GUIDELINES FOR
UNIVERSAL ACCESS TO
NEW PUBLIC DOCKS IN FALSE CREEK

FINAL DRAFT

Prepared for:

CITY OF VANCOUVER

453 West 12th Avenue
Vancouver, BC
V5Y 1V4

Prepared by:

moffatt & nichol

777 W. Broadway, Suite 301
Vancouver, BC, V5Z 4J7

Tel: 604-707-9004
Fax: 604-707-9005

In association with:

canadian barrier free design inc.

GUIDELINES FOR UNIVERSAL ACCESS TO NEW PUBLIC DOCKS IN FALSE CREEK

FINAL DRAFT

May 29, 2012

M&N Project No. 7453

Prepared by:

MOFFATT & NICHOL

[Original signed by:]

Michael Cho, M.Eng., P.Eng
Project Engineer

Reviewed by:

MOFFATT & NICHOL

[Original signed by:]

Paul Hoo, P.Eng.
Project Manager

REV	DESCRIPTION	DATE ISSUED	PREPARED BY	REVIEWED BY	APPROVED
3	Revised Final Issue	May 29, 2012	MC	PH	PH
2	Revised Final issue	February 9, 2012	MN/PH		
1	Final issue	August 11, 2011	MN/BM	PH	PH
0	Issued for Client Review	June 30, 2011	MN	PH	PH

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

1.0 INTRODUCTION

In December 1998, the Vancouver City Council adopted the Blueways Policies and Guidelines (recommendations for the future use and preservation of Vancouver's waterfront and waterways). Included in these policies and guidelines was a commitment from the City of Vancouver to make improvements to existing and new docks at strategic transportation nodes around False Creek to be accessible for people with disabilities.

Several of the existing public dock facilities in False Creek are nearing the end of their service lives, and are in need of replacement. As a result, opportunities have arisen to construct new dock facilities that are, to the greatest extent possible, accessible for people with disabilities.

The City of Vancouver (the City) retained Moffatt and Nichol (M&N) to conduct an accessibility review and to develop a set of recommended design guidelines for universal access to public docks in False Creek that could be used for future planning and design processes.

1.1 PURPOSE AND SCOPE

The purpose of this document is to present guidelines that would result in new public docks that are universally accessible to the greatest extent possible.

Statistics have shown that 1 in 4 people throughout the world have some type of disability[1]. In addition Statistics Canada reports that 1,000 people will turn 65 every day in Canada[2]. With an increase in age also comes an increase in the rate of disability; among older adults and seniors, 1 in 3 people are considered disabled. Further, Statistics Canada has projected that by 2051, 25% of the population in Canada will be over the age of 65. This implies that in the future, it may be the norm for an increasing number of users of the False Creek public docks to have a disability.

Architectural barriers in the existing built environment have precluded many older adults, seniors and people with disabilities from utilizing marine facilities regardless of their desire to participate. Improving access to such facilities will enhance safety and usability for the whole community.

There are many well established accessible design standards available (such as the Canadian Standard *CAN/CSA-B651 Accessible Design for the Built Environment* and the US Standard, *ADA (Americans with Disabilities Act) Standards for Accessible Design*); however, most were developed with interior and landside considerations and therefore do not necessarily consider marine facilities, and sometimes they explicitly exclude dock facilities. Further, such standards often represent the minimum requirements, rather than a best practices approach.

This document only addresses universal design as it relates to public ferry docks. The recommendations are derived from a comprehensive review of codes, standards, guidelines, community preference and current practice in other jurisdictions that are relevant to public dock facilities, applied over the unique conditions in False Creek.

Gangway requirements are not part of Canadian National Building Codes or CSA considerations. Nor do local building codes cover gangway/dock applications.

---

[1] Source: International Navigation Association (PIANC) - Disability Access Guidelines For Recreational Boating Facilities - Final Report of Working Group 14 of the Recreational Navigation Commission, (2004)

[2] Source: Statistics Canada. Table 051-0001 - Estimates of population, by age group and sex for July 1, 2010, Canada, provinces and territories, annual (persons unless otherwise noted), CANSIM (database).

Section 5.0 provides details on the reference standards, codes and guidelines that were used for the research and basis of this document.

The design guidelines and recommendations provided in this document are intended for public docks located in False Creek only, where the vessels include small passenger ferries (with a 10 to 30 passenger capacity) and small watercrafts such as kayaks and dinghies. It does not address the issues of access to and from vessels, except with respect to design considerations for the landing floats. Departures from recommended guidelines provided in this document through the use of other innovative designs, ideas and technologies is encouraged especially when the alternatives will provide substantially equivalent or greater access for older adults, seniors and people with disabilities. These guidelines were developed through a collaborative effort between City of Vancouver staff and universal design specialist Brad McCannell of Canadian Barrier Free Design Inc.

Although the ferry operators are currently the primary users of these False Creek dock facilities, it should be noted that the Blueways Policies and Guidelines seek to encourage additional use of these facilities for other purposes. These Guideline assume that public docks should, to the greatest extent possible, provide a universal environment for multiple user groups using the facility simultaneously.

1.1.1 Definitions

This document uses the World Health Organization's (WHO) framework for disability (see Table 1). This framework defines disability as:

> *'The relationship between body structures and functions, daily activities and social participation, while recognizing the role of environmental factors. Persons with disabilities are those who reported difficulties with daily living activities, or who indicated that a physical, mental condition or health problem reduced the kind or amount of activities they could do'.*

Table 1: World Health Organization Criteria for various Disabilities (WHO)

Disabilities Among Adults (World Health Organization Criteria)
Hard of Hearing: Difficulty hearing what is being said in a conversation with one other person, in a conversation with three or more persons or in a telephone conversation.
Deaf or Profoundly Hard of Hearing: People unable to hear at a functional level for the activities of daily living.
Vision Impairment: Difficulty seeing ordinary newsprint or clearly seeing the face of someone from 4 metres (12 feet).
Blind: No perception of light or people with less than 20/200 vision (legally blind).
Mobility: Difficulty walking half a kilometre or up and down a flight of stairs, about 12 steps without resting, moving from one room to another, carrying an object of 5 kg (10 pounds) for 10 metres (30 feet) or standing for long periods.
Agility: Difficulty bending, dressing or undressing oneself, getting into and out of bed, using fingers to grasp or handling objects, reaching in any direction (for example, above one's head) or cutting own food.

Mobility/agility problems are the type of disability most often reported by adults aged 15 and over. In 2001, nearly 2.5 million or 10.5% of Canadians had difficulty walking, climbing stairs, carrying an object for a short distance, standing in line for 20 minutes or moving about from one room to another. For all age groups, women were more likely to have mobility problems than men. Indeed, among adults aged 15 and over, there was a significant difference in the overall proportion of women (12.2%) and men (8.6%) reporting a mobility related disability. Also with respect to motor skills, activity limitations related to agility affect a substantial number of persons aged 15 and over. In all, 2.3 million or 9.7% of adults reported having difficulty with everyday activities that require these skills, such as bending down to pick up an object, getting dressed or undressed, or cutting one's food.

This report discusses disability groups only in reference to obstacles and barriers specific to those user groups, without regard to the cause of the disability. As with any population, the strengths and abilities of individuals within any given group will vary significantly.

Special consideration of the unique nature of seniors' access needs is also incorporated into the design review comments.

1.2 BACKGROUND AND CURRENT CHALLENGES

The City currently owns and/or manages seven floating public docks in False Creek:

- Aquatic Centre Dock
- David Lam Dock
- Hornby Street Dock
- Science World Dock
- Spyglass Dock
- Stamp's Landing Dock
- The Village Dock

These docks are used for short term moorage and launching of small watercraft such as kayaks and dinghies, and through a license agreement with the City, two private companies operate passenger ferry services in False Creek, using the public docks as terminals.

The major challenge in providing universal access for the design of docks in False Creek is the dramatic tidal range. Table 2: shows the water level elevations for False Creek referenced to Canadian Geodetic Datum (GD) and Chart Datum (CD).

Table 2: Site Water Level Elevations (CHS[3], False Creek)

TIDAL PARAMETER	Geodetic Datum (GD) ELEVATION, (m)	Chart Datum (CD) ELEVATION, (m)
Recorded Extreme High in Vancouver	2.6	5.6
Higher High Water Level (Large Tide) - HHWLT	2.0	5.0
Mean High Water Level (Mean Tide) - HHWMT	1.4	4.4
Mean Water Level – MWL	0.0	3.0
Mean Low Water Level (Mean Tide) - LLWMT	-2.0	1.0
Lower Low Water Level (Large Tide) - LLWLT	-3.1	-0.1
Recorded Extreme Low in Vancouver	-3.3	-0.3

[3] Canadian Hydrographic Services, Tide and Current Tables, Volume 5

As shown in Table 2, False Creek experiences a 5.1m tidal range between the higher high and lower low large tide elevations.

During low tides, many of the existing docks present accessibility challenges due to the steepness of the gangway. A gangway slope that meets the accessibility goals of recognized standards such as the *ADA Standards for Accessible Design* and the *CAN/CSA-B651 Accessible Design for the Built Environment* requires a significantly longer and therefore more expensive gangway system than one with a steeper slope. For example, a gangway system with a design slope of 1:12, or 8% grade, would have an overall length of approximately 61 m for access over a 5.1m tide range. Similarly, a gangway system with a design slope of 1:20, or 5% grade, would have an approximate overall length of 102 m for access over the same tide range.

When a marine facility is designed, the designer must determine the tide range which the design applies to. Therefore, it is important to understand the amount of time during which various tide levels are experienced. Based on 4 years of water level data[4] from Point Atkinson, West Vancouver, the percentage of time at which various tidal levels are exceeded are shown in Figure 1.

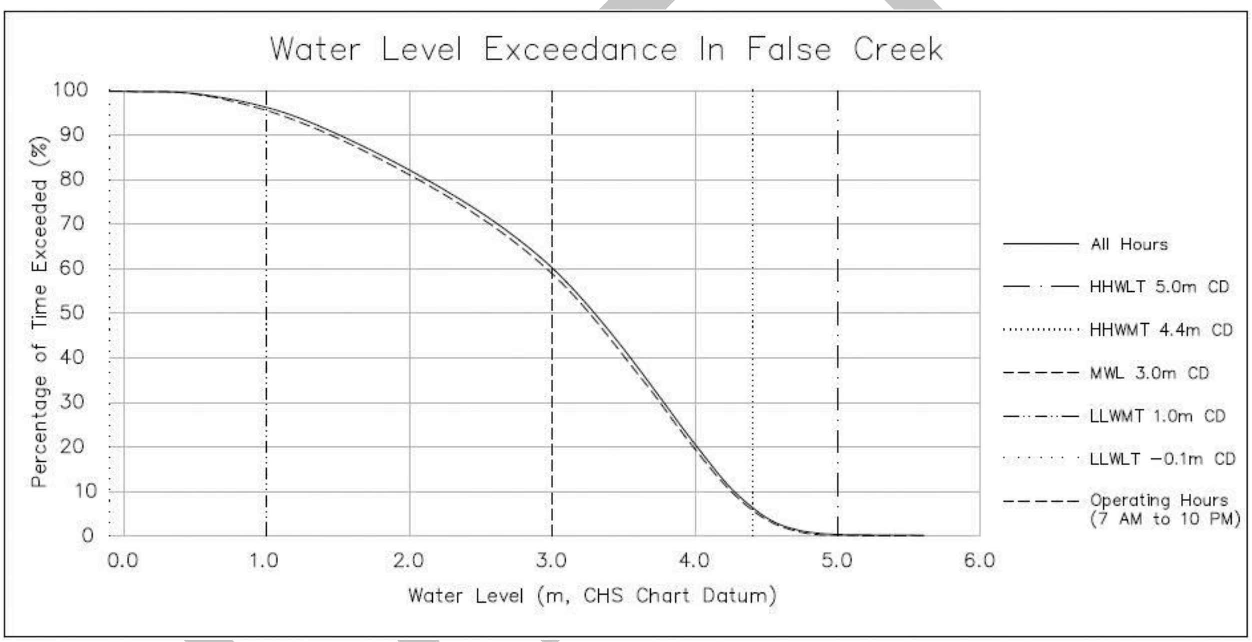


Figure 1: Percentage of Time Exceeded vs. Tide Levels

1.2.1 Analysis of Tide Levels During Operating Hours (07:00 to 22:00)

A summary of Figure 1 with respect to gangway slopes is provided below:

- If the gangway slopes are designed for the Lower Low Water Large Tide (LLWLT El.-0.1m), 99.9% of the operating time the gangways would not exceed the design slope;
- If the gangway slopes are designed for the Lower Low Water Mean Tide (LLWMT El.1.0m), 96% of the operating time the gangways would not exceed the design slope;

[4] Fisheries and Oceans Canada

- If the gangway slopes are designed for El. 2.0m CD, 81% of the operating time the gangways would not exceed the design slope, and;
- If the gangway slopes are designed for the Mean Water Level (MWL El.3.0m), 59% of the operating time the gangways would not exceed the design slope.

It is important to note that Figure 1 represents the average water levels per year, and that there are significant monthly variations. For example, it is noted above that 81% of the total operating hours per year the water level is above El.2.0m, or conversely 19% of the total operating time per year the water level is below El.2.0m. This varies from a low of 5% of the monthly operating hours during November to a high of 32% of the operating hours during the month of June. Generally, the water levels are lowest, and occur most frequently, during the summer operating hours.

Further analysis of the tide data is presented in Appendix A.

1.2.2 The Challenge of Restrictive Water Lot Boundaries

One of the other challenges that designers are typically faced with is the restricted water lot boundaries in False Creek, and the harbour headline. Harbour headline generally runs parallel to the shore of False Creek, and represents the boundary beyond which no marine structures can extend to ensure boat navigational clearances along False Creek. The harbour headline is located approximately 35 to 40m from shore along False Creek. Further, the City of Vancouver owns water lots, or leases water lots from the Province, within which the public docks must be constructed. In some cases, the water lot boundary is the constraining factor in determining the amount of space available to build a dock. Whether due to the harbour headline, or the dimensions of the water lot, space is limited, often likely dictating the use of zig-zag gangways instead of straight runs in the design of new public docks in False Creek.

1.3 ACCESS ISSUES

Observations made by ferry operators and City of Vancouver staff confirm that very few people with obvious disabilities attempt to access the existing public docks. There are likely a variety of reasons for this, including the excessive gangway slope experienced at some of the sites, and the limited numbers of ferry vessels that can accommodate wheelchairs and other mobility aids.

For those people with disabilities presently choosing to use the public docks, depending on the level of disability possessed, some or all of the following processes may need to be followed prior to that person boarding a ferry:

- Check for times at which high tide occurs, to ensure gangway slope will be safe;
- Check ferry schedules in advance to ensure pick-up will be available during high tide, and that the ferry that arrives for pick-up is able to accommodate wheelchairs or other mobility aids (as not all existing ferries are currently wheelchair accessible); and,
- If the person is not accompanied by a capable assistant, contact the ferry company to ensure that an employee from the ferry company will be available to provide assistance to ascend and descend the gangway and boarding the vessel.

For able-bodied people, the decision to ride a ferry can be much more spontaneous, and requires significantly less planning. These guidelines are intended to afford persons with disabilities the opportunity to enjoy the public docks with greater flexibility and less advance preparation. That said, it is recognized that full access to the passenger ferry service will require a joint effort with the private ferry operators. A step toward that was made with renewal of the ferry dock license agreement in 2011, through which the ferry companies committed to ensuring that all new or replacement vessels will be accessible to persons with disabilities.

These Guidelines assume that inclusion must be a key element in the overall design of any new dock facility. A universal approach will serve the broadest number of users and minimize costly retrofits in the future. Every opportunity to create common pathways, routes and gangways appropriate for all users is the objective, rather than designing separate routes or accommodations for people with disabilities, older adults and seniors.

The expected lifespan of any given installation needs to be compared against projected user demographics to determine the exact needs of the actual consumers over the life of the dock. Aquabus's management estimates that approximately 30% of current False Creek ferry passenger traffic is comprised of people over 55. This implies that people with mobility and sensory impairments already make up a significant portion of dock facility users. It is also a strong indicator that the practical maximum grade for meaningful access needs to be less than the maximum grade allowed by typical building code requirements. The City's redevelopment of the dock facilities will need to factor in the affect of the changing demographics within the community of people with disabilities (mobility disabilities other than paraplegia becoming more prominent), weather conditions, wet and/or slippery surfaces and pedestrian traffic volume when determining acceptable maximum gangway inclines. Further, modern dock facilities must accommodate a much broader group of people with disabilities than in the past.

As a starting position, these guidelines recommend that, in order to provide for universal access, no slope on the approaches to the dock or the gangways should exceed 5% for the tide range from LLWLT to HHWLT. Further discussion regarding guidelines for facility design, including a recommended design criteria for instances where space limits the ability to achieve this ideal, is presented in Section 2.2.

1.4 CONDITIONS AT EXISTING DOCKS IN FALSE CREEK

Currently, only the David Lam, The Village and Granville Island docks are equipped with a gangway system that provides for improved accessibility. All other public ferry docks utilize a single gangway whose slope routinely exceeds the building code limits; furthermore, there are instances when the single gangway slope exceeds the maximum safe slope for people without mobility impairments. These single gangway docks regularly exceed 20% in slope and in extreme tidal swings may reach up to 60%.

Despite the fact that this has been accepted practice for marinas, gangways with slopes exceeding 1:12 (8%), and lengths greater than 9m are not safe for most healthy, ambulatory users. Gradients in excess of 5% are not considered easily accessible to the majority of wheelchair users and people using walking aids. By way of comparison, when considering recreational bike trails, a 2% grade may not seem very steep, but it's enough to substantially reduce forward speed, and for most riders it will absorb more than half their power output; a 6% grade is enough to cut speed to well under half, and absorb more than 80% of a rider's power output, and; a 10% grade has anyone who is not a fit and frequent rider off their bike and walking. Also consider that a 6% grade on the highway warrants a warning sign for truck drivers to gear down and move to the right lane. The existing ramp designs (other than David Lam, Village and Granville Island) are too steep, too often.

The Granville Island, David Lam and Village Docks manage grades reasonably well, although they do rely on greater than 8% slopes in some conditions. As well, there are a number of unprotected drop offs at waters edge, tripping hazards and a lack of high contrast/tactile marking on edges and hazards. While these docks are by far the most accessible, welcoming and safe dock designs found in False Creek, they still possess limitations for a significant proportion of the population. To be truly inclusive, they need to do more.

1.4.1 Operational Issues

No public facility design operates in a void. The operational planning has a tremendous affect on providing access for everyone. False Creek dock operators need to become proactive in managing the safe and effective use of the facilities by all users – including people with disabilities. Pro-active management could include:

- Overlaying a City of Vancouver major event calendar with the corresponding tide charts as part of an annual review. This will reveal conflicts between peak use/demand periods and extreme tides for management action. For example, typical tide cycles move from maximum(spring) tides to minimum(neap) tides every 2 weeks, so rescheduling an event by 1-2 weeks may result in substantially reduced tides;
- Develop a simple graphic representation of the gangway inclines to display current conditions via area signage and on the internet on new or existing website(s). The system should also allow users to predict conditions at 2 hour intervals into the next day. This would be similar to BC Ferries 'Current Conditions' option on BCFS web sites. A mobile phone app for this site could also be part of this initiative;
- Publish a weekly or monthly 'gangway incline chart' via the internet and/or through community and disability organization's newsletters. This could be a stand alone bulletin or incorporated into current ferry schedules and tide information as currently distributed. Since tides are predicable developing the data should be a once for an indefinitely long period;
- In the event that for practical reasons gangway systems in place must exceed 5-6%, a series of warning icons should be developed that can be posted on websites and in on-site signage to characterize conditions in four categories: Easy; Sloped; Assistance May Be Required (slope greater than 5%); Not Recommended for Anyone (slope greater than 8%). This would allow individuals to make informed decisions about whether or not to use the facility, based on their own abilities;
- Explore the possibility of getting gangway conditions reported (at least in extreme conditions) as part of regular traffic reports on radio and television;
- Partner in a hotline phone number with ferry operators containing recorded information;
- Partner with ferry operators to provide at least one, appropriately trained gangway attendant (could be an existing worker), to provide assistance when ramp conditions exceed 5-6%. A push button intercom/ call button may be required to facilitate this assistance. Asking untrained staff to provide such assistance is not recommended;
- Wheelchair users, people using walking aids and young children should be discouraged from using the gangway when slopes exceed 8%. Gangway slopes in excess of 13% are not considered safe for most users;
- All dock information must be available in alternate formats, for example Braille and/or audio file(s); and,
- All websites containing False Creek Dock information should be W3C Compliant for accessibility.

1.5 DESIGN BASIS FOR VARIOUS DISABILITY GROUPS

The following section discusses six common disability groups, the functional impairments common in each group and the corresponding design basis to consider. It should be noted that the application of some design aspects will benefit more than one disability group. For example, the application of tactile warning surfaces will benefit people with vision impairment and people who are blind. The use of continuous handrails will benefit people with mobility or agility impairment, people with vision impairment and people who are blind.

1.5.1 Design Basis for People with Mobility and Agility Impairments

People who experience decreased agility; limited range of motion; decreases in strength, balance or co-ordination; or fatigue may require the use of a mobility device, such as a walker, cane, brace, crutch, wheelchair or scooter.

People who use walking aids, wheelchairs or scooters may have difficulty in the following conditions:

- Steep grades or cross slopes;
- Uneven or rough surfaces;
- Prolonged or excessive exposure to sun or rain;
- Reduced reach and range of motion;
- Balance;
- The lack of a free hand to grab for support or to carry items;
- Opening swing/spring doors or gates;
- Travelling long distances; and,
- Loose gravel or other unstable surfaces.

In reference to Annex B and C of the National Standard of Canada, *CAN/CSA-B651-04 Accessible Design for the Built Environment*, the following sub-sections provide typical dimensions and anthropometric sketches to guide accessible design for public docks. However, it is important to recognize that mobility aids come in many sizes and types. Most are manually operated but increasingly, people are turning to power operated wheelchairs and scooters. Power equipment results in larger, heavier devices that will need to be integrated into common pedestrian pathways and facilities. Circulation spaces, connecting pathways and holding/waiting areas will need to anticipate the need for more space progressively as the population continues to age and the use of adaptive equipment increases.

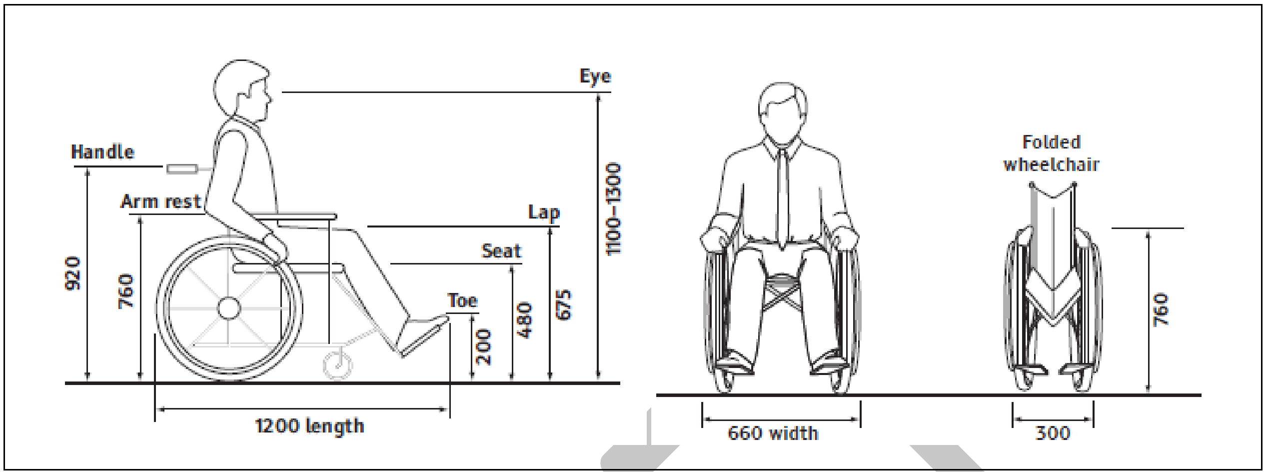


Figure 2: Typical Dimensions (in mm) of an adult manual wheelchair (CAN/CSA-B651)

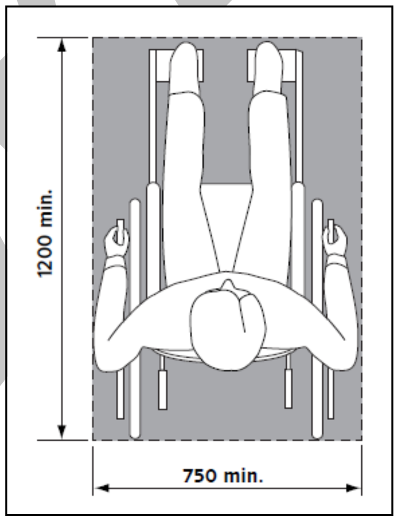


Figure 3: Minimum floor area (in mm) for a person using a manual wheelchair (CAN/CSA-B651)

1.5.1.1 Dimensions of Powered Devices

The footprints of power wheelchairs currently in use tend to be longer than those of manual wheelchairs (see Figure 4).

Some may have extended footrests or a ventilator at the back of the chair. Power wheelchairs are heavy, carry a battery that requires recharging when stored, and cannot be folded.

To better accommodate most wheeled devices, best practice is to use a footprint that is at least 1500mm long by 750mm wide.

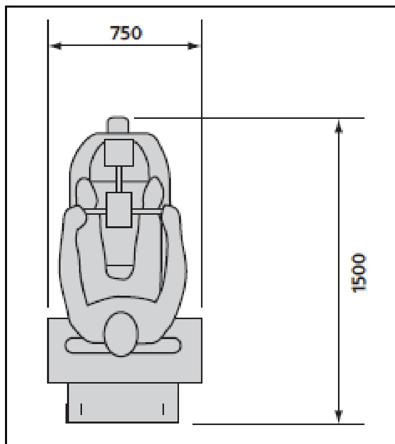


Figure 4: Minimum floor area (in mm) for a person using a power wheelchair/scooter (CAN/CSA-B651)

1.5.1.2 Dimensions for Walkers

Figure 5 shows typical dimensions for a person using a walker. These mobility aids are commonly used by elderly persons.

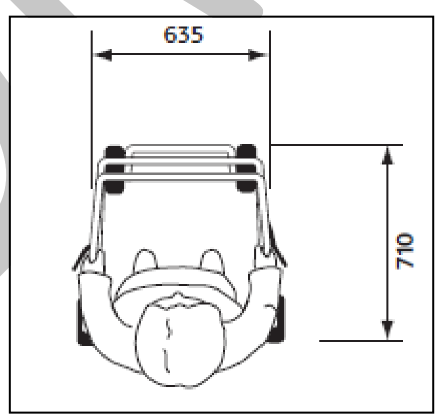


Figure 5: Floor area (in mm) for a person using a walker (CAN/CSA-B651)

1.5.1.3 Turning Areas

Manual wheelchairs require a turning area as shown in Figure 6. Powered devices, however, often do not have the same manoeuvrability. The turning diameter for a power wheelchair is shown in Figure 7. Scooters, due to their design, turn differently than wheelchairs and require even more space, as shown in Figure 8.

The turning space is important for areas such as landings, which must accommodate these devices. The turning radius for these power mobility devices indicates that the 1500 mm diameter required for a manual wheelchair is inadequate for manoeuvring powered devices.

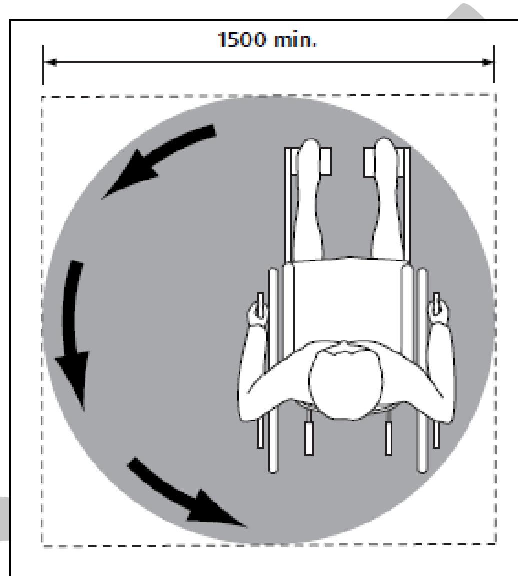


Figure 6: Turning area (in mm) for a person using a manual wheelchair (CAN/CSA-B651)

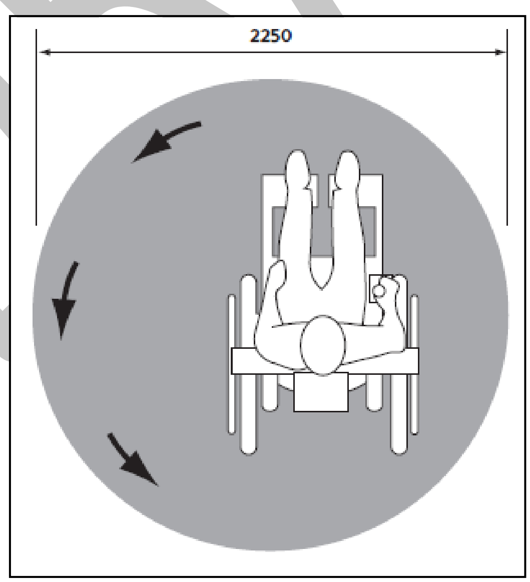


Figure 7: Turning area (in mm) for a person using a power wheelchair (CAN/CSA-B651)

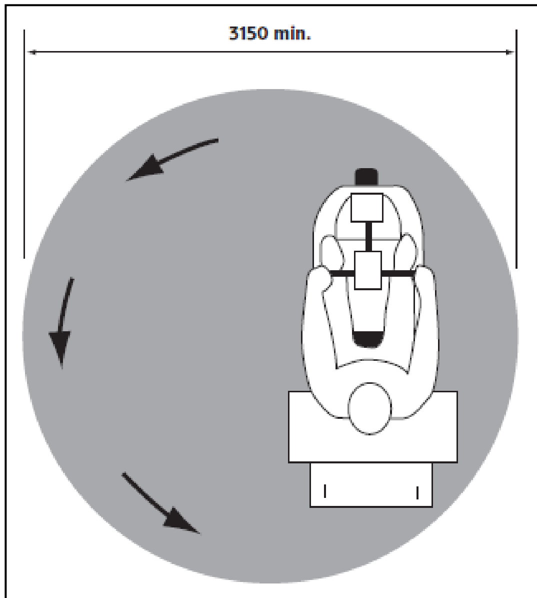


Figure 8: Turning area (in mm) for a person using a large scooter (CAN/CSA-B651)

1.5.1.4 Reach Ranges for a Person in a Manual Wheelchair

- Forward reach without obstruction

  The highest forward reach is 1200mm from the floor, and the lowest forward reach is 400mm from the floor (see Figure 9).

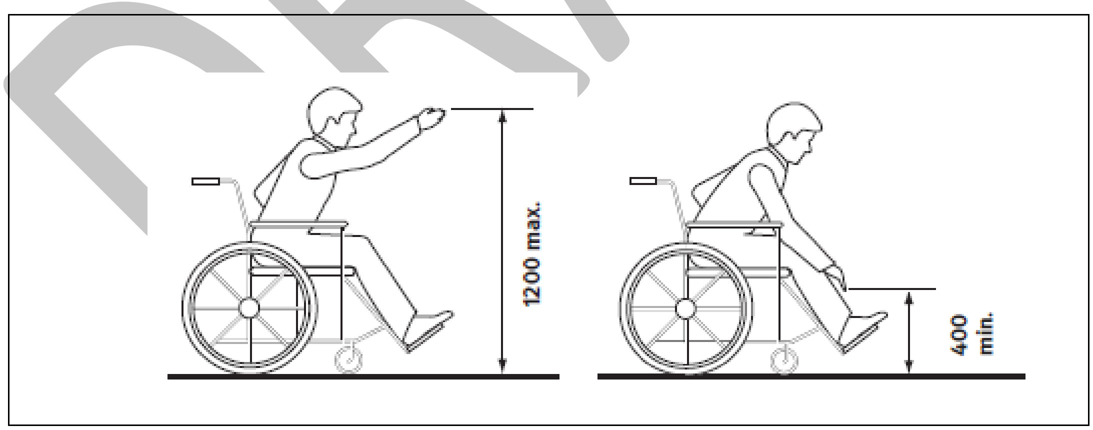


Figure 9: Forward Reach Without Obstruction (CAN/CSA-B651)

- Side reach without obstruction

  The highest side reach for touch (not operate) is 1400 mm from the floor, and the lowest side reach for touch is 230 mm from the floor (see Figure 10). Items to be operated such as latches, handles, card swipes, switches, buttons, etc. must be in an operating range between 450 – 1066mm above the finished floor.

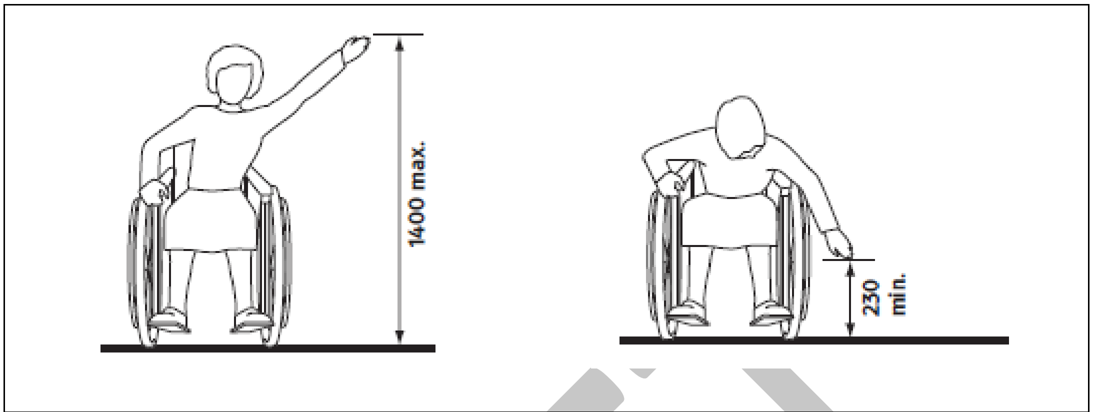


Figure 10: Forward Reach Without Obstruction (CAN/CSA-B651)

1.5.1.5 Walkway Widths for Persons Using Crutches

Although people who use walking aids can manoeuvre through a clear width of 810mm, for comfortable gaits they require a walkway width of 920mm (see Figure 11).

Crutch tips, which often extend down at a wide angle, are a hazard in narrow walkways where they may not be seen by other pedestrians.

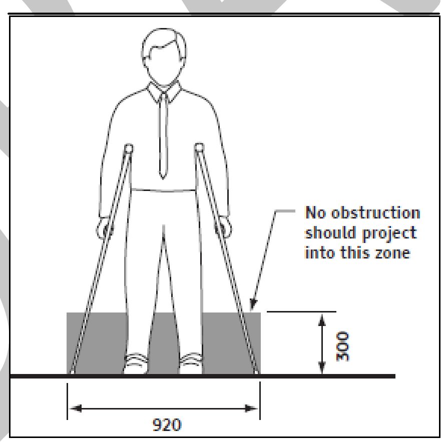


Figure 11: Walkway width (in mm) for persons using crutches (CAN/CSA-B651)

1.5.1.6 Detection Space for Persons Using a Long White Cane

People who use a long white cane to help them manoeuvre can detect an obstruction within a height range of up to 680 mm from the floor. Depending upon the person, their forward detection range can vary from 900 to 1500 mm (see Figure 12).

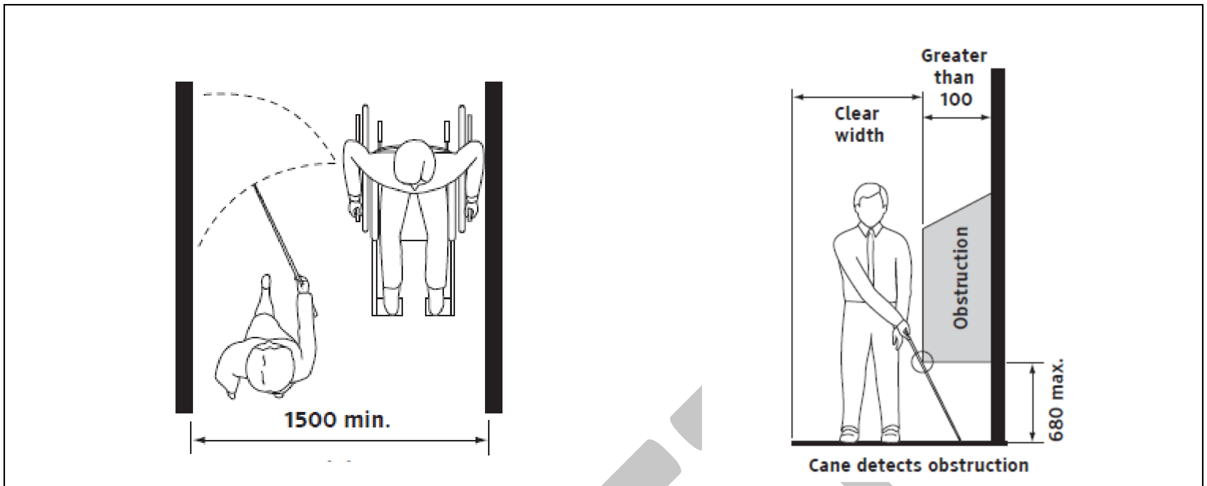


Figure 12: Detection space (in mm) for persons using a long white cane (CAN/CSA-B651)

1.5.1.7 Walkway Width for a Person with a Guide Dog or Other Service Animal

A person who uses service animal requires a comfortable clear walkway width of 1200mm (see Figure 13).

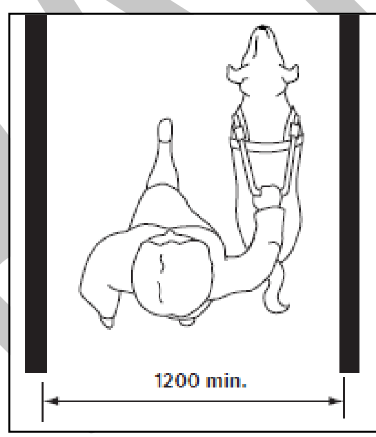


Figure 13: Walkway width (in mm) for persons with a guide dog (CAN/CSA-B651)

1.5.1.8 Weather Protection

In addition to the typical rain/sleet concerns affecting everyone, many people with disabilities, older adults and seniors are sensitive to direct sunlight and heat. Covered portions of the dock facility that includes some bench seating is highly desirable. Bench seating needs to incorporate a back rest and at least one armrest. Some open space needs to be available in covered areas to accommodate wheelchair users and people unable to use common seating.

1.5.2 Design Basics for People with Vision Impairments

People with vision impairment are not a homogenous group as there are many types and levels of eye conditions. They typically experience difficulties with reading signs, instructions or labels and may need to hear instruction and/or warnings for dangers others can see.

In order to provide effective design for public dock users with vision impairments, the following design aspects should be considered:

- Color/contrast cues to help one identify obstacles in the path of travel and to provide wayfinding information;
- High contrast signage on non-glare surfaces available at different mounting heights (high and low mounted);
- High contrast coloured handrails on gangways (powder coating recommended for reduced maintenance);
- Low mounted lighting highlighting transition changes (e.g. gangways, steps, ramps);
- Tactile and kinaesthetic cues, such as the application of different floor surfaces and approved tactile warning surfaces (refer to Section 2.2.7);
- Ergonomics, which can be applied to the dock layout such as the use of continuous handrails to guide his/her path of travel and avoid hazardous areas; and,
- Use of locating tones to assist in wayfinding.

1.5.3 Design Basis for Blind Persons

People who are blind rely on tactile, acoustic and kinaesthetic cues to navigate around dock facilities. In order to provide effective design for public dock users who are blind, the following design aspects should be considered:

- Use of tactile and Braille in appropriate signage;
- Tactile and kinaesthetic cues, such as the application of different floor surfaces and approved tactile warning surfaces (refer to Section 2.2.7) in front of structural obstacles located in the path of travel;
- Edge protection and/or high contrast tactile hazard warnings at all exposed dock /pathway edges and at all transitions; and,
- The application of soundscaping and acoustical wayfinding techniques such as locating tones.

1.5.4 Design Basis for Deaf Persons or Hard of Hearing Persons

People with hearing disabilities may have little or no functional hearing and may depend heavily on visual communication – signage, tactile and colour based wayfinding and gestural language(s). To support sign language interpretation and speech reading, 60-100 lux of flat even light is required to communicate effectively.

In order to provide an effective environment for public dock users with hearing disabilities, the following design aspects should be considered:

- Appropriate lighting at all decision points (refer to Section 3.4 for details on lighting requirements);
- Frequent, easy to read directional signage, instructions and/or labels;
- Sound damping to minimize acoustic levels where necessary/possible; and,
- Providing appropriate support to people who are hard of hearing or deaf as part of ferry operational considerations, for example text, email and/or TTY support).

1.5.5 Design Basis for People with Communication and Cognitive Disabilities

Communication disabilities (such as aphasia, i.e., difficulty talking, understanding, reading and/or writing) and people with cognitive disabilities can all be supported in recreational marine settings with similar design considerations and solutions. Providing effective inclusive design for public dock users with communication or cognitive disabilities requires the following design considerations:

- Consistent signage utilizing international symbols, simple icons & high contrast colour;
- Written information provided in plain language, limited to short, simple concepts; and,
- Outreach efforts made in the operation of the dock facility.

People with communication disabilities may also benefit from the use of design considerations for those with visual disabilities (refer to Section 1.5.2).

1.5.6 Design Basis for Older Adults and Seniors

The majority of older adults (55-64) and seniors (those 65 or over) are subject to some form of age-related change in their abilities, such as reduced visual acuity, loss of hearing, limited range of motion or reduced agility. Often, older adults and seniors can experience multiple disabilities - a combination of both sensory and mobility impairments. These factors create an increase in the number of people who rely on mobility devices such as canes, walkers, wheelchairs or power scooters. Adequate space should be provided in the dock layout to accommodate these mobility aids (Refer to Section 1.5.1). Seniors may also benefit from the use of design considerations discussed in Sections 1.5.1 to Section 1.5.5.

Tripping hazards are a primary concern of people with mobility impairments – particularly older adults and seniors. Dock edge protection, high contrast markings on fixed obstacles in the path of travel, smooth transitions on gangways, consistent wayfinding clues are all important parts of fall reduction planning that need to be applied to City of Vancouver dock facilities.

All of the design considerations discussed in previous sections will also benefit people who are able-bodied - particularly toddlers, pregnant women, people pushing strollers, using bicycles and/or people with luggage, large parcels or carts.

2.0 GUIDELINES FOR UNIVERSAL ACCESS TO NEW PUBLIC DOCKS

A fundamental requirement for developing more universal access is to provide a path of travel that is safe, continuous, and unobstructed to people with disabilities. Facilities that are designed and constructed in a manner that satisfies this objective need to consider various design measures such as ramp slopes, appropriate path dimensions, path surfacing, railings, signage, etc. The following section discusses some of the general guidelines to follow for inclusive dock facility planning and the major principal design considerations.

2.1 GUIDELINES FOR FACILITY PLANNING

The following general guidelines should be considered when planning and designing for public dock facilities in False Creek:

- Short and easy routes to follow;
- Fewest possible changes in level;
- Adequate route width and surface;
- Appropriate route and activity signage;
- Smooth and stable surfaces at all transition points; and,
- Easy to use facilities and equipment (if applicable).

One of the main design elements to consider for public dock facilities in False Creek is system/access consistency from dock to dock. People who rely on the access features of the dock need to know what to expect at both the departing and arriving dock facilities (knowing they can get on and also get off).

2.2 PRINCIPAL DESIGN CONSIDERATIONS

The following sub-sections focus on the various design elements to consider when designing universally accessible public docks in False Creek. The guidelines reflect standards and/or benchmarks that have been well established in the United States, Canada and worldwide (refer to Section 5.0 for references used), and take into consideration the tide conditions in False Creek. It is recognized that some of the guidelines provided in this document may go beyond minimum Building Code requirements, to provide meaningful access for older adults, seniors and people with disabilities.

2.2.1 Fixed Ramp and Gangway Gradient

These guidelines recommend a two-tiered criteria for design of ramp and gangway gradients for all new docks in False Creek:

1.0 Begin with the goal of providing a maximum gradient of 1:20 (5%) on all ramps and gangways within the tidal range from LLWLT (El. -0.1m CD) to HHWLT (El. 5.0m CD).

2.0 If, due to space constraints presented by the seawall, water lot boundaries or harbour headline, this cannot be achieved, then the design criteria should be a maximum gradient of 1:20 (5%) during the tide range El. 2.0m CD to HHWLT, and a maximum gradient of 1:12 (8%) during the tide range LLWLT (El. -0.1m CD) to El. 2.0 CD.

For the first scenario, ramps and gangways would provide safe and appropriate grades for all users for over 99% of the time. It also means that for occasional and very short periods, depending on tidal conditions, slopes on the gangways will exceed 1:20 (5%) and become more difficult for people with mobility impairments and others; however, according to these guidelines slopes should never exceed 1:12 (8%) during the LLWLT to HHWLT range.

In cases where the first tier of the criteria cannot be met due to space constraints, the second tier would be invoked. In this case, ramps and gangways would provide safe and appropriate grades for all users for about 80% of the time. This means that for several days each week throughout the year, for at least 4 continuous hours (i.e. during regular ferry operating hours) each day, the ramps and gangways would provide safe and appropriate grades for all users. It also means that for several hours each day, depending on tidal conditions, slopes on the gangways will exceed 1:20 (5%) and become more difficult for some seniors and some people with disabilities; however, according to these guidelines slopes should never exceed 1:12 (8%) during the LLWLT to HHWLT range.

The City and the ferry operators must ensure that the operational suggestions made in the guidelines are in place to warn, support and assist users caught during these anomalies in ramp gradients that are too steep for safe, universal use.

Because gangways are somewhat analogous to conventional ramps, some have felt it appropriate to simply use conventional ramp standards (i.e. Building Code) to govern gangway design. This is not recommended. Building Code requirements represent maximum allowable grades under optimum conditions and were developed more than 30 years ago for interior use by wheelchair users and do not apply to people using walking aids. If a gangway/dock project is allowed to exceed slopes of 5% due to cost or physical limitations, it needs to be recognized that:

a) This will increase the fall hazard to 30 – 50% of the users (i.e. assuming the facilities are intended for use by the general public);

b) This will completely prohibit many people from using the facility during these increased gangway slope times; and,

c) This has the potential of creating additional liability to the City because of the falling hazard.

In **no case** should gangway slopes exceed 1:12 (8%) in any tide condition. If gangway slopes exceed 1:12 (8%) then the gangways should be closed to all users.

Unlike ramps, gangways are variable-sloped pedestrian walkways used to transition between a fixed landing on shore and a landing on a floating structure. They are usually hinged or attached at one end and have a variable slope depending on changes in the water elevation due to tidal fluctuations. They are not ramps, which have a fixed slope.

Gangways for transition to floating docks present a trade-off between length and slope. The greater the change of elevation, the more challenging the solution becomes. If the slope is reduced, then the required length is greater. While the desired shallow slope can be more accommodating for wheelchair users, a longer path of travel to attain the required rise may be objectionable to some users who have difficulty travelling longer distances.

As the range in water elevation increases, the gangway slope or length increases as well. For public docks in False Creek that experience a significant tidal range, the desire to provide a flatter slope will require either the use of longer gangways or a series of gangways with intermediate level landings.

It should be recognized that gangways have variable slopes depending on the tidal fluctuations and the maximum slope will only be experienced at certain times during the tide range.

For dock facilities in False Creek where the height difference necessary to accommodate the large tidal range may result in either excessively steep gangway slopes or lengthy structures, there are two possible gangway system solutions that may meet the accessibility goal, as discussed in the following sub-sections.

2.2.1.1 Compound Gangway System

One possible solution is the use of a compound gangway system, which has proven successful but relatively costly. See examples of compound gangway systems installed at the David Lam Dock (see Figure 14) and Jack London Marina in California (see Figure 15). A similar system was also implemented at the Village Dock and Granville Island Public Marina. A compound gangway system basically consists of a combination of gangways, fixed platforms and floating platforms. The elevations of the floating platforms vary with water level, with a minimum elevation limited by a support collar underneath the platform. This feature restricts the gangway from steepening beyond the design maximum slope.

Figure 14: Compound Gangway System at the David Lam Dock, Vancouver

Figure 15: Compound Gangway System at Jack London Marina, Oakland, California

Potential problems with this solution include possible pounding on the floating platforms supports on the piles due to wave action; potential accumulation of debris that may interfere with operation; and walkway instability when floats are subjected to excessive eccentric loading or wave action.

2.2.1.2 Up-and-Down Gangway System

Another possible solution to reduce the gangway steepness during low water levels is to elevate the lower landing and provide a "fixed" ramp on the floating dock to move from the landing to the float deck. At high water levels, the gangway may actually slope upwards before sloping downwards on the zigzag ramps, namely the "up-and-down" system. The Monterey Marina in California utilizes this type of gangway system, where a single 60ft long gangway is supported on a raised landing on the floating dock, with a fixed, switchback zigzag ramp on the float to get from the gangway landing onto the float deck.

Figure 16 shows the gangway system during construction, viewed from shore landing. The gangway was not installed at the time but the float landing and switchback ramps on the float are clearly shown. Figure 17 shows the system during operation.

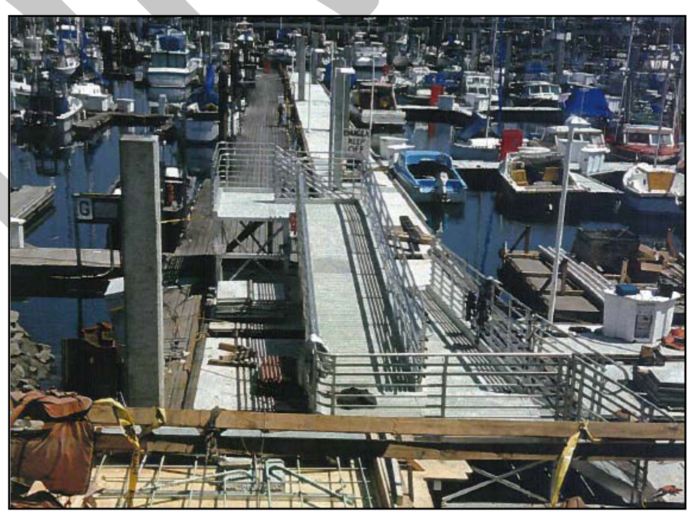


Figure 16: Up-and-Down Gangway System at Monterey Marina during Construction

Figure 17: Up-and-Down Gangway System at Monterey Marina during Operation

It is noted that the float on which with the switchback zigzag ramp structure would be mounted would be very heavy, which may preclude use in False Creek, particularly in instances where the sea bed level is already close to the bottom of the float at low tide.

2.2.2 Path of Travel Width

To allow greater accessibility and permit simultaneous travel of two wheelchairs in opposite directions (see Figure 4) or person using a cane and a wheelchair travelling in opposite directions (see Figure 12), the recommended clear width of all connecting pathways, ramps and gangways is 1500mm. Routes serving pedestrian traffic in one direction only are to be a minimum of 920mm clear width.

For areas such as landings and floating docks, where changes in direction occur and/or space is required for manoeuvring or resting, the recommended clear width is 3150mm (see Figure 8).

Refer to Section 1.5.1 for various design dimensions for people who use mobility devices, aids and their associated turning area footprint.

2.2.3 Path of Travel Cross-Slope

The cross-slope of a path of travel should be minimized while allowing a slight slope for drainage. The cross-slope of gangways, transition plates and floating docks should be designed and constructed to not exceed a maximum of 2 percent (1:50). For floating docks, it is desirable for the path of travel to be stable such that its cross-slope remains within acceptable limits for the reasonably expected live loads and changes in live load position, even when subject to winds, waves, or currents that cause unwanted float motions.

2.2.4 Path of Travel Surface

The path of travel should be free of abrupt changes in level or gaps. Refer to Section 2.2.7 for details on walking surface requirements and Section 3.2 on materials and finishes.

To eliminate abrupt changes in level or gaps, transition plates should be used. Transition plates are sloping pedestrian walking surface located at the ends of a gangway. They should also have a maximum of 1V:20H slope, similar to the gangways.

2.2.5 Handrails, Toe Rails and Guardrails

2.2.5.1 Handrails

Handrails are important features as they provide support and guidance, maintain balance, prevent falls and serve as a visual and tactile wayfinding guide. They should be graspable and provide a firm and comfortable grip for the hand to slide along the rail without obstruction. Mid-rails should also be used as a safety precaution for children or movement of carts and by people in wheelchairs to aid in negotiating ramps and gangways. Handrails are different from guardrails, which are used to protect users from the danger posed by the presence of a large drop-off or other hazard.

Handrails should:

- Have a circular section with an outside diameter of 30 to 40 mm or an equivalent gripping shape (see Figure 18).
- Be of uniform height and consist of top and mid-handrails where:
  - Top handrails should be located between 860 to 920mm, measured from the deck surface to the top of the rail. However, 920mm is preferred by older adults and seniors and is recommended.
  - Mid-handrails should be located between 600mm to 750mm, measured from the deck surface to the top of rail.
- Have a continuous gripping surface, without interruption by newel posts or any other construction elements or obstructions that can interrupt a hand hold;
- Have a clear space of 35 to 45mm underneath the handrail and between the handrail and adjacent surfaces (see Figure 18);
- Horizontal projections should occur 35 to 45mm below the bottom of the handrail gripping surface (see Figure 19);
- Be free of any sharp or abrasive elements;
- Resist a force of at least 1.3 kN applied in any direction;
- Be colour-contrasted with the surrounding surfaces;
- Be installed on both sides of the ramps or gangways; and,
- Extend horizontally beyond the top and bottom of the gangways at least 300mm (see Figure 20).

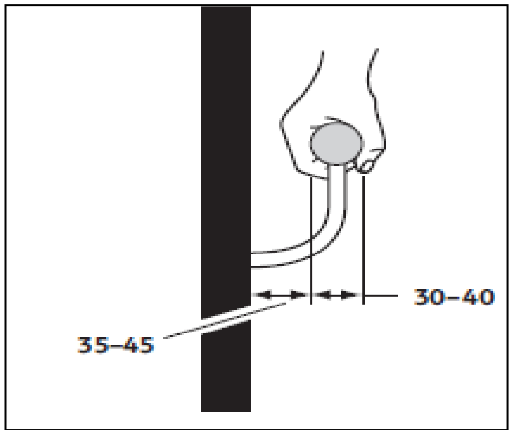


Figure 18: Handrails (CAN/CSA-B651)

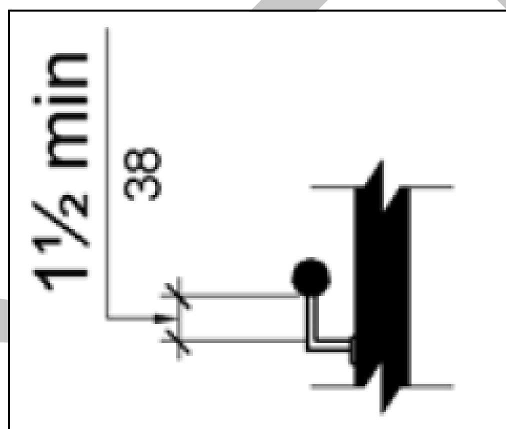


Figure 19: Horizontal Projections (in mm) Below Gripping Surface (CAN/CSA-B651)

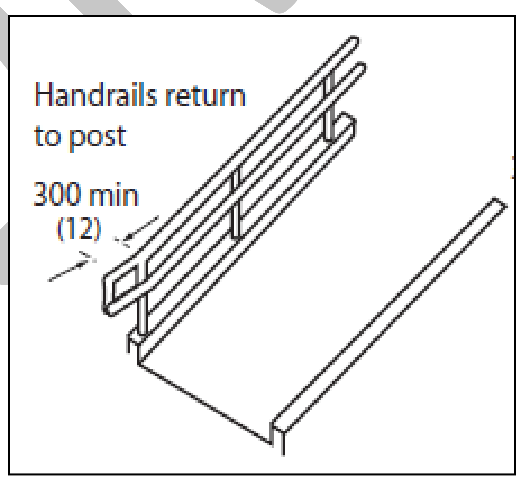


Figure 20: Handrail Extension in mm (City of Winnipeg Accessibility Design Standards)

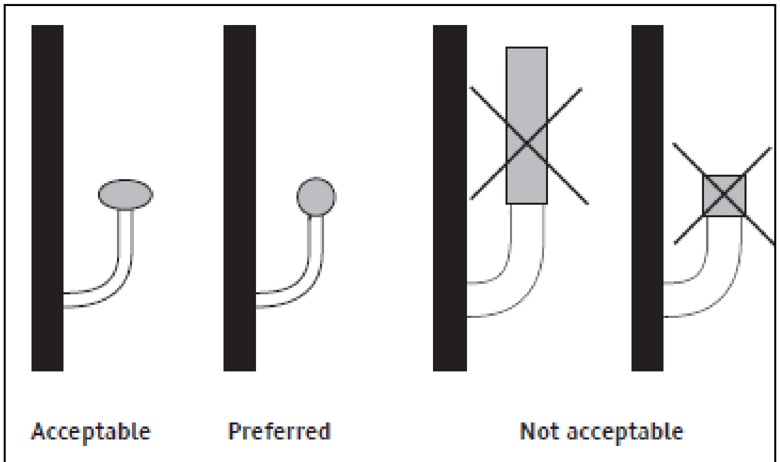


Figure 21: Handrail Shapes (CAN/CSA-B651)

A circular section is the preferred shape so that the thumb and fingers can lock around the handrail. Wide or deep handrails that allow only a pinched grip are undesirable unless a proper hand-size grasping area is provided (see Figure 21).

Where the wall has a rough surface, the clear space should be 45 to 60 mm between the handrail and the wall. The maximum clearance allowed between the rail and wall is to provide for adequate gripping room, but is also to prevent injuries to arms slipping through the opening. The depth of the handrail and clearance should not project more than 100 mm into the width of the gangway.

2.2.5.2 Toe Rails

Toe rails or toe boards, should be provided to prevent wheels or walking aids from slipping off the edge and to guide the visually impaired who rely on canes. The top of the toe rail/board should be at least 100mm above the ramp/gangway surface and the space between the bottom of the toe rail/board and the ramp/gangway surface must not exceed 13mm. The gap is provided to allow for drainage.

2.2.5.3 Guardrails

Guardrails should be provided along any open sides of an area such as landings or viewing platforms to prevent a fall to a lower level, where:

- There is a difference in elevation of more than 600mm between the walking surface and the adjacent surface; or,
- The adjacent surface within 1.2m of the walking surface has a slope of more than 1V:2H.

Guardrails should consist of the following characteristics:

- Height of the top guardrail should be not less than 1070mm high;
- Height of the mid-guardrail should be located approximately midway between the underside of the top guardrail and the top of the toe rails. Plastic or wire mesh fencing of adequate strength may be used in place of the mid-guardrail;

- Openings through any guard should be of a size that will prevent the passage of a spherical object having a diameter of 100mm unless it can be shown that the location and size of openings that exceed this limit do not represent a hazard; and,
- Designed such that no member, attachment or opening will facilitate climbing. The following criteria should be deemed to comply, where any elements protruding from the vertical and located within the area between 140mm and 900mm above the walking surface protected by the guard :
  - Are located more than 450mm horizontally and vertically from each other;
  - Provide not more than 15mm horizontal offset;
  - Do not provide a toe-space more than 45mm horizontally and 20mm vertically; or,
  - Present more than a 1-in-2 slope on the offset.
- Designed to resist the loads specified in Table 3 (the load that creates the most critical condition should apply):

Table 3: Minimum Design Loads for Guards

Minimum Design Loads for Guards (Ref: NBCC Table 9.8.8.2)		
Horizontal Load Applied Inward or Outward at any Point at the Top of the Guard	**Horizontal Load Applied Inward or Outward on Elements within the Guard, including solid panels and pickets**	**Evenly Distributed Vertical Load Applied at the Top of the Guard**
0.75kN/m OR concentrated load of 1kN applied at any point	Concentrated load of 0.5kN applied at any point on individual elements	1.5kN/m

If glass is used in guards, it should be:

- Safety glass of the laminated or tempered type conforming to CAN/CGSB-12.1-M. "Tempered or Laminated Safety Glass"; or,
- Wired glass conforming to CAN/CGSB-12.11-M, "Wired Safety Glass".

2.2.6 Edge Protection

Edge protection is desirable whenever there is a concern about falling into the water or the presence of a hazardous drop-off. A high contrast, detectable ground warning surface as opposed to a raised curb to indicate the location of the dock edge should be preferred for public docks (refer to Section 2.2.7.1). Raised curb should not be used in high traffic public dock facilities because they create a potential tripping hazard for people with disabilities, as well as the able-bodied, who prefer a clear edge to transfer themselves between the dock and the boat. That notwithstanding, all exposed edges of the dock not used for vessel (ferry and private) transfers need to have guardrail protection for dock users.

2.2.7 Walking Surface

All walking surfaces that are within a barrier-free path of travel should:

- Be stable, firm and non-slip;

- Remain non-slip and firm under wet conditions;
- Avoid too much texture for slip resistance, which could create rolling friction that interferes with wheelchair mobility;
- Have no opening that will permit the passage of a sphere more than 13mm diameter; and,
- Have no elongated openings oriented approximately perpendicular to the direction of travel.

Detectable warning surfaces provide important navigation cues for people with vision impairment and are used to inform people who are walking over them of possible hazards. Two of these, relevant to public dock facilities, include:

- A hazard indicator signals that a person should stop; and,
- A warning indicator signals that caution should be taken.

Detectable ground warning surfaces consist of standardized features that are intended to be detected either underfoot or by a long white cane.

2.2.7.1 Hazard Indicators

As discussed in Section 2.2.7, a detectable hazard indicator should be located at an unprotected drop-off edge, such as the leading edge of a floating deck (see Figure 22) to serve as a "stop" sign for the visually impaired.

These hazard indicators are typically implemented in transit platforms and curb ramps. These tactile warning surface products are available in many forms. For new construction, the cast in place detectable warning tiles are most commonly used. These products typically come in discrete tile units with integral embedment flanges (see Figure 24) and each unit is pressed into place in the freshly poured concrete. For retrofit applications, there are surface applied tiles that include the tile, adhesive, fasteners and sealant. Refer to Section 3.0 on details on the characteristics of these tactile warning surfaces.

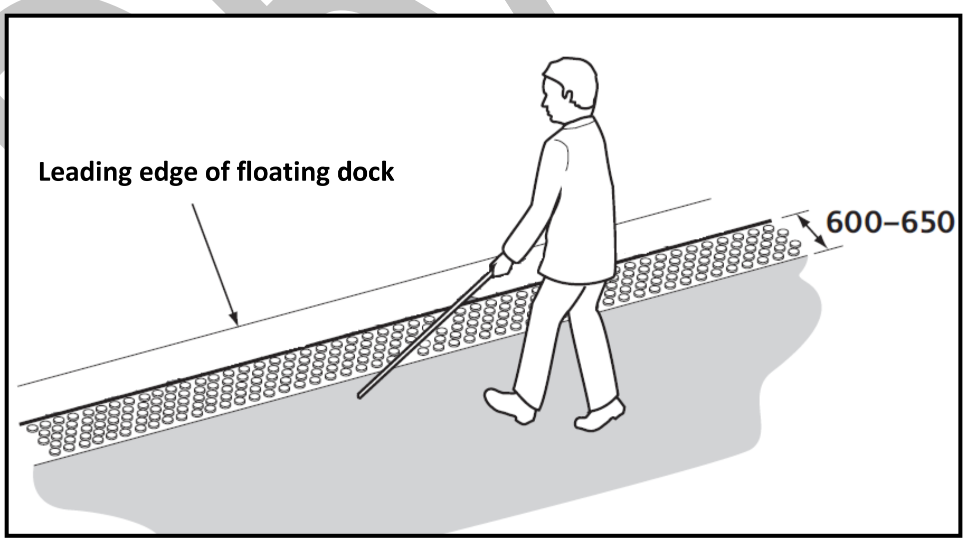


Figure 22: Detectable Hazard Indicator Surface (CAN/CSA-B651)

Configuration of Hazard Indicators

A detectable hazard indicator should:

- Be composed of truncated domes (see Figure 23);
  - (i) With a height of 5 ± 0.5 mm,
  - (ii) With a base diameter of 23 ± 2 mm,
  - (iii) Organized in a regular pattern with spacing of 60 ± 5 mm on centre,
- Be slip-resistant; and,
- Have a colour that;
  - (i) Contrasts at least 70% with the surrounding surface,
  - (ii) If yellow, contrasts at least 40% with the surrounding surface. The colour specifications for yellow should be:
    - (a) Munsell system: hue 5.0, chroma value 8.0/12,
    - (b) CIE 1931 system: 59.10% luminosity at the chroma coordinates of x = 0.4562 and y = 0.4788,
    - (c) An equivalent.

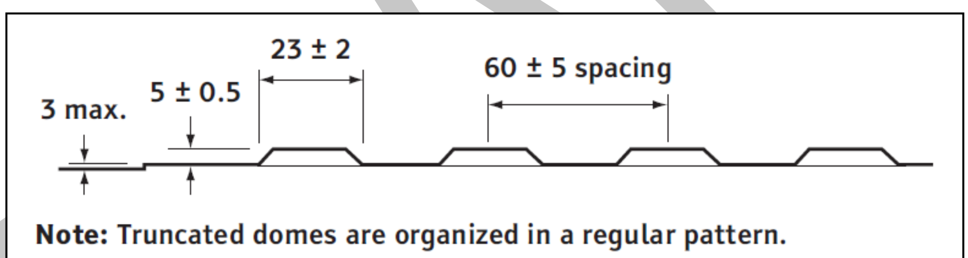


Figure 23: Detectable Hazard Indicator Surface Configuration (CAN/CSA-B651)

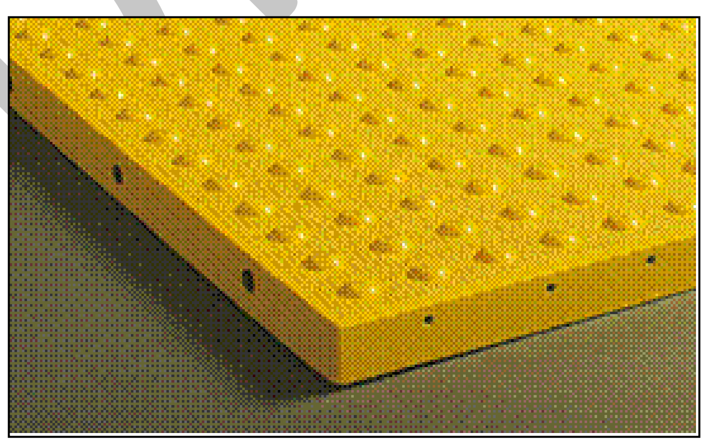


Figure 24: Example of Yellow Cast-in-Place Detectable Warning Tile (Armor-Tile Tactile Systems)

Installation of Hazard Indicators

A detectable hazard indicator should be installed:

- A distance of 600 to 650 mm from the edge of the hazard;
- Along the full width of the hazard;
- So that the base surface is level with, or not more than 3 mm above, the surrounding surface; and,
- Without creating a tripping hazard.

2.2.7.2 Warning Indicators

A detectable warning indicator should be located at transition points (such as from a fixed structure on shore to a gangway or at the top of stairs) to caution people that they are approaching the onset of change (see Figure 25).

Configuration of Warning Indicators

A detectable warning indicator should be composed of continuous ridges that have the following (see Figure 26):

- Height of 4 ± 1 mm;
- Width of 4 to 8 mm; and,
- Are spaced from 40 to 60 mm on centre.

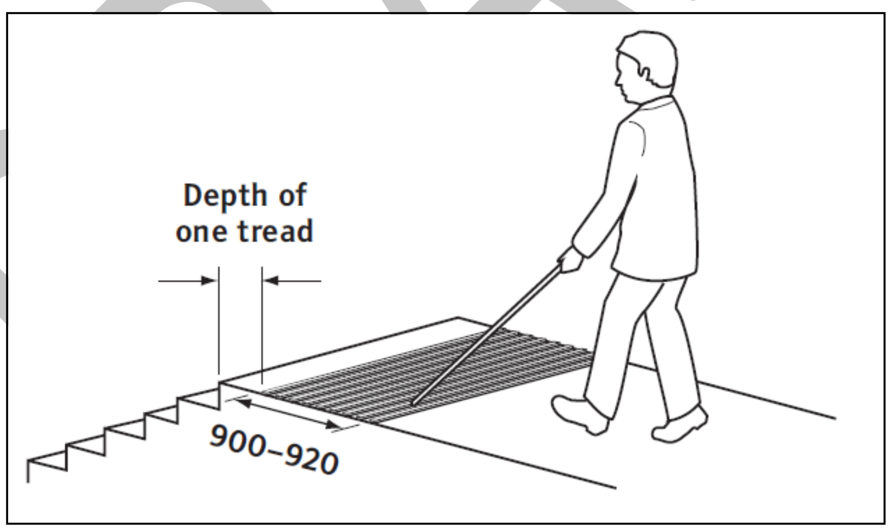


Figure 25: Detectable Warning Indicator Surface (CAN/CSA-B651)

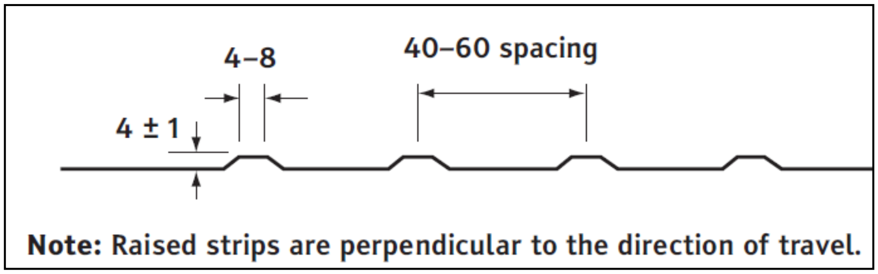


Figure 26: Detectable Warning Indicator Surface Configuration (CAN/CSA-B651)

Installation of Warning Indicators

A detectable warning indicator should be installed to:

- Have ridges that run perpendicular to the route of travel;
- Not create a tripping hazard; and,
- Have the base surface level with, or not more than 3 mm above, the surrounding surface.

2.2.8 Transferring between Dock and Boat

There are many different configurations of boats and many approaches and personal preferences for people with disabilities to transfer between the dock and the boat. As a result, it is desirable to leave the responsibility for the transfer to and from the boat to the boater (or ferry operator), as opposed to the facility. There are many devices available to facilitate the transfer of people with disabilities to and from boats, some of which can be mounted on the dock while others are carried on-board the boat. Currently, disability access to/from ferries in False Creek has relied on ramps that are carried on board. For small craft that cannot accommodate a wheelchair on board, the person can be transferred onto the boat by hoists or physical lifting. It is not recommended that people be physically carried onto any vessel unless the person assisting has received appropriate training on the handling of people with disabilities.

3.0 COMMUNICATION AND CONTROLS

The following section discusses some of the major features that are used to promote communication and safe access, relevant for public docks inclusive of people with disabilities.

3.1 SIGNAGE

Signs provide essential information to everyone. Signage, in general, should include the following characteristics:

- Simple, uncluttered and incorporate plain language;
- Use of international standard graphic symbols;
- Use of sharp contrast in color;
- Be consistently located;
- Be positioned to avoid shadow areas and glare; and,
- Be placed at decision-making points along routes of travel, such as entrances/exits.

Uniform and consistent placement of signs enhances usability for everyone. The use of graphic symbols is helpful for individuals such as children, those with a limited literary level or to overcome language barriers. Sharp contrasts in colour make signage easier for everyone to read, particularly someone with vision impairment. People may have a limitation in moving their head or a reduction in peripheral vision. Signs facing the direction of travel and both low and high mounted signage are easiest to notice and read. Vertical wording and electronic scrolling signage should be avoided. If scrolling signage has to be used, characters and symbols should move slowly across the screen and provide a minimum 70% contrast.

The intent of the symbol must be evident, culturally universal and not counterintuitive. To enhance readability, raised tactile lettering should incorporate edges that are slightly smoothed.

3.1.1 Configuration of Signs

Where signage, including electronic display monitors, is provided, it should:

- Have a glare-free surface;
- Be of uniform design;
- When used to give the same type of information within the same facility, be consistently shaped, coloured, and positioned; and,
- Be colour-contrasted with its background.

3.1.2 Characters

On signs, letters and numerals should have the following characteristics:

- Be a sans serif style font;
- Have Arabic numbers;
- Have a width-to-height ratio between 3:5 and 1:1;
- Have a stroke-width-to-height ratio between 1:5 and 1:10;

- Be colour-contrasted by at least 70% with its background (see Figure 27);
- Have the character height relative to the intended viewing distance comply with Table 4; and,
- Use an upper case “X” for character measurement.

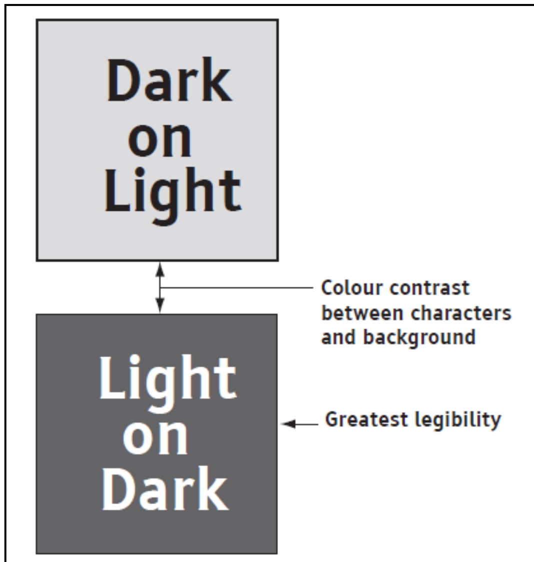


Figure 27: Legibility of Printed Characters (CAN/CSA-B651)

Table 4: Character Height Relative to Viewing Distance [Ref: Table 3, CAN/CSA-B651]

Minimum Character Height, mm	Maximum Viewing Distance, mm
25	750
50	1500
75	2250
100	3000
150	4500
200	6000
250	7500
300	9000

Nearsighted persons may have to approach much closer to read a sign than persons with average visual acuity. Signs at eye level allow persons to get closer to the sign. Lower case lettering is generally easier to read than capital letters. A mixture of upper case and lower case letters (e.g., “Canada”) can be read more easily and recognized more quickly than capitals only. Where the background colour of a sign does not contrast significantly with the surrounding surface, a contrasting border around the sign is recommended. Illuminated red letters should not be used because of their low contrast to their surroundings.

Examples of colours that contrast more than 70% are navy blue with matte white (95%), apple green with white (72%), and silver with saddle brown (70%). Colour combinations that should be avoided include yellow/grey, yellow/white, blue/green, red/green, black/violet, and red/black.

3.1.3 Pictograms and Symbols

In additional to characters, pictograms and symbols should also be colour-contrasted by at least 70% with their background.

3.1.4 Tactile Signs

Tactile markings should supplement the text of all signage (except overhead) including:

- Regulatory signs, such as prohibition and mandatory signs;
- Warning signs, such as caution and danger signs; and,
- Identification signs, such as rooms, titles, names, or numbers.

Prohibition signs denote an order forbidding an action, while mandatory signs denote an order requiring an action. Caution signs denote a potential hazard, while danger signs denote a definite hazard. Identification signs denote general orientation or specific information, such as at washrooms, routes of egress or stairwells. Overhead signs do not have to be tactile since they cannot be reached for touching.

3.1.4.1 Tactile Characters

On tactile signs, letters and numerals should be:

- Raised 0.8 to 1.5 mm above the surface (see Figure 28);
- Sans serif fonts;
- 16 to 50 mm in height;
- Accompanied by Grade 1 Braille near the bottom edge of the sign; and,
- Colour-contrasted with their background by at least 70%.

3.1.4.2 Pictograms and Symbols on Tactile Signs

On tactile signs, pictograms and symbols should be:

- Raised 0.8 to 1.5 mm above the surface;
- Placed on a sign at least 150 mm in height;
- Accompanied by the equivalent description in Grade 1 Braille placed directly below the pictograph or symbol; and,
- Colour-contrasted with their background by at least 70%.

3.1.4.3 Location of Tactile Signs

A tactile sign should:

- If used to identify a gate, be mounted on the nearest adjacent vertical surface beside the latch edge of the gate;
- Where applicable, have the leading vertical edge 150 ± 10 mm from the gate knob (see Figure 28);

- Allow a person to approach the sign to within 100 mm without encountering protruding objects or standing within a gate swing;
- Be mounted with the horizontal centreline 1500 ± 25 mm from the ground surface; and,
- Have a clear area around the sign at least 75 mm wide.

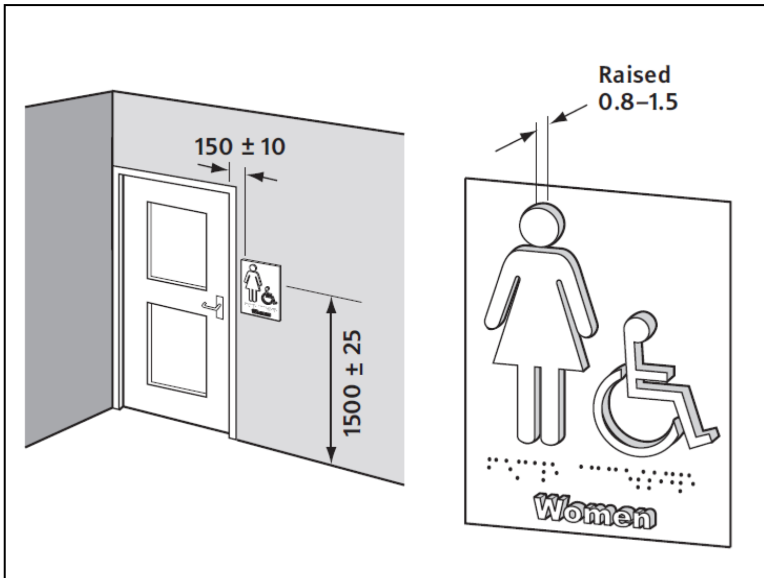


Figure 28: Location and Size of Tactile Signs (CAN/CSA-B651)

3.1.5 Symbol of Accessibility

Elements and spaces of accessible facilities should be identified by the International Symbol of Accessibility (see Figure 29).

For public dock facilities, accessible entrances should be identified only when not all are accessible (inaccessible entrances should have directional signage to indicate the route to the nearest accessible entrance).

Figure 29: Universal Symbol of Accessibility

3.2 MATERIALS AND FINISHES

The selection of suitable walking surfaces is critical to the safe and easy movement of persons using all kinds of mobility aids as well as person with vision impairment. Finishes that are slip resistant and not highly reflective is desirable. Table 5 below references the Canadian Standard CAN/CSA-B651, Table D.1 Potential for slip of floor and tread finishes, and only include materials applicable to public dock facilities.

Table 5: Potential for Slip of Floor and Tread Finishes* [Ref: CAN/CSA-B651]

Material	Dry and Unpolished	Wet	Remarks
Concrete	Low	Moderate to Low	If textured finish or a non-slip aggregate is used, potential for slip can be low
Mastic Asphalt	Low	Low	-
Resin, enhanced slip resistance	Extremely Low	Low	The anti-slip properties depend upon sufficient, uniformly distributed aggregate. Areas of reduced aggregate can present a serious slip hazard
Resin, smooth, self-levelling	Extremely low	High to Moderate	-
Rubber (sheets or tiles)	Extremely low	High	Not suitable near entrance or other foreseeably wet areas
Rubber, smooth and ribbed	Low	High	-
Stainless Steel	Low	High	Wet slip potential is highly dependent on surface finish. Quoted values for 0.5 µm Rz (din) surface roughness
Steel profiled (Diamond plate)	-	Moderate	Class determined by DIN ramp method. No dry value determined
Timber (finished)	Extremely Low	High	Applies to sealed, varnished or polished timber
Timber	Low	Moderate	-

* Depending on the precise nature of the wearing surface, seemingly similar products made from the same material can be totally different in terms of their slip-potential characteristics. It is especially important that specifiers are aware that many products will change significantly merely on installation. Wear, usage, contamination, cleaning, and maintenance regimes will all affect the performance of the product over its lifetime.

Other materials not mentioned in the reference table but are often used in public dock facilities include aluminum and asphalt with non-slip coatings. Extruded aluminum decking is frequently used for gangway decks, typically with small continuous raised ridges that provide good traction. The traction on these decking can be further enhanced by running the deck material through a knurling roller that impacts small v-grooves across the ridges at close intervals, resulting in a multiple-row tooth-like surface. Relatively "soft" aluminum alloys should not be used to manufacture these decking as it can wear smooth in high traffic areas over time. As for asphalt, there are non-slip coatings available on the market that can be applied to enhance traction.

Suitable paving surfaces for walkways include asphalt, concrete and compacted gravel screenings. Such materials used as walkways should:

- Have joints that are no greater than 6 mm (0.25 in.) wide, with variations in level of no more than 3 mm (0.125 in.);
- Be laid to drain; and,
- Be laid on a base that is stable.

3.3 TEXTURE AND COLOUR

The ability of many people – including an individual with a visual disability to navigate an environment - can be promoted through the strategic use of colour and texture. Heavy or busy patterns should be avoided as these can add visual confusion to settings for persons with low vision.

Colour schemes should incorporate a pronounced colour contrast, to differentiate boundaries of objects, distinguish objects from their background, and to generally enhance spatial orientation. Generally, for seniors and persons with vision impairment, colours in the warm end of the spectrum (yellow, orange, bright red, etc.) are easier to recognize than those at the cool end of the spectrum.

Signs should incorporate pronounced glare-free colour contrast. A minimum colour/brightness contrast of 70% light reflectance is required. For signs, the most visible colours are white or yellow on a black, charcoal or other dark background, such as brown, dark blue, dark green or purple. Black lettering on white is also acceptable, although less readable than the reverse. Unacceptable background colours are light grey and pastel colours. Red lettering on a black background is also unacceptable.

All textured surfaces used as detectable warning devices should be cane-detectable and clearly differentiated from the surrounding paving surfaces. For details, refer to Section 2.2.7 on walking surfaces. If, for any reason, the standardized detectable warning surfaces cannot be implemented, suitable surfaces that include a change in texture and/or high color contrast should at least be incorporated into the design. The same texture should be used to identify the same type of hazard consistently throughout all the public docks in False Creek.

3.4 LIGHTING

Along routes of travel and at entrances to public dock facilities, exterior illumination should provide a consistent level or pattern. Lighting should also be used to emphasize important features such as entrances, stairs, ramps or gangways.

Generally, exterior lighting should be 25% higher than the Illuminating Engineering Society of North America Standards, Recommended Illuminance Levels for Pedestrian Ways. At pedestrian entrances, lighting levels should be minimum 100 lux consistently over the entrance area, measured at the ground. Lighting should minimize glare on adjacent public and private uses, including residential and on the water for vessel operators. Consideration should be given to the use of full cut-off fixtures with colour corrected light sources.

All lighting should:

- Provide a full colour spectrum;
- Be evenly distributed to minimize cast shadows; and,
- High enough to clear normal snow accumulation.

Supplementary lighting should be provided to highlight key signage and orientation landmarks. The level of illumination on signs that depend on incident lighting should be at least 200 lux.

4.0 MAINTENANCE AND COST IMPLICATIONS

To preserve the life of any structure and associated components, regular and routine inspection and maintenance is highly recommended. For universal accessible docks, routine inspection and maintenance is especially vital to ensure a safe and accessible facility is always available or available when needed. The following section discusses some of the operational/maintenance implications for universal accessible public docks and their associated costs.

4.1 GANGWAYS

One of the key criteria in maintaining accessible gangways is to ensure that the walkway is clear of any obstructions and tripping hazards. The 13mm gap provided between the deck surface and underside of the toe rail will provide adequate drainage. Periodic pressure washing should be conducted to keep the surfaces clean from bird droppings or miscellaneous debris. Any non-slip surfaces applied on the deck surface should also be checked regularly and replaced if damaged. An example of a black non-skid rubber surface installed on top of the aluminum gangway grating deck is shown in Figure 30.

Figure 30: Non-skid Black Rubber Gangway Surface at David Lam Dock, Vancouver

Mechanical components such as rollers, pins and bushings should be checked for signs of wear such as flat spots, missing fasteners or dislodged bearing material.

4.2 RAILING

Handrails, toe rails and/or guardrails on gangways, ramps, stairs and intermediate landings (fixed or floating) should also be regularly checked to ensure they are continuous, smooth and free from any damage and/or obstructions. Periodic paint touch-up may be required to ensure a sharp colour contrast is maintained since the visually impaired rely on for their safety.

4.3 FLOATING DOCKS

Accessible design docks typically require a greater surface area to allow people with mobility devices to manoeuvre. The associated increase in cost will depend on how much additional space is provided. That being said, too small a space will create a series of difficulties from a user perspective. Therefore, an analysis of the typical user demographics projected over the expected lifespan of the dock is beneficial in anticipating the needs of its users over the long term.

Reinforced concrete docks are generally more expensive than pressure-treated timber docks but they are typically more durable, sturdier, require less maintenance and are more environmentally friendly. Concrete also provide better traction when wet compared to timber.

In terms of maintenance, floating docks should also be checked regularly for damage and/or obstructions. Renewal of UHMW pads at guide pile support locations and fender rub strips may be required. Periodic pressure washing, inspection of paint coatings and/or cathodic protection (if installed) for the guide piles should also be conducted.

4.4 DETECTABLE WARNING SURFACES

Detectable warning surfaces such as the truncated domes that serve as hazard indicators as described in Section 2.2.7.1 are typically composed of glass, carbon or fibreglass reinforced composite. Depending on each specific product, they typically have the following characteristics:

- Slip-resistant;
- High abrasion and wear resistance;
- Salt spray resistance (no change when tested according to ASTM B117, Salt Spray Test);
- Colorfast and non-staining;
- UV stable to resist fading and material breakdown when exposed to sunlight/UV rays;
- Non-porous so water is not absorbed through freeze and thaw cycles;
- Certified to meet ADA requirements; and,
- 5-year manufacturer warranty.

To simplify maintenance, a replaceable cast in place system is also available that features the ability to replace individual tiles without the need to remove or replace the concrete through the use of embedded anchors (see Figure 31).

Figure 31: Replaceable Cast In Place Tactile Surface System (ADA Solutions Inc.)

Although the tiles are non-porous and wear resistant, regular cleaning is still required to ensure a sharp colour contrast is maintained since the visually impaired often rely on contrast for their safety. The appropriate cleaning solution to be applied should be verified with the manufacturer. Surface coatings such as sealants and waxes are to be avoided as they could create a thin barrier that may modify the non-slip resistance and visibility properties. These tiles are also prone to snow removal damage.

Based on discussions with a local supplier, the cost of the non-replaceable cast in place versus the replaceable cast in place tactile warning surface systems are very similar. In general, the price will be dependent on the quantity supplied but on average, a 2 ft by 4ft tile is approximately $200 CDN, equating roughly $269/sq.m (based on 2011 cost level and excludes installation cost).

Detectable warning surfaces that serve as warning indicators as described in Section 2.2.7.2 are composed of continuous ridges that can be cast into the concrete with minimal additional cost. For surfaces other than concrete, raised strips may be installed.

5.0 REFERENCES

The following list of reference codes, standards and guidelines are used for the research and basis of this document:

- CAN/CSA-B651, Accessible Design for the Built Environment, 2010
- PIANC Disability Access Guidelines for Recreational Boating Facilities, 2004
- ADA Standards for Accessible Design, 2010
- National Building Code of Canada, 2010
- BC Building Code, 2006
- WorkSafeBC, OHS Regulations
- VPA Building Guidelines for Residential Waterfront Facilities, 2007
- Barrier-free Design Guide from Alberta Safety Codes Council, 2008
- Standards for Barrier-Free Design of Ontario Government Facilities, 2004
- City of Winnipeg Accessibility Design Standards, 2006
- City of Toronto Accessibility Design Standards, 2004
- City of London Accessibility Design Standards, 2007
- Accessible Boating Facilities, United States Access Board, 2003
- Guidelines for Marina Berthing Facilities, California Department of Boating and Waterways, 2005
- Illuminating Engineering Society of North America, Recommended Illuminance Levels for Pedestrian Ways
- Armor-Tile Tactile Systems, http://www.armor-tile.com
- ADA Solutions Inc., http://www.adatile.com
  - Urban Access Solutions (Local distributor in the Lower Mainland), 604-834-7234

    http://www.urbanaccesssolutions.ca/
- International Best Practices in Universal Design – A Global Review, Canadian Human Rights Commission
- Canadian Hydrographic Services, Tide and Current Tables, Volume 5

6.0 CONCLUSIONS AND CLOSURE

The importance of making public dock facilities accessible for everyone is becoming increasingly recognized in many countries. Our communities have also begun a dramatic shift commonly known as the 'Silver Tsunami'. Simply put, the baby boom is aging and that compounds access issues in an already challenging environment for marine facilities.

The design of public dock facilities in False Creek must consider the needs of a steadily aging population as the newest and growing majority of the community of people with disabilities. "Access" may no longer refer to a narrow list of accommodations for wheelchair users. Ultimately, the goal to make public dock facilities more accessible for all will also require properly outfitted vessels and support programs.

In a growing population of significantly reduced agility and mobility, visual acuity and hearing – often all combined in a single individual - planners, designers and management need to understand that in the new millennium, it is the norm to have a disability.

By applying the guidelines in this document new public dock facilities in False Creek will greatly enhance accessibility for people with disabilities.

6.1 CONCLUSIONS

To provide universal access for public docks in False Creek, these guidelines recommend a two-tiered criteria for the design of ramp and gangway gradients for all new docks in False Creek as follows:

1. Begin with the goal of providing a maximum gradient of 1:20 (5%) on all ramps and gangways within the tidal range from LLWLT (El. -0.1m CD) to HHWLT (El. 5.0m CD).
2. If, due to space constraints this cannot be achieved, then the design criteria should be a maximum gradient of 1:20 (5%) during the tide range El. 2.0m CD to HHWLT, and a maximum gradient of 1:12 (8%) during the tide range LLWLT (El. -0.1m CD) to El. 2.0 CD.

This criteria takes into consideration the fact that limiting the ramps and gradients to a maximum of 1:20 (5%) is not always feasible given the relatively large tidal range and space considerations in False Creek. In essence, the typical (and slightly steeper) gangway gradient of 1:12 (8%) is limited to the lower water levels only (below El.2.0m), while the preferred gradient of 1:20 (5%) is maintained throughout the remainder of the water levels (El.2.0m to HHWLT).

The elevation 2.0m CD was determined to be a reasonable design operation level to provide the desired gangway gradient slope of 1:20 (5%) for the majority of the operating time. For reference, elevation 2.0m CD will provide a gangway slope of 1:20 (5%) for over 80% of the total operating time on average per year and approximately 70% of the total operating time in the summer. Furthermore, it was determined that approximately 60% of the operating time in summer there is at least a four hour window during which the facility would be fully accessible (1:20 or 5% gangway gradient).

By applying the guidelines recommended in this document new public dock facilities in False Creek will greatly enhance accessibility for people with disabilities.

6.2 CLOSURE

This report has been prepared by Moffatt & Nichol for the sole benefit of City of Vancouver. It may not be used by any third party without the expressed written consent of Moffatt and Nichol and City of Vancouver. Any use of this document by a third party is at its sole risk. The statements and conclusions presented herein are valid as of the date of publication.

Future changes in the conditions affecting the underlying assumptions of this report may alter its findings and the conclusions. Moffatt and Nichol does not undertake to revise and update this report should future events reflect changed conditions.

Note for electronic editions:

Electronic versions (including Microsoft Word formats or Adobe Acrobat PDFs) are provided for reference only, and should not be relied upon as a final work product. Electronic copies are potentially subject to alteration by others beyond Moffatt and Nichol's control, and Moffatt and Nichol assumes no responsibility for damages suffered by any party as a result of decisions made or actions based on any electronic report. Refer to the original, printed and signed version of this document for the official and final Moffatt and Nichol work product.

APPENDIX A

ANALYSIS OF TIDE LEVELS DURING OPERATING HOURS

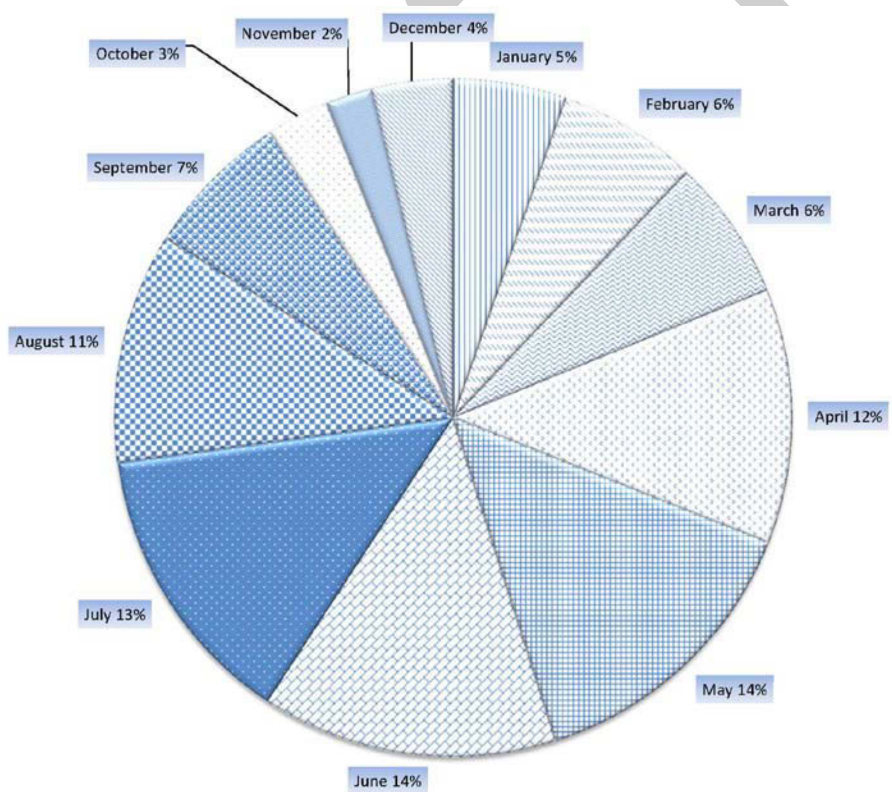
ANALYSIS OF TIDE LEVELS DURING OPERATING HOURS

The following analysis was done to understand frequency of occurrence and distribution of time during ferry operating hours when water levels fall below the recommended design operational water level.

It was discussed in Section 2.2.1 that due to physical space constraints, the desired 1:20 (5%) slope is not achievable within all tidal ranges from LLWLT to HHWLT. If the 1:20 (5%) slope cannot be achieved, then it is recommended that the design criteria should be a maximum gradient of 1:20 (5%) slope during the tide range 2.0m CD to HHWLT and 1:12 (8%) slope during the tide range LLWLT to 2.0m CD.

It was earlier noted that the water level rarely, if ever, falls below the LLWLT, and that the percentage of the total operating time per year the water level falls below Elevation 2.0m CD is 19%; Figure 32 shows how the 19% per year is distributed monthly.

Figure 32: Monthly Distribution of Water Levels Falling Below El. 2.0m (CD)



As shown in the pie chart, these occurrences happen most frequently during the spring and summer months (May, June and July).

Table 6 shows the percentage of monthly operating hours that the water levels fall below El.2.0m CD.

Table 6: Percentage of Monthly Operating Hours Water Levels Fall Below El. 2.0m (CD)

Month	% of Operating Hours Water Levels Fall Below 2.0m CD
January	12%
February	16%
March	23%
April	27%
May	30%
June	32%
July	29%
August	24%
September	16%
October	6%
November	5%
December	8%

As shown in Table 6 the water level falls below El.2.0m approximately 30% of the operating hours during the summer months of May, June and July. This drops to less than 10% of the operating hours during October, November, and December.

For comparison purposes the same analysis was done for the LLWMT (El. 1.0m CD). The percentage of the total operating time per year the water level falls below Elevation 1.0m CD is 4%. Figure 33 shows how the 4% per year is distributed monthly, and Table 7 shows the percentage of monthly operating hours that the water levels fall below El.1.0m CD.

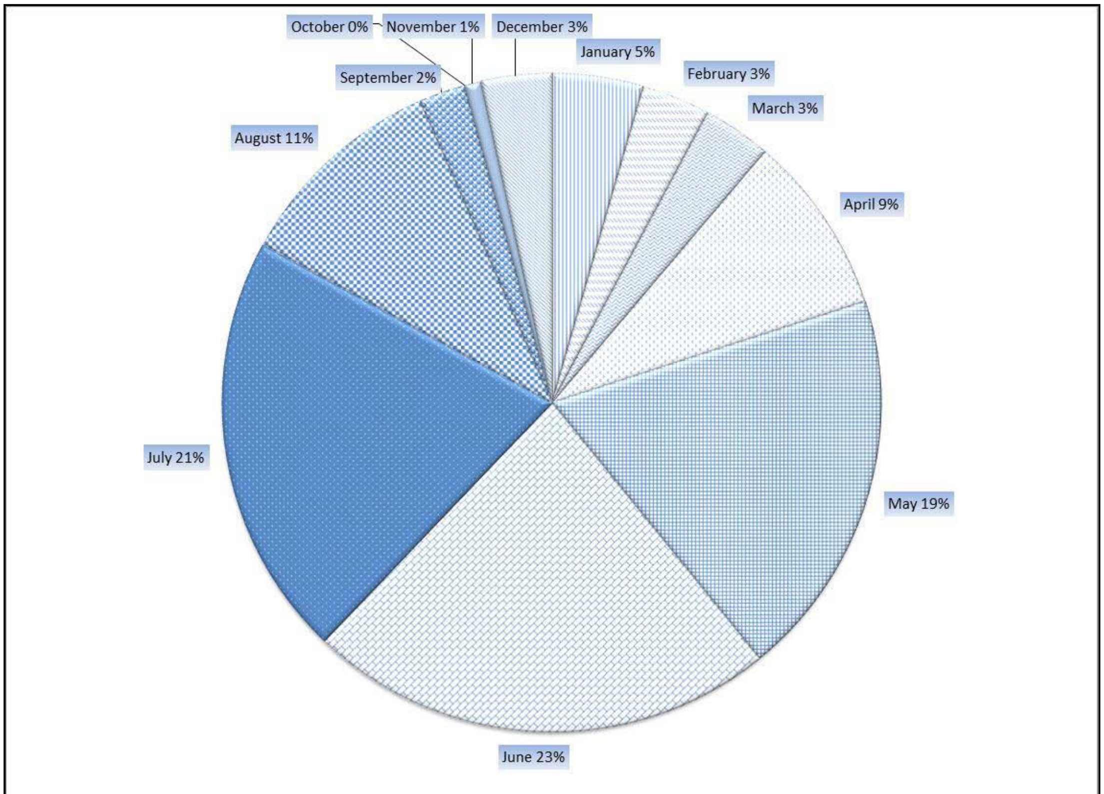


Figure 33: Monthly Distribution of Water Levels Falling Below El. 1.0m (CD)

Table 7: Percentage of Monthly Operating Hours Water Levels Fall Below El. 1.0m (CD)

Month	% of Operating Hours Water Levels Fall Below 1.0m CD
January	2%
February	2%
March	1%
April	4%
May	8%
June	10%
July	9%
August	5%
September	1%
October	0%
November	0%
December	2%

As shown in Figure 33, the monthly distribution for Elevation 1.0m CD is similar to Elevation 2.0m CD, although the percentages are more in the summer and less in the winter for the lower elevation. Also, Table 7 shows that water level falls below El.1.0m approximately 10% of the operating hours during the summer months of May, June and July, which is less than compared to Elevation 2.0m. This drops to 2% or less of the operating hours from September to March.

The previous analysis showed the percentage of operating time the water level falls below a certain design level (El.2m CD or El.1m CD) averaged per year and per month. In practice, it would be useful to understand the percentage of time the water level would be above a certain design elevation for at least, say, 4 hours. In other words, this would provide an indication of the percentage of time there is at least a four hour window during which the facility would be fully accessible. Table 8 shows the percentage of operating hours the water levels rise above 1.0m CD and 2.0m CD for > 4 hour duration.

Table 8: Percentage of Operating Hours Water Levls Rise Above (for > 4 hour Duration)

Month	% of Operating Hours Water Levels Rise Above (for > 4 hr Duration)	
	El.1.0m (CD)	El. 2.0m (CD)
January	98%	87%
February	99%	83%
March	98%	74%
April	96%	66%
May	90%	59%
June	86%	60%
July	87%	66%
August	93%	73%
September	98%	81%
October	100%	92%
November	100%	95%
December	99%	91%

APPENDIX B

GANGWAY LENGTH OF SIMILAR WIDTH VS. COST

GANGWAY LENGTH OF SIMILAR WIDTH VS. COST

As discussed in Section 2.2.1, for public docks in False Creek that experience a significant tidal range, the desire to provide a 1:20 slope or less will require either the use of greater gangway lengths or a series of gangways with intermediate level landings. Gangways are typically constructed of aluminum due to their light-weight advantage. In general, the longer the span length the greater the cost of the gangway. Figure 34 shows the general relationship between the relative gangway unit cost ($ per meter) versus gangway length based on the same gangway width. As shown, there is a general exponential relationship between cost and length. For example, a relative unit cost of $820 per meter for a 12m long gangway can be compared to $3500 per meter for a 30m long gangway, based on the same gangway width.

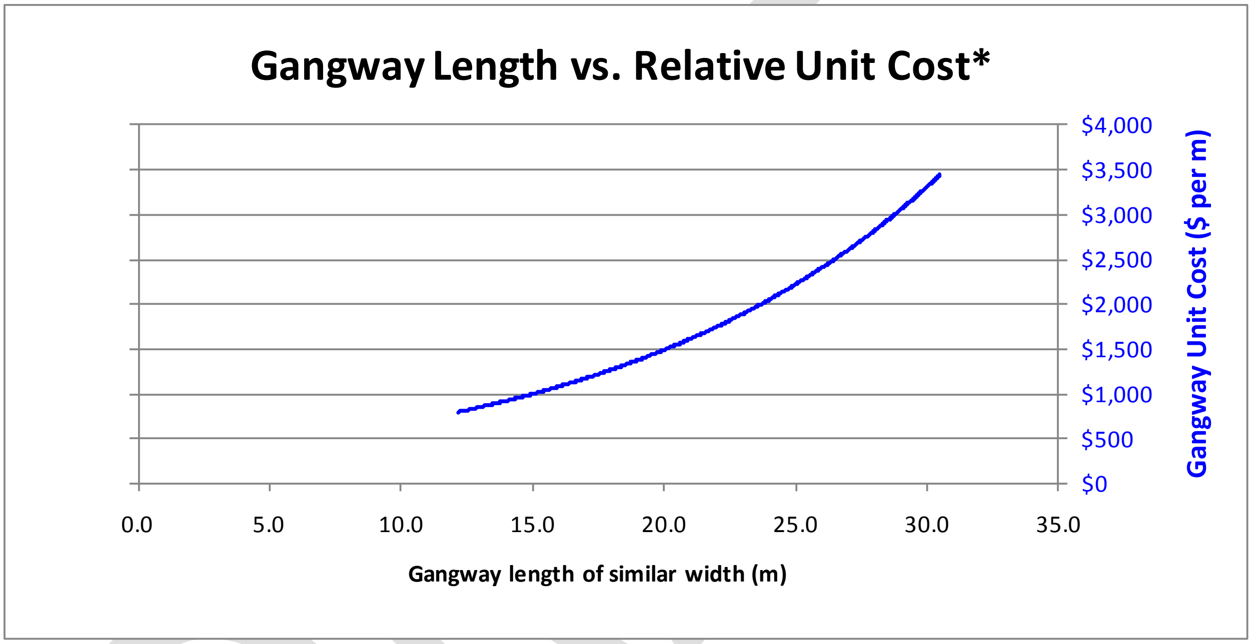


Figure 34: Gangway Length of Similar vs. Cost

***Intended for general comparison only**