BUILDING AND INFRA-STRUCTURAL DESIGN AND FACILITIES FOR THE DISABLED

CHIN SIN LIN

A project report submitted in partial fulfilment of the requirements for the award of the degree of Bachelor (Hons.) of Quantity Surveying

Faculty of Engineering and Science
Universiti Tunku Abdul Rahman

August 2011

DECLARATION

I hereby declare that this project report is based on my original work except for citations and quotations which have been duly acknowledged. I also declare that it has not been previously and concurrently submitted for any other degree or award at UTAR or other institutions.

Signature : _____

Name : CHIN SIN LIN

ID No. : 09UEB01096

Date : 26th August 2011

APPROVAL FOR SUBMISSION

I certify that this project report entitled **"BUILDING AND INFRA-STRUCTURAL DESIGN AND FACILITIES FOR THE DISABLED"** prepared by **CHIN SIN LIN** has met the required standard for submission in partial fulfilment of the requirements for the award of Bachelor of degree (Hons.) Quantity Surveying at Universiti Tunku Abdul Rahman.

Approved by,

Signature : _____

Supervisor : Prof. Dr. Ng See Seng

Date : _____

ACKNOWLEDGEMENTS

I would like to thank everyone who had contributed to this project. Most of all, I aspire to express my sincerest gratitude to my final year project supervisor, Dr. Ng See Seng for his invaluable advice, guidance and his patience throughout the process of the research.

Moreover, I am very grateful to my loving parent and friends. Without their support, encouragement, and caring, I would not have completed this final year project.

In addition, I would like to express my gratitude to the professional architects who spent their valuable time with me to complete the interviews. Besides, their profound and sincere response and cooperation, the further explanations they shared without hesitation have abundantly benefited me and subsequently contribute much in the analysis part of my research.

Last but not least, I am indebted to all the kind and cooperative disabled individuals who had participated in my research. Without their important comments and suggestions, this report would not have been the same as presented here.

BUILDING AND INFRA-STRUCTURAL DESIGN AND FACILITIES FOR THE DISABLED

ABSTRACT

The purpose of this research is to study and improve the design and services in buildings and infrastructures to cater for the disabled people. This study highlights the existing design and services provided in buildings and infrastructures. The definition and issues of disability, design principles, regulations and guidelines are emphasized in Chapter 2. Three types of research methods used are indicated in Chapter 3. Case studies on the facilities provided at public building and infrastructures are executed to observe whether the related facilities are complied with building regulations and requirements. Besides, questionnaires and interviews are deliberated and executed in order to find out the problems exist on design and to discover the dissatisfaction of the disabled party while they are using the facilities and services in the buildings. Factors that caused failure to provide the disabled facilities are public discrimination, impartiality of human rights against the disabled, comportment of local authorities, developers and town planners. It led to the problems such as (a) inappropriate design of facilities, (b) impracticable facilities provided, (c) lack of maintenance and upgrading of facilities, (d) facilities are inadequately provided, (f) facilities are damaged or occupied by non-disabled, (g) lack of understanding on disabled needs and (h) no strict enforcement of building by-law still exist in building and infrastructure. Some recommendations collected through studies to improve the facilities are to seek and obtain recommendations from the disabled, motivating them to participate and give opinions on facilities at discussion stage. Local authorities should impose penalty for non-compliance, negotiate with and give incentives to developers, learning from the west to provide sufficient educations for public. Finally, the conclusion and recommendations will be done based on the analysis of the case studies, questionnaires and interviews.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

LIST OF SYMBOLS / ABBREVIATIONS

m	*Meter*
mm	*Milimeter*
sq.meter	*Square meter*
°	*Degree*

LIST OF APPENDICES

CHAPTER 1

INTRODUCTION

Disabled people is defined as a person who are unable to participate fully in the community due to physically or mentally disability whether occurred since birth or later in life. Disabled people faced a lot of disadvantages, challenges and difficulties in this country. Their daily lives are restricted such as in walking, hearing, working, learning, seeing and performing manual tasks in their life. Besides that, their lives are filled with barriers wherever they go, at home, public buildings, schools, offices, roads and etc. In order to ease the accessibility difficulties facing by the disabled people, the design and construction of a building and infrastructure should be taken into consideration of their needs by architects, engineers and developers in construction project.

1.1 Context of the research

According to statistics from the Welfare Department in Malaysia, there are 313,685 people who are registered as a disabled by August 2010. This figure did not include the number of senior citizens who have become disabled because of old age and illness. The 3rd of December was declared as the National Day for disabled.

The built environment in Malaysia is still not much accessible for disabled people. The improvement of setting up facilities for the disabled in Malaysia is

moving slowly compared to other countries due to ignorance of the government and public apathy. In addition, the disabled people are isolated from the normal one. Thus, they need to adapt to the cruel discrimination from others as the impairment at their bodies has made them look different.

There are many provisions for disabled people in the building which enforced by-law 34A of the Uniform Building By-law. But nevertheless there are still many disabled people facing problems of accessibility. There is still inconvenient access. For example, parking lots for the disabled people are too small; there are also insufficient parking lots for the disabled person, sometimes this situation is also forcibly by the non-disabled who inconsiderately takes up those limited parking slots. Ramps are too narrow and toilets are not fully functional convenient for their usage.

1.2 Rationale of the research

Due to the various circumstances above, this research is established to study the design, facilities and services provided for the disabled people, problems or barriers faced by disabled people and suggestion for improvement in the future in order to make our country a more disabled-friendly country.

Moreover, readers can be more aware of the difficulties faced by the disabled people's life. This research can allow the readers to be more conscious and courteous towards the disabled people.

1.3 Aim

The aim for this research is for improvements in the design, facilities and services in building and infrastructure to suit the disabled people needs.

1.4 Objectives

- To determine the design, facilities and services provided in building and infrastructure.
- To identify the existing problems and dissatisfaction usage regarding the facilities and services in building and infrastructure of the disabled people.
- To recognize the regulations and requirements approach on design, facilities and services in building and infrastructure.
- To make suggestions to improve the current design, facilities and services to the disabled people.

1.5 Scope and limitation

This research was intended to look into the design, facilities and services provided in building and infrastructure. The objective is to find out all current design, facilities and services existing in building and infrastructure.

Throughout this study, the difficulties and problems faced by disabled people would be pointed out. All dissatisfaction data would be collected from disabled people and analyzed. Opinions from the disabled people are valuable because they are the people who will be using all disabled facilities in building and infrastructure.

Moreover, regulation and legislation would be recognized in order to enforce all relevant parties to provide accessibility in building and infrastructure for the disabled. Literature review is done to find out any improvement suggested and convey the result to the government.

Besides, there are limitations in this study due to time constraint. Hence this study only focuses on the facilities provided in building and infrastructure only. In

addition, the cost also the factor needs to be considered in this research. Due to limited budget, many cases study from overseas cannot be carried out.

Furthermore, the accurate opinion cannot obtain from disabled people due to communication problems. It is also difficult to make appointment for interview with architects.

1.6 Chapter outline

Chapter One is an introductory chapter. It describes the overall research in summary. The context, rationale, aim and objective, scope and limitation and chapter outlines of this project can be found in this chapter.

Chapter Two is literature review. All information will be gathered and explained thoroughly. The concept of the research, discussion and critics of all appropriate information and references will be indicated in this chapter accordingly.

Chapter Three explains the methodology used for data collection. Theoretical aspect of research methodology and research design will be explained in this chapter.

Chapter Four is data analysis and discussion. Data analysis tools are determined and used to analyse the data. The result of data gathered will be discussed to support understanding.

Lastly, data and information analysis will be finalised in Chapter Five. It expresses the conclusion and recommendation of overall research.

CHAPTER 2

LITERATURE REVIEW

The disabled problems became hot topic in our country since the few recent years. Accessibilities issue is a major problem faced by disabled on their living community. There had various types of disabled people in our country. Yet, this study will be focused on physical disability. Majority of people with physical disability would find it difficult to be using the existing conventional facilities and services provided on building and infrastructure. Hence, they should be taken into consideration by architect, town planner, contractor and etc.

2.1 Definition

2.1.1 Disability

Wikipedia had defined disability is “an impairment in body function or structure. It is an individual who is restricted to participate in particular activity in their life situations.”

It is stated that, “the disability is conceptualized or multidimensional experience for the person involved”. A person might effect to participate in areas of life due to effects on organs or body parts. Respectively, three dimensions of

disability are recognized such as body structure and function impairment, activity restriction and participation restriction.

2.1.2 Physical disabled requirements

A physically disabled is a person who had physical or mental impairment making in certain part of body. It caused difficulties in their daily usual activities. The impairments are mobility, vision, hearing and etc. Hereby, they need other facilities and assistance equipments to support their daily life activities such as moving, hearing, learning, seeing and communicating.

Mobility disabled

Mobility disabled needs movement assisting equipment such as wheelchairs to enhance their movement capability. Therefore, all building and infrastructural design should be wheelchair user friendly.

Visible disabled

A visible disabled need crutches or Braille type's board to guide them as they move. Sometimes, a guide dog is also an option. For instance, connective pathways furniture is used to lead them from one place to another.

Hearing disabled

Hearing disabled has their directional sense based on seeing. Some disabled might use hearing assistance to support their hearing, but this does not mean they can fully hear their surrounding sound. Hereby, they need signage and guiding blocks to guide them through their journey.

A physical disabled is a target on this study. They had rights to tell us the problems exist on disabled facilities and services.

2.2 Issues of Disability

2.2.1 Inaccessible car park and toilet

This complaint is expressed towards PLUS Expressways Berhad (PLUS) not providing accessibility facilities at rest and service area (RSA). According to Peter Gabriel Tan who is wheelchair user, said the parking for disabled at RSA is not complied with the Malaysian Standard 1184. There are insufficient car park spaces for disabled people to park and manoeuver their car. Furthermore, some parking lots are also occupied by other non-disabled drivers.

In addition, Peter Gabriel Tan said the toilets at RSA have good aesthetic values but they lack disability friendly. He finds that the toilet door is opened inwards. It is difficult for someone like him to close the door due to limited space inside to manoeuver. Peter continued to admonish the PLUS official that all facilities provided should comply with Malaysian Standard MS 1184: Code of Practice for Access for Disable Persons to Buildings. (Source: Peter Gabriel Tan, 2010)

The establishment of Malaysia Standard is not supposed to be treated as guidelines but an agreement that is to be enforced. Every code provided inside the Malaysian Standard serves its own purposed. From an article, it shows the local authorities had not strictly enforced the Malaysian Standard on design and facilities provided at RSA. He advised that the local authorities should conduct an evaluation to ensure all facilities at RSA are really functional.

Figure 1 Toilet for disabled at Ulu Bernam RSA Southbound
(Source: Peter Gabriel Tan, 2010)

2.2.2 Inaccessible public transport

According to Ding Jo-Ann, in report dated reported on 19 February 2010, Peter Tan whom disability rights advocate said the development of the disability accessibility facilities in Malaysia is slow. He said it is difficult for wheelchair users to depart from Cheras to Suria KLCC because of the many obstructions met throughout their journey. He mentioned every journey is troublesome and inconvenient to him.

Peter added to say the local bus transportation company had promised to provide accessibility for the disabled but it became void. Bus drivers currently do not allow wheelchair user to board their bus. Even if a bus driver allows stopping for a disabled, the bus stop is also unsuitable for them to board the bus. No code of practice has been enforced for the disabled to access public transportation. (Source: Ding Jo-Ann, 2010)

Peter can apply the 'Person with Disability Act 2008: Section 27 of Act 685' for access to public transport facilities into this matter. Disabled had rights to access and use all public transport facilities. Besides, government also needs to provide proper facilities for the disabled on public transport. All facilities provided should comply with universal design and accessible for the disabled. Throughout this act, any displeasure can be expressed towards the government. Hereby, government can imposed and amerced an irresponsible bus company by using this act.

Figure 2 Bad services provided by Rapid KL for disabled
(Source: Ding Jo-Ann, 2010)

2.2.3 The woes of wheelchair users

According to Star Metro on September 30, 2009, K. Bathmavathi who is wheelchair user said she always feared finding a disabled parking lot. It is because time is wasted during the search. She also gets annoyed to discover when a disabled parking lot is engaged by non-disabled. Even if she found a normal parking lot, the parking lot is not usable due to insufficient space for her to manoeuver from her car to the wheelchair.

The author observed some wheelchair users moving on the road without using the pathway. This is because the kerb is high for the wheelchair users to cross over. Thomas Yeo said there are two factors to cause bad facilities for the disabled. It is vandalism and building design. Vandalism is doing something against the disable's needs. He said he was difficult to go to a bank because buildings are not disabled-friendly. Some banks are design with high entrance and some building are without ramps.

Lack of disabled parking lots provided at a place can cause congestion to others. Due to the inconvenience to manoeuver, disabled people would simply park their car at side of the road. Town planner should solve this matter as fast as possible. Furthermore, building design should conform to universal design and suited for disabled needs.

Figure 3 Wheelchair user using the road
(Source: Chirisitina Low, 2009)

Figure 4 A wheelchair user needs help to go over the kerb
(Source: Chirisitina Low, 2009)

2.2.4 Impracticable stair lift

According to Star Metro on March 16, 2010, K. Bathmavathi who is wheelchair user had faced inaccessibility at Suria KLCC. She said there are no signs provided in directing her to the LRT station. When she entered the linking passageway, she discovered a folded stair lift just a way to lead her down to next level. Nevertheless, the stair lift needs a key to be unlocked. And even after a guard gets hold of the key, nobody knew how to operate the stair lift.

Kenneth Thian had suggested the technician's services should engage to warrant the stair lift function at all times. All guards should have proper training to operate the stair lift and help the wheelchair users. An alternative way would be recommended to an access at linking passageway for the disabled.

Figure 5 Disabled group are inaccessible to LRT station due to unworkable stair lift
(Source: Jade Chan, 2010)

2.2.5 Lack of improvement on public transport system

According to Malaysia's public transport forum on March 15, 2010, Sam Wong said the awareness of disabled needs on public transport is very low. He said it was barely able to find disabled people at Taman Paramount station because lack of parking lots for them. Entrances have no ramp for the wheelchair users to access. He recommended there should have guiding blocks and tactile mapping to help directing blind people at LRT stations.

The spokesperson promise they would provide disabled-friendly facilities at all LRT stations to response Wong complaint. The facilities such as lifts, tactile flooring, wide manual gates at paid area, toilets, special compartment for wheelchair-bound in train, entry ramp to station and special parking bays should provided.

2.2.6 Planning by local authority

Maniam Sinnasamy who is a project manager of United Nation Development Programme of Malaysia government project had mentioned five major things wishing for next five years for disability. Five major things are as follows:-

a) Reviewing of Malaysian Standards on Accessibility according with international standards and requirements. Reformation and improvements all guidelines, adopting a common framework on technical guidelines and good practices on accessibility.
b) Review all building plans which included inside and outside ensuring accessibility are integrated. Providing an access plan and issue of certificated for who compliance to standards of accessibility employed by local council's access unit with dedicated and trained access officers.
c) The "Guidelines on Universal Access of Public Transport (Buses)" is adopted and enforced by Ministry of Transport and also other modes of transport.
d) Improving accessibility on transport infrastructure including pedestrian infrastructure and walkways along selected corridors in order for connectivity and seamless travel.
e) Launching the public awareness programme through the media and television, continuing professional education, review of driver training schools and simulation exercises on accessibility for all Members of Parliament. (Dorodi Sharma, 2010)

2.3 Regulation and legislation of building requirements

2.3.1 Person with Disabilities Act (PWDA)

The Person with Disability Act 2008 (Act 685) (PWDA) was passed at Malaysia in 2008. Its rights are under Convention on the Rights of Person with Disabilities.

Under section 26 and 27 of Act 685, it provided the rights for disabled people to access into public facilities, amenities, services, buildings, recreation and public transport. Accessibility section under Act as followed:

Access to public facilities, amenities, services and buildings

a) **Section 26. (1):** Persons with disabilities shall have the right to access to and use of, public facilities, amenities, services and buildings open or provided to the public on equal basis with persons without disabilities, but subject to the existence or emergence of such situations that may endanger the safety of persons with disabilities.
b) **Section 26. (2):** For the purposes of subsection (1), the Government and the providers of such public facilities, amenities, services and buildings shall give appropriate consideration and take necessary measures to ensure that such public facilities, amenities, services and buildings and the improvement of the equipment related thereto conform to universal design in order to facilitate their access and use by persons with disabilities.

Access to public transport facilities

a) **Section 27. (1):** Persons with disabilities shall have the right to access to and use of public transport facilities, amenities and services open or provided to the public on equal basis with persons without disabilities.
b) **Section 27. (2):** For the purposes of subsection (1), the Government and the providers of such public transport facilities, amenities and services shall give appropriate consideration and take necessary measures to ensure that such facilities, amenities and services conform to universal design in order to facilitate their access and use by persons with disabilities. (Law of Malaysia, 2008)

Section 26 and 27 of PWDA are explained that disabled people had rights to access and used all building and public transport facilities, amenities and services as usual as non-disabled. In order to ensure all facilities are safe, government and providers should given an appropriate consider and care. All facilities should comply with universal design and accessible by disabled people.

2.3.2 Uniform Building By-Laws 1984 (UBBL)

Uniform Building By-Laws 1984 is amended in 1990 for additional provision of by-law 34A. All facilities and accessibility for public and disabled are required under this by-law. The requirement of by-law is:

a) **First section**: Required to provide accessibility for disabled to enter, exit and move around within the building. The design must be suitable for disabled.
b) **Second section**: All specification of facilities for disabled must be complied with the Malaysian Standard MS 1184 and MS 1183.
c) **Third, fourth and fifth sections**: Local authorities must ensured the submission of building plans must complied with Malaysian Standard which included facilities for disabled and others alternation building.
d) **Sixth section**: Stated down the buildings which required abiding to this by-law. It included office buildings, terminals, car parks and public buildings. Public buildings also contained hospitals, government buildings, restaurants, cinemas, sports complexes, schools, hostels, hotels and others.

2.3.3 Malaysian Standard

Malaysian Standard Code of Practice is recognized by Industrial Research Institute of Malaysia (SIRIM). This standard specification is basic requirements for accessibility to public buildings and facilities for disabled. It applied to all buildings used by disabled people. The following is code practices provided.

a) <u>Code of Practice for Access for Disabled to Public Buildings (MS1184)</u>

This code issued by SIRIM in 1991 is represents Malaysian Standard. It provided the special design facilities within building. This code aimed to ensure all specifications of facilities are suitable and safe used by disabled. The facilities included ramps, handrails, stairs, toilets, bars, signs and symbols.

b) Code of Practice for Access for Disabled to Outside Buildings (MS 1331)

This code issued by SIRIM in 1993 represented Malaysian Standard for provision special facilities design at outside buildings. Outside buildings facilities are pavements, lighting, ramps, stairs, handrails, street furniture, pedestrian walkways, special seating, underpasses, footbridges, pedestrian crossings, traffic island, special parking areas, bus stops, signage and symbols. This code applied to all types of building included work place and public building except private residences.

c) Code of Practice for Means of Escape for Disabled (MS 1183)

This code as guidelines provided for designers and contractors to construct new building and renovation of existing buildings. It issued in 1990. All specifications of fire prevention facilities are explained under this code. Fire prevention facilities are stairs, space, exists, emergency lifts and phones provided for public and disabled.

2.4 Universal Design

Universal design is a design of a product or an environment that would be use by all people without any alteration. It is a new model that emerges with "barriers-free" concepts. It focuses on the accessibility design and assistive technology. Universal design is provided for all people. For instance, sidewalk ramps are constructed not only for wheelchair user but public. Colour contrast dish at steep sides had assisted visual disabled and oldest.

2.4.1 Principles of Universal Design

Seven principles of universal design had been set up by center of universal design. It would assess the existing designs, guide the design process and educated for both designers and consumers. It purposed is to meet up the people's needs at all ages and abilities. Seven principles as follows:

1st Principle: Equitable use

The design is useful and marketable to any level of users.

- Equivalent use for all users.
- Avoid any discrimination or stigmatizing on using the products.
- Provided privacy, security and safety for all users in equally.
- Made the design attractive for all users on it.

2nd Principle: Flexibility in use

The design accommodates a wide range of individual preferences and abilities.

- Provided much choice on method in use.
- Contained right- or left-handed access and used.
- Assisted user's accuracy and care.
- Provided flexibility to user's pace.

3rd Principle: Simple and Intuitive

The design is provided in easy ways to understand, regarding to user's experience, knowledge, language skills, or current concentration level.

- Avoid any unnecessary complexity.
- Be consistent with user expectations and intuition.
- Accommodated wide range of literacy and language skills.
- Arranged information consistent with its importance.
- Provided effective feedback for subsequently conduct.

4th Principle: Perceptible Information

The design communicates are effective to user, regardless of surrounding conditions or user's sensory abilities.

- Used the simple indicated such as symbol, slogan and tactile to represent the simple but essential information.
- Provided adequate contrast between significant information and surrounding conditions.

- Maximized “legibility” information in all sensory facilities.
- Differentiated elements in easy ways to describe in term of given instruction and direction.
- Provided consistently among variety techniques and devices used.

5th Principle: Tolerance for Error

The design must minimize hazards and any unpleasant accidental.

- Arranged the elements to minimize hazards and errors.
- Provided alerts upon hazards and errors.
- Provided fail safe features.
- Impeded unaware action in tasks that required caution.

6th Principle: Low Physical Effort

The design must be efficiently and comfortably used and minimized of weakness.

- Allowed user to maintain a neutral body position.
- Used reasonable operating forces.
- Minimized cyclical actions.
- Minimized continued physical effort.

7th Principle: Size and Space for Approach and Use

The design must be provided in appropriate size and space for approach, reach, manipulation and used according to user’s body size, posture or mobility.

- Provided an obvious sight to vital elements for any seated or standing user.
- Made all components comfortable for any seated or standing user.
- Accommodated variations in hand and grip size.
- Allowed accessible space for used of assistive devices or personal assistance.

2.5 Barrier-free guidelines for disabled

The “barrier-free” guideline is established for disabled people. It will improve their living conditions inside and outside building. Through “barrier-free” design guideline, it would help wheelchair users, elderly, visually or hearing impaired, children and etc toward independents and achieved their development potential.

2.5.1 Accessible connection

All accessibility facilities must be connected in order to make disabled people free from barrier in their journey.

a) Connection between internal and external accessible route must be seamless. For example, Public Street, sidewalk with adjacent development and public transportation nodes must be connected.
b) Provided ramps, steps and automatic doors at accessible entrance.
c) Accommodated wide circulation path projected at human traffic volume and wheelchair users.
d) Located lift at main circulation area and enabled to serve every floor for wheelchair users.

2.5.2 Space allowance

The enough space should be provided for person using mobility devices such as wheelchairs, crutches and walkers or walkers with other person assistant.

Clear floor space	• Minimum 750mm x 1200mm for single wheelchair. • Minimum 1500mm x 1500mm for wheelchair turns over.

	• 920mm clear floor wide for walker(s).

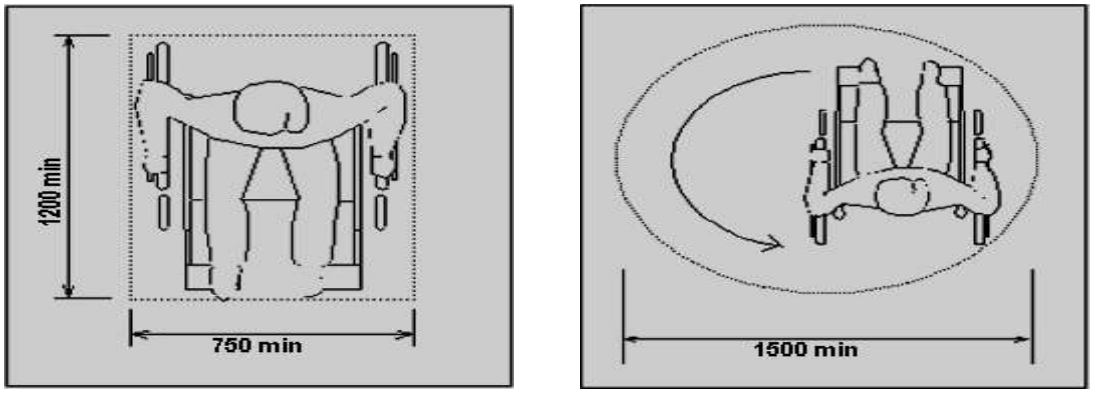


Figure 6 Space allowance for wheelchair

(Sources: DINF, 2011)

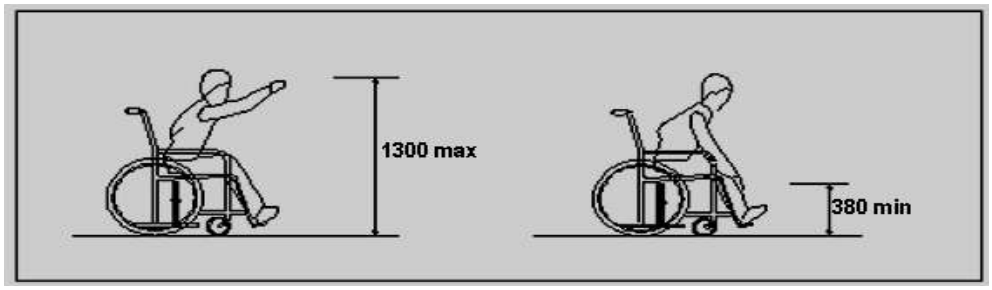


Figure 7 Forward reach without obstruction

(Sources: DINF, 2011)

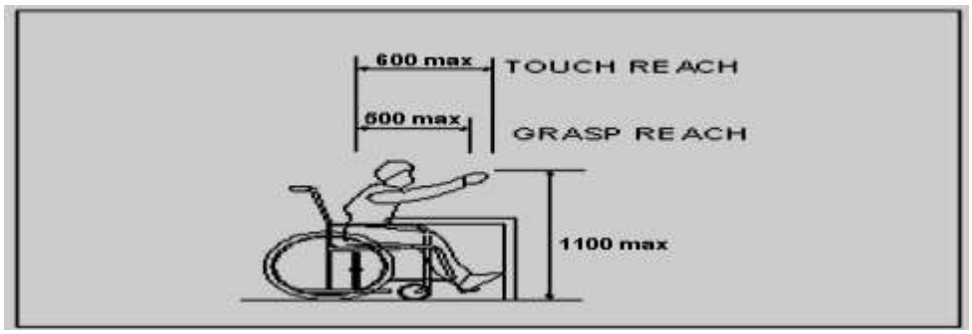


Figure 8 Forward reach over obstruction

(Sources: DINF, 2011)

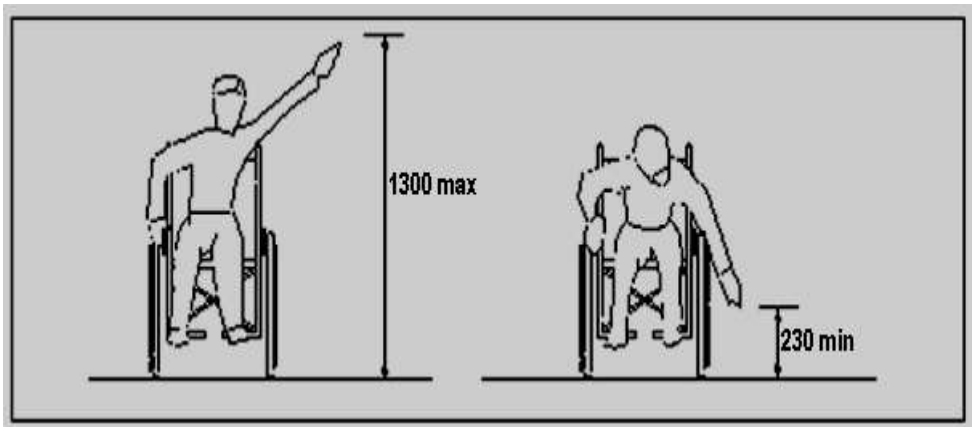


Figure 9 Side reach without obstruction

(Sources: DINF, 2011)

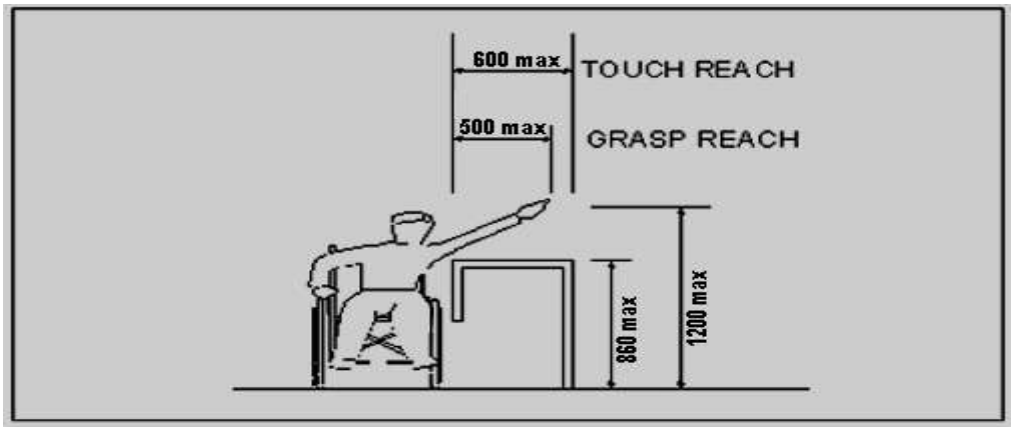
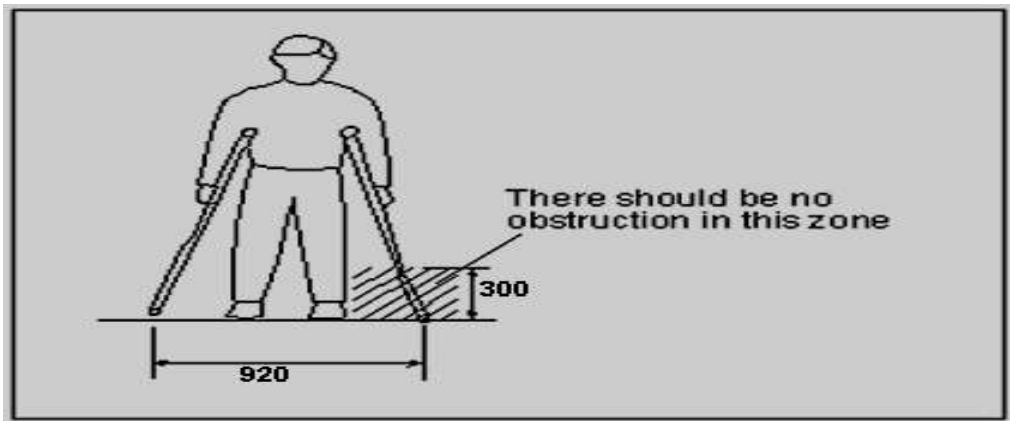


Figure 10 Side reach over obstruction

(Sources: DINF, 2011)



(Sources: DINF, 2011)

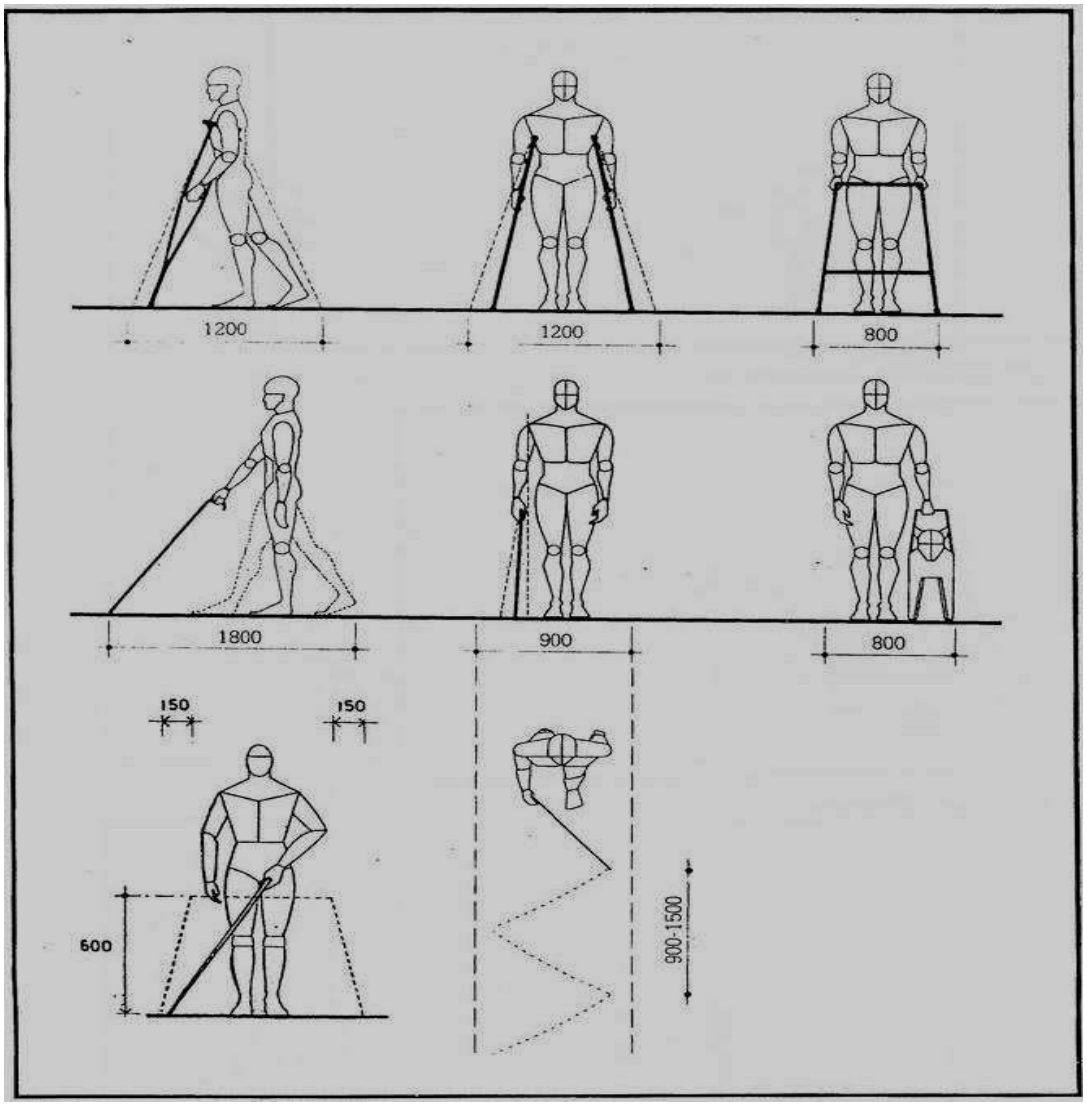


Figure 11 Space allowance for walker(s) with crutches

(Sources: Disabled Person Penang, 2011)

2.5.3 Car park

Dimension	• 3500mm x 4800mm.
Floor surface	• 600mm wide textured surface provided to separate the pathway from vehicular area. • Levelled with anti- slip surface. • Painted with contrast colours or sign to differentiate with

	other lots.
Accessibility	• Sufficient accessibility area provided for wheelchair users in and off the car. • Provided pedestrian lanes to enhance safety of users. • Located car park at accessible position in term of next to lift lobby to shorter transfer. • Provided well ventilated and clearly light.
Drop off area	• At least 3.60m wide and 1.20m wide for picking up and dropping off purposed. • Sign used to identify drop off zone to prevent misuse of parking space.

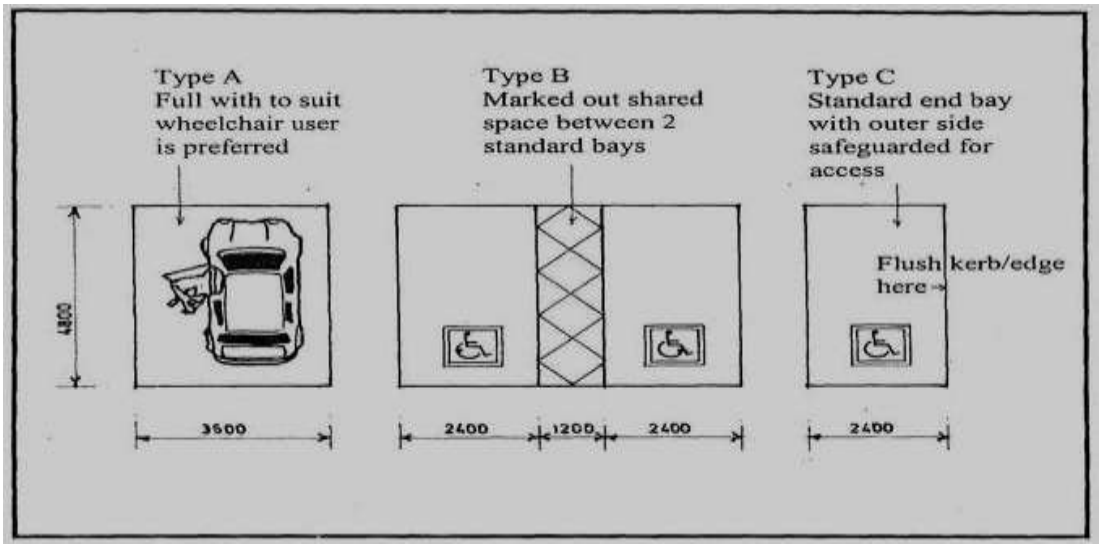


Figure 12 Parking spaces

(Sources: Disabled Person Penang, 2011)

2.5.4 Pathways

Space allowance	• Minimum 1200–1500mm area provided for wheelchair

	access. • Provided turning space at reasonable intervals if corridor wide less than 1500mm.
Minimum clear width	• Minimum 800–900mm wide for single wheelchair. • Minimum 1500mm wide for two wheelchairs. • Minimum 900mm wide for angle 90° turn. • Minimum 1000–1200mm for turn around an obstruction.

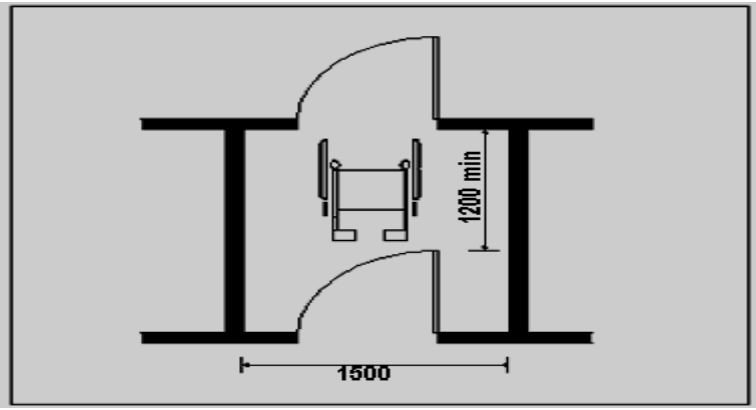


Figure 13 Space allowance for wheelchair

(Sources: DINF, 2011)

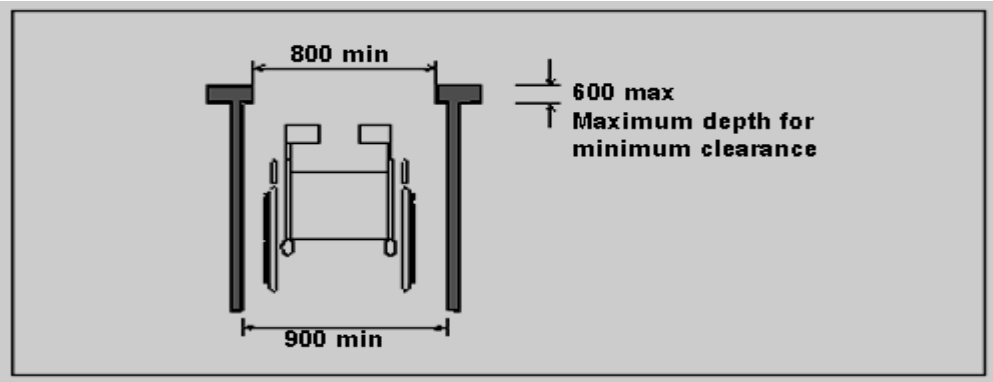


Figure 14 Minimum clear width for single wheelchair

(Sources: DINF, 2011)

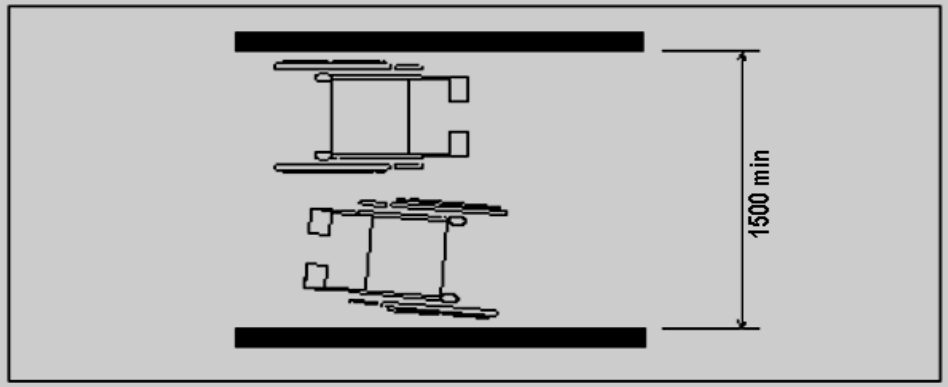


Figure 15 Minimum clear width for two wheelchairs

(Sources: DINF, 2011)

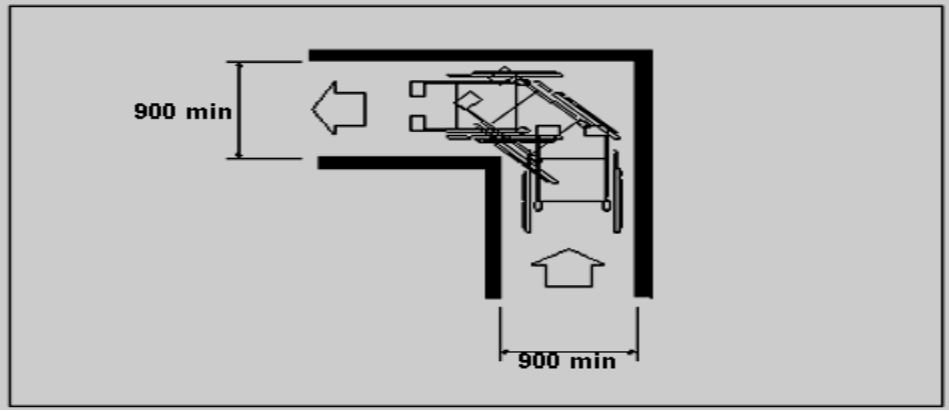


Figure 16 Minimum clearance for 90° Turn

(Sources: DINF, 2011)

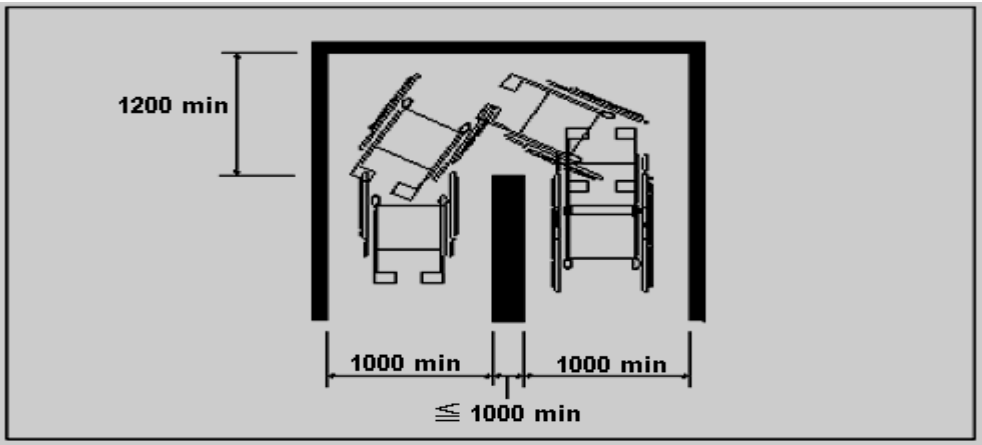


Figure 17 Turn around an obstruction

(Sources: DINF, 2011)

2.5.5 Ramp

Ramp width	• Minimum 1200mm wide.	
Ramp surface	• Flat but not smooth texture. • Levelled with slip-resistant.	
Gradient of ramp	Changes in vertical rise	: Gradient not steeper than
	0–15mm 15.1–50mm 50.1– 200mm exceeding 200mm	1:2 1:5 1:10 1:12
Other equipments	• Landing provided at every 6 meters. • Handrails installed at both sides. • Open edges should provided raised kerbs.	

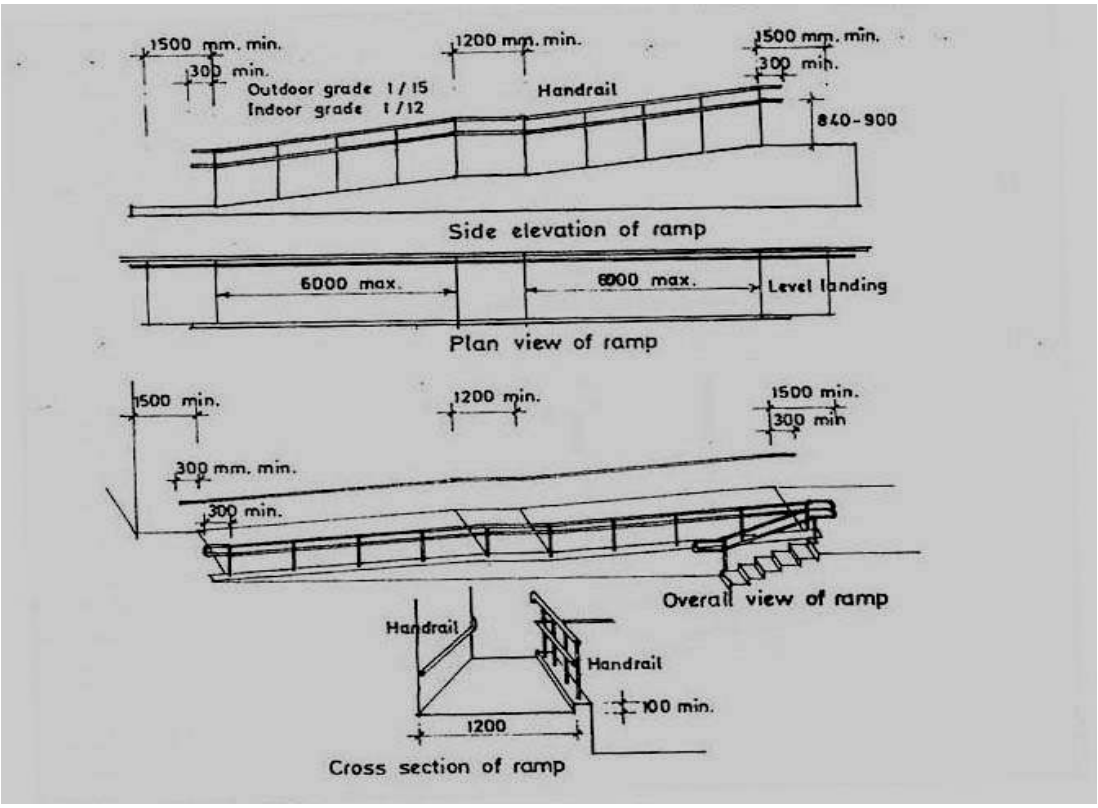


Figure 18 Ramps

(Sources: Disabled Person Penang, 2011)

2.5.6 Kerb ramp

Types of ramp	• **Standard kerb ramps**: cut back into the pavement with flared sides providing transition in three directions.  • **Returned kerb ramps**: providing slope in one direction. This could be dangerous measure if the sides are not protected.  • **Build up kerb ramp**: usually with flared edges. 
Positioned	• Located out of usual line of pedestrian flow to avoid confusing sightless pedestrian. • Separated in level on pedestrian paths or cross paths. • Avoid located at place with water accumulates.

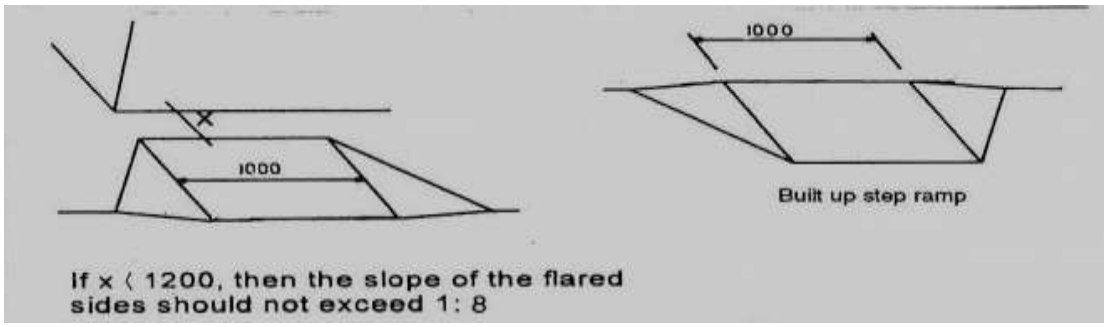


Figure 19 Kerb ramps

(Sources: Disabled Person Penang, 2011)

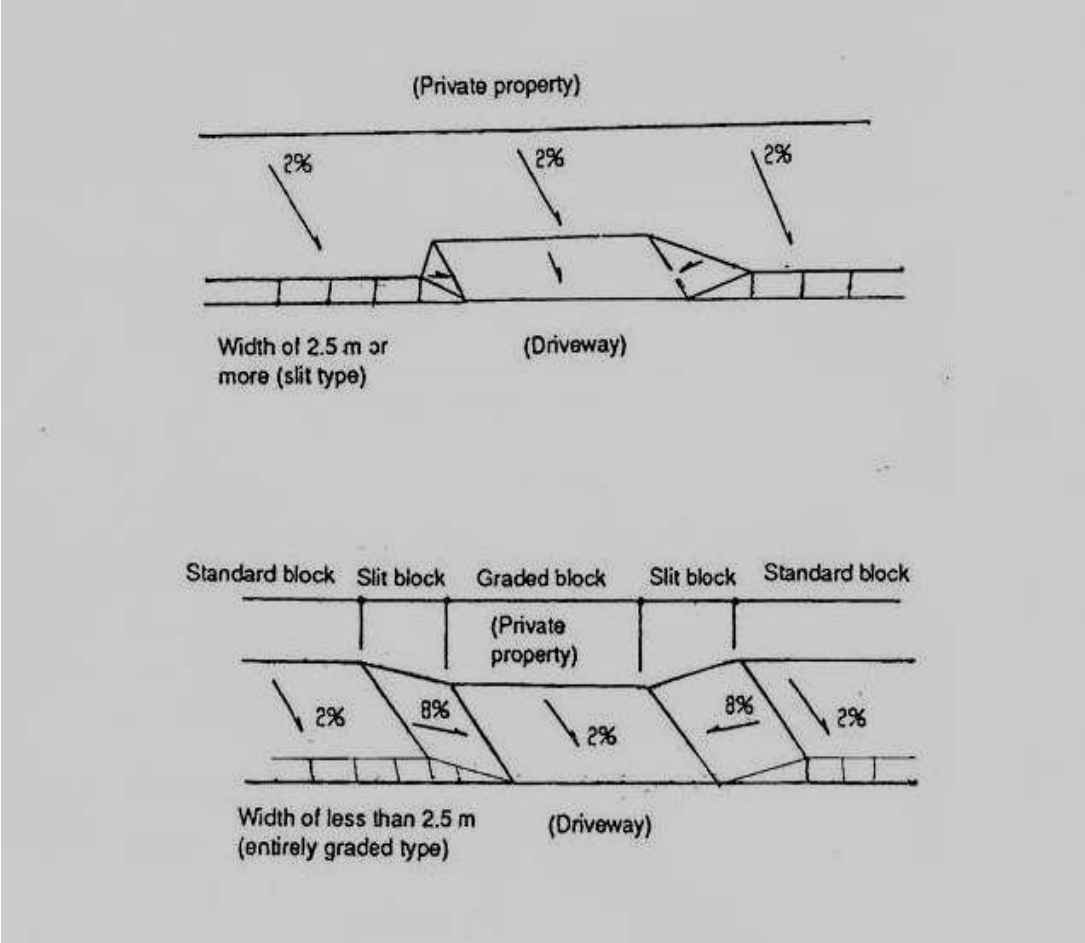


Figure 20 Grading level differences at vehicle driveways

(Sources: Disabled Person Penang, 2011)

2.5.7 Guiding block

Function	• As a guide strip to indicate alternative routes exist or at junction of guide strips. • Normally used in rubber tiles.
Dimension	• 300mm x 300mm.
Venue to place	• In front of traffic present. • In front of entrance or exit and from a staircase or multi-level crossing facility. • Entrance or exits at public transport terminal or boarding

	areas. • Guiding path from a public facility to the nearest transport station.
Types of guiding block	• Dot-type block used as warning signal. • Line-type blocks indicate the correct route to follow.

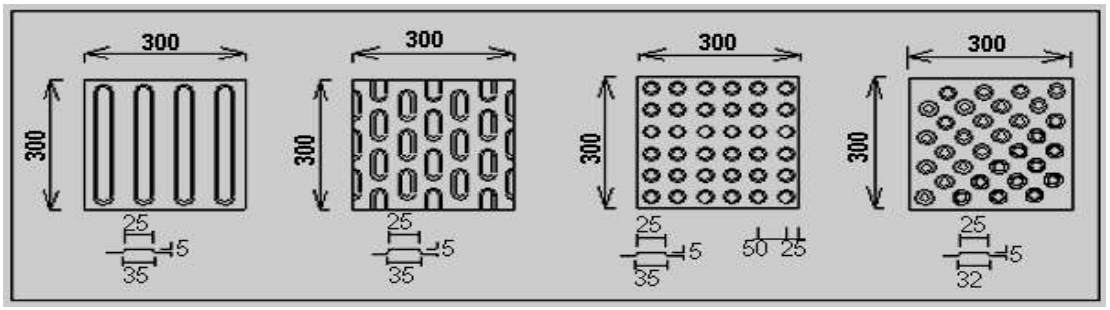


Figure 21 Types of guiding blocks

(Sources: DINF, 2011)

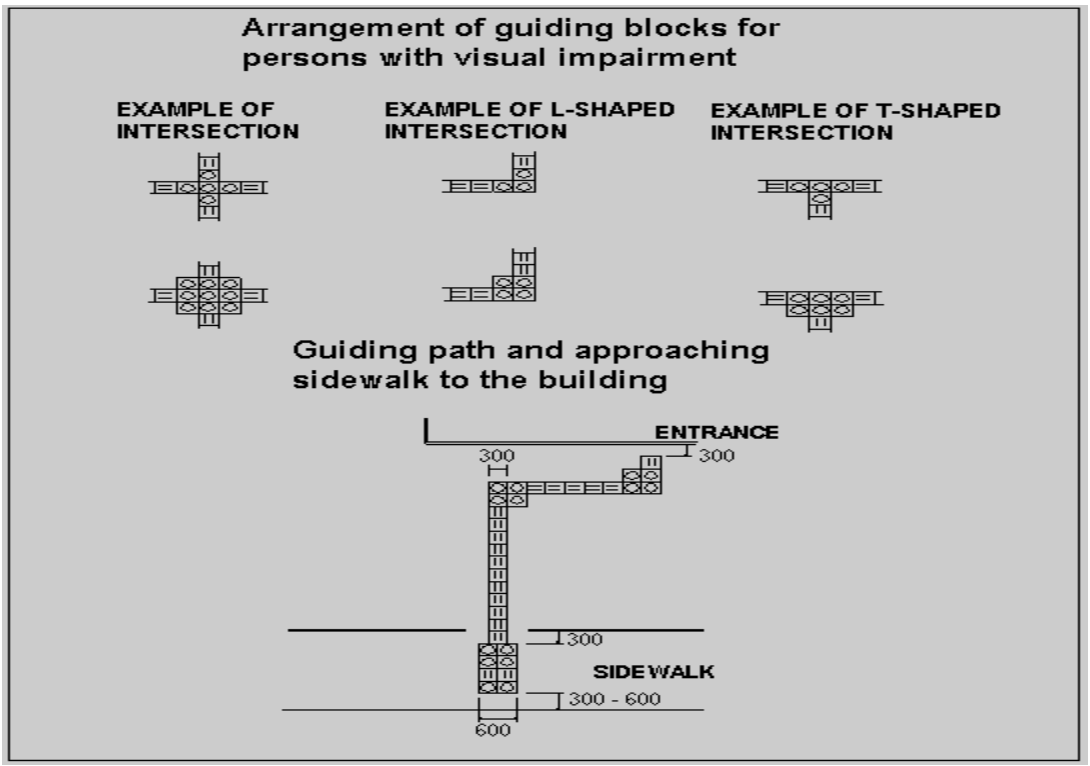


Figure 22 Diverse arrangements of guiding blocks

(Sources: DINF, 2011)

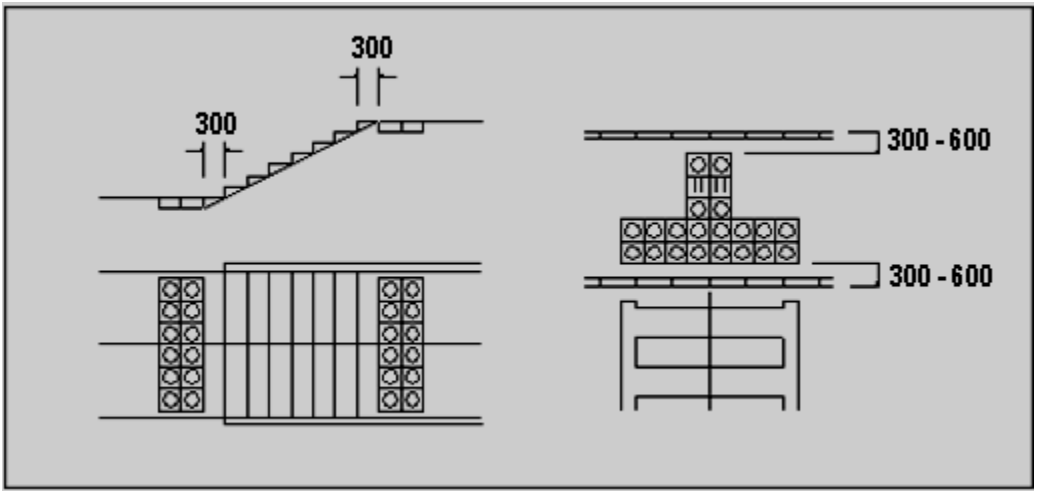


Figure 23 Stairs and crosswalk

(Sources: DINF, 2011)

2.5.8 Handrail

Features	• Easy to grasp. • Slip-resistant. • Firm and comfortable grip. • Slide along the handrails without obstruction. • Small plate Braille should use at beginning and end of handrail to indicate its position for visual impaired people. • Painted with contrast colour to differentiate surrounding area.
Appropriate diameter	• Adults should be 30–45mm. • Children should be 30–35mm.
Proper located height	• Adults should be 800–900mm. • Children with 7 to 12 years old should be 580–700mm.

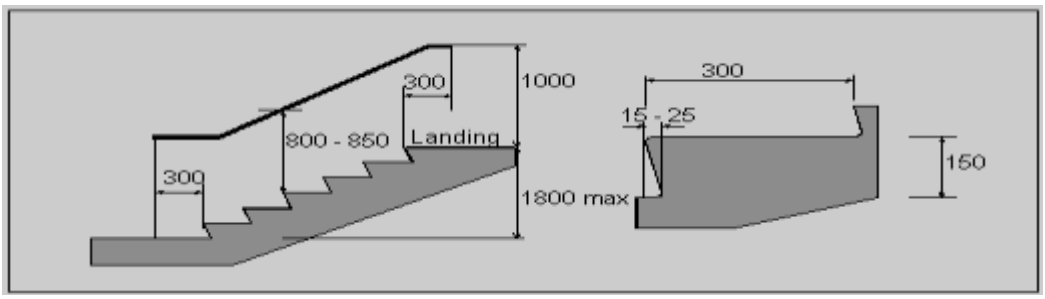
Figure 24 Handrails

(Source: PUKUKM, 2009)

2.5.9 Staircase

Stairs	• Adequately illuminated. • Painted with sharp colour. • Width and depth of intermediate landing at least width of flight. • Underside of staircase should enclose to prevent people walking underneath resulted head injured. • Closed riser stair is recommended. • Flight of stair should have gentle gradient.
Steps	• Protrude nosing should provided on every step. • Nosing should extend into full width of step. • Approximately 300mm wide of tread and 150mm high of riser. • Have standardized risers and goings. • Corduroy-profile hazard warning tactile paving should presented at top and bottom of steps.
Handrails	• Installed on both sides. • Easily gripped. • Extend beyond the top and bottom of the stairs. • 45–50mm diameter circular cross-section handrail is used.

	• 1000mm high above the nosing step or 900mm high above the pitch line handrail should provided.



(Sources: DINF, 2011)

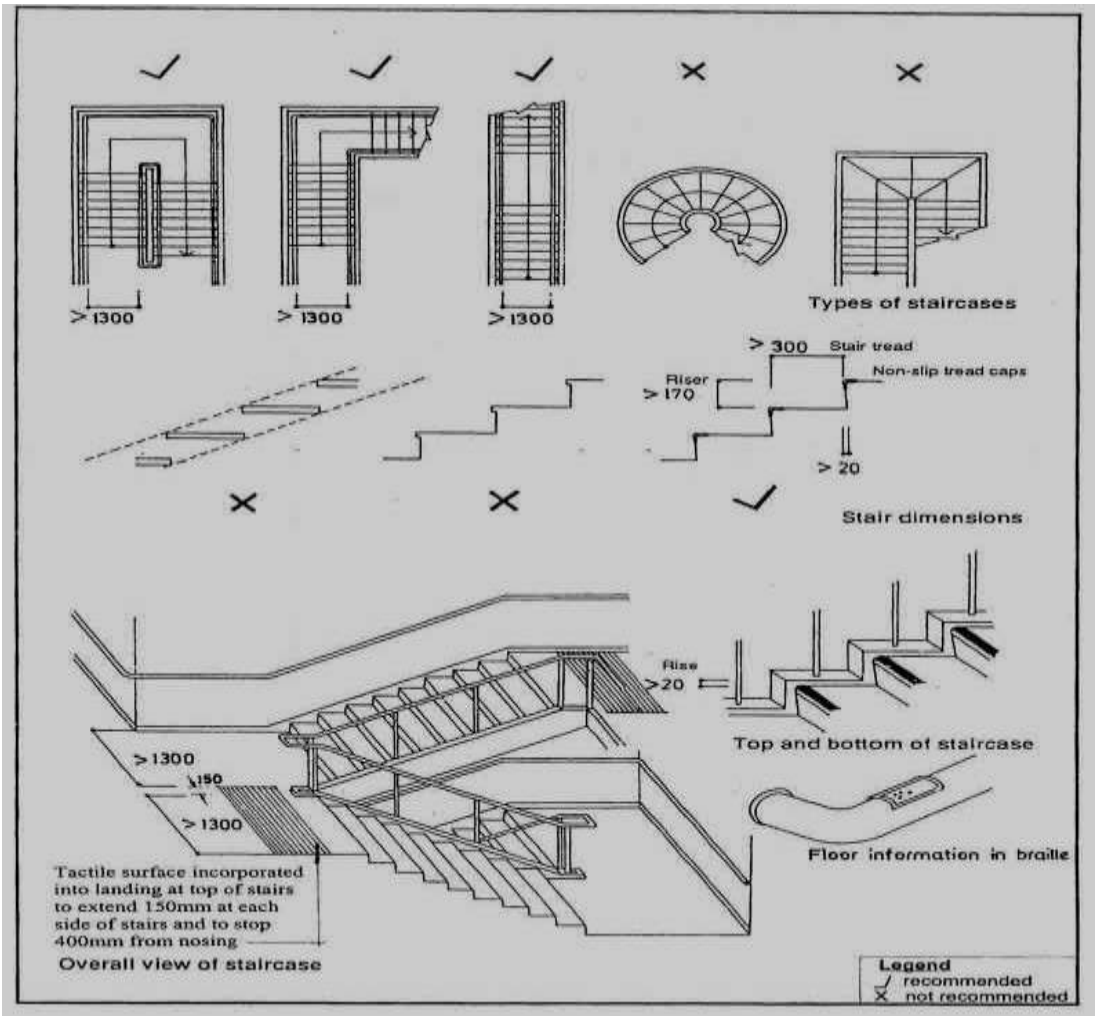


Figure 25 Stairs

(Sources: Disabled Person Penang, 2011)

2.5.10 Lift

Space allowance	• 1500mm x 1500mm of movable space provided in front of the lift. • At least 1500mm x 1500mm space provided inside lift. • Gap between floors of platform and lift must not exceed 30mm.
Location	• Located at places which accessible for disabled people. Normally near to main entrance of building.
Lift door	• Minimum 0.90mm wide lift door provided. • Closing mechanisms are adjusted to give adequate entry time for disabled people. • Photo-electric sensor should detected objects at 300–1400mm from floor level to control the closing lift door. • Automatic re-opening device is used to open the door when people or object is trapped between the door panels. • Lift door should indicate in bright colour with surrounding wall.
Operating devices	• Call-button, operating panel, interphone switches must placed within 800–1200mm from floor level. • Push button control panel is used. • Braille type label should used on operating panel and interphone. • Internal operating panel provided at right-side wall (view from main entrance) and mounted at 800 mm high from floor level.
Other equipments	• Horizontal handrail provided at three sides of interior lift without separation at height 800–850mm from floor level. • A mirror provided at side wall of lift in order for passenger to view door opening or closing.

	• Visual and voice indicators should installed on each platform to announced floor location. • Lift floors should cover with non slip material.

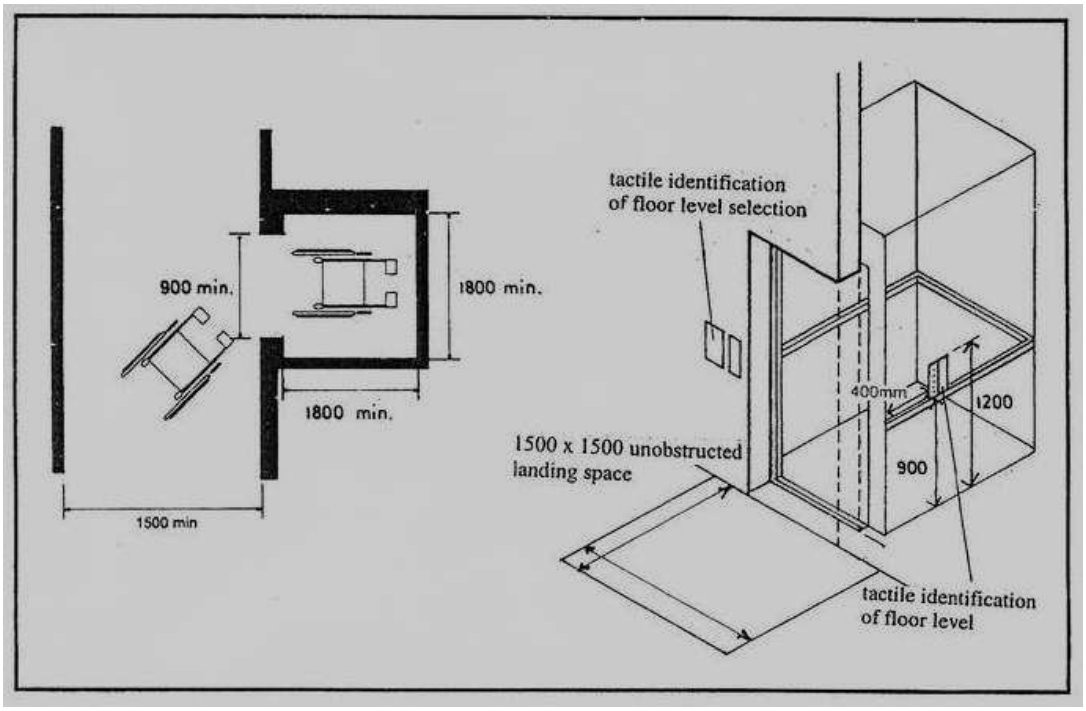


Figure 26 Space allowance in lifts

(Sources: Disabled Person Penang, 2011)

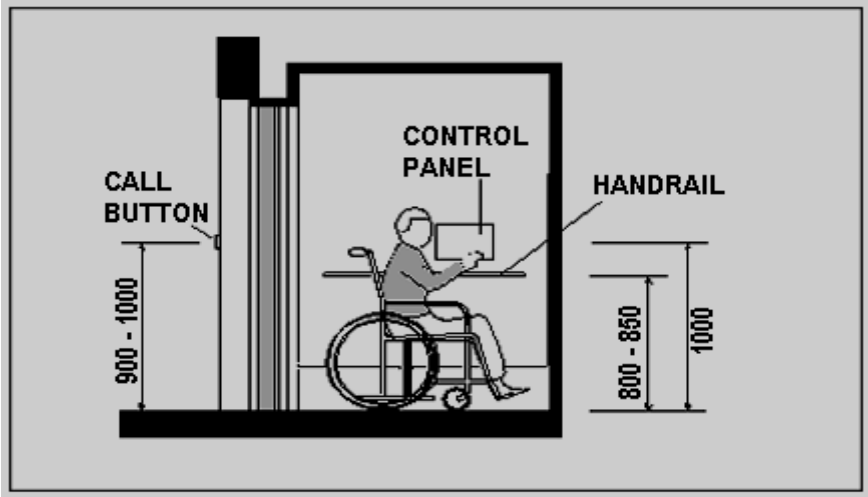


Figure 27 Height of control panel and handrail in lifts

(Sources: DINF, 2011)

2.5.11 Doorways

Space allowance	• Sufficient space for moving past door handles. • Space to manoeuver should provide in front of doors.
Thresholds	• Not exceed 20mm wide. • Levelled off the raised threshold and floor level changes at doorways with slope on each side. • Slope at threshold must simple and movable ramp.
Handles	• Height of handle at 850–1100mm from floor level. • Easy for people to reduce strength and dexterity to control. • Lever handles and push type mechanisms are recommended.
Doors	• Minimum 900mm wide for wheelchair access. • Distinguished door and wall with colour is useful for visual impaired people. • Revolving or turnstiles doors should provide at entrance for wheelchair access.

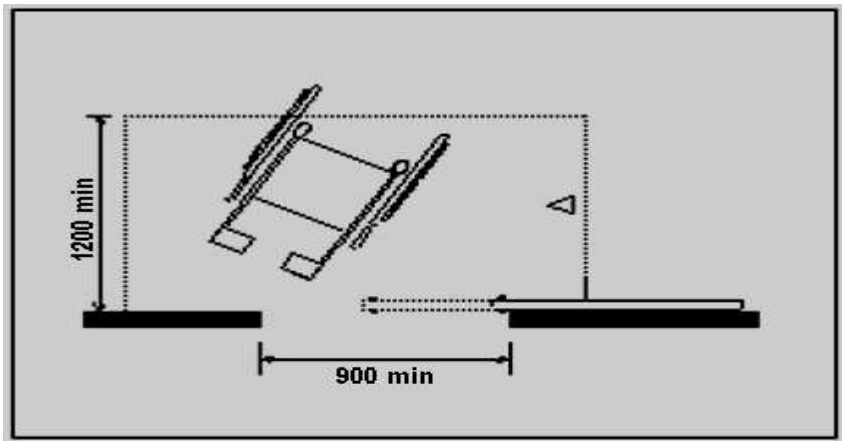


Figure 28 Sliding door

(Sources: DINF, 2011)

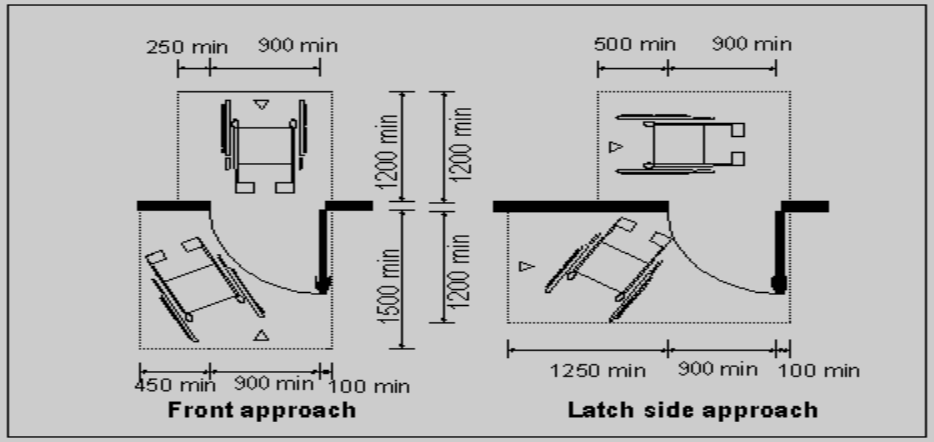


Figure 29 Doorways

(Sources: DINF, 2011)

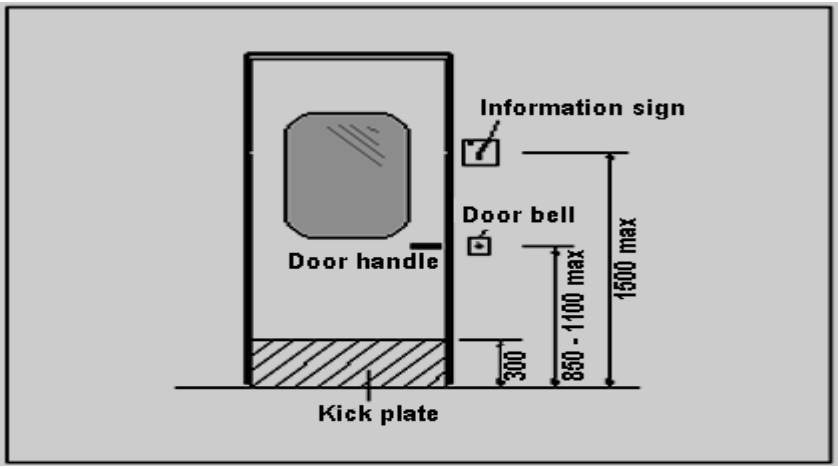


Figure 30 Outsides of door

(Sources: DINF, 2011)

2.5.12 Signage

Signage direction	• Clearly indicated the type and location of available facility. • Not excessive number. • Visible, clear, simple and easy to read and understand.

	• International symbol of accessibility is identified.
Signage surface	• Lit at night. • Used contrast colours to differentiate the figure from background. (Normally used white, black, yellow, red, blue and green.) • Avoid using combination of red/green and yellow/blue because colour blind people would confuse.
Positioned	• Placed at main entrances or place where changed in direction or level occurred. • Avoid placing behind glass due to reflection. • Avoid placing on pedestrian path due to obstruction.
Height of signage	• At 900mm high and 1800mm high.

Figure 31 Direction graphic signage

(Source: Land Archy Malaysia, 2008)

Figure 32 Maps and information panels for disabled

(Source: Land Archy Malaysia, 2008)

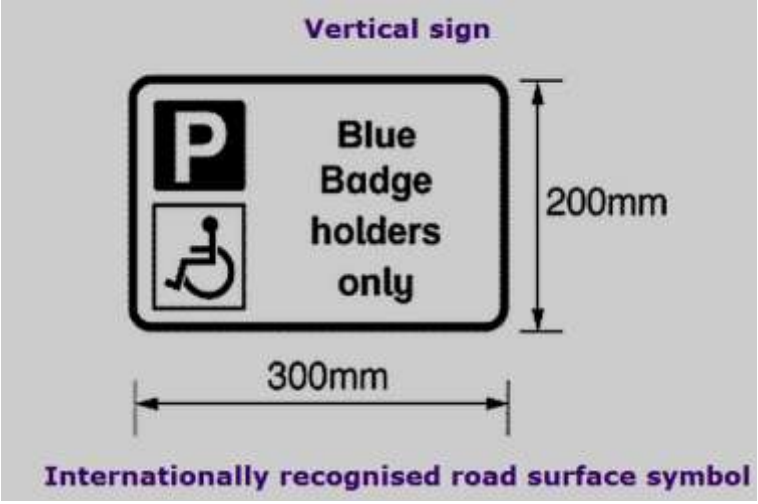


Figure 33 International recognised symbol

(Source: Access Code, 2011)

2.5.13 Toilet

Floor space	• Minimum 2.13m by 2.13m, at least 4.5sq meters.
Doors	• At least 900mm wide. • Door handles at 500mm high from floor level. • Door handles fixed along 900mm long at edge of door.
Water closet	• 400–475 mm high from floor level. • Distance between centre lines of water closet to adjacent wall is 460–480 mm.
Mirror	• 900 mm high from floor level. • Slant between 5° and 10°.
Handrails	• Located at 600–750mm high from floor level.
Emergency fittings	• Emergency alarms are fitted. • Emergency cord fitted to each side of seat and sink. • Emergency siren and light beacon are fitted.
Tissue holders	• Fitted next to toilet seat with distance 500mm.
Urinals	• Mounted at height not more than 400mm from floor

	level.
Basins	• 700mm wide x 400mm deep x 680mm high. • Rim not higher than 780mm.

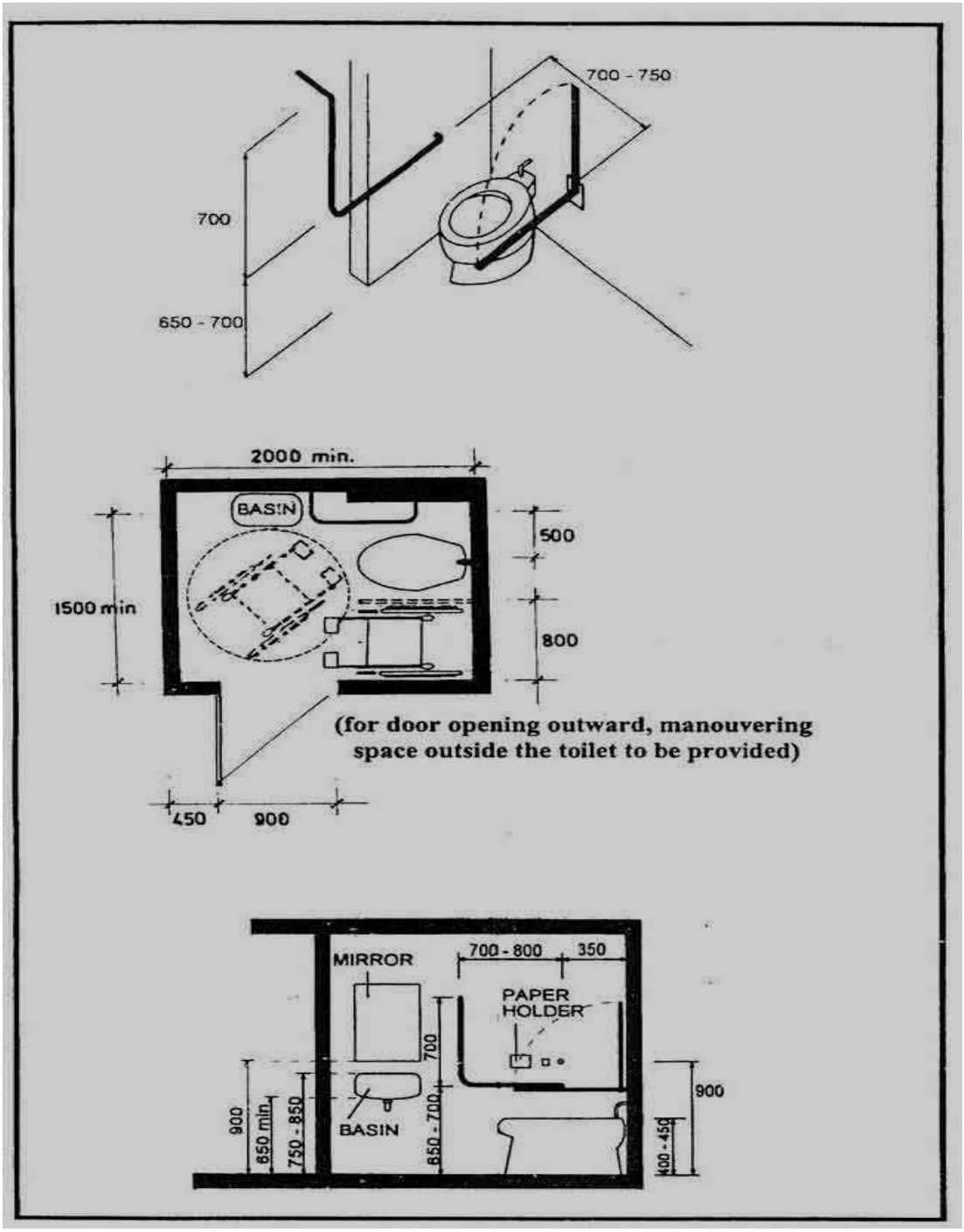


Figure 34 Water closet

(Sources: Disabled Person Penang, 2011)

CHAPTER 3

RESEARCH METHODOLOGY

This chapter discussed the research method used. Research is a process to gather, analysis and interpreted the information, data and facts for the advancement knowledge to support in this research. It was carried out to answer the problem faced in the study. The method of research should be determined based on the objectives of the project.

3.1 Steps of research

Figure 35 Steps of research

3.2 Identify aim and objectives

It is essential to know the project aim and objectives of the research. This research is aimed to improve the design, facilities and services in building and infrastructure. The objective in this research is:

- To determine the design, facilities and services provided in building and infrastructure.
- To identify the existing problems and dissatisfaction usage regarding the facilities and services in building and infrastructure of the disabled people.
- To recognize the regulations and requirements approach on design, facilities and services in building and infrastructure.
- To make suggestions to improve the current design, facilities and services to the disabled people.

3.3 Literature review

Literature review is a process to gather all information from other sources finding from reference books, newspapers, magazines, online sources and etc. It also includes evaluate and present the information. It serves as an introductory chapter. It critically analyses and assesses previous research.

3.4 Determine research methods

3.4.1 Case study

Checklist and observation are undertakes together in order to check and ensure the disabled facilities have provided at public building and infrastructure. The aim of the checklist is to confirm whether the facilities provided in the public building and

infrastructure have fulfilled with the regulations and requirements assured by local authorities. Besides, the observation is conducts to identify the problems and difficulties faced by disabled in public building and infrastructure. All issues identified were record down. Photos are being taken as evidences to support the issues identified. The content of the checklist is shown at below:

Table 1 Checklist for disabled facilities at public building and infrastructure

NO	Description	Yes / No (√)
1.	**Car park**	
A.	Is the surface levelled with anti-resistance?	
B.	Are the car park lots painted with contrast colours or sign to differentiate with others?	
C.	Is there provided sufficient area for accessibility?	
D.	Are the pedestrian lanes provided?	
E.	Are the car park lots located at accessible area?	
F.	Is the car park lots located at well ventilated and clear light area?	
G.	Is the picking up and dropping off area provided?	
2.	**Pathways**	
A.	Is there sufficient space for wheelchair users to manoeuver?	
B.	Are the pathways well connected?	
3.	**Ramp and kerb ramp**	
A.	Is the surface levelled with anti- slip?	
B.	Is the ramp width enabling for wheelchair users to access?	
C.	Is the gradient of ramp proper provided?	
D.	Are the handrails provided?	
4.	**Guiding block**	
A.	Are the guiding blocks provided?	
B.	Are the guiding blocks placed at proper places?	
5.	**Handrail**	

NO	Description	Yes / No (√)
A.	Is the handrail presented in firm and comfortable grip texture?	
B.	Is the plate Braille available at beginning and end of handrail?	
C.	Is the handrail painted with contrast colours with surrounding area?	
D.	Is the handrail provided at proper height?	
6.	**Staircase**	
A.	Is the staircase painted with sharp colours?	
B.	Are the nosing illuminated or protruded?	
C.	Are the handrails provided?	
7.	**Lift**	
A.	Is there sufficient space for wheelchair users to manoeuver?	
B.	Is the lift located at accessible places?	
C.	Is the doorway width enabling for wheelchair users to access?	
D.	Is the lift door indicated in bright colours with surrounding wall?	
E.	Is the Braille types label buttons presented?	
F.	Is the lower internal operating panel presented?	
G.	Is the handrail installed?	
H.	Is the visual and voice indicators installed?	
I.	Is the lift floor covered with non-slip material?	
8.	**Doorways**	
A.	Is the doorway width enabling for wheelchair users to access?	
B.	Is the threshold levelled with kerb ramp?	
C.	Is the mechanism door provided at entrance?	
9.	**Signage**	
A.	Are the directions clear indicated?	
B.	Are the signage lit at night?	
C.	Are the signage used contrast colours to differentiate the figure from background?	
D.	Are the signage placed at proper places?	
10.	**Toilet**	
A.	Is the doorway width enabling for wheelchair users to access?	

NO	Description	Yes / No (√)
B.	Is there sufficient space for wheelchair users to manoeuver?	
C.	Are the handrails provided?	
D.	Are the emergency fittings provided?	

3.4.2 Questionnaire

Questionnaires were sent to disabled center to interview the disabled people such as vision impaired and wheelchair bound. The interview is used to obtain the valuable opinions and dissatisfaction on using facilities and services in building and infrastructure. Expected respondents are 20 persons. The questions showed at below are the questions proposed to interview for disabled people. The proposed interview questions as below:-

Questionnaire questions:

1. Among them, please rank your satisfaction based on the place's facilities provided for the disabled people.
   This question is get know which public area provided more satisfy disabled facilities for disabled people. This question is achieved the first objective, "to determine the design, facilities and services provided in building and infrastructure.

2. Which kinds of facilities for the disabled do you use often?
   This question is to get know which kind of disabled facilities is most preference used by disabled people. This question is achieved the first objective as well.

3. In your opinion, do you think the current facilities provided for the disabled are practicable?

This question is to get know whether the current disabled facilities provided have proper functional or form as obstruct for disabled people. This question is achieved the first objective.

4. In your opinion, how would you rate the satisfaction of the following disabled facilities provided in public buildings and infrastructure?

5. If 10 marks are the full marks, how would you rate the satisfaction on overall disabled facilities provided in public buildings and infrastructure?
   Question 4 and 5 are to get know the overall satisfaction of the facilities provided for disabled people in public building and infrastructure.

6. Do you face any difficulties when moving around or using the facilities for the disabled? If yes, what difficulties have you faced?
   This question tries to find out the difficulties faced by disabled people. Through this question, the second objective is achieved.

7. In your opinion, do you think the facilities provided for the disabled in public buildings and infrastructures are complying with building regulations?
   This question is achieved the third objective, "to recognise the regulation and requirement approach on design, facilities and services in building and infrastructure". This question is to get know whether the disabled facilities constructed according to the regulation required.

8. In your opinion, where is the most essential place to provide facilities for the disabled?

9. In your opinion, which kind of facilities for the disabled is most significantly provided?
   Question 8 and 9 are the questions to get know the place and kind of disabled facilities are most critical for disabled people. Both questions are achieved the fourth objective which recommend the crucial place and facilities must available.

10. In your opinion, which kind of facilities for the disabled is critical and needs to be improved immediately?
    This question is achieved the fourth objective as well. A question is to get know the kind of disabled facilities is most dissatisfied by disabled people tends to require improve instantly.

3.4.3 Interview

In this project, the architects would be interviewed. Two or three persons of the professional will be involved. Perspective design explanations and suggestions on disabled facilities will be acquired from architects.

The questions showed at below are the questions proposed to interview for architect.

Interview questions:

1. Is necessary to provide facilities in public building and infrastructure for the disabled? Why?
   This question is to check out the opinion of the interviewee whether provided the disabled facilities is crucial. It is met the first objective.

2. Which type of buildings provides more facilities for the disabled, public or private? Could you elaborate and give examples?
   This question is to get know whether the public building or private building is more concern on disabled facilities provided. This question is achieved the first objective "to determine the design and facilities in building and infrastructure".

3. What are the probable reasons for developers or town planners to neglect on facilities provided for the disabled?
   This question tries to determine the reason on why the developer or town planner not provided the disabled facilities in development project. It achieved the second

objective, "to identify the problem exist on design, facilities and services in building and infrastructure".

4. Would implementing facilities for the disabled involve substantial-cost in the development of the projects? Could you approximately give a percentage involved on the contract sum?

5. Do you think the cost limitation on the development project would cause many defects on the design of facilities for the disabled?
   Question 4 and 5 are asked to determine whether the variable cost will affect the design of disabled facilities. It tried to find out the problems exist in the disabled facilities and met the second objective.

6. Which kinds of facilities for the disabled can be prioritised in the event of cost constraint on development projects?
   This question is to identify the basis disabled facilities must be provided in the development project in order to meet the building's regulation in Malaysia. The question is achieved the third objective, "to recognise the regulations and requirements approach on design, facilities and services in building and infrastructure.

7. Person with Disabilities Act (PWDA), Uniform Building by-Law (UBBL) and Malaysia Standard are the building and infrastructural regulations provided to control the design of facilities for disabled people. Do you think that those facilities provided in Malaysia are complying with the regulations? If no, what factors caused the developers or town planners not to comply with the regulations?
   This question is to get know whether the regulation and legislation provided have imposed on the disabled facilities in building and infrastructure. It met the third objective as well.

8. Recently, there have been many complaints regarding defects on the design of facilities for the disabled. How can we overcome the problems to satisfy the needs of the disabled?

This question tries to attain the methods to improve the design and facilities in building and infrastructure. It achieved the fourth objective, "to make suggestion to improve the current design, facilities and services.

9. What is your perspective on the design of facilities for the disabled in the future?
   This question is achieved the fourth objective as well. It tries to obtain the opinions to improve the future design of disabled facilities.

10. How can we enforce developers and town planners to provide disabled facilities in building and infrastructure?
    This question will get some suggestions to impose the developer and town planner to provide the disabled facilities for disabled people and met the fourth objective.

3.4.4 Analysis of past documents

This involves summarizing all information from the previous research. All data can be collected from internet, books, articles, journals, newspapers, and magazines. Information collected would be related to disabled facilities and services in building and infrastructure.

3.5 Data collecting, analysing and conclusion

Data collected through case study, questionnaire, interview and literature review would be analysed. From the data gathered, the recommendation can be made to improve the facilities.

CHAPTER 4

RESULTS AND DISCUSSIONS

This chapter is analysing and discussing the data gathered. Case study, questionnaire and interview are conducted to collect the data. The purpose of case study is to ensure the buildings are complied with building regulations. Furthermore, questionnaire and interview are performed to find out the existing problems and disable people's dissatisfaction when using the facilities.

4.1 Case Study Analysis

Two public buildings were selected in Setapak area to do the case studies about the facilities design provided for disabled people. Purpose to carry out the case study is to examine whether the disabled facilities are provided in building and infrastructure.

Jusco Wangsa Maju, a shopping centre and Wangsa Maju Putra LRT station, a terminal of public transport were chosen to conduct the case studies. Checklist is performed to collect the data and information. In addition, photographs were taken during the case studies as evidences for the research.

4.1.1 Case Study 1: Jusco Wangsa Maju

4.1.1.1 Building Background

Jusco Wangsa Maju (formerly known as Alpha Angle Wangsa Maju) is intelligently designed building as a landmark of Wangsa Maju district. There are two storeys of rooftop car parks and two storeys of shop lots. Jusco Wangsa Maju was completed in year 1992. It is located not far from Wangsa Maju LRT Station. The purpose of construction of the Jusco Wangsa Maju is to create a leisure place and convenient retail shops for occupants in Setapak area. It embraced a large varieties food court, kid's entertainment place, health centre, bookstore, supermarket and etc.

Figure 36 Jusco Wangsa Maju located at Setapak Wangsa Maju
(Source: http://www.mycen.my/alpha-angle-shopping-centre/)

4.1.1.2 Design Checklist

Table 2 Checklist for Jusco Wangsa Maju

No.	Description	Yes / No (√)
1.	**Car park**	√
A.	Is the surface levelled with anti-resistance?	
B.	Are the car park lots painted with contrast colours or sign to differentiate with others?	√
C.	Is there provided sufficient area for accessibility?	**Narrow**
D.	Are the pedestrian lanes provided?	√
E.	Are the car park lots located at accessible area?	√
F.	Is the car park lots located at well ventilated and clear light area?	√
G.	Is the picking up and dropping off area provided?	√
2.	**Pathways**	√
A.	Is there sufficient space for wheelchair users to manoeuver?	**Narrow**
B.	Are the pathways well connected?	**Unconnected**
3.	**Ramp and kerb ramp**	
A.	Is the surface levelled with anti-slip?	
B.	Is the ramp width enabling for wheelchair users to access?	
C.	Is the gradient of ramp proper provided?	
D.	Are the handrails provided?	
4.	**Guiding block**	
A.	Are the guiding blocks provided?	
B.	Are the guiding blocks placed at proper places?	
5.	**Handrail**	√
A.	Is the handrail presented in firm and comfortable grip texture?	**Coarse & hard to grasp**
B.	Is the plate Braille available at beginning and end of handrail?	
C.	Is the handrail painted with contrast colours with	

No.	Description	Yes / No (√)
	surrounding area?	
D.	Is the handrail provided at proper height?	**Inappropriate**
6.	**Staircase**	√
A.	Is the staircase painted with sharp colours?	
B.	Are the nosing illuminated or protruded?	√
C.	Are the handrails provided?	√
7.	**Lift**	√
A.	Is there sufficient space for wheelchair users to manoeuver?	√
B.	Is the lift located at accessible places?	√
C.	Is the doorway width enabling for wheelchair users to access?	√
D.	Is the lift door indicated in bright colours with surrounding wall?	√
E.	Is the Braille types label buttons presented?	√
F.	Is the lower internal operating panel presented?	
G.	Is the handrail installed?	√
H.	Is the visual and voice indicators installed?	√
I.	Is the lift floor covered with non slip material?	**Slippery floor tiles**
8.	**Doorways**	√
A.	Is the doorway width enabling for wheelchair users to access?	√
B.	Is the threshold levelled with kerb ramp?	
C.	Is the mechanism door provided at entrance?	√
9.	**Signage**	√
A.	Are the directions clear indicated?	√
B.	Are the signage lit at night?	
C.	Are the signage used contrast colours to differentiate the figure from background?	√
D.	Are the signage placed at proper places?	√

No.	Description	Yes / No (√)
10.	**Toilet**	√
E.	Is the doorway width enabling for wheelchair users to access?	√
F.	Is there sufficient space for wheelchair users to manoeuver?	√
G.	Are the handrails provided?	√
H.	Are the emergency fittings provided?	

4.1.1.3 Discussion and Analysis

Table 3 Discussion and analysis of facilities provided at Jusco Wangsa Maju

Facilities	Observation	Comment	Suggestion
Parking lots  Figure 37 Disabled parking lots  Figure 38 Pedestrian lanes connected to main entrance	**Parking lots** • No levelled with anti-resistance. • Painted with contrast colours. • Located at front of main entrance for easy accessibility. • Located at space that is well-ventilated and clear lights are provided. • Accessible width between two parking lots is narrow.	• There is a risk to fall especially during raining day, as there is no installation of the anti-resistance elements. • Accessible width between two parking lots is narrow; it is very inconvenient for wheelchair users to move around.	• Anti-resistance must be applied at parking lots and access area. • Sufficient accessible area among two parking lots should provide.
	Signage • Presented to differentiate with other lots.	• Presented to avoid misuse by normal people.	

Facilities	Observation	Comment	Suggestion
	• Lighting is installed.	• Lighting is installed; easy to read at night.	
	Pedestrian lane • Furnished and connected to main entrance. • Roof for shading is not provided. • Guiding blocks are not furnished.	• Connected to main entrance to ensure users' safety. • It causes difficulties for pedestrians during raining day. • Unable to guide the visual and hearing disabled people.	• Roof for shading should be installed for pedestrians. • Guiding block should be furnished at pedestrian lane.
Picking up and dropping off zone 	**Zone** • Space is wide enough for users to access. • Located at the front of main entrance with shading cover. • Located at area with adequate daylight and well ventilated. • Guiding blocks are not	• Located at suitable area. Users can slowly move in or out from car during raining day. • Absent of guiding blocks; unable to guide the visual and hearing disabled people.	• Guiding blocks should be furnished. • Change the floor tiles or paint with sharp colour to indicate the zone.

Facilities	Observation	Comment	Suggestion
 Figure 39 Drop off and pick up zone and signage	furnished. • Colours floor tiles are used. **Signage** • Presented to identify the pickup and drop off zone.	• Colour of floor tiles is pale, difficult to attract people's attention. • Presented to prevent users misuse as parking space.	
Pathway   Figure 40 Pathway	**Pathway** • No connected. • Located far from car park area. • Surface of floor is uneven. • Shading cover is presented. • Width of pathway is narrow. • Handrail is not provided. • Guiding blocks are not furnished. • Lighting is not installed.	• Located far from car park area, user's safety is secured. • Unacceptable floor surface presented. It will cause accidents when pedestrians pass through. • Shading cover is provided to protect people from exposing to sunlight and raining. • Pathway is not wide enough for wheelchair users to move	• Seamless connected pathway must be provided for pedestrians. • Proper and smooth floor finishes must be available for pedestrians. • Anti-slip floor tiles should be applied to prevent pedestrians from falling down during raining day. • Minimum width of pathway

Facilities	Observation	Comment	Suggestion
		around. • Handrail is not provided to assist pedestrians. • Absent of guiding blocks to lead users. • No lighting provided, pedestrians' safety are being threatened.	must at least enable to allow the wheelchair users to access. • Handrail should be installed. • Guiding block should be furnished. • Adequate lighting has to be supplied to enhance user's well-being.
Handrails  Figure 41 Handrail	**Handrails** • Not painted with contrast colour to differentiate with surrounding area. • Surface of handrails is coarse and hard to grasp. • Located at improper area. • Installed at inappropriate height.	• People are not aware the handrail when painted in consistent colour with surrounding. • Coarse and sharp surface of handrail will easily harm the user's hand. • Simply located the handrail	• Contrast colours are recommended to use. • Smooth, firm and comfortable grip handrail has to be installed. • Locate at proper places and with appropriate height. • Braille type small plates

Facilities	Observation	Comment	Suggestion
	• Braille plates are not available at beginning and end of handrail.	will cause inaccessible by wheelchair users. • Handrail is too high; unreachable by wheelchair users. • Absent of Braille plate which cannot indicate its position for visual impairment people.	should be attached at beginning and end of handrail.
Staircase  Figure 42 Staircase	**Steps** • Not painted with sharp colour. • Absent of warning tactile.	• Not painted with contrast colour to differentiate with flat floor. • Warning tactile is not present to guide the vision impaired people.	• Painting with protrude colours to distinguish from flat floor. • Hazard warning tactile paving should be furnished at top and bottom of steps.
	Nosing • Anti-slip materials are not furnished.	• Non-slip nosing tiles are not present. Users may encounter	• Anti-slip nosing tiles should be applied.

Facilities	Observation	Comment	Suggestion
	• Protrude nosing are present.	the danger of slipping down from staircase.	
	Handrail • Firm and comfortable grip handrails are provided at both sides. • Braille type small plate is not attached at beginning and end of handrail.	• Braille type small plate is not attached at beginning and end of handrail to indicate the staircase position for vision impaired people.	• Braille type small plate should be attached at beginning and end of handrail.
	Landing • Width of landing is narrow.	• Landing is too narrow; unable for wheelchair users to move around.	• Width and depth of intermediate landing should be at least the width of flight.
Lift	**Lift door** • Located at accessible place. • Indicated with bright colour to discriminate with the wall. • Width of lift door is wide	• Absent of automatic re-opening sensor which cannot trap the passengers between the door panels.	• Photo- electric sensor has to be installed to detect the passengers and control the door.

Facilities	Observation	Comment	Suggestion
	enough for wheelchair users to access. • Opening and closing sensors are deficient. • Visual indicator is present outside the platform to announce the lift position.	• Sound indicator is not provided to enable the open and closing sound of the lift door to be heard. Vision impaired people are not alerted whether the lift door is open or close.	• Audio device is proposed to be installed at lift door to indicate whether the door is opened or closed.
	**<u>Operation panel</u>** • Braille type label buttons are available for visual impairment people. • Single control panel is placed at proper height at right hand side of lift. • Call-button, interphone switches, visual and voice indicators are installed inside the lift.	• Only single sided control panel provided. Wheelchair users cannot reach the buttons by their heights.	• Both sided control panels and one control panel at lower level should be provided inside the lift.

Facilities	Observation	Comment	Suggestion
 Figure 43 Lift	**Lift accessories** • Sufficient space is available inside the lift. • Gap between floor of platform and lift is smaller. • Transparent glass is used as lift wall. • Horizontal handrail provided at three sides of interior lift. • Slippery floor tiles are used.	• Adequate space provided inside the lift for wheelchair users to manoeuvre. • Gap between floor of platform and lift is smaller. It does not create obstruction for wheelchair users to access. • Clear glass wall is not suitable to be lift wall. Some passengers who have acrophobia may fear to use the lift. • Smooth floor tiles are inappropriate to be used inside the life. Passengers will lose their stability as the lift moves.	• A mirror wall is recommended to be provided at three sides of wall lift for passengers to know whether the door is opened or closed. • Anti-slip carpet is advised to use as floor finishes.

Facilities	Observation	Comment	Suggestion
Doorways  Figure 44 Doorway	**Door** • Glass door is used. • Width of the door is wide enough for wheelchair users to access. • Sticker is placed on the glass to distinguish between door and wall. • Threshold is not required. • Automatic re-opening sensor is installed above the door. • Audio indicator and guiding block is not provided.	• Transparent glass door is used. Users can easily see things and people from the opposite side. • Absent of sound device and guiding blocks to guide the visual and hearing disabled people.	• Sound indicator and guiding blocks should be provided.
Signage  Figure 45 Signage	**Signage** • The types and location of available facilities are clearly indicated. • Visible, clear, simple and easy	• Colour used for signage is not bright enough to attract people's attention. • Height of signage creates	• Bright colours have to apply to signage for differentiation between the symbols and background.

Facilities	Observation	Comment	Suggestion
	to read and understand. • Contrast colours are used to discriminate between symbol and background. • Placed at ceiling height which will not impede people walkway.	difficulties for people who has visual problem.	• Height of signage should be adjusted to proper height.
Toilet  Figure 46 Toilet Furniture	**Toilet furniture** • Sufficient space provided. • Basin and water closet are provided at suitable height. • Handrails are installed for disabled people. • Mirror is installed above the basin. • Tissue holder and tissues are not provided. • Emergency fittings are not	• Adequate space provided for wheelchair users to manoeuvre. • Braille type small plates are no attached at surface of handrail to tell the visual impairment people the location of toilet furniture. • Tissue holder and tissues are not provided. They are basic	• Braille type small plates should be attached at surface of handrails. • Tissues holder and tissues must be supplied at all times. • Emergency fittings such as alarm, cord, siren and light beacon should be installed in toilet.

Facilities	Observation	Comment	Suggestion
 Figure 47 Toilet Door	provided. • Sufficient door width provided. • Wallpaper is stacked at door. • Signage is present.	things which should be supplied. • Emergency fittings are not available; people cannot discover any accident that happens inside the toilet. • Door is wide enough for wheelchair users to access. • Wallpaper is stacked at the door to distinguish between the door and wall.	

4.1.2 Case Study 2: Wangsa Maju LRT Station

4.1.2.1 Building Background

Wangsa Maju LRT station is an elevated rapid transit station in northern Kuala Lumpur, Malaysia. It forms part of the Kelana Jaya line which formerly known as PUTRA. The station was opened on June 1, 1999. It is a main transportation line of Wangsa Maju district. The station is formed by three storeys of platform levels.

Figure 48 Wangsa Maju LRT station
(Source: http://en.wikipedia.org/wiki/Wangsa_Maju_LRT_station)

4.1.2.2 Design Checklist

Table 4 Checklist for Wangsa Maju LRT station

NO	Description	Yes / No (√)
1.	**Car park**	√
A.	Is the surface levelled with anti- resistance?	
B.	Are the car park lots painted with contrast colours or sign to differentiate with others?	
C.	Is there provided sufficient area for accessibility?	

NO	Description	Yes / No (√)
D.	Are the pedestrian lanes provided?	
E.	Are the car park lots located at accessible area?	√
F.	Is the car park lots located at well ventilated and clear light area?	
G.	Is the picking up and dropping off area provided?	√
2.	**Pathways**	√
A.	Is there sufficient space for wheelchair users to manoeuver?	
B.	Are the pathways well connected?	**Unconnected**
3.	**~~Ramp and~~ kerb ramp**	√
A.	Is the surface levelled with anti- slip?	**Indent lines are used**
B.	Is the ramp width enabling for wheelchair users to access?	**Post as an obstruction**
C.	Is the gradient of ramp proper provided?	√
D.	Are the handrails provided?	
4.	**Guiding block**	√
A.	Are the guiding blocks provided?	√
B.	Are the guiding blocks placed at proper places?	**Improper placed**
5.	**Handrail**	√
A.	Is the handrail presented in firm and comfortable grip texture?	√
B.	Is the plate Braille available at beginning and end of handrail?	
C.	Is the handrail painted with contrast colours with surrounding area?	
D.	Is the handrail provided at proper height?	√
6.	**Staircase**	√
A.	Is the staircase painted with sharp colours?	
B.	Are the nosing illuminated or protruded?	√
C.	Are the handrails provided?	√
7.	**Lift**	√

NO	Description	Yes / No (√)
A.	Is there sufficient space for wheelchair users to manoeuver?	√
B.	Is the lift located at accessible places?	√
C.	Is the doorway width enabling for wheelchair users to access?	√
D.	Is the lift door indicated in bright colours with surrounding wall?	√
E.	Is the Braille types label buttons presented?	√
F.	Is the lower internal operating panel presented?	
G.	Is the handrail installed?	**2 sided only**
H.	Is the visual and voice indicators installed?	√
I.	Is the lift floor covered with non slip material?	√
8.	**Doorways**	√
A.	Is the doorway width enabling for wheelchair users to access?	√
B.	Is the threshold levelled with kerb ramp?	
C.	Is the mechanism door provided at entrance?	
9.	**Signage**	√
A.	Are the directions clear indicated?	√
B.	Are the signage lit at night?	
C.	Are the signage used contrast colours to differentiate the figure from background?	√
D.	Are the signage placed at proper places?	√
10.	**Toilet**	√
A.	Is the doorway width enabling for wheelchair users to access?	√
B.	Is there sufficient space for wheelchair users to manoeuver?	√
C.	Are the handrails provided?	√
D.	Are the emergency fittings provided?	

4.1.2.3 Discussion and Analysis

Table 5 Discussion and analysis of facilities provided at Wangsa Maju LRT station

Facilities	Observation	Comment	Suggestion
Parking lots  Figure 49 Parking lots	**Parking lots** • Adequate space provided for users to park in the car. • Insufficient space provided between two parking lots. • Located near to lift. • Placed proximity to bus stop. • No levelled with anti-resistance. • No painted with contrast colour.	• Even the size of parking lot is big enough for car to park in, but there is insufficient space provided between two parking lots for wheelchair users to manoeuver. • The air surrounding the bus stop is polluted. The place is unsuitable for disabled people to access. • Users cannot recognise the place if the parking lots no paint with bright colour.	• Accessible area among two parking lots should be provided for users to access. • Parking lots should be properly arranged and placed at appropriate area. • Anti-slip material must be furnished at parking lots and accessible area. • Sharp colour should be applied at parking lots.

Facilities	Observation	Comment	Suggestion
	Pedestrian lane • No presented.	• Absent of pedestrian lane means put the users on risk.	• Pedestrian lane should be furnished to enhance users' safety.
Picking up and dropping off zone  Figure 50 Picking up and dropping off zone	**Zone** • Improper furnished the zone. • Absent of signage. • Placed behind the parking lots. • Guiding blocks are not furnished.	• Inappropriate positioned of zone; users will ignore to use it. • Absent of signage; people will misuse the area as parking lots. • Located behind the parking lots. Users' safety is being threatened when the car reverses. • Absent of guiding blocks; unable to guide the visual or hearing disabled people.	• Zone should be located at accessible area. • Signage must be presented to indicate people. • Guiding blocks must be available for pedestrian.

Facilities	Observation	Comment	Suggestion
Pathway  Figure 51 Pathway	**Pathway** • No connected. • Shading cover is presented. • Many columns are erected at center of pathway. • Bus stop is built at center of pathway. • Insufficient space is allowed for wheelchair users to manoeuver. • Lighting is not installed. • Handrail is not provided. • Guiding blocks are not furnished.	• Shading cover is provided to protect people from exposing to sunlight and raining. • Columns are formed an obstruction for users. • Bus stop is created an impediment for users. • Pathway is narrow; unable for users to access. • No lighting provided, pedestrians' safety are being threatened. • Handrail is not provided to assist pedestrians. • Guiding blocks are not presented to indicate the direction.	• Seamless connected pathway must be provided for pedestrians. • Columns must be removed or placed at side of pathway. • Bus stop is recommended to build at particular place. • Sufficient space must be at least enable to allow for users to access. • Adequate lighting must be supplied to enhance user's well-being. • Handrail should be installed at both sides of pathway. • Guiding block should be furnished to lead the users.

Facilities	Observation	Comment	Suggestion
Kerb ramp   Figure 52 Kerb ramp	**Kerb ramp** • Returned kerb ramp is presented. • Located at place out of usual line of pedestrian flow. • Placed at area which avoid from water accumulates. • A post stands at among of ramp. • Indent lines are presented. • No painted with sharp colours. • Absent of guiding blocks.	• Improper placed the post; ramp becomes useless. • Indent lines are used as slip-resistant purpose. • Ramp no painted with contrast colours; people may encounter the danger of falling down. • Guiding blocks are not presented to warn the users.	• Proper design should be planed before building. • A post should be removed. • Paints the kerb ramp with contrast colours to distinguish the ramp and floor area. • Guiding blocks should be furnished to assist the vision impaired people.
Guiding blocks	**Guiding blocks** • Inappropriate placed of guiding blocks. • Unconnected guiding blocks presented. • Colour of guiding blocks is	• Improper placed of guiding blocks; indicate users in wrong direction. • Colour of guiding blocks is light; unable to attract users'	• Systematic guiding blocks should be provided to guide the users. • Guiding blocks should be furnished with sharp colour.

Facilities	Observation	Comment	Suggestion
  Figure 53 Guiding blocks and lines	light.	awareness.	
Handrails  Figure 54 Handrail	**Handrail** • Firm and easy to grasp. • Installed at corner. • Installed at proper height. • Unconnected handrail is presented. • Colour of handrail is same with the wall. • Absent of Braille type small plate.	• Unconnected positioned of handrail; unable to assist people. • Similar colour used at handrail and wall; people cannot recognise the handrail position. • Braille type small plates are not attached at beginning and end of the handrail; unable to	• Connected handrail is recommended to install. • Contrast colours must be used to differentiate between the wall and handrail. • Braille type small plates should be presented at beginning and end of handrails to indicate its position.

Facilities	Observation	Comment	Suggestion
		guide the users.	
Staircase    Figure 55 Staircase	**Steps** • Risers and treads are standardised built up. • Absent of warning tactile. • No painted with sharp colour.	• Warning tactile is not present to guide the vision impaired people. • Not painted with contrast colour to differentiate with flat floor.	• Hazard warning tactile paving is recommended to furnish at top and bottoms of steps. • Painting with protrude colours to distinguish from flat floor.
	Nosing • Protrude nosing tiles is used.		
	Handrails • Presented at both sides. • Located at proper height. • Easy to grip.		
	Landing • Guiding blocks are furnished.		

Facilities	Observation	Comment	Suggestion
Lift      Figure 56 Lift	**Lift doors** • Located at accessible area. • Lift door is wide enough for wheelchair users to access. • Lift door and wall are showed in contrast colours to differentiate with each other. • Automatic re-opening sensor is not installed between the lift doors.	• Absent of automatic re-opening sensor which cannot trap the passengers between the door panels.	• Photo-electric sensor has to be installed to detect the passengers and control the door.
	Operation panel • Call-button, operating panel, interphone switches are presented at proper height. • Braille type push operating buttons are used. • Internal operating panel is provided at left-side wall	• Only single sided control panel provided. Wheelchair users cannot reach the buttons by their heights. • Visual and hearing disabled people are required the visual and voice indicators have	• Both sided control panels and one control panel at lower level should be provided inside the lift. • Visual and voice indicators should be installed at inside and outside the lift to assist

Facilities	Observation	Comment	Suggestion
	(view from main entrance). • Visual and voice indicators are installed at inside the lift to announce the floor location for visual impairment people.	install at outside the lift.	the visual and hearing disabled people.
	Lift accessories • Sufficient space is provided inside the lift. • Floor is covered with non-slip carpet. • Horizontal handrail is attached at both sides of interior lift. • Guiding blocks are furnished at lift doorway.	• Adequate space provided inside the lift for wheelchair users to manoeuvre. • Non-slip carpet is furnished to avoid any accidents happen when the lift moves.	• Three sides horizontal handrail should be provided without separation. • A mirror is recommended to provide at inside of wall lift for passengers to view the door opening or closing.
Doorway	**Door** • Door is wide enough for wheelchair users to access. • Manual opening type door is	• Manual opening door is used. It makes difficulties for wheelchair users when they	• Automatic re-opening sensor door is recommended to install.

Facilities	Observation	Comment	Suggestion
 Figure 57 Doorway for disabled to access	used. • Similar colour is used at door and other equipments.	access. • Same colour is used at door and other equipments; users are hard to recognise it.	• Contrast colour should be used to differentiate between door and other equipments.
Signage   Figure 58 Signage	**Signage** • The types and location of available facilities are clearly indicated. • Visible, clear simple and easy to read and understand. • Contrast colours are used to discriminate between symbol and background. • Placed at main entrance. • Absent of Braille type signage.	• Figures of signage are presented in smaller size. Visual problems users are hard to read. • Absent of Braille type signage; cannot guide the visual impairment people.	• Figures and symbol at signage should be written in bigger size. • Braille type signage is suggested to provide.

Facilities	Observation	Comment	Suggestion
Toilet  Figure 59 Toilet	**Toilet furniture** • Sufficient space provided. • Basin and water closet are provided at suitable height. • Handrails are installed for disabled people. • Mirror is installed above the basin. • Toilet door is wide enough for wheelchair users to access. • Tissue holder and tissues are not available. • Emergency fittings are not installed. • Braille type small plates are not attached at surface of handrails.	• Tissue holder and tissues are not provided. They are basic things which should be supplied. • Emergency fittings are not available; people cannot discover any accident that happens inside the toilet. • Braille type small plates are no attached at surface of handrail to tell the visual impairment people the location of toilet furniture.	• Tissues holder and tissues must be supplied at all times. • Emergency fittings such as alarm, cord, siren and light beacon should be installed in toilet. • Braille type small plates should be attached at surface of handrails.

As the conclusion, Wangsa Maju LRT station is provided with more facilities for disabled people. Car park, pathway, staircase, lift, doorway, signage and toilet are the basic facilities that have been provided in both buildings. Nevertheless, the most important facilities such as guiding blocks are mostly not provided for visual impairment people. The problem faced by wheelchair users is manoeuvre problem. For instance, doorway is not wide enough to access and absent of ramp causes inaccessible for wheelchair users. Even though, some facilities that are provided in both buildings are not being placed at appropriate area and subsequently, they become useless.

4.2 Questionnaire Analysis

20 respondents had participated in this questionnaire interview. Most of the respondents are wheelchair users. Only several respondents are vision impaired people. An analysis formula is shown at below:

Important index

Qualitative data such as Likert scale can be measured using a 3 points, 5 points or 10 points measurement scales. Qualitative data can be converted to quantitative data by using the following formula adopted from Lim & Alum (1995) (NTU, Singapore) published in the International Journal of Project Management.

Conversion formula = $\frac{5N_1 + 4N_2 + 3N_3 + 2N_4 + N_5}{5(N_1 + N_2 + N_3 + N_4 + N_5)}$

N_1 = Number of respondents strongly agree

N_2 = Number of respondents agree

N_3 = Number of neutral respondents

N_4 = Number of respondents disagree

N_5 = Number of respondents strongly disagree

Question 1

Among them, please rank your satisfaction based on the place's facilities provided for the disabled people.

Analysis:

Table 6 Result of ranking places which provided the most satisfied facilities

Ranking places which provided the most satisfied facilities	Frequency Index	Rank	Percentage
Government department	0.630	3	21%
Residential Building	0.470	4	16%
Shopping Complex	0.810	1	27%
Public Transportation	0.660	2	22%
Garden or Leisure area	0.430	5	14%

Discussion:

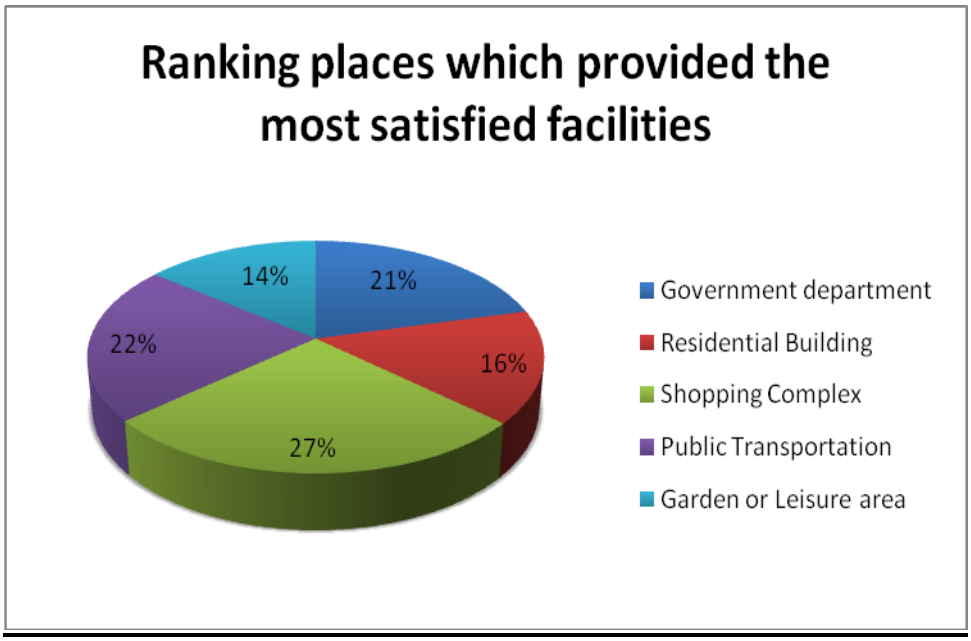


Figure 60 Chart of ranking places which provided the most satisfied facilities

Summary:

According to answers obtained, 27% of respondents were satisfied that shopping complex was the place that provided with superior facilities for disabled. Conversely, garden or leisure area was the place that lack of facilities for disabled with merely 14% of respondents agreed on it. Public transportation area was ranked by 22% of respondents to be second place of satisfaction levels. Places which were ranked at third and fourth are government department with 21% and residential building with 16% respectively.

Generally, it can be assumed that the disabled people are potential customers for shopping complex. Good services should be granted for disabled people. Besides, self-centred public would think that providing the facilities at garden or leisure place is worthless. Disabled people will not go for exercise due to their disabilities. It will cause discrimination between the public and disabled people. Consequently, disabled people will often stay at home avoiding to join others.

Question 2

Which kinds of facilities for the disabled do you use often?

Analysis:

Table 7 Result of preference use of facilities

Preferences use of facilities	Frequency Index	Rank	Percentage
Car Park	0.625	6	12%
Toilet	0.875	1	17%
Lift	0.875	1	17%
Pathway with guiding block	0.713	4	14%
Ramp /Kerb Ramp	0.788	3	15%
Handrail	0.650	5	13%
Stair Lift	0.575	7	11%

Discussion:

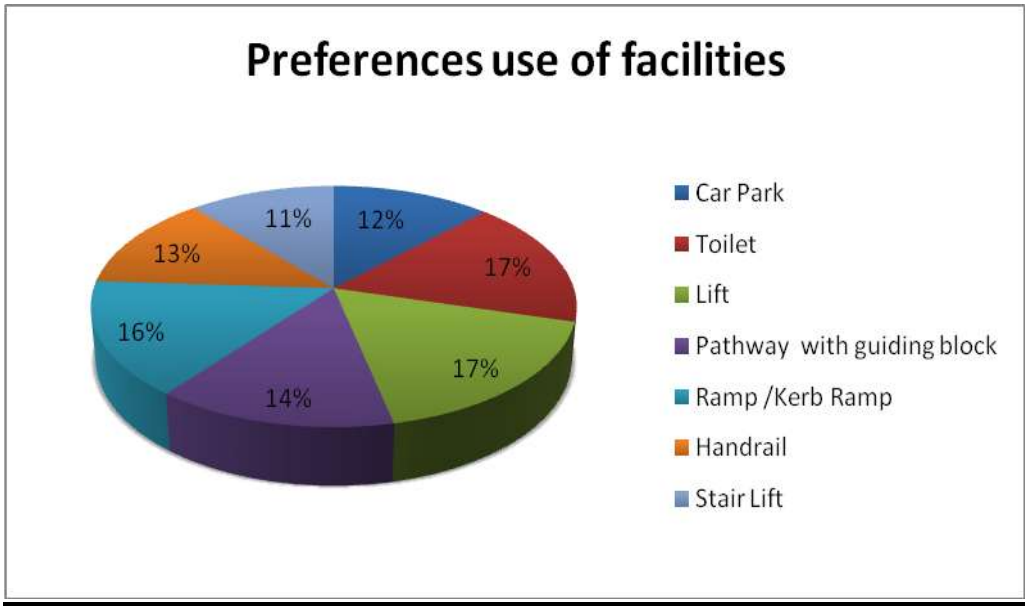


Figure 61 Chart of preference use of facilities

Summary:

Current facilities provided in building and infrastructures are commonly used by disabled people. 17% of respondents used toilet and lift most. Ramp was used by approximately 16% of respondents. 14% of respondents chose pathway. 13% of respondents used the handrail most. 12% of respondents chose car park and stair lift was the choice of 11%.

All facilities provided in the buildings and infrastructures are essential. It is human rights. Everybody has the right to use the facilities and services without any alternation. Toilet and lift are common facilities that should be provided for everyone. Hence, it should present at any kinds of buildings. Stair lift is a facility rarely provided in building and infrastructures. So, it becomes seldom used by disabled people. Moreover, no driving license is a reason which caused the disabled people not frequently use the car park. They normally will use the public transports.

Question 3

In your opinion, do you think the current facilities provided for the disabled are practicable?

Analysis:

Table 8 Result of practicable current facilities provided

Practicable current facilities provided	Total respondents	Percentage
Yes	17	85%
No	3	15%

Discussion:

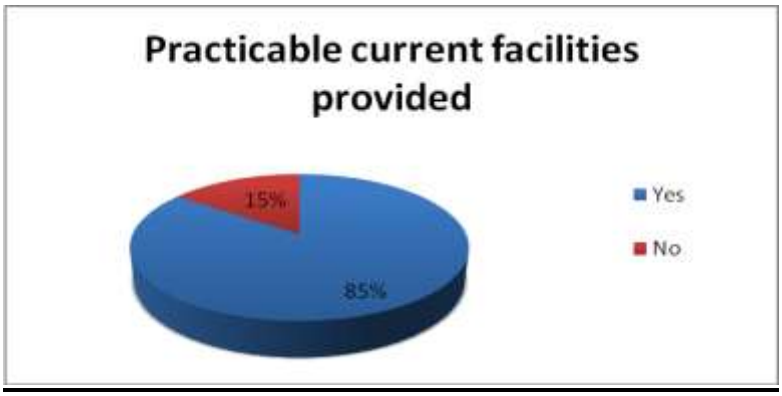


Figure 62 Chart of practicable current facilities provided

Summary:

Majority of the respondents agreed that the current facilities provided in buildings and infrastructures were workable. Only 3 respondents (15%) deemed that the current facilities provided in buildings and infrastructures were impracticable.

Cost constraint, time constraint and limited space are the factors that cause developers not to provide the facilities. If the developers decide to build the facilities, he/she will build the facilities in accordance with building requirements. If the facilities are no properly provided, the facilities are useless. Eventually, time, cost and space are all wasted.

Question 4

In your opinion, how would you rate the satisfaction of the following disabled facilities provided in public buildings and infrastructure?

Analysis:

Table 9 Result of satisfaction facilities provided

Satisfaction facilities provided	Frequency Index	Rank	Percentage
Car Park	0.700	2	16%
Toilet	0.670	3	16%
Lift	0.720	1	17%
Pathway with guiding block	0.540	6	13%
Ramp /Kerb Ramp	0.530	7	12%
Handrail	0.610	4	14%
Stair Lift	0.550	5	13%

Discussion:

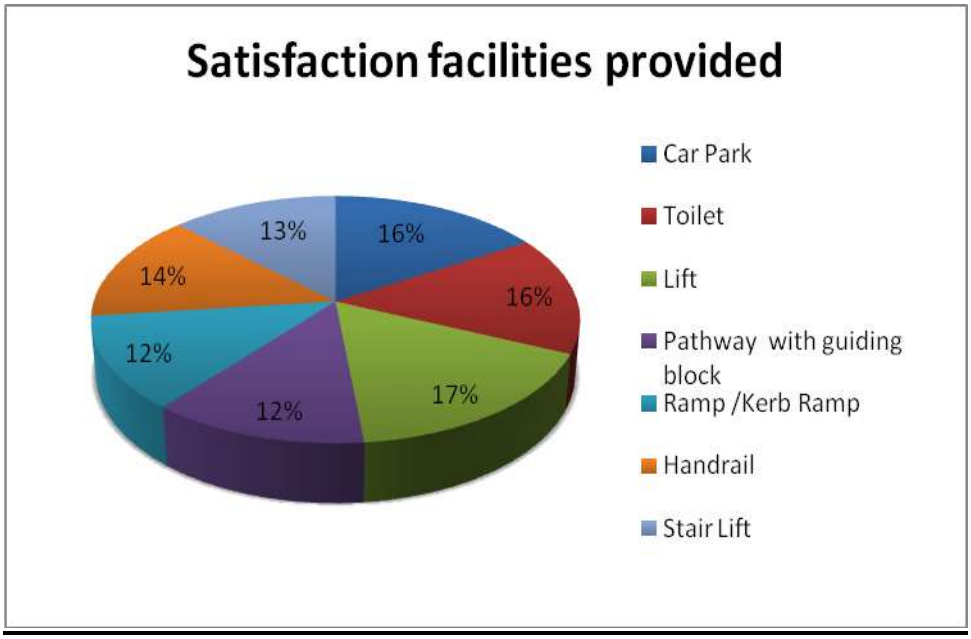


Figure 63 Chart of satisfaction facilities provided

Summary:

From the result above, 17% of respondents were satisfied about the lifts that were provided in public buildings and infrastructure. Both car park and toilet are equally

the second satisfaction level with 16% of respondents. The following satisfaction facilities are handrail (14%), stair lift (13%), ramp (12%) and pathway (12%).

Lifts are considered to be always well-maintained. It is because periodically maintenance and inspection are required by local authorities. Local authorities pay more concern on lift maintenance comparing to other facilities because majority of people tend to use the lift often. Other than lift, toilet and car park are also needed to serve the public rather than only supplied for disabled. Hence, proper satisfaction level of facilities should be achieved.

Question 5

If 10 marks are the full marks, how would you rate the satisfaction on overall disabled facilities provided in public buildings and infrastructure?

Analysis:

Table 10 Result for rate of satisfaction

Rate of satisfaction	Marks	Respondents	Total respondents
Dissatisfied	1	0	**2**
	2	0	
	3	2	
Neutral	4	4	**8**
	5	2	
	6	2	
Satisfied	7	7	**10**
	8	2	
	9	1	
	10	0	

Discussion:

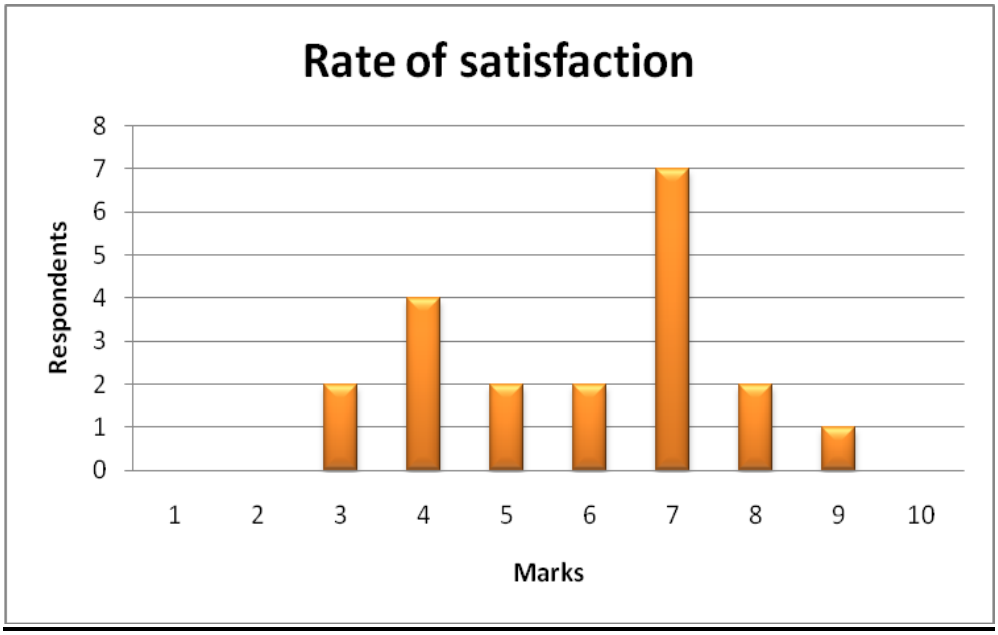


Figure 64 Chart for rate of satisfaction

Summary:

Respondents were averagely given their satisfaction marks from 3 marks to 9 marks. Majority of respondents gave 7 marks. 2 respondents gave 3 marks. 4 respondents gave 4 marks. 5, 6 and 8 marks are given by 2 respondents respectively. Only 1 respondent gave 9 marks.

From the data analysis, most of the respondents are satisfied with the facilities provided in public buildings and infrastructure. It means all facilities provided are routinely performed; it still can improve in future.

Question 6

Do you face any difficulties when moving around or using the facilities for the disabled? If yes, what difficulties have you faced?

Analysis:

Table 11 Result of difficulties faced by disabled

Difficulties faced by disabled	Total difficulties faced	Percentage
Design Problem	48	7%
Not Functioning	35	5%
Vandalism *Damaged or occupied by people	24	3%
Not Provided	66	9%
No Problem	527	75%

Discussion:

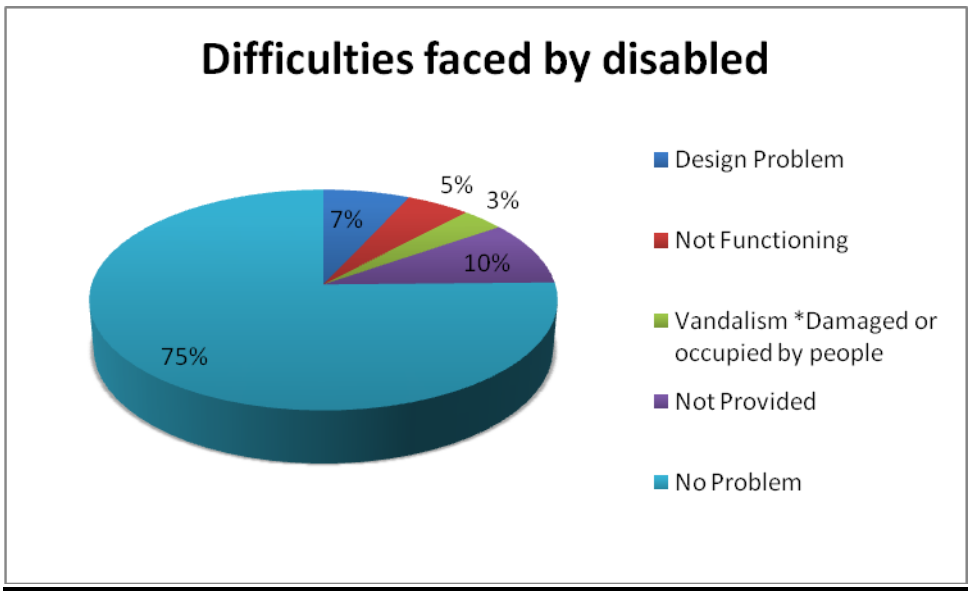


Figure 65 Chart for difficulties faced by disabled

Summary:

Most of respondents have the opinion that there is not much difficulties faced by them when moving around or using the facilities. 10% of respondents said the facilities are not provided. 7% of respondents complained about design problems. 5%

of the respondents thought that facilities are not functioning. 3% of respondents considered the facilities had broken down due to vandalism or occupied by non-disabled.

Due to cost constraint and time constraint, the developers will only provide the basic facilities in buildings and infrastructure. Hence, any uncommon facilities will be ignored. In addition, improper design of facilities will cause the wheelchair users inaccessible or unreachable for the facilities. It also creates a trouble for vision impaired people when the facilities indicate wrong direction. Sometimes, the facilities are damaged or engaged by immoral people. For their own convenient, they damaged or occupied the facilities as a result; the disabled people are not able to use the facilities.

Question 7

In your opinion, do you think the facilities provided for the disabled in public buildings and infrastructures are complying with building regulations?

Analysis:

Table 12 Result of compliance with building regulations

Compliance with building regulations	Total respondents	Percentage
Yes	4	20%
No	16	80%

Discussion:

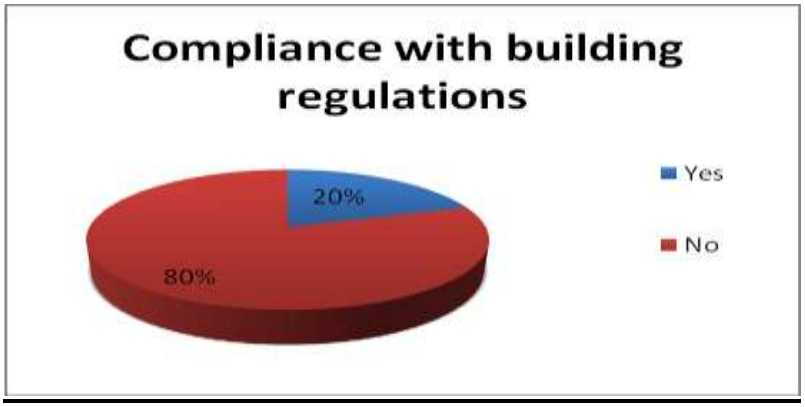


Figure 66 Chart of compliance with building regulations

Summary:

There were 4 respondents (20%) considered the facilities provided for disabled in public buildings and infrastructure are complying with building regulations. Only 16 respondents (80%) deemed the facilities provided are not complying with the building regulations.

Many difficulties faced by disabled people is a reason caused the respondents to think that the facilities provided are not complying with building requirements. Therefore, local authorities should deeply understand the needs of disabled people before enacting the building by-law.

Question 8

In your opinion, where is the most essential place to provide facilities for the disabled?

Analysis:

Table 13 Result of essential places should provide the facilities

Essential place should provide the facilities	Total Respondents
Government Department	1
Residential Building	2
Shopping Complex	8
Public transportation	9
Garden, Leisure area	0
Total	**20**

Discussion:

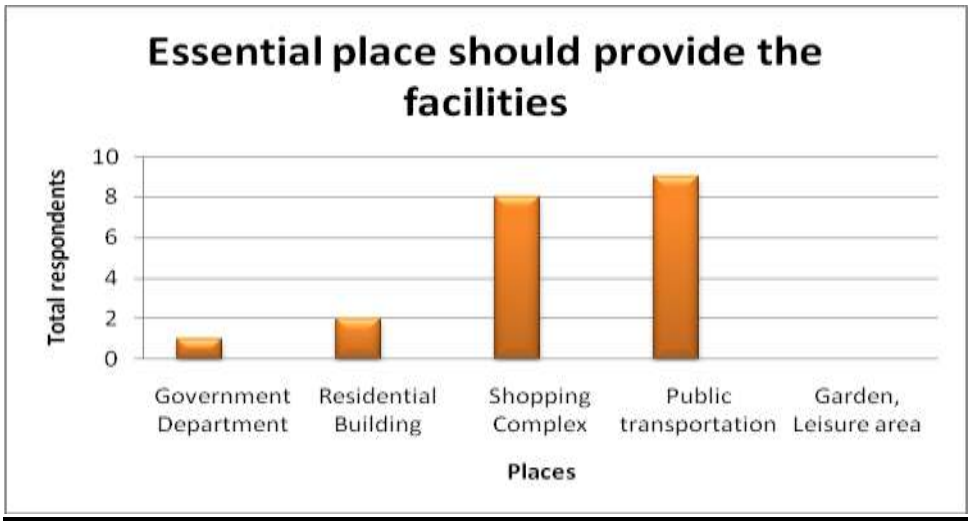


Figure 67 Chart of essential place should provide the facilities

Summary:

Most of the respondents were in the opinion that the public transportation area is crucial place that should provide the facilities for disabled. The subsequent place was shopping complex with 8 respondents. Minority of respondents selected the

residential building and government department which are 2 and 1 respondents respectively.

Majority of respondents do not have driving license. Public transports are their main transportation. So, they consider that public transportation area is an essential place that needs to have all the necessary facilities provided.

Question 9

In your opinion, which kind of facilities for the disabled is most significantly provided?

Analysis:

Table 14 Result of significant facilities should provide

Significant facilities should provide	Total Respondents
Car park	2
Toilet	8
Lift	5
Pathway with guiding block	4
Ramp/ Kerb Ramp	1
Handrail	0
Stair Lift	0
Others	0
Total	**20**

Discussion:

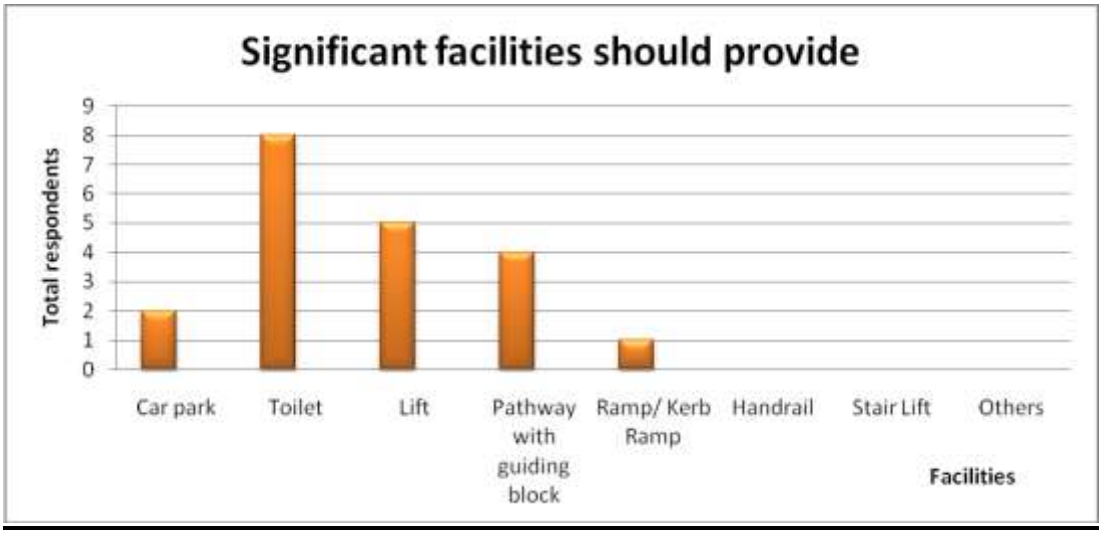


Figure 68 Chart of significant facilities should provide

Summary:

From the chart above, there are 8 respondents selected the toilet as an important facility that should be provided. 5 respondents deemed that the lift is significant provided for them. 4 respondents chose the pathway. 2 respondents chose car park and 1 respondent selected the ramp. Toilet and lift are the basic facilities should provide at public buildings and infrastructure.

Question 10

In your opinion, which kind of facilities for the disabled is critical and needs to be improved immediately?

Analysis:

Table 15 Result of critical facilities should improve immediately

Critical facilities should improve immediately	Total Respondents
Car park	0
Toilet	7
Lift	1
Pathway with guiding block	9
Ramp/ Kerb Ramp	3
Handrail	0
Stair Lift	0
Others	0
Total	**20**

Discussion:

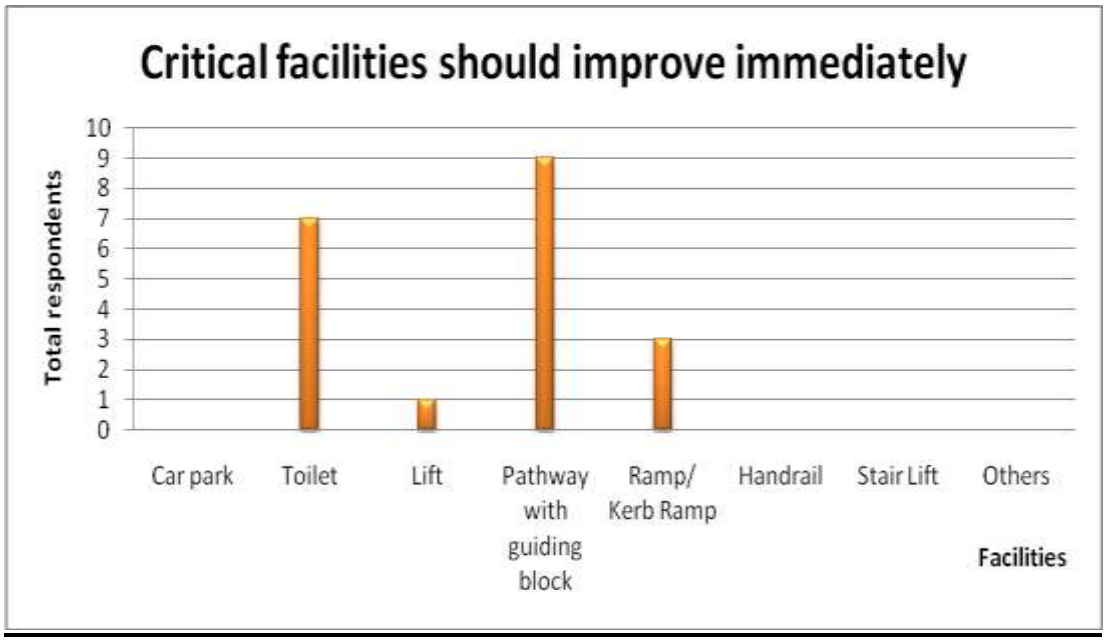


Figure 69 Chart of critical facilities should improve immediately

Summary

9 respondents selected the pathway to be the facilities that should be improved immediately. 7 respondents said that the toilet should be improved. 3 respondents deemed the ramp should be improved and 1 respondent deemed the lift.

Unconnected pathway with guiding blocks provided at buildings and infrastructures will create trouble for users, especially for vision impaired people. Absent of certain toilet furniture causes the respondents to consider that the toilet should be improved immediately.

Based on the response, majority of respondents suggested that the shopping complex and public transportation area are ideal and crucial places that should provide the facilities for disabled. All facilities provided in these areas are practicable and satisfied by disabled people. Contrariwise, garden is unpopular place to grant the disabled facilities. Toilet and lift are significant facilities which should present in public buildings and infrastructures. In the same way, both facilities are satisfied by respondents. A facility which the respondents considered that there is such need to improve instantly is pathway. In addition, facilities no provided and functioning, facilities design problems, facilities engaged by non-disabled or damaged by vandalism are the difficulties faced by disabled people. Hereby, majority of disabled people deemed that the facilities provided for disabled in public buildings and infrastructures are not complying with building regulations and requirements.

4.3 Interview Analysis

An interview was conducted with architect who is expertise in building design. Thus, in-depth information and explanations can be acquired from architects. Through interviewing, the design requirement for disabled people can be known. Their explanations and suggestions are served to be valuable information in this field of research. The architect's details are showed as below:

Name	Profession	Interview Date and Time	Venue	Contact No.
Ar. Wong Choong Hing	Lecturer at TAR College	24-06-2011 4.30 p.m.	KTAR, M105	012- 223 2673
Ar. Liaw Kok Chuan	Lecturer at UTAR	25-06-2011 3.00 p.m.	UTAR, S101	016- 238 3068

Question 1

Is necessary to provide facilities in public building and infrastructure for the disabled? Why?

Ar. Wong:

Yes, of course. The reasons are:-

- It is basic human rights. Disabled people are a small unlucky group compared to us. A same level of human rights should be treated to them.

- No discrimination. Even though they are a small group of people, they have the rights to use the public facilities as well. It is unfair for them if no special facilities are provided for them.

- Facilities usage can help in physically and emotionally aspects. In fact, the facilities will give more assistance for them. It encouraged them to live as normal people and learn to be independent. For example:-

  a) It improved their psychology. Discrimination such as people laugh them, no friend and no friendly environment provided will cause them to hide themselves, avoiding them to join the others for social activities.

  b) Special facilities should be provided at park for disabled to do exercise as normal people. It can help them to maintain their health and easy for them to connected to other normal people.

- Developed the nation images in eyes of world. Learned from western country. Getting the disabled people a maximum requirements but no minimum.

Ar. Liaw:

It must provide. It is a part of human rights. It is same with other facilities provided. For example, western country; they took this as physical challenges. They would strictly impose the facilities according to by-law.

From the conversation with two architects above mentioned, they are accordant agreed that it is necessary to provide facilities in public building and infrastructures for disabled. They were in the opinion that must treat the disabled people as same level of human rights with normal people. Both architects have given a same example which is learning from western country and providing maximum requirements for disabled people.

Question 2

Which type of buildings provides more facilities for the disabled, public or private? Could you elaborate and give examples?

Ar. Wong:

Public buildings provided more facilities for disabled. For example:-

a) Hospital and clinic. They always need to go hospital and clinic to obtain the medical services.

b) Local authorities' customs. They need to make payment for Employee Provident Fees (EPF), water and electrical bills, local authorities' fees and etc.

c) Recreational, museum, concert hall and art gallery. These are the places that generate confidences in them and provide opportunities for them to mix and connected to normal people and to enjoy the same rights.

Ar. Liaw:

Public building such as commercial buildings, offices, restaurants, cinemas, shopping malls, parks, galleries, exhibition center, and etc are provided with more facilities. On the other hands, private buildings are less provided unless required. For instance,

if the family has disabled person, then that family just needs to install the facilities at home. If no, it better to use the extra places to build for others.

Public buildings provided more facilities for disabled. Architects were in the opinion that the public area should take care of all categories of people other than disabled people. So that, universal design is applied in order to serve for all public. In addition, Ar. Liaw had mentioned that if the private buildings have provided the facilities, it must have benefits purposes. It depends on their potential customers requirements whether they required the services.

Question 3

What are the probable reasons for developers or town planners to neglect on facilities provided for the disabled?

Ar. Wong:

The reasons are:-

- Land usage. Example: ramp. The optimum ramp's gradient is 1:12. But it needs bigger space to construct it. Developer will use the extra spaces to rent out for business purpose better than construct the facilities.
- Construction cost. Building the facilities would cause higher cost. Besides, it also needs other specialists who are expert in this aspect.
- Development period. It takes longer time to build up the facilities.
- Abuse approval system. Developers might pay "some money" to get approval of ignoring to provide the facilities.

Ar. Liaw:

The reasons are:-

- Cost expense. It needs large amount of moneys to build the facilities.

- Space optimisation. If no facility is provided, the developer can use the space to build other extra rooms to earn more incomes.

- Mentality of developer's thinking. They will use 'include of disabled facilities' as selling point to attract the potential customers. Inversely, they also can use the extra space to build for others to gain the opportunities costs. It depends on the developers' business policy.

The main reasons for developers and town planners neglect to provide the facilities for disabled are land usage and construction cost. As a developer, they always developed something to bring them profit. Therefore, they will disregard the facilities provided and construct some properties to earn more opportunities cost. Scarcity of land and limited cost are the reasons caused the developer cut the cost on disabled facilities provided.

Question 4

Would implementing facilities for the disabled involve substantial-cost in the development of the projects? Could you approximately give a percentage involved on the contract sum?

Ar. Wong:

Generally, it depends on how big of the project and where the project located. If the project located at city center, the project cost will become high. The transportation costs will increase due to traffic jam. Construction cost around 8% of contract sum. Opportunities cost can increase up to 20%. It can save the time from building the facilities and doing other projects. Besides, building the facilities also need bigger space. It will cause the developer to lose the opportunities to build for others to earn extra incomes.

Ar. Liaw:

No, it would not involve a substantial-cost. It only involved 5% to 8% of contract sum. Developer is more concerned on space. They will use the space to construct other buildings to gain more. Profit can be increased to 10%.

Implementation of the facilities for disabled does not involve an extensive cost. It only involves around 8% of contract sum. The main reason leads the developers not to provide the facilities is because of limited space. They may use the extra space to earn for opportunities cost rather than building the facilities which does not gain anything from them.

Question 5

Do you think the cost limitation on the development project would cause many defects on the design of facilities for the disabled?

Ar. Wong:

No. Should not be constraint. Building the facilities will not involve much cost. So, if it is provided, it must be provided in safely and functionally manner.

Ar. Liaw:

Defect is another issue. It depends on either have provided or not provided the facilities. If provided, it must have functions. Since, it would not involve much cost in the project. Example: ramp. If it provides in too steeply, disabled cannot use it because it is hard to climb up. It will become a display facility and not used. If it is about the furnishing, yes. The aesthetics of furnishing will not well present in event of cost constraint.

Cost limitation on the development project would not affect the defect on the design of facilities for disabled. It only depends on either have provided or not provided. If provided, it must provide in optimal. Further, Ar. Liaw had clarified that the defect

and furnishing is different. Defect can caused by workmanship and material used, but not cost limit. Cost limitation only can affect on the aesthetic of design of facilities.

Question 6

Which kinds of facilities for the disabled can be prioritised in the event of cost constraint on development projects?

Ar. Wong:

The facilities descending showed at below:-

- Disabled friendly access building. For example: ramp. All accessible buildings must comply with by-law.
- Disabled friendly lavatory. For instance, some disabled people have diabetes; they always need to use the toilet.

Ar. Liaw:

Escape route. In event of emergency purposed, disabled people need to escape. Their movement are slower comparing to normal people. So, escape route is more significant facility to be provided for them. For example: hotel. Developer can provide all facilities at lobby and first floor for disabled. First floor of hotel is only used to serve for disabled people. Thus, there is no need to provide the facilities at all floor levels and save the cost. Otherwise, developer can bargain with local authorities in order to strike for balance. For instance, developer can offer to comply with major by-law and ignore the minor.

Accessible in building is a mutual point getting from both architects in opinion of prioritised facilities provided. This mean, if the building cannot achieve the friendly accessibility; other facilities provided in building will become useless due to unreachable by disabled. Besides, Ar. Liaw has given the suggestion that let the developers bargain with local authorities in order to get the win-win situation to solve the problem on facilities provided.

Question 7

Person with Disabilities Act (PWDA), Uniform Building by-Law (UBBL) and Malaysia Standard are the building and infrastructural regulations provided to control the design of facilities for disabled people. Do you think that those facilities provided in Malaysia are complying with the regulations? If no, what factors caused the developers or town planners not to comply with the regulations?

Ar. Wong:

Not complied. The reasons are same with my answers in question No.3.

Ar. Liaw:

Comply. Guidelines must be followed in minimum. No point to cut corner because the facilities will become useless or not functioned. Either complied or give more extra as a selling point. Like, cinema can advertise that the cinema has provided the facilities for disabled to attract more potential customers.

There are extremely different opinions from both architects. Ar. Wong said the facilities provided are not complied with the regulation because of developer's mentality thinking which gained more benefits from the project. On the other hands, Ar. Liaw said is complied. It was because the development cost on building the facilities is small amount. If want to provide must provide in maximum, if not, then better not to provide.

Question 8

Recently, there have been many complaints regarding defects on the design of facilities for the disabled. How can we overcome the problems to satisfy the needs of the disabled?

Ar. Wong:

The suggestions are:-

- Rope in the disabled people to participate on design of facilities or comment on them.
- Seek advices from disability associations. Let the disabled people to comment on the problems they are facing.
- Impose healthy penalty for non-compliance. Come out with all abuses, controlled and enforced in strict. No issued the Certificate of Fitness or Certificate of Completion and Compliance for developers who do not comply.

Ar. Liaw:

The suggestions are:-

- Advised the developers to build the facilities in maximum but no minimum.
- Developers to be smart in selection of contractor to avoid any workmanship problems.

According to Ar. Wong's comments, the facilities provided are used by disabled people. They have rights to tell us their requirements and comments on disabled facilities. Therefore, they should be invited to participate in the design discussing stages of disabled facilities building conference as well. Further, Ar. Liaw settled the problems by giving advice to the developers. He said need to change the developer's mind and attitude on the development project.

Question 9

What is your perspective on the design of facilities for the disabled in the future?

Ar. Wong:

His perspectives are:-

- Difficult to achieve optimum design, especially in our country. No practical at all.

- Need to learn from other development countries. Learn to build up the disabled friendly environment.
- Provide the sufficient education for public in order to avoid any discrimination and vandalism.
- Change the public mind through education.

Ar. Liaw:

His perspectives are:-

- Awareness of disabled people and voice out their consents in order to accomplish mutual.
- Big corporate should prospect the solving points within the market and provides extra facilities through advertisement.

Ar. Wong suggested changing the public's minds through education in order to build up the country without discrimination. He proposed our country should learn from other countries. They are the best paradigm country for us to practical in future. In addition, Ar. Liaw said the disabled people must voice out their views with the aim of achieve a mutual country.

Question 10

How can we enforce developers and town planners to provide disabled facilities in building and infrastructure?

Ar. Wong:

The actions should be taken to enforce the developers and town planners to provide the facilities are:-

- An addition to UBBL code of practice and strict enforcement. Implemented system of penalty for non-compliance. For instance, if the contractor does not comply with by-law, the local authorities have rights to instruct them to demolish

it or not to issue the Certificate of Fitness or Certificate of Completion and Compliance.

- Government gives incentives like tax rebates, goods grant, subsidies for building and etc. Government can launch the policy like Green Building Index (GBI). For example, import the solar cells with waiver of import taxes. Another example is that offer developer when they have provided the disabled facilities. Local authorities will not strict impose some by-law at minor part.

Ar. Liaw:

The actions should be taken to enforce the developers and town planners to provide the facilities are:-

- Local authority must strict forward to impose on whom that is not complying with by-law. Officials are distributed to check and ensure all buildings are complied with regulations.

- Local authority can negotiate with developers in order to achieve the win-win situation. For instance, local authority can only impose the by-law on major parts and ignore the minor one.

The answers from both architects are consistent. They advised the local authorities to take action to penalise those that not complying with the building regulations. Further, they also advocated the government should give some encouragement to developer to strike for balance and impose them to provide the facilities for disabled.

To conclude, the disabled facilities are surely needed to provide at public building and infrastructure. This is human rights and excludes any discrimination between the public and disabled people. Public building is most important place that requires the facilities for disable to be provided. This is because public building is mainly accessible by public. The main reasons for developers or town planners to ignore the facilities provided are limited land usage, cost constraint and restricted period. However, cost limitation on the development is not an excuse which causes the defects on design of facilities. It depends on either provided or not provided. If

provided, it must be fully well-designed. Comments from disabled, awareness of public and local authorities' enforcement are the methods to improve the design of facilities in the future.

CHAPTER 5

CONCLUSION AND RECOMMENDATIONS

5.1 Conclusion and recommendations

The disabled people really suffered a lot of difficulties when living in this non disabled-friendly country. Therefore, this research is carried out with the aim of improving the design and services in building and infrastructure to suit the needs of disabled people. The research is conducted by accumulated data through literature review, case study, questionnaires and interviews.

From the literature review, many complaint issues, building regulations, principles of design and design guidelines are recognised and studied. Issues related to disability are obtained from newspapers and internet. Furthermore, building regulations, design concepts and building guidelines are acquired through the research done by other institutions. Person with Disabilities Act, Uniform Building by-Law, Malaysia Standard, principles of universal design and barrier-free design guidelines are helpful criteria and can be applied in further research.

The case studies had been carried out at Jusco Wangsa Maju and Wangsa Maju Putra LRT stations in Setapak area. The purpose of these case studies is to ensure the buildings are complied with building requirements. The facilities in buildings are studied and compared with criteria found in literature review. The comments and suggestions are stated for each facility in order to have improvement

in future. More facilities are provided at Wangsa Maju LRT station compared with another building. All basic required facilities are presented in both buildings notwithstanding some minor defects that have to be improved.

Questionnaire had been conducted in this research. The aim to carry out the questionnaire is to comprehend the satisfaction level of the disabled regarding to the facilities provided in buildings and infrastructures. The respondents agreed that all necessary facilities are provided, especially for the public buildings. Toilet and lift are oftentimes used by the disabled people and both of these facilities are indispensable that ought to be provided in every building. Many difficulties faced by disabled people are fervently commented in the questionnaire. This phenomenon indicated that there are dissatisfactions about the facilities provided in the surrounding buildings which lead certain problems to the disable people.

Interviews with architects had been carried out in order to obtain the opinions about facilities design, reasons that caused the problems to exist and actions to overcome the problems. The interviewees explained that it is the disabled's right to have special facilities provided for them. Time, cost and land usage are the main factors that caused the developers and town planners neglecting to provide the facilities. Awareness and cooperation among all public, local authorities and the disabled persons are suggested to solve the problems on facilities provided.

It is found that many factors have caused the failure in providing the disabled facilities. The factors that caused failures in providing disabled facilities are public discrimination, impartiality of human rights against the disabled, comportment of local authorities, developers and town planners. It led to the fact that the problems still exist in building and infrastructure which is inaccessible by disabled. The problems including (a) inappropriate design of facilities, (b) impracticable facilities provided, (c) lack of maintenance and upgrading of facilities, (d) facilities are inadequately provided, (e) facilities are damaged or occupied by non-disabled, (f) lack of understanding on disabled people's needs and (g) no strict enforcement of building by-law.

There appears to be many building regulations, design concepts and design guidelines which are published to assist the construction parties to provide facilities for disabled, but the problems are not improving. Besides, misinterpretation between disabled people and construction parties is a reason which causes difficulty on facilities provided. According to data analysed, it is found that the opinions obtained from disabled people and the architects are inconsistent. Disabled people deemed that toilet is facility which must be provided significantly, on the contrary, architects have their opinion that accessibility within building is more important. Regardless of that, both of the interviewees have the same opinion that public buildings should fully provide the facilities for disabled people.

Since there are quite a number of problems found through the research, the interviewees did not hesitate to share their comments. They recommended seeking and obtaining advices from disabled people in order to let them to voice out their consents, motivating them to participate in facilities design discussion stage and give comments on the problems they are facing. In other aspect, local authorities should impose the healthy penalty for non-compliance and negotiate with developers in order to strike a balance in providing the facilities. For government, it is suggested that incentives should be given to the developers. Learning from western country on facilities design provides ways. Sufficient education should provide for public as to change the mind of public without discrimination.

To conclude, all objectives set for this research; (a) determine the current facilities provided, (b) identify the existing problems and disabled dissatisfaction upon using the facilities, (c) recognise the building regulations and requirements approach on facilities and (d) suggestion is made to improve the facilities are all achieved.

REFERENCES

Chapter 1

1) ILTC Malaysia. *The Department of Social Welfare*. Retrieved on February 13, 2011, from http://iltcmalaysia.blogspot.com/
2) My Government. *The Malaysia Government's Official Portal*. Retrieved February 13, 2011, from http://www.malaysia.gov.my/EN/Relevant%20Topics/Society%20and%20Life/Citizen/SocialWelfareandCommunication/DisabledPersons/Pages/DisabledPersons.aspx
3) Peter Tan and Naziaty Yaacob. (2008).*Memorandum to the Government of Selangor Darul Ehsan on acilities for Disabled People*. Retrieved on February 13, 2011, from http://www.petertan.com/blog/2008/04/08/memorandum-to-the-government-of-selangor-darul-ehsan-on-facilities-for-disabled-people/
4) ANG YEE XUAN, (2008). *A Study of Incorporation of Special Facilities for Physically Disabled Students in Existing Buildingwithin Tunku Abdul Rahman College*.
5) TAN YEE LEE, (2008). *A Study into Building Design and Facilities to satisfy Wheelchair Disabled Persons' Needs*.

Chapter 2

1) Wikipedia. *Disability*. Retrieved on February 21, 2011, from http://en.wikipedia.org/wiki/Disability
2) Disabled World. *Definition of Disabilities*. Retrieved on February 21, 2011, from http://www.disabled-world.com/disability/types/
3) PUKUKM. (2009) *Guidelines on Access for Disabled Persons to Public Buildings*. Retrieved on February 18, 2011, from http://pkukmweb.ukm.my/ppa/dokumen/OKU-Malaysian%20Standard.pdf
4) eHowtm. *The Definition of Physical Handicap*. Retrieved on February 23, 2011, from http://www.ehow.com/about_5220260_definition-physical-handicap.html
5) Peter Gabriel Tan (2010). *Inaccessible Toilet for Disabled People at Ulu Bernam RSA*. Retrieved on February 16, 2011, from http://www.petertan.com/blog/category/disability-issues/accessibility-in-public-places/page/3/
6) Ding Jo-Ann (2010). *A disabled-friendly Malaysia?* Retrieved on February 15, 2011, from http://www.thenutgraph.com/disabled-friendly-msia/
7) Chrisitina Low. (2009). *The woes of the disabled*. Retrieved on March 6, 2011, from http://www.bu6wawasan.com.my/content/view/1373/

8) Jade Chan. (2010). *Wheelchair users want more access to transport*. Retrieved on March 6, 2011, from http://thestar.com.my/metro/story.asp?file=/2010/3/16/central/5799750&sec=central
9) Nadirah H. Rodzi. (2010). *Making public transport better for all*. Retrieved on March 6, 2011, from http://transitmy.org/2010/03/16/making-public-transport-better/
10) Dorodi Sharma, (2010). *"The needs of disabled persons in Malaysia are still seen largely as a welfare function," Maniam Sinnasamy.Disability News and Information Services.org.7(6)*. Retrieved on February 28, 2011, from http://dnis.org/interview.php?issue_id=6&volume_id=7&interview_id=150
11) KHAIZAN SHARIZAD. (2010). *The disabled have rights, too*. Retrieved on March 2, 2011, from http://thestar.com.my/columnists/story.asp?col=putiklada&file=/2010/3/4/columnists/putiklada/5779213&sec=Putik%20Lada
12) Law of Malaysia (2008). Act 685, *Person with Disability Act 2008*. Retrieved on March 2, 2011, from www.malaysiancare.org.my/newsmaster.cfm?&menuid...action...
13) Zamil_uitm_perak, *LEGAL PROVISIONS IN MALAYSIA RELATED TO BARRIER FREE DESIGN*. Retrieved on February 28, 2011, from http://landarchymalaysia.blogspot.com/2008/09/barrier-free-design-guidelines.html
14) Jane Hodges-Aeberhard, Carl Raskin, International Labour Office, International Labour Organisation. *Affirmative action in the employment of ethnic minorities and persons with disabilities*.(p.61).Retrieved on March 2, 2011, from http://books.google.com/books?id=P2bAfabd-98C&pg=PA61&lpg=PA61&dq=Malaysian+Standard+for+disabled&source=bl&ots=dOO2bN6XHd&sig=VcemeYznRJzgQb37TxcgUdSvV0A&hl=en&ei=-whuTdyKN8zJrAfQvqjvDg&sa=X&oi=book_result&ct=result&resnum=6&ved=0CD8Q6AEwBQ#v=onepage&q=Malaysian%20Standard%20for%20disabled&f=false
15) Wikipedia. *Universal design*. Retrieved on February 28,2011, from http://en.wikipedia.org/wiki/Universal_design
16) Disability WA. *Principles of Universal Design*. Retrieved on February 28,2011, from http://www.disability.wa.gov.au/aud/planningbetteraccess/universaldesign/principles_of_universal_design.html#principleone
17) Disability Information Resources. *Design Recommendation*. Retrieved on February 28, 2011, from http://www.dinf.ne.jp/doc/english/intl/z15/z15009gl/z1500907.html#0
18) Disabled Person Penang. *Accessibility*. Retrieved on March 6, 2011, from http://www.disabledpersonspenang.org/access.htm
19) Access Code. *Car parking dimensions*. Retrieved on February 28,2011, from http://www.accesscode.info/external/5_16.htm
20) Land Archy Malaysia. *Design Guideline*. Retrieved on February 28, 2011, from http://landarchymalaysia.blogspot.com/2008/08/barrier-free-design-guidelines.html
21) Design of Large Passenger Ships & Passenger Infrastructure: Guidance on Meeting the Needs of Disabled People. *Section 5: Lifts, Steps, Stairs and Ramps*

on Vessel. Retrieved on March 4, 2011, from http://dptac.independent.gov.uk/pubs/guideship/06.htm
22) Global B2B Marketplace. *Elevator for the Handicapped (no machine room) Optimized for users' convenience*. Retrieved on March 3, 2011, from http://www.ec21.com/product-details/Elevator-for-Handicapped--1316541.html#
23) Access Code. *Car parking dimensions*. Retrieved on February 28, 2011, from http://www.accesscode.info/external/5_16.htm
24) TAN KARR WEI. (2009). *Guidelines for toilets for the disabled*. Retrieved on February 28, 2011, from http://thestar.com.my/metro/story.asp?file=/2009/9/30/central/4801346&sec=central

Chapter 3

1) Experiment-Resources.com. *Definition of Research*. Retrieved on February 27, 2011, from http://www.experiment-resources.com/definition-of-research.html

2) Experiment-Resources.com. *What is a literature review?* Retrieved on February 27, 2011, from http://www.experiment-resources.com/what-is-a-literature-review.html
3) Willie Tan. (2007). *Practical Research Methods*. Pearson Education South Asia.

Chapter 4

1) AEON. Co. (M). Bhd. (2011) *History*. Retrieved on August 1, 2011, from http://www.jusco.com.my/history.html
2) Wikipedia. (2011). *Wangsa Maju LRT station*. Retrieved on August 15, 2011, from http://en.wikipedia.org/wiki/Wangsa_Maju_LRT_station

APPENDICES

APPENDIX A: Learned Statement

After completed this report, many interested knowledge I have learned from the research. In fact, disabled people can be categorised into physical and mental types. Yet, this research only emphases on physical disabled. Many issues and problems regarding to disabled are more comprehend through this research. Building regulation, design concept and guidelines are get recognised. Besides, techniques to set the questionnaire and interview question are get learned from the progress of research. Through this research, I was become confident in interview sessions. I had visited to disabled association and invited the architects for interview. Data analysis tool is get known to analyse all the data collected. Conclusion and recommendation are done to finalise for the whole report.

UNIVERSITI TUNKU ABDUL RAHMAN

FACULTY OF ENGINEERING AND SCIENCE

DEPARTMENT OF BUILT ENVIRONMENT

BACHELOR OF SCIENCE (HONS) CONSTRUCTION MANAGEMENT/ QUANTITY SURVEYING

Student's Name : CHIN SIN LIN **ID Number :** 09UEB01096

Supervisor's Name : DR. NG SEE SENG

RECORD OF SUPERVISION/ MEETING

	Date	Time		Student's Initial	Lecturer's Initial	Subject of Discussion
		Start	End			
1	19th Jan 2011	3.00p.m.	3.15p.m.			Discussed information finding.
2	16th Feb 2011	9.00a.m.	10.00a.m.			Discussed Chapter 1 Introduction.
3	24th Feb 2011	11.00a.m.	12.00noon			Discussed Chapter 3 Research Methodology.
4	2nd Mar 2011	9.00a.m.	10.00a.m.			Discussed Chapter 2 Literature Review.
5	13th June 2011	11.00a.m.	12.00noon			Discussed Research Methods.
6	4th July 2011	11.45a.m.	12.15a.m.			Discussed research methods and certified the letter consent
7	11th July 2011	11.00a.m	12.00noon			Discussed data analysis.
8	18th July 2011	10.00a.m.	11.00a.m.			Discussed data analysis and finalisation.