

ACCESSIBILITY FOR TRAIN INFRASTRUCTURE

Accessibility for Train Infrastructure

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ABOUT THE AUTHOR



Cassandra Lee Taha is a Licensed Professional Engineer with Bachelor's Degree in Civil Engineering, an advanced diploma in Civil Engineering Technology, and holds both PMI-RMP® and PMP® certifications. Cassandra has experience in various fields including infrastructure, buildings, water/wastewater, transportation, bridges, rail infrastructure and project management. Throughout her career, Cassandra has led and worked with multidisciplinary teams including mechanical, electrical, civil, process, traffic, operations, track, utilities and commercial teams. Currently, Cassandra is supporting initiatives as a Culture Champion and a LEAN Champion with Metrolinx in addition to her duties as a Manager. In her free time, Cassandra works with Ontario Society of Professional Engineer's Research and Innovation Committee and is an advocate for accessibility in rail infrastructure to ensure inclusivity in Canada's rail infrastructure.

INTRODUCTION

Throughout Canada, rail infrastructure is expanding providing more transportation options to citizens. With this increase in rail transportation development and use, we will likely see less vehicles on the roads and more people making public transportation their first choice. However, accessibility at the train-platform interface is an issue for many mobility people, including device users.

Rail infrastructure throughout Canada is not always accessible for all people. Even when the public can access the platform to board the train, they face another obstacle: a gap between the train platform and the train floor. Trying to board the train from the platform can be a daunting experience as there is a horizontal and vertical gap that needs to be bridged or jumped. This gap can be so large that small children's legs can get caught, cane users' canes fall through the gap, wheelchair users' wheels get stuck in the gap or they are unable to get their wheelchair over the gap, the gap becomes a tripping hazard for the visually impaired, and more.

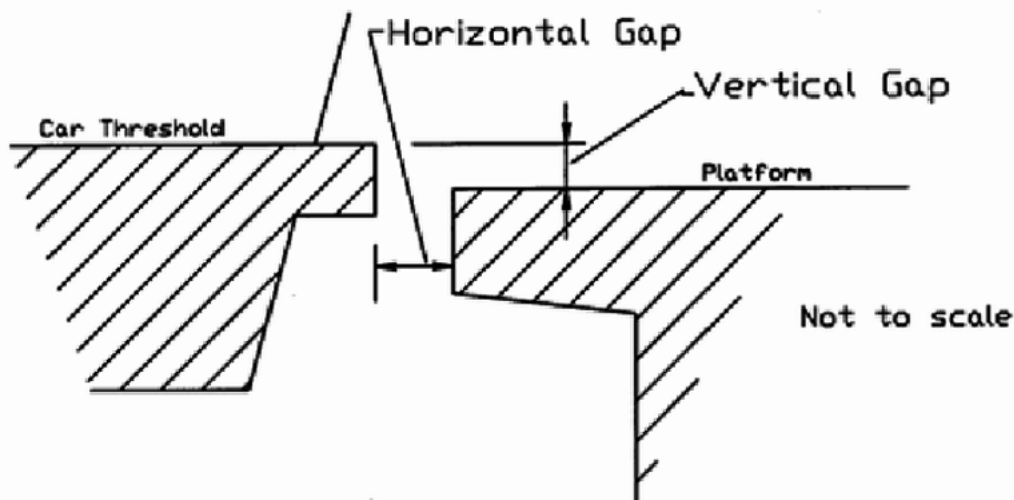


Figure A: Horizontal and Vertical Gap

The interface where the public board the train from the platform is called the train-platform interface and there are various reasons that cause this gap to be larger or smaller. This includes but is not limited to, maintenance on the rail, degree of wear on the train's wheels, loading of the train, dynamic vs static envelope of the train car, design, construction tolerances, new or old station, and more.

As Canada does not currently have an accessibility standard or regulation for rail infrastructure, this document will include a comparative analysis of relevant existing codes, standards, guidelines, studies and wide-reaching peer reviewed publications. This document will also provide a recommendation on an allowable horizontal and vertical gap at the train-platform interface to ensure accessibility.

DIVERSITY AND INCLUSION

Canada is working towards ensuring diversity and inclusion throughout the country. An important aspect to diversity and inclusion is ensuring that existing and new infrastructure is accessible to all people. Designing for accessibility improves equality, inclusivity and can also have significant economic benefits.

Throughout the majority of Canadian public rail infrastructure, accessing the train from the platform can be a devious, difficult, and sometimes an unrealistic task for individuals who may require mobility aids or assistance. The interface between the platform and the train can be a difficult task for individuals of all ages and mobility. This gap at the train-platform interface can also become a tripping hazard or be large enough for young children's feet to slip within this gap.

Currently throughout Ontario, the majority of the existing rail infrastructure is not fully accessible or barrier-free. Instead, there are small sections of the platforms that may be accessible. However, these accessible platform sections are often an unreasonable distance from the platform's elevators, which are the way many mobility aid users' must access the platform.

Reducing the gap size at the train-platform interface will establish a more inclusive, reliable, safe and accessible transit system. In addition, reducing this gap can result in the reduction of potential tripping hazards, unforeseen accessibility obstacles and a reduction to system and operational delays.

Large investments have been placed into upgrading accessibility in transportation services throughout Canada. Many locations have implemented ramped access, accessible seating, clearer signage and on-platform help points. The amount of people with restricted mobility, visual impairment or other disabilities is increasing as the population ages. Types of Disabilities, as defined by the Canadian Government, are any severe and prolonged condition that inhibits a person.

According to the 2017 Canadian Survey on Disability by Statistics Canada, about one in five Canadians (or 6.2 million) aged 15 years and over had one or more disabilities that limited them in their daily activities. In addition, the prevalence of disabilities among Canadians tends to increase with age. However, more than 540,000 youths aged 15 to 24 years (13%) had one or more disabilities. This compared with 20% or 3.7 million of working age adults (25 to 64 years), and 38% or 2 million of seniors aged 65 and over. Women (24%) were more likely to have a disability than men (20%) and this was the case across all age groups.

For many of these Canadians, challenges and obstacles in their day-to-day lives may limit their full participation in society. In order to meet the requirements of people with disabilities, The Accessibility for Ontarians with Disabilities Act, AODA, became law on June 13, 2005. Ontario is the first province in Canada to pass legislation to develop mandatory accessibility standards. This act aims to identify, remove, and prevent barriers for people with disabilities in crucial areas of daily living.

CODES AND RECENT STUDIES

The station as public architecture is fundamental to the commuter experience and individual response to the built environment (Burnsⁱ). It provides shelter, amenities, provides directional cues and is perceived as a local identity or reference point. It is integral to facilitating the movement of passengers between trains and alternate destinations (Mougⁱⁱ). The interface between the platform and rail vehicle itself is one of the largest railway challenges in terms of accessibility, particularly for wheelchair users (WCRRⁱⁱⁱ).

Currently Canada does not have any laws specifying the accessibility requirements in regard to the horizontal and vertical gap between the platform and the train floor. The closest standard geographically that can be compared is the Americans with Disabilities Act (ADA). The ADA's horizontal and vertical gap tolerance for accessibility as well as other international standards is outlined below in Table A.

Table A: Gap Standards, Codes and Studies

Location and Code	Horizontal Gap	Vertical Gap
USA: Americans with Disabilities Act (ADA) - Existing Stations with New Trains	• 76.2 mm	• 38.1 mm
USA: Americans with Disabilities Act (ADA) - New Stations with New Trains	• 76.2 mm	• 15.9 mm
Australia: Disability Standards for Accessible Public Transport (DSAPT)	• 45 mm	• 15 mm
Europe: Rail Vehicle Accessibility Regulations (RVAR)	• 75 mm	• 50 mm
Northern Ireland: Rail Vehicle Accessibility Regulations (RVAR)	• 75 mm	• 50 mm
South Yorkshire: Supertram for Wheelchair Accessibility	• 45 mm	• 20 mm
Canada: Region of Waterloo	• 50 mm	• Not Available
Canada: Canadian Transportation Agency (CTA)	• Not Available	• Not Available
Canada: Accessibility for Ontarians with Disabilities Act (AODA)	• Not Available	• Not Available
Canada: Integrated Accessibility Standards Regulation (IASR)	• Not Available	• Not Available
Canada: Ontario Human Rights Commission (OHRC)	• Not Available	• Not Available
Canada: Advisory Committee on Accessible Transit (ACAT)*	• Not Available	• Not Available
Notes: * ACAT endorsed an allowable horizontal gap of 89 mm and a vertical gap of 38 mm between the platform edge and the train floor to be refined in a formal standard at a later date.		

The United States' Americans with Disabilities Act (ADA) is a civil rights law that prohibits discrimination against individuals with disabilities in all areas of public life, including jobs, schools, transportation, and all public and private places that are open to the general public. The ADA has developed standards for people with disabilities in regard to the platform and train floor gap. This was established due to the public frustration for individuals that have mobility issues that were unable to ride public transit. In addition, people without mobility issues were falling in between the gap between the train floor and platform. The ADA has developed two allowable gap standards at the train-platform interface. This includes a horizontal gap of 76.2 mm and vertical gap of 15.9 mm if there are new vehicles operating in existing stations. With new trains running in existing subway stations, the ADA provided a larger horizontal and vertical gap of 76.2 mm and 38.1 mm respectively.

Australia's Disability Standards for Accessible Public Transport (DSAPT) was passed into law in 2002. The creation of DSAPT recognised that access to public transport is vital for people with disabilities, their families and their carers in order to fully participate in community and social life. This standard became the regulatory means by which the government seeks to remove discrimination against people with disabilities. According to the DSAPT, a boarding device must be provided when a vertical gap exceeds 12 mm or a horizontal gap exceeds 40 mm at the train platform interface.

Europe's Rail Vehicle Accessibility (Non-Interoperable Rail System) Regulations 2010 (RVAR 2010) set standards designed to improve accessibility for disabled people on light rail passenger vehicles. The RVAR states that a boarding device is not required for accessibility needs if the horizontal gap is less than 75 mm and the vertical gap is less than 50 mm.

The Canadian Transportation Agency (CTA) is an independent, quasi-judicial tribunal and economic regulator. The CTA makes decisions and determinations on a wide range of matters involving air, rail and marine modes of transportation as set out in the Canada Transportation Act and other legislation. At this time, the CTA does not have gap allowances for accessibility in regards to the train-platform interface.

The Accessibility for Ontarians with Disabilities Act, 2005 (AODA) is a statute enacted in 2005 by the government of Ontario, Canada for the purpose of improving accessibility standards for Ontarians with physical and mental disabilities to all public establishments by 2025. Currently, the AODA does not have a gap standard for accessibility at the train-platform interface.

The purpose of the Integrated Accessibility Standards Regulation (IASR) under the Accessibility for Ontarians with Disabilities Act, 2005 (AODA) is to remove these barriers (physical, attitudinal, or otherwise) in acting on the long-term objective to "make passenger transportation services under provincial and municipal jurisdiction accessible for persons with disabilities". The IASR does not have a gap standard for accessibility at the train-platform interface.

ACAT has endorsed an allowable horizontal gap of 89 mm and a vertical gap of 38 mm at the train-platform interface. However, this endorsement has not become a standard.

In the absence of an Ontario or Canadian standard, this report will take into consideration international standards and peer reviewed papers to recommend an accessible gap standard at the train-platform interface that improves accessibility while making allowances for the existing infrastructure and vehicle design and operational tolerances.

ACCESSIBILITY REPORTS AND DEVICES

In addition to accessibility standards for gaps between train platforms and train floors, several studies and reports were reviewed. Reports included insight into wheelchair users' abilities to maneuver over gaps at various horizontal and vertical distances, analysis of station infrastructure design to improve accessibility between the platform and suburban train carriages, wheelchair shimmy and turning resistance and more.

People with mobility restrictions may not always use a mobility device with wheels. Any accessibility barrier, gaps at the platform-train interface included, is also likely to impact people with other physical or sensory limitations. In addition, able-bodied children and adults have been known to be tripped by or have their foot stuck or injured because of the gap at the platform-train interface. Nevertheless,

it is expected that wheeled mobility devices more readily encounter the challenge in negotiating vertical and horizontal gaps, and a study of the issues affecting wheelchair use at the interface could give insight into what kind of gap is generally more manageable for persons using wheeled mobility devices.

A rigorous study completed in July of 2009, titled Accessibilities of Wheelchair Users to Cross the Gaps and Steps between Platforms and Trains (Hashzume et al.^{vi}), investigates the impact of platform-train interface gap on wheelchair use. This study involved manual wheelchairs, electric wheelchairs and scooters to evaluate the user's ability to get on or off the train with varying gap sizes. This study determined that "no wheelchair participant can go over gaps when the horizontal difference is more than 75 mm or the vertical difference is more than 50 mm". The study concluded by recommending the horizontal and vertical gaps be less than 50 mm and 20 mm respectively.

Standard dimensions of wheelchair casters and mobility equipment user's ability to maneuver gaps of varying sizes will be reviewed when deciding the allowable gap at the train-platform interface. An oversized gap could lead to the mobility device user getting their front wheels trapped between the platform and train floor, posing a safety hazard.

The absolute maximum allowable horizontal gap should be set smaller than the diameter of the smallest caster. This will help prevent the wheel from falling entirely into the gap between the two floors as long as the caster is perpendicular to the platform edge when entering into the train.

Front castor wheel dimensions of several types of mobility devices are listed in Table B.

Table B: Available Accessibility and Mobility Devices

Accessibility and Mobility Device	Front Caster Wheel Diameter	Front Caster Wheel Width
Manual Wheelchair	• 76.2 mm	• 19 mm
Electric Wheelchair (Light Weight)	• 88.9 mm	• 25.4 mm
Electric Wheelchair (Standard)	• 203.2 mm	• 50.8 mm
Scooter	• 177.8 mm	• 31.8 mm
Roller Walker	• 101.6 mm	• 25.4 mm
Notes: The caster's diameter can be as small as 76.2 mm with a width of 19 mm.		

TRANSIT AGENCIES

Every day, millions of people ride rail infrastructure including subways, light rail trains (LRTs) and passenger trains to get to their destinations. Every day people are required to manage their travel based on the infrastructure that is readily available to them. Ensuring all people are able to access rail infrastructure with as little difficulty as possible will ensure more wide use of rail infrastructure and less hazards to people with vision impairment or people using mobility devices.

Transportation is an integral part of independent daily activity and involvement in the broader community and work life.

It is suggested that achieving positive customer experiences involves affirmative interactions. One key aspect of an individual's positive travel experience should be the enabling of unassisted access (Moug). Having personal choice of when and where to participate throughout the intended trip is also integral to customer satisfaction (Weinstein^{iv}).

Accessibility barriers are also a potential cause for increased stop times at stations (dwell time). Dwell time usually includes an anticipated period of time to allow the exchange of passengers but is susceptible to elongated periods when involving persons with reduced mobility and accounting for unpredictable passenger behaviour (Coxon 2010^v). Improvements to station accessibility will help reduce the cumulative impact of these effects on timely delivery of service.

CONCLUSION

Presently, Canada does not have any standards for the allowable horizontal and vertical gap at the platform-train interface. In addition, no published Canadian Standards for the gaps regarding accessibility needs exist.

Although there are no available Canadian Standards, Canadian rail infrastructure organizations should implement the smallest feasible gap between at the train platform interface to make platforms and trains more accessible and ensure equity, diversity and inclusion within rail infrastructure.

Canada prides itself in being an inclusive, equitable and diverse country. However, we must ensure all people have access to infrastructure like transportation so we can certify that all Canadians can participate in the community with ease. Part of this process includes making sure transportation barriers are removed.

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