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	×	×	✓	✓	✓	**88.24**
2	Sunway Medical Centre Velocity	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	×	✓	×	✓	✓	✓	×	**82.35**
3	Terminal Bersepadu Selatan (TBS)	✓	✓	×	✓	✓	×	×	✓	×	✓	✓	✓	×	×	✓	✓	×	**58.82**
4	Kuala Lumpur Sentral (KL Sentral)	✓	✓	×	✓	×	×	×	✓	×	✓	×	✓	×	✓	✓	×	✓	**52.94**
5	Kuala Lumpur City Centre (KLCC)	✓	✓	×	✓	✓	✓	✓	✓	×	✓	×	✓	×	✓	✓	✓	✓	**76.47**
6	National Museum of Malaysia	✓	✓	×	✓	✓	×	×	✓	✓	✓	×	✓	×	✓	✓	✓	✓	**70.59**
7	Mid Valley Megamall	✓	✓	✓	✓	✓	✓	✓	✓	×	✓	×	✓	✓	✓	✓	✓	✓	**88.24**
8	Sunway Velocity Mall	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	×	✓	✓	×	✓	**88.24**

Legend:

No	Standards
(a)	At least one disabled toilet must be provided for wheelchair user.
(b)	Clearly shown disabled toilet signage
(c)	Emergency alarm including reset control must be install at 800mm-1100mm height from floor
(d)	The entrance must be 900mm x 900 minimum
(e)	The door must be opened to outside direction with width of at least 800mm.
(f)	The floor must not be slippery
(g)	The size of the toilet must at least 1700mm x 2200mm for wheelchair user
Requirements for wash basin:	
(h)	Height 400mm-480mm
(i)	Minimum distance from the wash basin to the back wall is between 650mm to 800mm
(j)	Minimum distance from the wash basin to the side wall must be 250mm.
(k)	Grab rails must be placed at both sides at distance of 300mm to 350mm from the wash basin and the minimum distance to wall must be 40mm. If there is wall besides, the rails must have height of 200mm to 300mm from the wash basin and 1700mm from the floor.
Requirements for the equipment in the disabled toilet	
(l)	Soap dispenser, tower or dryer must be 800mm-1100mm height from the floor
(m)	Toilet paper dispenser: 600-700mm height from the floor
(n)	Mirror: not more than 900mm height from the floor.
(o)	Sink must be provided in the toilet
(p)	The height of the sink should be between 750mm to 850mm from the floor.
(q)	Distance to the pipe must not exceed 300mm

The result is been analyzed by using scoring method. It shows that Cardiac Vascular Sentral (CVS), Midvalley Megamall and Sunway Velocity Mall scored 15/17 points, Sunway Medical Centre 14/17, Kuala Lumpur City Centre (KLCC) 13/17 followed by National Museum Negara with 12/17, Terminal Bersepadu Selatan (TBS) 10/17 and lastly Kuala Lumpur Sentral (KL Sentral) 9/17. Each requirement will hold 5.88% of marks as there are 17 requirements in total. Among the eight buildings, result shows that CVS, Midvalley Megamall and Sunway Velocity Mall has the same score which is 88.24%. It shows that these three building are following most of the guidelines or requirement provided by Malaysian Standard or MS1184:2014 Code of Practice on Access for Disabled People to Public Building. This includes all the required measurement of wash basin and sink inside the disabled toilet. Next, Sunway Medical Centre has met 82.35% of the requirements followed by KLCC and National Museum Negara with 76.47% and 70.59% respectively. TBS and Kl Sentral place last with 58.82% and 52.94 respectively.

Among the 17 items that the disabled toilet needs to comply, the highest percentage for noncomplying is item (m) which is the height of toilet paper dispenser. During the measurement and data collection, it can be observed that most of the toilet paper dispenser was too high which above the value required. This can give discomfort to wheelchair user and also can be considered as hazard for the wheelchair user.

The second item that most of the disabled toilet does not comply is the minimum distance of wash basin to back wall and also the availability of emergency alarm. The emergency alarm system is crucial item which it needs to be present inside the disabled toilet. The function of emergency alarm is to inform person outside if incident happen inside the disabled toilet and when help is needed. Therefore, it can be said that each items of

requirements stated in the guidelines has its own function and reasons for wheelchair user safety and comfort. The summary of the percentage of noncompliance items can be seen in the pie chart below.

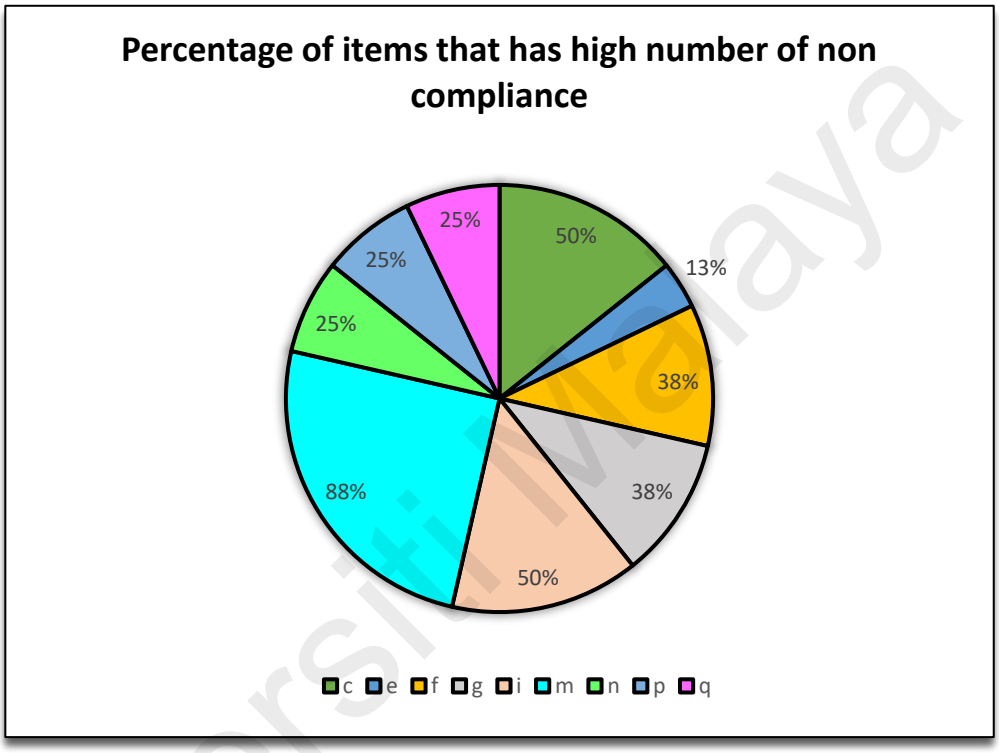

Figure 4.2: Pie chart showing the percentages of items that do not comply with Malaysian Standard

As there are 4 different sectors for this study, the summary of the findings in shown below. From the bar chart, it can be observed that disabled toilet located at Business and Retail Sector has high applicability of requirements by MS1184:2014 with range of 82% to 88%. This followed by Tourism sector with percentage for both publics buildings, National Museum Negara and KLCC are 71% and 76% respectively. Lastly, transportation sector is

the least sector that follow the guidelines. In general, major flaws in term of applicability and designing the disabled toilet can be seen from this study especially for transportation sectors.

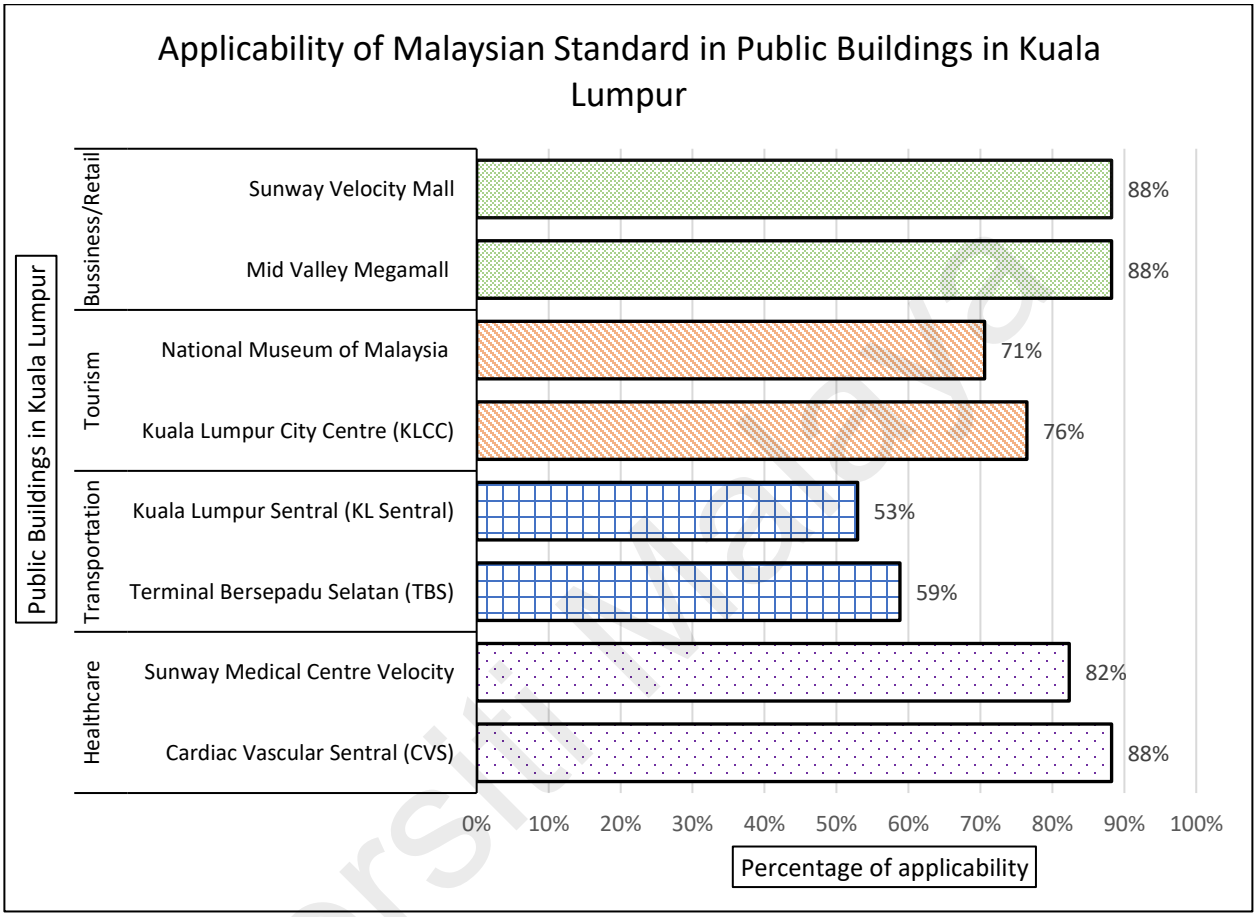

Figure 4.3: Applicability of Malaysian standard in public building for four different sectors

4.5 Relationship between accessibility of disabled toilet and applicability of Malaysian Standard or MS1184:2014

Accessibility can be defined as a group of term that can be used for all aspects which influences ability of people to function in certain environment (Rios, Magasi, Novak, & Harniss, 2016). Therefore, accessibility of disabled toilet can be expressed as the ability of people specifically PWD to use the disabled toilet with safe and comfort. Whilst applicability is defined as capable or suitable to be applied. All the requirements stated in MS1184:2014

is a guidelines measurement and design required to follow so that all the disabled toilet can be accessed.

Based on the result from survey questionnaire and access audit, it can be said that transportation sector has major flaws in terms of accessibility and applicability of Malaysian standard. The overall design of disabled toilet at transportation hub like Kl Sentral and TBS is not suitable to be accessed by wheelchair user. The sized of the toilet for both location is below the requirement and there is no emergency alarm button or rope provided. As mentioned before, emergency alarm is a crucial item that must be allocated inside the disabled toilet to prepare for any emergency situation. Wet floors also can be observed when entering the disabled toilet. The maintenance unit or cleaning service provider must also take extra care to maintain the disabled toilet to avoid any circumstances to happen in future. The height of the toilet paper dispenser also needs to be between 600mm to 700mm from the floor which then can easily be accessed by wheelchair user.

For tourism sector, the disabled toilet is relatively can be accessed and most of the items are aligned with the guidelines by Malaysian Standard. However, as the demand for accessible tourism and barrier free tourism is high, there are rooms for improvements can be done to the disabled toilet located in tourist attraction' buildings. This is because, according to Malaysia Tourism Statistics (2019), tourism is considered as one of the key industries which contribute to the country's economic. This can be seen in the growth of revenue for tourism sector which showed an increment of 16.9% to reach RM21.4 billion at first quarter of 2019 compare to 2018 with RM18.3 billion. Therefore, an action need to be taken to improve current facilities so that it can be an asset to attract more tourist with different capability to visit Malaysia (Jamaludin & Kadir, 2012).

Last but not least, for Healthcare and Business sectors, both generally scores high in terms of level of accessibility and applicability. it can be seen that most of the wheelchair user prefer to go to shopping mall rather than visiting any public places as the facilities provided in that particular business sector's building easily can be accessed and comfortable to use. The access audit also proved that the design of the disabled toilet located at both sectors has met all requirements listed in the standard.

CHAPTER 5

CONCLUSION

Based on the overall result and analysis, it can be said that most of the disabled toilet located in Kuala Lumpur that had been assessed can be considered as accessible and meet most of the requirements stated in the guideline provided by Malaysian Standard MS1184:2014. However, small modification might need to be considered for sector that falls behind in term of applicability and accessibility compare to the others like transportation industries. As the need for travelling is a common need for everyone, a barrier free facility must be provided for all location not only for transportation hub. There are about 25% of wheelchair user that took part in the survey stated that they faced difficulties to travel because there were insufficient number of disabled toilets provided and from the access audit it can be observed that the current disabled toilet provided not meet the requirement. Therefore, an action needs to be taken by necessary body or organization to assess and solve the issue.

Besides that, other sectors like business, healthcare and tourism shows a great performance in term of design as it follows the guidelines provided. Only minor improvement is suggested for these three sectors. In National Museum of Malaysia for example, the disabled toilet can be more accessible by wheelchair user if the toilet always been monitored for any wet floor. The management and maintenance unit need to set a proper Standard Operating Procedure or SOP for the cleaning service provider to always make sure the floor is dry to avoid any accident from happening. These improvements may contribute to overall accessibility of disabled toilet and give opportunity for wheelchair user to experience a freedom of mobility without interferences. Therefore, it can be concluded that

the accessibility of disabled toilet is related to the applicability of the disabled toilet to the guidelines provided in MS1184:2014.

From the result, it can also be seen that several items inside the disabled toilet are subject to improvements in future. For instance, each sector need to refer guideline by Malaysian Standard for the height of the toilet paper dispenser as the current been provided is too high and difficult for wheelchair user to reach and possibly can cause harm and injury. Besides that, emergency alarm is an important emergency aid that need to be installed in each of every disabled toilet as wheelchair user or PWDs in general faced a doubled times hazard compared to healthy or disabled-free person.

Even though this overall study of accessibility and applicability of Malaysian Standard for the disabled toilet in public buildings in Kuala Lumpur shows a satisfactory result and relationship, further investigation and analysis need to be done by using different methods or approaches such as by simulation by the user itself to rate the accessibility level of the facility. Besides that, the location or public buildings chosen need to be widen for other sectors and industries like offices and education to get varieties of views and perceptions on current disabled toilet provided in Kuala Lumpur. By assessing the accessibility of this facility from different perspectives might help discovering new recommendation in making a more accessible and barrier free environment for all user especially for PWDs.

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