Making Montreal's Indoor City Accessible for People with Disabilities

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ABSTRACT

Indoor pedestrian networks are a facet of the built environment in many cities around the world. They are built for many reasons, including separating pedestrians from motor vehicle traffic, providing a refuge from seasonal inclement weather, or to bring pedestrian traffic and retail businesses to otherwise unused floors of office buildings. In Montreal, an Indoor City (RÉSO) has been in existence since 1962 and has grown to a length of 32 km within the downtown area. While previous studies have examined the network growth and its effects on the levels of accessibility to retail space within the indoor city, the results of these studies do not hold true for people with disabilities. This research examines the ability of a person with physical disabilities and/or mobility impairments to function within Montreal's Indoor City. This is done through an examination of the existing indoor network and measuring the existing barriers that a person with disabilities faces when moving inside Montreal's Indoor City using a simple accessibility measure. Also in this research several scenarios were developed to determine the most important links that could substantially increase the accessibility levels for people with physical disabilities. Results suggest that while certain segments are more accessible than others, the majority of the Indoor City is currently inaccessible to people with physical disabilities. The paper concludes with a series of recommendations for upgrading key connection points in order to increase the level of accessibility inside the Indoor City by implementing universal design measures; legislative improvements aimed at ensuring accessibility in future extensions and as part of any major renovations; organizational improvements, such as a municipal department dedicated to running the Indoor City; and the launch of a RÉSO website.

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INTRODUCTION

"The moral test of government is how it treats those who are in the dawn of life, the children; those who are in the twilight of life, the aged; and those in the shadows of life, the sick, the needy and the handicapped." Hubert H. Humphrey, former U.S. Senator

Montreal's Indoor City – often called the Underground City and officially known as RÉSO (réseau de ville souterrain) – is one of the largest networks of interconnected complexes in the world. This network links shopping malls, office towers, metro and train stations, hotels, apartments, and convention centres in the downtown area. It provides Montrealers with the ability to travel between any of these destinations without stepping outdoors. The Indoor City is well used by pedestrians looking to escape from Montreal's harsh climate, especially during the cold winter and hot summer days. As Montreal's downtown is located on a hillside, buildings that comprise the Indoor City tend to have a variety of levels, often with a tunnel entering the building on one level, but leaving towards the next building on a higher or lower level. Consequently, stairs are a common feature of the Indoor City; however, because the majority of the system was constructed before the advent of the concept of universal access, there are few elevators or ramps to be found in the tunnels and walkways connecting buildings.

The Indoor City network poses complications for people with physical disabilities. In addition, many of its components are especially inaccessible for people with mobility impairments. Having full access to all services within the Indoor City is currently a big challenge, if not an impossible one, for people with mobility impairments. Therefore, this study will examine the current level of accessibility of Montreal's Indoor City for people with mobility impairments and suggest modifications to the existing network that could improve the level of accessibility for people with mobility impairments. Figure 1 is a map of Montreal's Indoor City.

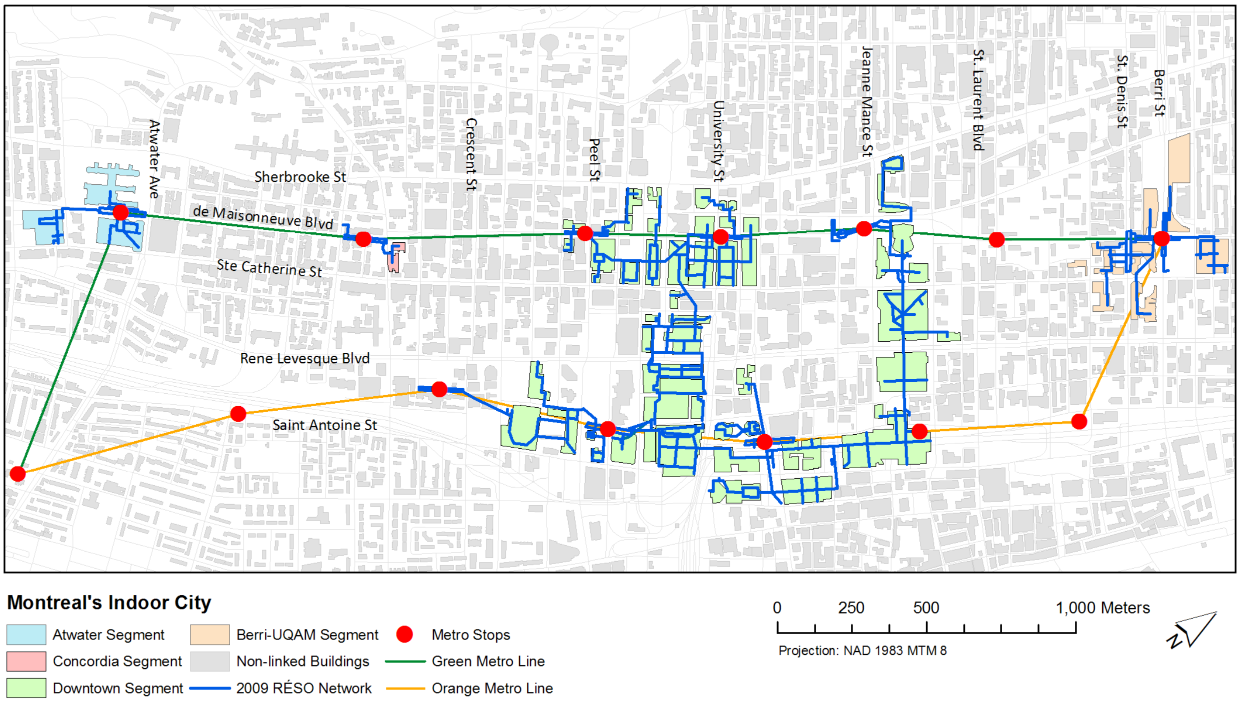

Figure 1: Montreal's Indoor City (RÉSO)

This study is divided into six chapters. It begins with a background discussion on indoor cities in general, followed by a look at why accessibility for persons with disabilities is important. Chapter Two focuses on Montreal's Indoor City, including a discussion of its history and "raison d'etre", the legislative background which governs how the Indoor City was built and operates, and the quasi-public space that the Indoor City encompasses, as well as the metro system that the RÉSO has been built around. The third chapter is a brief overview of other similar indoor cities and how their accessibility compares to Montreal's RÉSO. Chapter Four explains the methodology used to undertake this study. The fifth chapter involves analysis and discussion, including the results from the field study undertaken, along with several scenarios that have been generated to show the significance of changing the levels of accessibility along some key links and the extent these changes will benefit people with mobility impairments. Finally, recommendations for future accessibility improvements within the Indoor City are presented.

BACKGROUND

Indoor Cities

Numerous indoor pedestrian networks exist in cities around the world. These networks, which are often called indoor cities, underground cities or skyways, usually connect buildings, mass transportation systems, and parking facilities, and allow pedestrians to travel between them without venturing outside. These networks can usually be classified into two different types: systems that are primarily underground, and systems that are primarily above grade, usually on the second stories of buildings. Montreal's indoor pedestrian network is unique because around half of the network is at or above grade. Pedestrian networks across the globe have developed as important indoor pedestrian environments that host a diversity of activities and purposes, especially in downtown areas. In Canada, Montréal's *Indoor City*, Toronto's *PATH* and Edmonton's *Pedway* underground pedestrian routes have gained fame, as have other systems all over the world such as *Forum des Halles* in Paris, Japan's *Crysta Nagahori*, and Singapore's *CityLink Mall*. Above grade "skyway" systems are also common in North America, such as the Minneapolis' *Skyway,* and Calgary's *PLUS 15*.

Historically, there have been varying rationales behind the construction of indoor cities. In Canada, they were largely constructed to provide a refuge from climate extremes, while in other cities, such as in Houston as well as in those in Asia, the reasoning behind construction was primarily to separate pedestrians from automobile traffic as part of the segregation of street users for increased safety and efficiency [1, 2]. Elsewhere they have often been constructed to provide a quick route between mass transit stations and large trip generators.

Underground and indoor cities provide benefits for many stakeholders. They offer climate protection and safety for pedestrians; increased property values and more opportunities for high-rent spaces for property owners; and they allow municipalities to show off a model of compact sustainable environment [3]. Increased visibility and exposure for retailers is also a key element in the underground city. After Montreal's Metro was constructed in 1966, retailers saw the advantage of opening shops in the Indoor City as they could rely on extensive traffic to and from the metro passing by their storefronts. Indeed, prior to the opening of the metro and the indoor city there was no below-ground retail space, but as of recently, 65% of all the retail space in Montreal's downtown core can be accessed via the indoor city [2, 4].

Accordingly, granting smooth access to people with disabilities is a must so they can have equal opportunities in term of access to transportation, retail, and protection from severe weather conditions.

The Importance of Accessibility

It is a common misconception that persons with disabilities are limited just to people in wheelchairs. In fact, there are a wide range of disabilities including mobility, visual, auditory, and cognitive impairments, among others. Although the scope of this research study will be limited to physical disabilities and mobility impairments, all of these aforementioned disabilities are important, and people with each of these disabilities could certainly face difficulties in accessing and navigating Montreal's Indoor City.

Even so, focusing on persons with physical disabilities actually covers a wide range of conditions. Kéroul, a Quebec based organization that aims to make cultural and tourism attractions more accessible to persons with disabilities, defines a person with a physical disability as someone who, either temporarily or permanently, has trouble with mobility due to his size or physical condition. It widens the definition to include people with deficiencies resulting from illness or accident and who consequently get around with the help of a wheelchair, crutches or a cane. Their definition also includes people who live with a visual or auditory impairment and people who tire easily due to pregnancy, age, arthritis or heart problems, or being overweight [5]. Nevertheless, it is a basic tenet of our society that persons with disabilities should have the right to access and use the same public space that other people can [6, 7]. Unfortunately, and despite the best efforts of advocacy organizations, this is not always the case.

In today's world, the built environment is usually designed for the perceived model pedestrian: that is, the young and able bodied [8]. This is problematic, because a growing percentage of the population is aging and not able bodied, and studies have found that the design of today's built environment generally does not meet the needs of persons with disabilities [7]. According to recent statistics, about 15% of the Canadian population has some sort of physical disability [9]. Combine this with the fact that temporary injuries or permanent disabilities that make it very difficult, if not impossible, to climb stairs will affect 70% of the population at some point during their lives, and perhaps we should adjust our thinking on who a model pedestrian is [8].

Recent studies on the interaction between people with disabilities and their environment have found that the built environment is actually more of a constraint to people with disabilities than their disability is. In fact, any person can be disabled if the built environment is not designed according to his or her needs [6]. Public spaces are often socially produced in ways that deny disabled people the same levels of access as non-disabled ones [6, 10]. In a recent survey, over two-thirds of disabled respondents agreed that society was their main cause of disability, not their impairment [11]. Accordingly, it is the duty of transportation engineers, planners, architects, and other professions to work closely with people with disabilities in order to understand their needs and include them in the development of public space.

Impediments in the built environment can lead to marginalization within society for persons with disabilities. This is likely because the built environment is often planned by persons whose awareness of disabilities is limited. Certainly, for those who are not disabled, it can be difficult to conceive of life as a person with a mobility impairment. There are many examples in our everyday lives that require totally different behaviour for persons with disabilities. A narrow aisle or tight corner, which is a common sight in many Montreal dépanneurs, can mean the difference between being able to get a package off the shelf by oneself, and having to rely on others to help. One UK study noted that numerous accessibility problems exist in shops, including narrow doorways and aisles, changing rooms that are difficult to use, shelves that are too high, and stock that is poorly placed, not to mention that 37% of respondents rated accessibility to these shops as "poor" [11]. Stairs, steep gradients, or heavy doors might be the barrier between being able to use the front door of a building, just like any other person, or having to travel around to the side or rear of a building to use a special wheelchair-accessible entrance. Even just a single stair can cause an area, store, or building to be off-limits for someone in a wheelchair, as seen in

Figure 2. Denial of access to public places due to physical obstructions can actually cause social isolation for people with disabilities [6].

Figure 2: Inaccessible store in Montreal's Indoor City.

To ensure accessibility for persons with disabilities, it is necessary to redefine our view of designing the built environment for the model pedestrian. Instead, universal design (also known as universal access or universal accessibility) – that is designing urban environments to be accessible to everyone, regardless of any disability or impairment – is a new approach, and one that has been adopted by most organizations and jurisdictions, including Montreal, in recent years.

Designing for universal access is beneficial in that it is not only persons with disabilities that benefit from accessibility improvements. Everyone does, including groups such as parents with strollers, elderly persons, pregnant women, or people with temporary injuries from accidents. Building owners and tenants also benefit from universal design as easier and better access will inevitably lead to increased pedestrian traffic, allowing owners to charge higher rent, and allowing tenants to benefit from more customers and increased revenue. Universal access will become especially useful in the future as the population ages. It is expected, for example, that 50% of the population will be over the age of 55 by the year 2030 and as the baby boomers age, the amount of people with ambulatory and breathing difficulties is expected to rise, as is the number of persons using wheelchairs to shop [8, 11]. By designing for universal access, impediments such as stairs, heavy doors, steep ramps, and poor signage can be minimized, and an environment that is truly open to everyone can be created [11, 12].

Historically, universal accessibility, or even just accessibility for people with disabilities, has not been a high priority for the developers of pedestrian networks. A comprehensive study completed in 1978 on the development, design and implementation of pedestrian systems and networks in Canada failed to even mention accessibility for persons with disabilities. It did mention, however, the lack of wayfinding and proper signage, and the possibility of becoming disoriented within the system was acknowledged even then [13].

It was not until the 1990s that universal design began to be acknowledged as an important principle in Canada. While this was recognized by governments around the world, including the United States and the United Kingdom, which passed national disability acts in 1990 and 1995 respectively, Canada has yet to implement national disability legislation. Nevertheless, local building codes have, for the most part, begun to require newly constructed publicly accessible buildings to be accessible to persons with disabilities.

MONTREAL'S INDOOR CITY

History and Background

Montreal's Indoor City, is one of the world's largest indoor pedestrian networks. Located across the downtown core of Montreal, the Indoor City is a hybrid of the underground and above-grade indoor city system types and is comprised largely of underground corridors connecting the underground and at-grade retail levels of downtown buildings.

This network began with the construction of the Place Ville Marie complex in 1962, which was linked at its south end by two underground corridors to Central Station, Montreal's primary terminus of commuter and intercity trains, and to the Queen Elizabeth Hotel, which is located above Central Station. Since then, the network has been expanded over many phases and several decades, with numerous crossings under streets and a wide variety of standards for access. As of 2007, there were 30.7km of corridors in the Indoor City, travelling through 69 buildings and used by over 230,000 people each weekday. From a transportation perspective, the Indoor City is very well connected, as it is directly connected to all four commuter and intercity train and bus stations, 10 of the 12 metro stations in the downtown area, and 38 parking garages with a total of 17,500 parking spots.

The Indoor City also provides access to over two-thirds of the commercial space in downtown Montreal [2, 4]. Examples of nearly every type of store or service can be found in the Indoor City, including grocery stores, pharmacies, hair salons, tailors, bookstores, and theatres, as well as connections to numerous other types of buildings, from concert halls to hotels, and apartments to office buildings. All of this has occurred despite the complete lack of a master plan for the Indoor City, and little in the way of public investment or guidelines. Instead, the Indoor City has grown organically over the years since its inception, primarily through private sector development; however, the lack of public regulations has resulted in an environment that is unfriendly to persons with disabilities.

When the network began to be implemented in 1962, and throughout the bulk of its growth between the 1960s and 1980s, there were no standards for universal accessibility and thus, many impediments to persons with disabilities exist today. For example, there are numerous locations in the Indoor City where two areas or corridors are connected with a few stairs, as shown in Figure 3. These stairs may look harmless and not even be noticed by many people, but they act as a major barrier to a people with mobility devices, such as a wheelchair. As a result, there are many areas of the Indoor City that are very inconvenient or even impossible to access for persons using a wheelchair or other mobility device; however, stairs are not the only impediment for persons with mobility impairments. Poor navigation and wayfinding signs, substandard ramps, overly heavy doors that lack wheelchair buttons, lack of handrails, and inaccessible washrooms can all be found in the RÉSO. In fact, a first-hand account of the navigation difficulties that can be found in Montreal's Indoor City, noted that navigating the indoor city as a parent with a stroller was very difficult, and that someone in a wheelchair would not be able to do it at all [14].

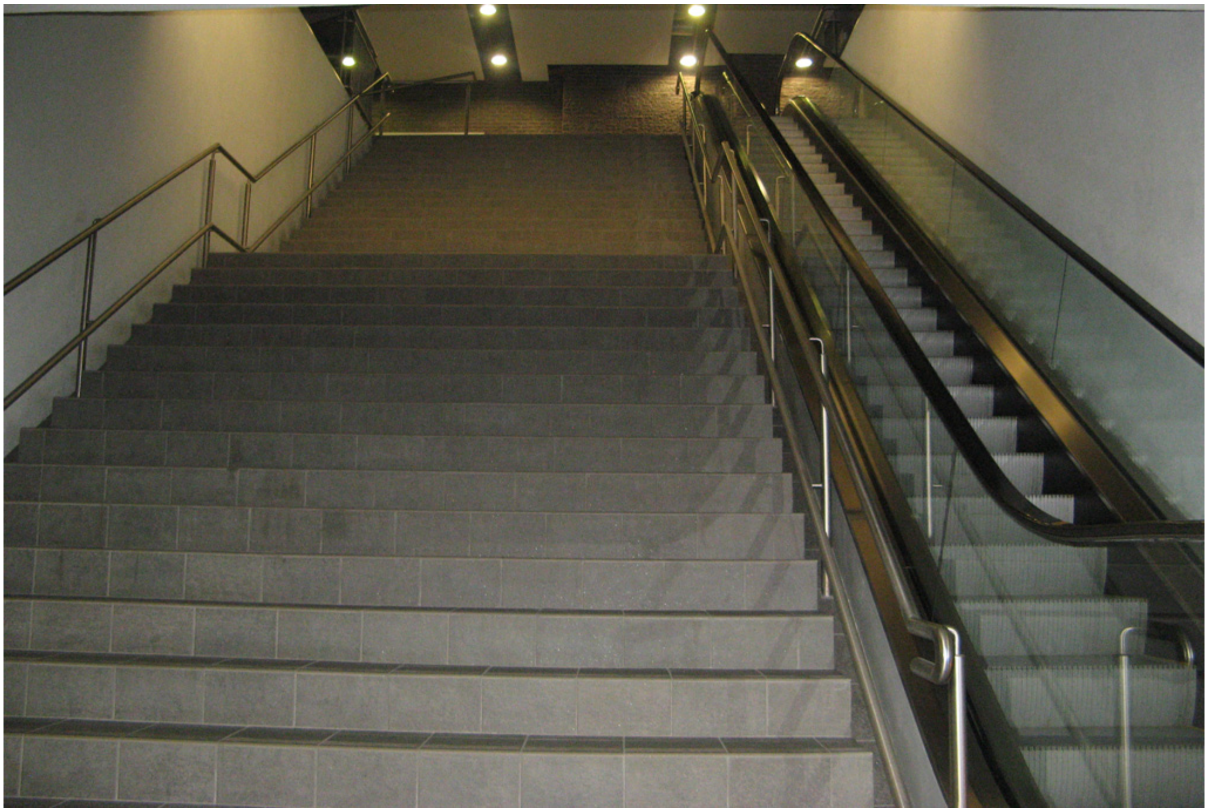

Figure 3: A typical connection between buildings in the Indoor City.

A major irritant for people with mobility devices is that the passageways which connect the concourse levels of buildings are often unnavigable, forcing one to take elevators up to street level, travel across busy streets, and then enter the second building only to take another elevator back down to the retail concourse level. This makes navigating through the Indoor City, and shopping in general, discouraging for disabled persons. One survey in the U.S. found that "shoppers who are wheelchair mobile cannot count on compliance (with accessibility legislation) and cannot predict which physical barriers they will find in shopping centres" [15]. The same is true for shoppers in Montreal's Indoor City, as the existing quasi-public system and lack of proper legislation has created an environment where one can never be sure just what type of accessibility barriers one will face around the next corner.

Legislative Background

Four separate levels of government have passed legislation or have implemented programs that directly or indirectly affect the Indoor City. These include the City of Montreal along with its Ville Marie borough, as well as the provincial and federal governments.

The City of Montreal has taken a largely hands-off approach to the Indoor City over its 47-year history. While at times in the past the City has made sure Indoor City connections were provided for before issuing building permits; banned above-grade skyway connections; and even imposed a moratorium on further expansion in the 1990s due to fears that the Indoor City was contributing to a lack of street life, for the most part the City has been content to let private developers be in control of the expansion and operation of the Indoor City [4, 16].

In recent days, the City has, however, been slightly more proactive and has incorporated the Indoor City into its master planning. Section 4.23 of Montreal's Master Plan of 2004 defines the indoor pedestrian network as one of its Detailed Planning Areas and sets out goals and planning guidelines for the future development of the system. This section acknowledges that mobility-impaired persons are at a disadvantage in the underground, mainly because of the "variation in levels and the lack of adequate signage" [17]. As a result, one of the five planning guidelines for the indoor pedestrian network is to move towards providing universal access throughout the RÉSO for mobility impaired persons. The Master Plan also notes that there is a lack of consistent and integrated planning in the network and that standards related to access and design need to be defined and applied to the RÉSO [17]. This Detailed Planning Area will be implemented through action 7.3 of the Montreal Master Plan which is intended to "guide the development of the indoor pedestrian network" and is committed to ensuring universal accessibility of the Indoor City as one of its implementation measures [17]; however, since the development of the Master Plan, the City has yet to announce any details or pass bylaws to implement specific measures or actions related to this Detailed Planning Area. The only other recent mention of the Indoor City is in Montreal's 2007 Transportation Plan, which notes that the City is looking to improve access to the Indoor City for persons with mobility-impairments, but does not mention any specific plans to do so [18].

The city has, however, adopted a universal accessibility program with the intent of eliminating undue obstacles in public sector buildings and ensuring that access is available to all. The genesis of this plan was the Montreal Summit, held in 2002, during which the city committed itself to making the public realm universally accessible, but it was not until 2006 that an accessibility program was implemented as mandated under the Government of Quebec's *Loi assurant l'exercice des droits des personnes handicapées en vue de leur intégration scolaire, professionnelle et sociale* [19]. Since then, the City of Montreal has been creating a yearly Universal Accessibility Action Plan. This plan lists all the accessibility actions that are proposed or are being undertaken by the City, as well as the results from previous years. The plan focuses on different areas of city life, such as architecture and urban planning as well as other areas such as training, municipal communications, and accessibility to programs, services and employment. Unfortunately, there is no mention in any of the plans so far about any accessibility work related to the indoor city, despite the fact that the city has committed itself to making the indoor city more accessible [19]. Consequently, as of June 2009, there seems to be little, if any, progress on the City's plans to move towards universal accessibility in the Indoor City.

At the provincial level, the current inaccessible state of much of the Indoor City would appear to contravene section 15 of the Quebec Charter of Human Rights and Freedoms which states that "No one may, through discrimination, inhibit the access of another to public transportation or a public place, such as a commercial establishment, hotel, restaurant, theatre, cinema, park, camping ground or trailer park, or his obtaining the goods and services available there," as the Indoor City contains six of these eight establishments [20]. This charter applies both to the province and to the private sector, but not to federally regulated activities. Other relevant provincial legislation includes the aforementioned *Loi assurant l'exercice des droits des personnes handicapées en vue de leur intégration scolaire, professionnelle et sociale,* which gives the Ministry of Labour the responsibility to regulate which categories of buildings must be made accessible [21].

Unlike the wide-ranging Americans with Disabilities Act, which governs nearly all aspects of accommodation for persons with disabilities in the American public realm, Canada has no applicable national disability legislation. The closest applicable federal legislation is the Charter of Rights and Freedoms, which applies to the federal government and all of its agencies, along with the provincial governments. The relevant part of the Charter, section 15, states that discrimination based on physical disability is forbidden [22]. Whether or not the Charter would apply to the Indoor City is complicated due to the public/private nature of the RÉSO and is discussed further below.

Despite all of this legislation, the links between buildings in the Indoor City and, in some cases the buildings themselves, remain inaccessible to people with disabilities. This problem of poor access for persons with disabilities is not a situation unique to Montreal and, in fact, occurs throughout the world. In many cases, legislation exists to require authorities to take action against buildings that do not provide for accessibility for persons with disabilities, but they are often ineffective and enforcement is often non-existent [6]. In other jurisdictions, voluntary compliance with accessibility legislation is used to try and improve the existing situation, which experience has shown generally does not work. For example, after the enactment of the U.K.'s Disability Discrimination Act in 2004 which prescribed hefty fines for violations of the law, 42% of members of the Federation of Small Businesses preferred instead to wait and see rather than do anything about compliance with the legislation. Accessibility can be a costly proposition for small businesses, which could explain why it is difficult to ensure compliance with accessibility norms, rules, and legislation. On the other hand, accessibility compliance and the expenses associated with it should not be an issue for the big businesses which, by and large, control the Indoor City [11].

Part of the problem is certainly due to the fact that much of the Indoor City was constructed decades ago, before accessibility legislation applied and because there is no legislation mandating that older private sector buildings become accessible. This is common around the world, where, in many cases, only new buildings and buildings that are undergoing major renovations are required to become accessible [7]. Even though, by most definitions, the Indoor City would be recognized as public space, and would logically have to comply with public space accessibility legislation, legally it is much more complicated than that, and the Indoor City might best be described as "quasi-public space".

Quasi-Public Space

Public space is generally defined as space that is freely open to everyone, regardless of social or economic considerations, with a typical example being a city street, or a town square. While the Indoor City operates in the public realm, and has many qualities of a city street, such as plants, benches, and storefronts opening up to public areas, legally, the Indoor City is actually a complicated network of quasi-public space, owned by numerous entities, both public and private. In fact, the City of Montreal owns just 10% of the RÉSO, with the vast majority owned by the private sector, while other public entities, such as the federal government and Hydro Québec, own small segments [23]. This ownership arrangement is problematic in terms of devising building and architectural standards and regulations for the Indoor City as there is currently no uniform set of rules or guidelines that govern the entire system. The result is that the RÉSO has become a series of connected private-public spaces with each part designed and operated differently [16, 24]. This was noted in 1985 when a study by Brown and Sijpkes [25] stated that the Indoor City was a haphazard arrangement with no clear motivations or plans for growth, and desperately in need of rules and standards, such as for signage and maps. While the city has since taken responsibility for signage, few other rules and standards have been developed for the Indoor City.

In this respect, the Indoor City is no different than most other skyway and tunnel systems in North America. One author noted that these systems are a place where one is not subject to the usual freedoms and rights that one enjoys, but rather subject to the rules of private industry, with curtailed legal rights [24]. A basic example would be the signage commonly seen at the entrances to businesses forbidding entrance to those without shirts and shoes, both of which would be permitted in public space. Nevertheless, whereas buildings such as malls, restaurants, and theatres are technically private property, since they are open to and for use by the public, they should be fully accessible to everyone [6].

To remedy the issue of quasi-public space in the Indoor City, one study envisioned a type of condominium ownership whereby the City would take ownership of all publicly accessible Indoor City corridors and become responsible for their maintenance and upkeep while the storefronts along them would remain in the hands of the private sector, much like a typical public street [16]. This idea, as well as others for remedying the issue of quasi-public space, is discussed further in the analysis section of this paper.

Metro System Background

The Montreal Metro system forms an integral part of the Indoor City and is connected to it at many points. Unfortunately, Montreal is also one of the last major cities in the world to implement accessibility improvements in their Metro system. In Europe, for example, most public transit systems are already

Figure 4: Only three suburban Montreal Metro stations, shown with "Ascenseur" symbols, are currently equipped with elevators. Source: STM

fully accessible, and those that are not must meet a 2015 deadline to become so [26]. In contrast, at the present time, none of the downtown Montreal Metro stations have elevators, as seen in Figure 4.

Montreal's deep level Metro stations dating from the 1960s through 1980s are problematic in that they simply were not designed for wheelchair accessibility. At the time of the construction of these stations, it was common practice to provide a separate paratransit service which was seen as sufficient to accommodate the needs of persons with disabilities. As such, none of these stations were equipped with elevators, and most stations are not even equipped with escalators between all levels. Today, while paratransit service is still, and will continue to be, necessary for some of the population, designing transportation systems to take advantage of universal design will allow persons with disabilities to utilize the excellent public transit system that Montreal has to offer. Indeed, many persons with disabilities would much rather be able to take the same forms of public transit that everyone else can, whenever and to wherever they choose, rather than having to book appointments and miss out on unforeseen or unplanned opportunities simply because there are no paratransit vehicles available.

By enabling persons with mobility impairments to travel on the metro, expensive paratransit costs can be avoided. A report by Toronto's TTC, operator of that city's public transit system, noted that it actually costs the TTC over $30 in subsidies every time a ride is taken on their paratransit system. Over the long-term, equipping stations with elevators may actually be more cost effective than continuing to provide paratransit for mobility impaired customers that could use the regular transit network instead.

It has only been recently that the Societé de transport de Montréal (STM), operator of the public transit authority, has changed its stance on paratransit. Previously, in a policy dating from 1991, the STM had simply encouraged persons with disabilities to use low-floor buses and paratransit where necessary; however, in recent years the STM has committed to universal design, and improvements are now slowly being phased in across the system. Elevators are currently under construction in five key metro stations, two of which, Bonaventure and Berri-UQAM, will provide the first accessible connections to the RÉSO, as shown in Figure 5 [27].

New fully-accessible metro cars are also on order and are due to arrive by 2013. Once the metro is accessible to people with mobility impairments, the city will be under pressure to make the Indoor City accessible as well.

Figure 5: Elevator construction at the Bonaventure Metro Station.

Accessibility of Comparable Indoor Cities

While there are numerous indoor pedestrian networks located in cities elsewhere, Toronto's PATH system is the most suitable comparison to Montreal's RÉSO because of its many similarities, such as the length of the network, the mix of above and below-grade segments, and because it has been developed in a similar legislative, regulatory, and transportation context. While Montreal's RÉSO, at 30.7km in length, bills itself as the largest network of interconnected complexes in the world, Toronto's PATH, with 27km of walkways, has been recognized as the world's largest underground shopping complex, as it has more retail space in total than the RÉSO [28]. Both networks are located downtown in their respective cities and connect rapid transit stations and transportation hubs to retail and office buildings.

The PATH also has a similar ownership model to that of RÉSO. Although the system appears to be public, in fact, the vast majority of the system is owned by the private sector, which is responsible for security, maintenance, and capital upgrades. This setup is starting to change, however, as the City of Toronto has steadily begun to take a more active role in determining the future of the PATH in recent years. Toronto took control of coordinating PATH development in 1987, and installed a universal wayfinding system to aid in navigating the sometimes complex corridors of their indoor city [29]. Indeed, one fable regarding the PATH is that the city's mayor became lost while trying to locate his dentist and insisted that comprehensive maps and signage be developed so that it would not happen again [30].

Today, while most extensions to the PATH system are still made by private developers, the City is currently involved in developing a new northwest connection in order to relieve pedestrian congestion on the busiest points of the system. The City has indicated that this new connection will meet all accessibility requirements and will be fully accessible to persons with mobility impairments [31, 32]. In fact, most of Toronto's PATH network is already accessible to persons with disabilities. Although many of the connections are not always immediately apparent, there are usually automatic doors, ramps and elevators available, even if one must travel slightly out of their way. Toronto's PATH Manager estimates that 95% of the PATH network is wheelchair accessible, and noted that the City is encouraging private property owners to upgrade non-accessible segments of the PATH [33].

Other North American indoor cities are similarly accessible to persons with disabilities. For example, the original plan for the City of Edmonton's indoor pedestrian network, which was approved in the late 1970s, had foresight in suggesting that ramps be provided for people with disabilities and for baby carriages [34]. Nevertheless, this advice was not always followed. To remedy this, the city decided to require all air leases (which enable connections to be built across city streets) to provide accessibility to people with disabilities unless technically infeasible [35]. As a result, most of Edmonton's pedestrian network is wheelchair-accessible today.

In the United States, Houston, Texas, which has one of the largest tunnel systems in the U.S., is largely wheelchair accessible, a feature that stems from a 1977 report of the Houston Planning Department which mandated that all future tunnels should be fully accessible to persons in wheelchairs. Exceptions included previously existing buildings that were accessible through the tunnel level, but that did not have elevators connecting the tunnel to the building above [1].

Overall, the trend in comparable cities is towards indoor pedestrian networks that are as fully accessible as possible, although some cities have made more progress towards this goal than others. Judging solely by the literature, Montreal has a long way to go before it can catch up to the level of universal accessibility that can be found in other indoor cities around the globe. Accordingly, prioritizing the changes that could be made to the existing network is a key element in the process of making Montreal's Indoor City accessible to people with mobility impairments, as discussed further in Chapter's 5 and 6.

METHODOLOGY

A field study of the Indoor City was conducted in June, 2009 to gather information on accessibility barriers, such as segments accessible only via stairs or escalators, or ramps that are too steep to navigate with a mobility device. Data that was collected included the locations of all stairways, including the number of stairs in each location; escalators, in one or both directions; ramps, including those that were satisfactory and others that were too steep; elevators; doorways with and without wheelchair buttons; and any other barriers which are located on the main path of the Indoor City. Also, data was collected on the ability of a person with a mobility device to travel between the Indoor City and street levels of each connected building. This data was then integrated in a geographic information system (GIS) environment with an indoor city network that was developed by the McGill TRAM research group as part of their previous Indoor City research.

This new GIS network was then used to produce accessibility measures that illustrate the current levels of accessibility for persons with and without mobility impairments. Accessibility is a measure of potential opportunity [36]. Accessibility is measured here using the cumulative opportunity measure, which was among the earliest ones to be developed and the simplest to calculate [37, 38]. Cumulative opportunity reflects the number of opportunities available from a predetermined point within a certain travel time or travel distance. In this research, the amount of retail space that can be reached from certain points within the Indoor City will be measured and will not be limited by distance.

The network was then analyzed to determine the optimal locations in which to implement new accessibility measures in order to increase the level of accessibility for persons with mobility impairments. Several methods were employed to do so, such as re-connecting the network in locations where simple door improvements such as a wheelchair button could make the connection accessible, or reconnecting the network where ramps could easily be installed. In other cases, a trial and error approach was used to determine the minimum action required in terms of cost that could produce the maximum benefit possible in terms of increase in accessibility. This was used for key locations where the installation of an elevator could drastically increase the level of accessibility in the network. Several options have been produced to discuss further in the following section.

ANALYSIS AND DISCUSSION

Montreal's Indoor City has been the subject of numerous research papers and studies, the first of which were conducted in the 1980s. There have been many different areas of study, including papers which have researched the growth of the Indoor City and examined the context in which it was developed, and others which have modelled the flow of pedestrians throughout the Indoor City network and looked at ways to enhance the efficiency of the system; however, there has been very little work completed on the issue of accessibility for persons with disabilities. In fact, only one existing paper has even mentioned this issue, and very briefly at that [16]. Due to the lack of study in this area, this research paper seeks to fill this niche and to provide much needed discussion on an important topic.

The amount of retail and office space has grown over time in the Indoor City, as well as the links between these spaces. A total of 69 buildings have been linked into the Indoor City network between 1962 and 2006, connecting a total of 45,372,176 square feet of office space and 3,907,662 square feet of retail space. While this growth has led to an increase in the number of opportunities that can be reached, this is not true for a person with physical disabilities. In fact, the primary finding of this field study is that it would currently be a frustrating and time-consuming exercise to try and navigate the Indoor City in a wheelchair or mobility device. While almost all of the individual buildings of the Indoor City are accessible on their own, travelling between them without returning to street level is often quite difficult. A map of the downtown segment of the Indoor City is shown in Figure 6.

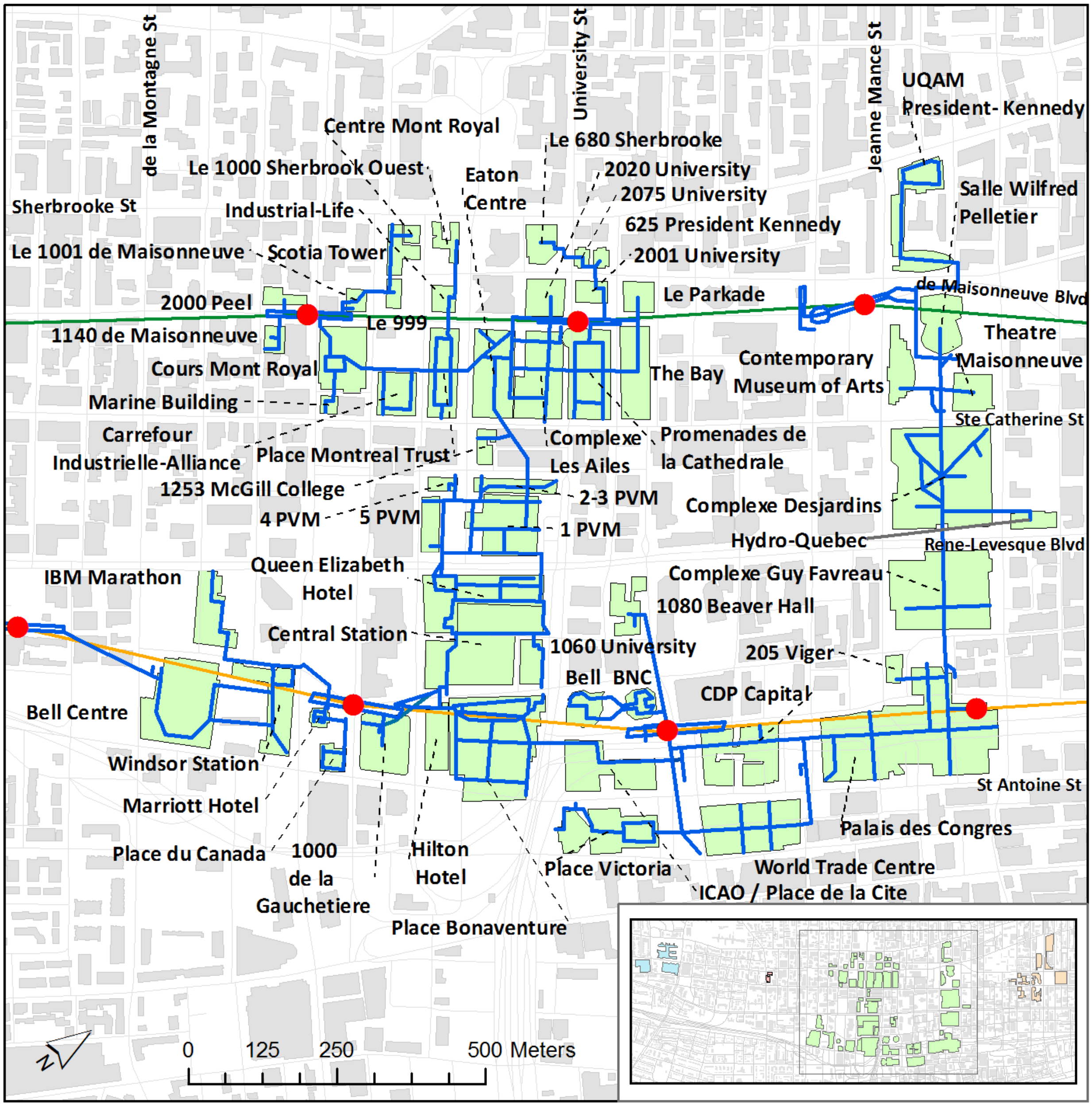

Figure 6: Close-up view of the downtown segment of Montreal's Indoor City

Street Level Access

For the most part, access to street level is not a problem in the Indoor City. Elevators are ubiquitous in the Indoor City, and almost all connected buildings have elevators that operate between the Indoor City and street level. One notable exception is the connection between the Eaton Centre and Place Ville Marie. This connection is one of three buildings in the RÉSO that contains shops and services at the Indoor City level that cannot be accessed by persons in wheelchairs as there are no public elevators, an example of which is seen in Figure 7.

Figure 7: Inaccessible stores in the Cours Mont Royal building in the Indoor City

Signage

There are currently two types of signage in the Indoor City: signs installed by individual building owners, which typically provide information related to that particular building; and coordinated RÉSO signage (Figure 8), which was designed to help people navigate between different buildings. While this coordinated signage was installed throughout much of the Indoor City starting in 2002, these signs cannot always be relied on by the typical pedestrian, as they are primarily located in the newer sections of the Indoor City and have not been completely deployed throughout the network, even though it has been seven years since installation began.

Figure 8: Coordinated RÉSO signage, with an inaccessible connection beyond.

Signage with regard to accessibility for persons with disabilities is also poor in the Indoor City. The coordinated RÉSO signage fails to give any sort of indication of wheelchair accessibility, while only some individual building signage conveys this information. In some cases where signage does depict accessible routes, the information is confusing or incorrect (Figure 9). The lack of signage is especially apparent in buildings where elevators are in a different location than the more commonly used stairs and escalators. Examples of this can be found in Place Ville Marie (PVM), where the accessible connection from the Indoor City to 1 PVM is located down a service hallway, far from the escalators typically used to access the building. This connection can be seen on the mall directory map, but there are no other signs directing users where to go. Another confusing location is in Place Victoria/Tour de la Bourse, where it is quite difficult to find the single elevator that travels between street level and the various Indoor City levels. Clearly marked accessibility signage that is visible from all directions would benefit users of both of these buildings.

Figure 9: While it might seem that this sign points the way to the Delta Hotel, or a connection between various levels of this building for mobility device users, in fact, only the washrooms and parking lot are actually accessible via this route.

A different type of example can be seen in the connection between PVM and Central Station, shown in Figure 10. While an accessible Indoor City connection is currently available between these two busy nodes, it actually involves taking an alternate route via an elevator located in the Queen Elizabeth hotel; however, this alternate route is problematic in that there is only directional signage from one direction, the meaning of which could be confusing for someone not familiar with the area. In addition, there is no indication within the elevator to note which floor one should exit on to continue through the Indoor City. Simple signs depicting a wheelchair and a directional arrow would fix these problems and thus drastically improve wayfinding for those in mobility devices in this Indoor City segment.

Figure 10: Place Ville Marie to Central Station connection. An accessible, yet unsigned, connection is available via the Queen Elizabeth Hotel, through the top doors.

Network Analysis for People with Disabilities

In comparing origin-destination matrices between the regular network, and the network accessible by persons with disabilities, a huge difference can be seen. Whereas in the regular downtown network, a person with no disabilities can reach any other connected downtown building, in the disabled network, a person with disabilities can just reach a handful of other buildings. Figure 11 shows the existing level of accessibility for a person without disability. It is important to note these figures show the amount of retail areas that are accessible through walking in the Indoor City, without the need to use a metro or to cross a street.

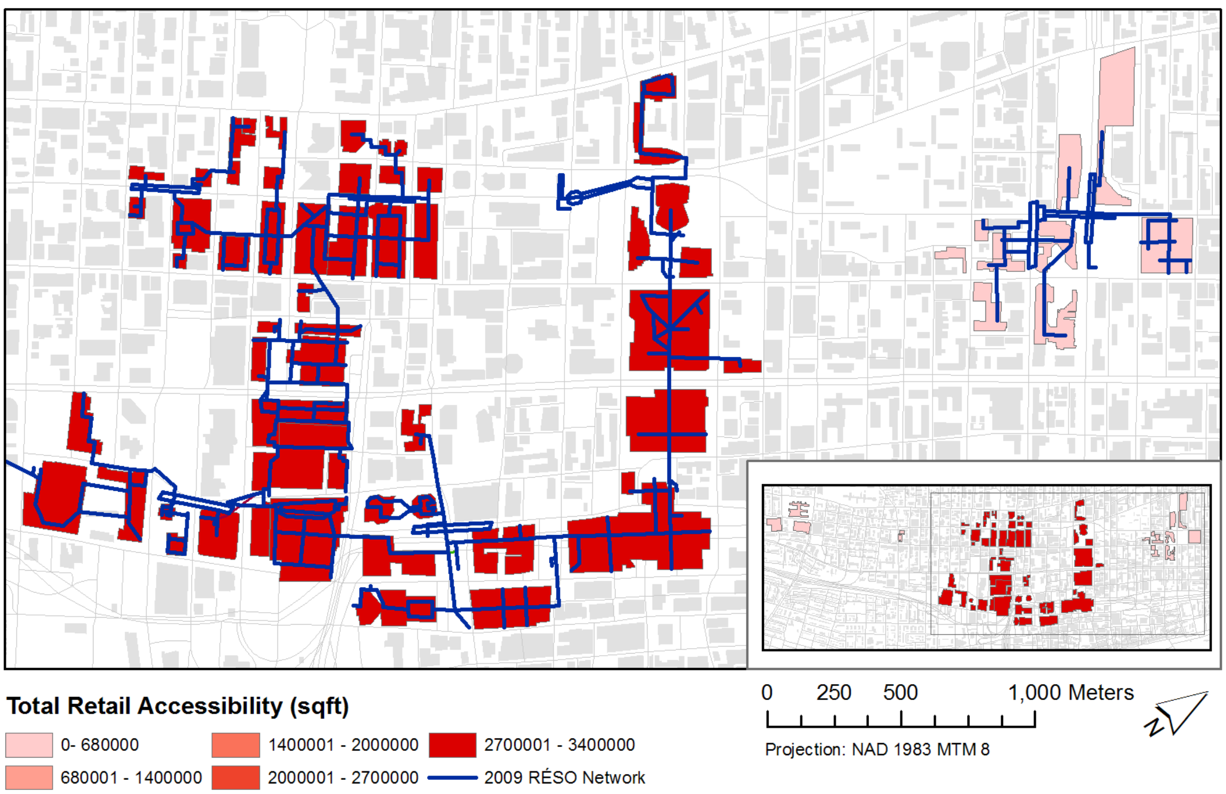

Figure 11: Map depicting the amount of retail space (sqft) that can be accessed from individual buildings within the network, not including the metro. People without disabilities can reach any building in the downtown network from any other downtown building, while people in the Atwater, Concordia, or Berri segments can only reach retail space in those segments.

Currently, the most accessible section of the Indoor City for persons with disabilities is in the north-western segment along the Ste-Catherine Street shopping district and includes ten linked accessible buildings. The eastern Indoor City segment is the second most accessible with six linked accessible buildings. It is clear that the majority of the Indoor City is not accessible and the "difference map," as seen in Figure 12, shows the current situation and the difference in the level of accessibility between a person without any mobility impairments and a person with a physical disability.

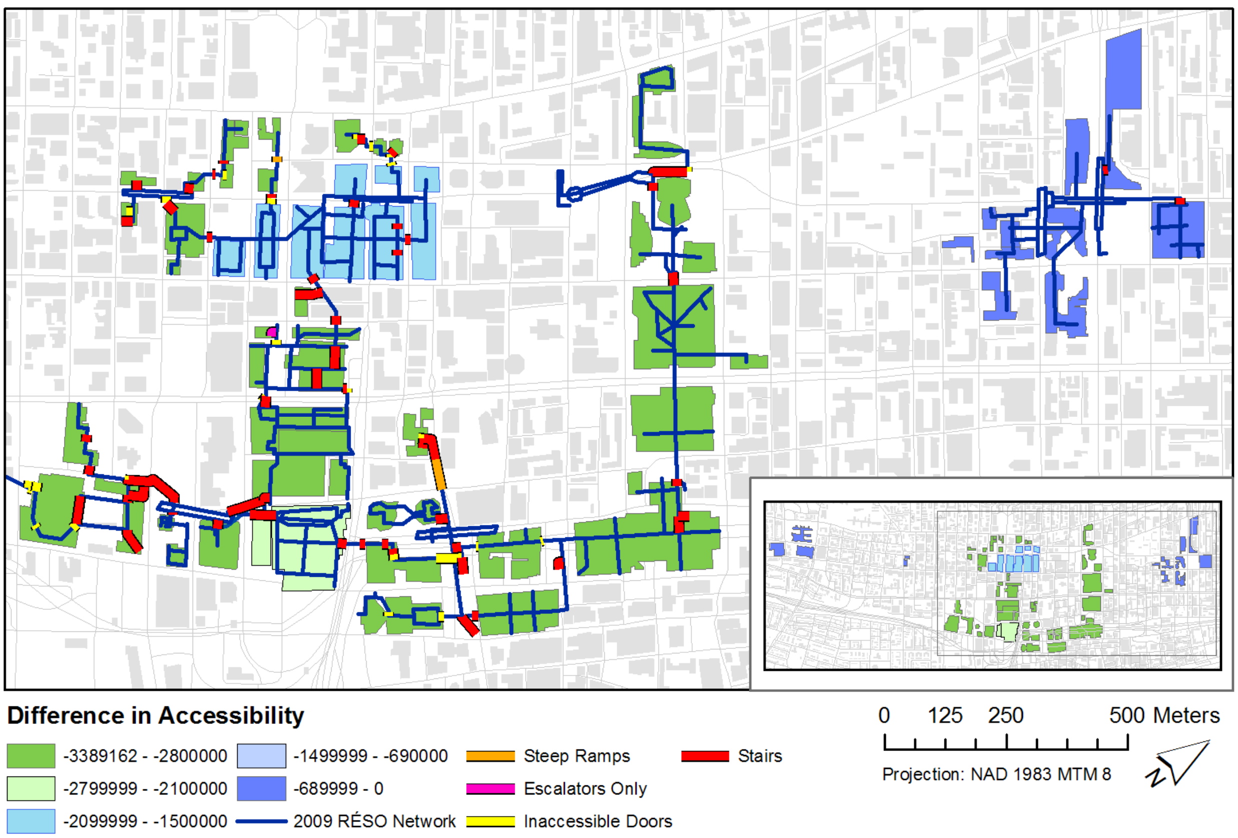

Figure 12: Map showing the difference in accessibility for persons with physical disabilities between the base network and the current disabled network. Values closer to zero mean that the level of accessibility is closer to that of the base network.

To make the entire Indoor City 100% accessible for persons with physical disabilities, several barriers need to be overcome. Creating a barrier-free Indoor City would require the construction of at least 17 ramps and at least 40 new elevators and "mini-elevators" (smaller elevators that can typically hold just one mobility device user with an attendant, which are often used in retrofitted spaces where it would be impractical to install a ramp or a full sized elevator), along with 38 locations where automatic doors activated by sensors or wheelchair buttons would need to be installed. Implementing all of these improvements would be quite expensive.

Sixteen locations were identified where no impediments exist other than doorways. Accordingly, installing automatic doors controlled by wheelchair access buttons can lead to an increase in the level of accessibility by 24%, compared to the existing level of accessibility for people with disabilities. As shown in Figure 13, while this increase in accessibility is small and results in little visible change on the map, it is a necessary precursor to other improvements, such as new ramps and elevators, which result in greater increases. Therefore, this improvement has been made before implementing all other improvements on the following maps.

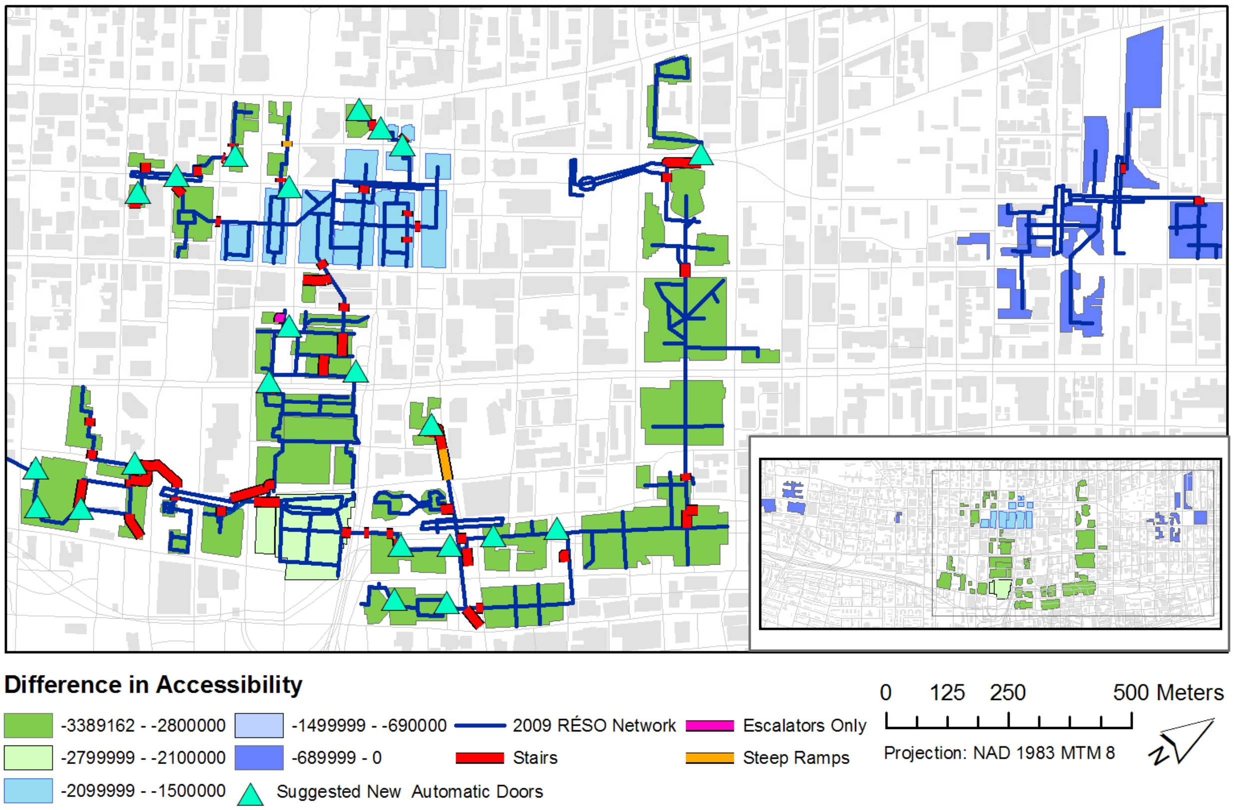

Figure 13: Map showing the difference in accessibility for persons with disabilities between the base network and the disabled network with suggested new automatic door locations.

Further suggested accessibility improvements were determined using a trial and error approach to locate segments of the Indoor City that would require a minimum amount of investment, yet produce the maximum benefit. This approach was focused on connecting the busiest segments of the Indoor City, which is located in the heart of the "U" shaped section; that is around the "U" formed between McGill Metro and Complexe Desjardins.

The single greatest improvement in universal accessibility in the Indoor City would be achieved by upgrading the corridor between the north and south-western segments, which is the tunnel from the Eaton Centre to Place Ville Marie. This connection is one of the most significant links in the entire Indoor City, as it completes the western connection between the green and orange metro lines and unites what were previously two separate networks; however, from the point of view of a person in a wheelchair, this connection does not even exist, as persons with disabilities must exit to street level to travel between the two sections [16]. Connecting this section of the Indoor City would improve the level of accessibility by 113%, in terms of the total amount of retail space that can be accessed, compared to the existing level of accessibility for people with disabilities,. As shown in Figure 14, this is a huge impact as it would effectively double the connected space that people with disabilities can access with just one improved link, and would only require the installation of two elevators.

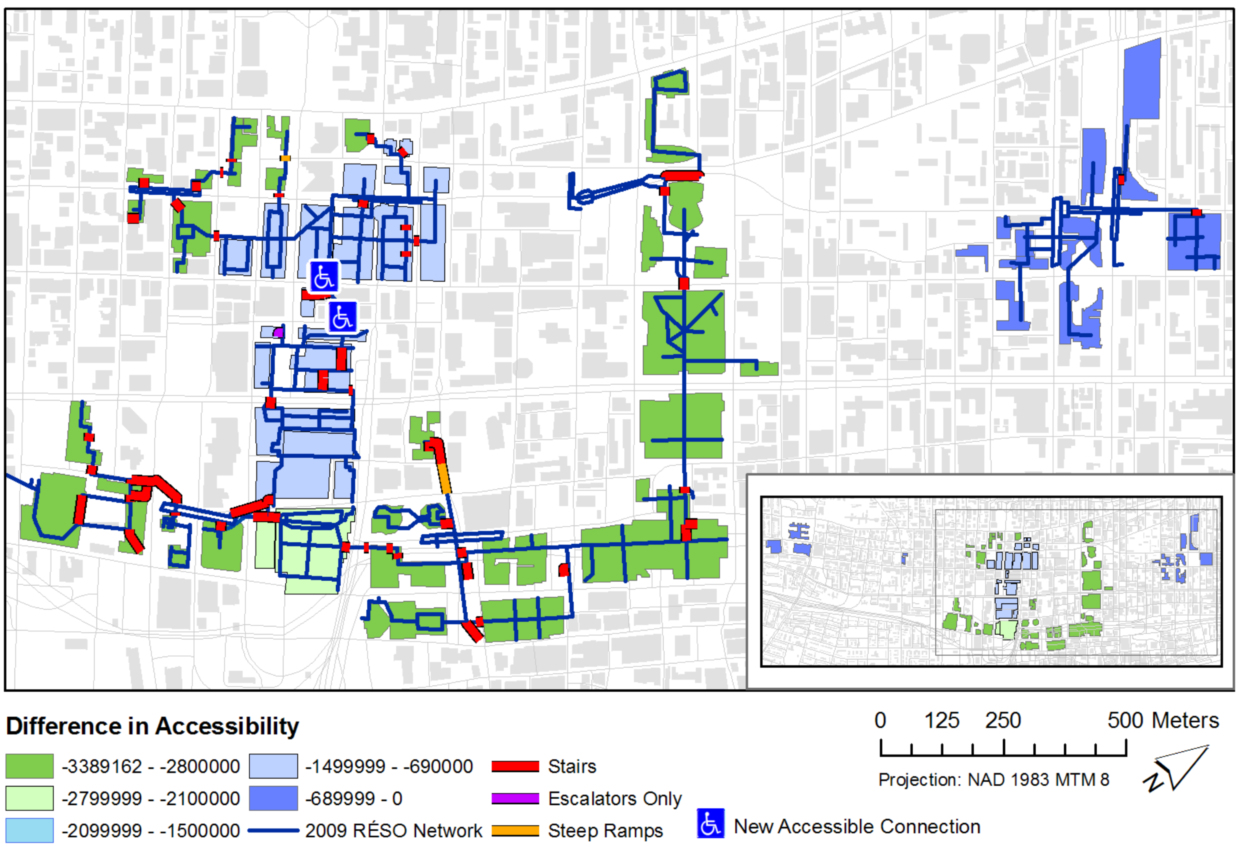

Figure 14: Map showing the difference in accessibility for persons with disabilities between the base network and the disabled network with Eaton Centre to Place Ville Marie accessible

There are four critical locations in the Indoor City that, if made accessible, would result in the greatest increase in universal accessibility. These are:

- the connection between the Eaton Centre and Place Ville Marie (733 Cathcart);
- the connection between Central Station and Place Bonaventure;
- the connection between Place Bonaventure and ICAO/Place de la Cité; and
- the connection between the Palais des Congrès and Complexe Guy Favreau.

If these four links were made accessible, which could be done with the installation of nine elevators and seven automatic doors, then the Indoor City network would become fully accessible for persons with disabilities between the McGill metro station and Complexe Desjardins. This would increase accessibility by 396%, in terms of the total amount of retail space that can be accessed by people with disabilities as compared to the base scenario, as shown in Figure 15.

Implementing these improvements would allow the segments of the Indoor City with the greatest amount of retail space, and the connections between them, to become accessible to persons with disabilities. This change would allow most of the Indoor City to have the same level of accessibility for everyone and represents the most cost effective approach to making this vital public space more accessible. The remaining buildings that continue to be inaccessible for people with disabilities in this approach are primarily buildings that would have little impact on the accessibility of the overall network.

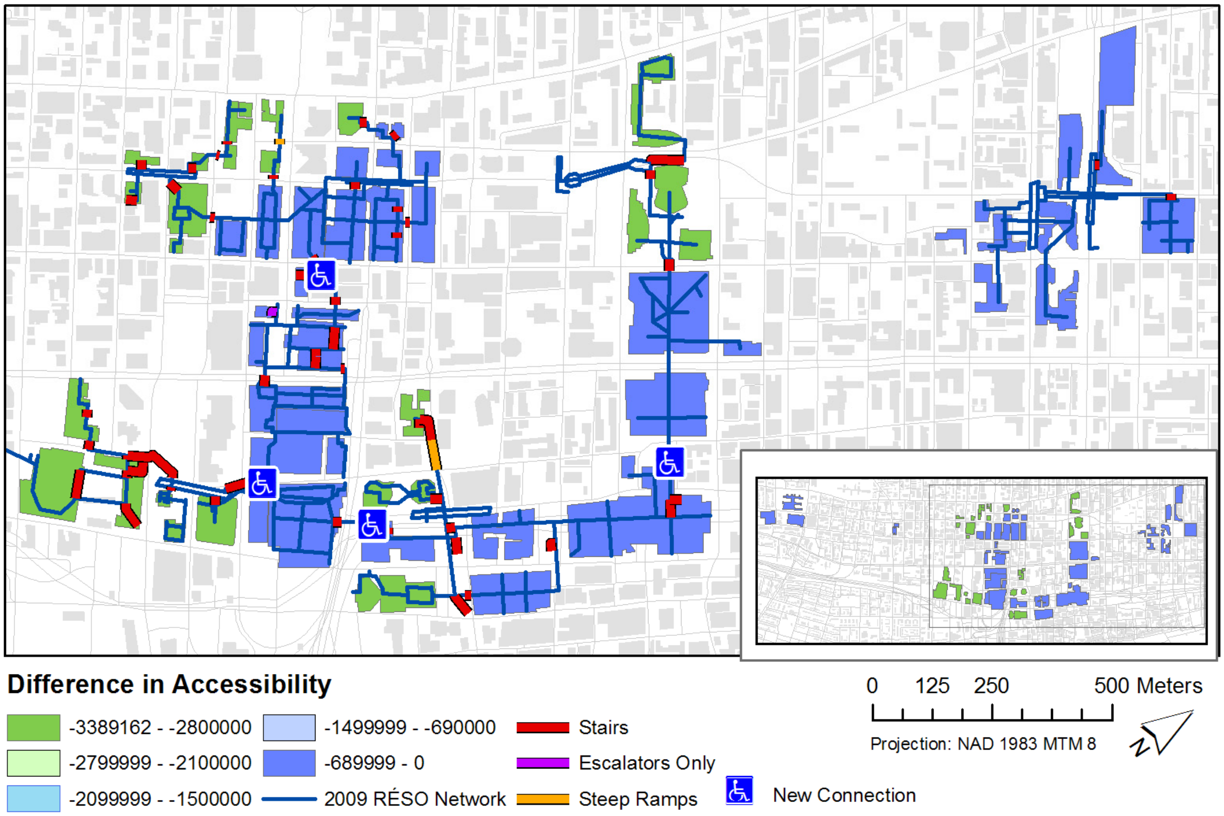

Figure 15: Map showing the difference in accessibility for persons with disabilities between the base network and the disabled network with four key locations made accessible

Metro Accessibility Improvements

The ongoing project to enhance the accessibility of STM's metro system will also help to increase access for persons with disabilities within the Indoor City. Currently, elevators are under construction at two downtown stations, Bonaventure and Berri-UQAM. These elevators are critical to making the Indoor City more universally accessible, as they may, depending on their configuration, enable accessible connections between the central and eastern segments of the Indoor City when completed (as long as accessible connections from Metro Bonaventure to adjacent buildings are also constructed). A map of metro stations connected to the Indoor City is shown in Figure 16.

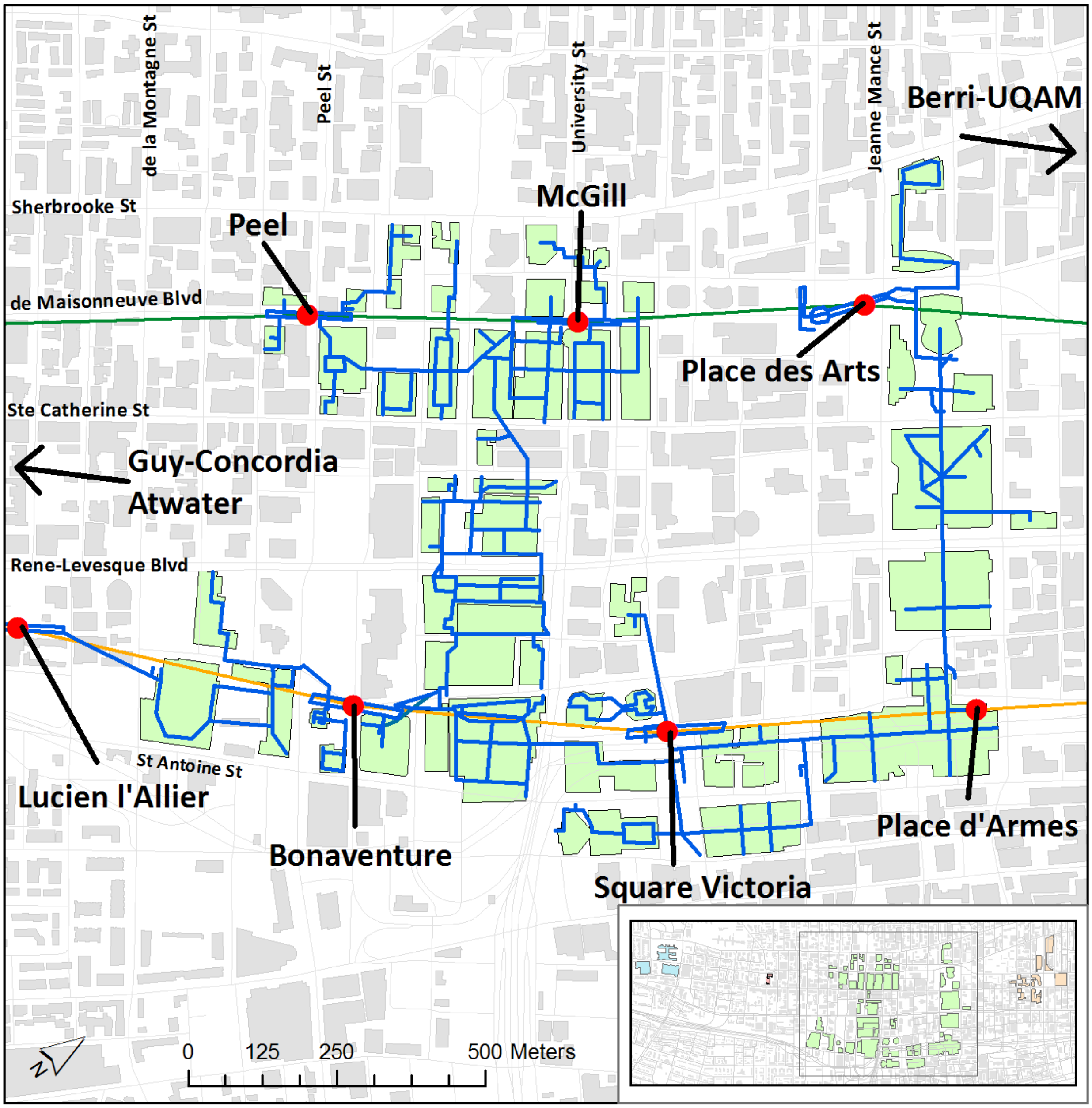

Figure 16: Metro stations linked to the Indoor City

Even once the elevators are completed, accessibility will still be complicated for transit riders until the STM's new metro cars arrive in a few years. While imperceptible to the typical metro user, Figure 17 shows that the current metro cars have a small step up from the platform, which persons travelling with mobility devices may find insurmountable. The current STM practice for the three existing accessible metro stations is to notify an attendant who will then travel with the client in order to deploy a ramp to board and disembark the train. Once more stations become accessible and passengers with disabilities can travel further across the STM's metro network, this practice will no longer be feasible due to the manpower required, and a different solution will be need to be found until the new metro cars are in service.

Figure 17: Images depicting the process of boarding a STM metro car with a ramp, and of the gap that exists between the car and the platform. Source: STM.info

In the future, when funds are available to make the STM's metro network 100% universally accessible, the STM could save on elevator installation costs by utilizing elevators in buildings already connected to metro stations. At McGill, Peel (west side), Guy-Concordia, and Square Victoria, installing elevators between the metro platforms and the mezzanine levels would allow persons with disabilities to access certain neighbouring buildings and street level without any further upgrades. This alone would significantly improve the level of accessibility in the Indoor City. At Place des Arts, Peel (east side), Atwater, and Place d'Armes, ramps would need to be installed in addition to elevators between the platforms and the mezzanine, while at Lucien l'Allier elevators would need to be installed to connect adjacent buildings. In all cases, good signage would be important, in order for passengers to be able to easily navigate through the stations and to elevators that may be in adjacent buildings.

Figure 18 displays a comparison between two possible changes to the network for people with disabilties with the metro taken into account. The upper map (A) shows that while making the metro stations themselves more accessible will certainly help to increase accessibility, the increase is not as great as one would expect, as many of the neighbouring buildings surrounding and connected to each station are not accessible to people with disabilities. While the increase in accessibility of 141% that is shown in Map A does seem like a lot when compared to the existing level of accessibility for people with disabilities, it pales in comparison to the increase shown in the lower map (B). Map B shows that accessibility would be greatly enhanced by the upgrading of the four key locations, previously mentioned, as well as upgrading one additional metro connection, with a total increase in accessible retail space of 646% when compared to the existing level of accessibility for people with disabilities.

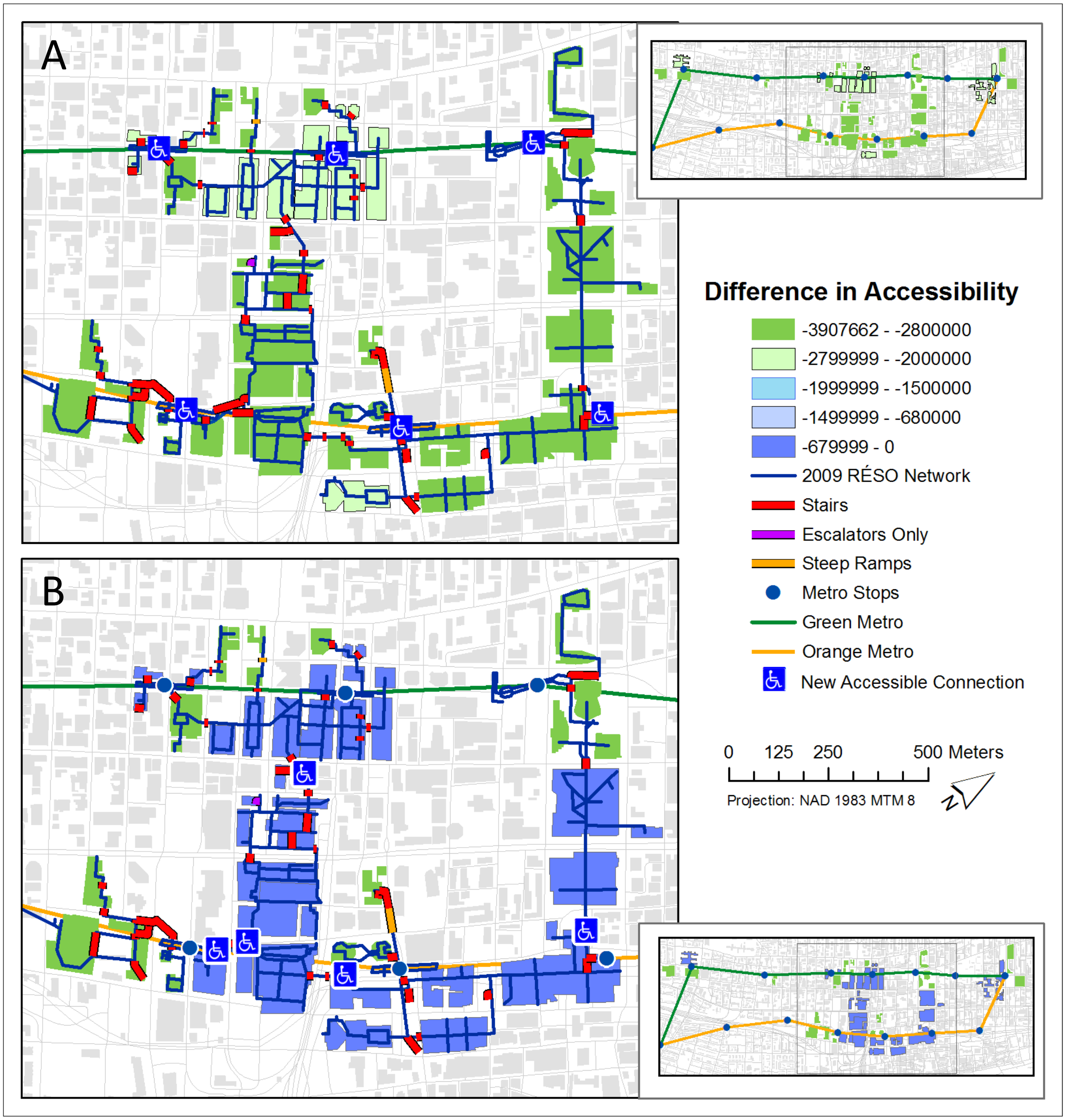

Figure 18: Map A shows the difference in accessibility for persons with disabilities between the base network and the disabled network with all Metro stations accessible. Map B shows the difference in accessibility between the base network and the disabled network with all Metro Stations and the four key locations accessible.

Eastern and Western RÉSO Accessibility

In the Atwater section of the Indoor City, shown in Figure 19, one ramp could easily connect Place Alexis-Nihon to Metro Atwater and Dawson College, ensuring accessibility for persons with disabilities between these busy trip generators. Providing universal accessibility to Westmount Square would be more difficult, although installing ramps may be possible. Only two elevators would be required to make the Atwater metro station accessible, one for each platform, as the existing elevator in Place Alexis-Nihon could be used to exit to street level. Figures 19 through 21 show existing Indoor City buildings and corridors in order to complement the text describing where accessibility improvements would be needed.

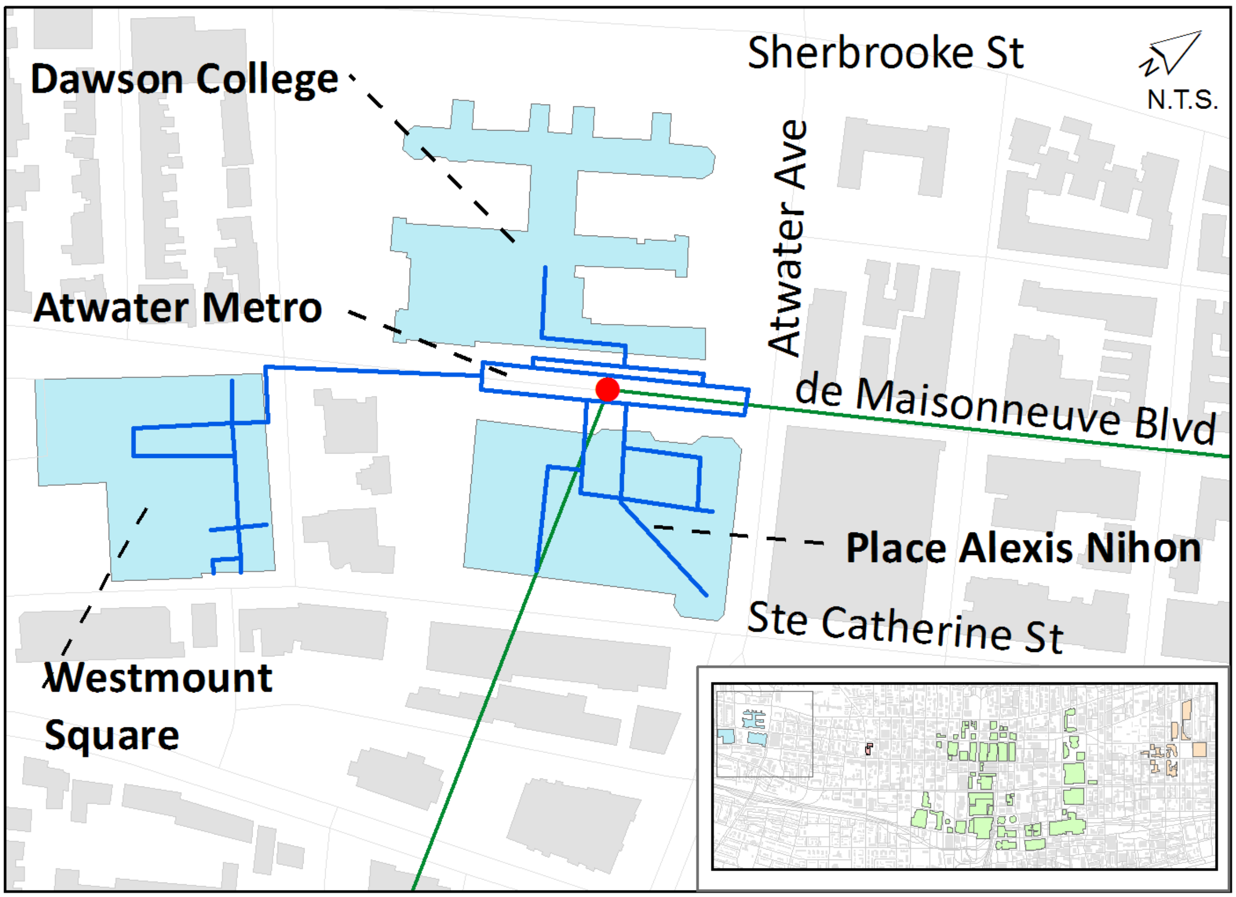

Figure 19: Close-up view of the Atwater section of the Indoor City

In the Guy-Concordia section of the Indoor City, shown in Figure 20, the mezzanine level of the Guy-Concordia metro station is already accessible via the adjacent Concordia EV building. In the next few years, additional Concordia buildings will become part of this

RÉSO section, as they are connected with newly constructed tunnels. Providing accessibility for persons with disabilities to the platform levels of this metro station could be a challenge due to its depth, but three elevators would likely be required: two between the platforms and the lower mezzanine, and one between the lower mezzanine and the upper mezzanine/ Indoor City level, while the existing elevators in Concordia's EV building could be used to exit to street level.

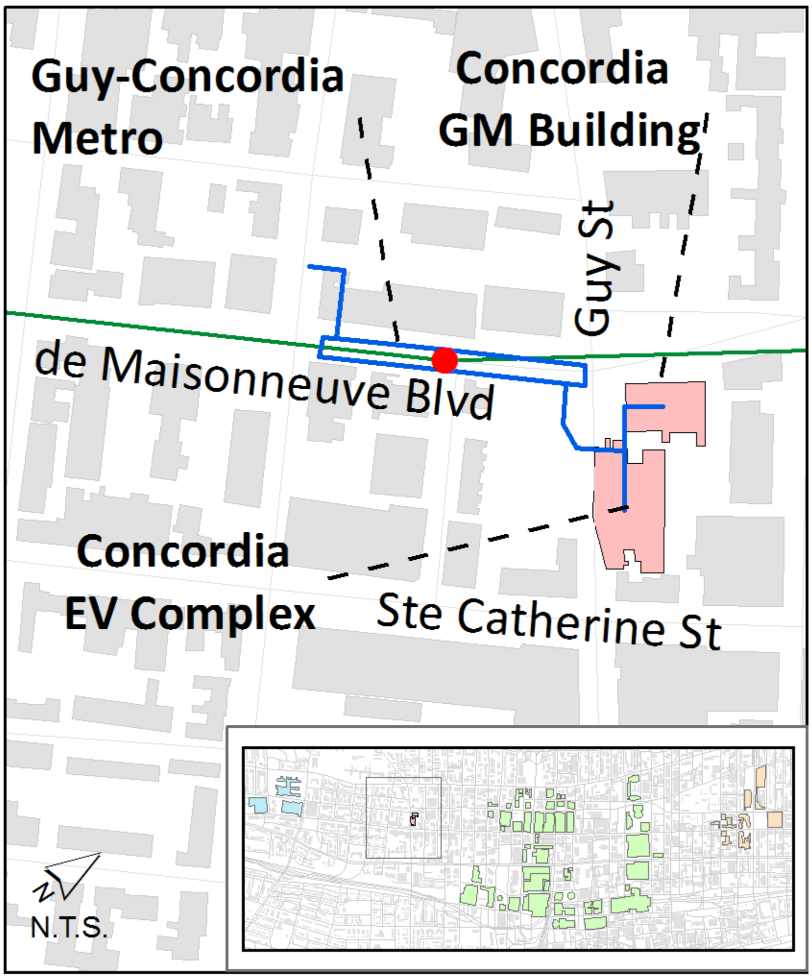

Figure 20: Close-up view of the Concordia section of the Indoor City

In the eastern Indoor City segment, shown in Figure 21, the Grande Bibliotheque and the entire UQAM campus are already accessible via the mezzanine level of the Berri-UQAM metro station. Additionally, in Fall 2009 the orange line platforms of the metro will become accessible. A new central bus station is currently being built just to the north of the existing one and will likely have an accessible connection to the metro upon completion, while the remaining existing building, Place Dupuis, would require a single elevator to become accessible.

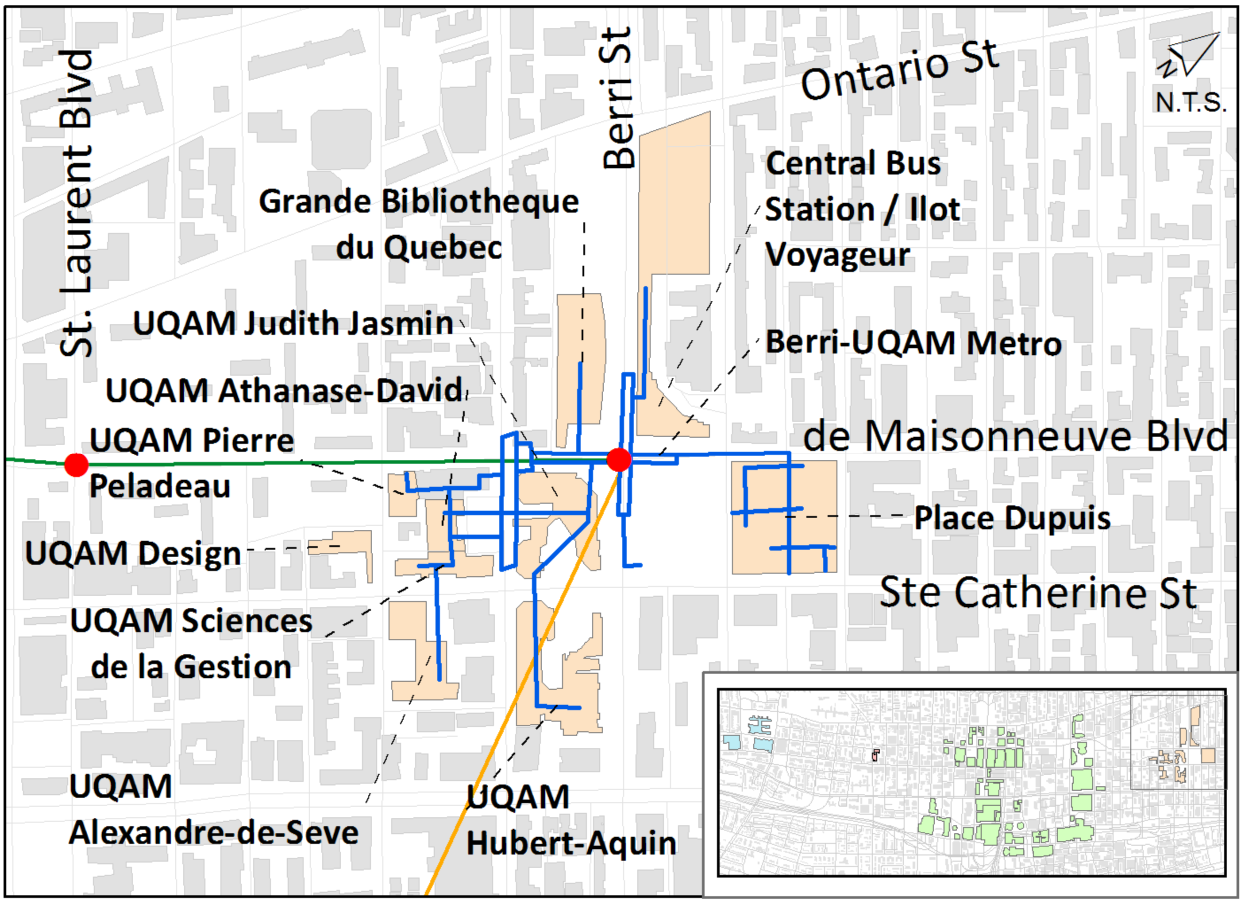

Figure 21: Close-up view of the Eastern section of the Indoor City

Recommendations

There are several initiatives that could be implemented in order to help bring the Indoor City closer to being accessible to all. These include physical improvements, such as new ramps or elevators; legislative improvements, including specific legislation relating to the accessibility of the Indoor City; as well as other improvements, including creating a website.

Physical Improvements

There are a number of physical improvements that could be made in order to bring the system to a higher level of universal accessibility. These improvements would involve adding ramps or elevators to critical locations in the indoor city; however, just the addition of an elevator is not enough to ensure that access is available for all, as other small and often overlooked improvements must be completed as well. This includes ensuring that automatic sensor or button operated doors are provided and in good repair, ensuring that doors are not overly heavy or difficult to open, and installing doors that are wide enough for wheelchairs to safely navigate. Other areas to improve include ensuring that there are no obstacles along a corridor, such as planters, benches, or sign pillars; ensuring that ramps are of an adequate grade; and providing adequate signage if access for persons with disabilities is in a different location than the default route, as shown in Figure 22.

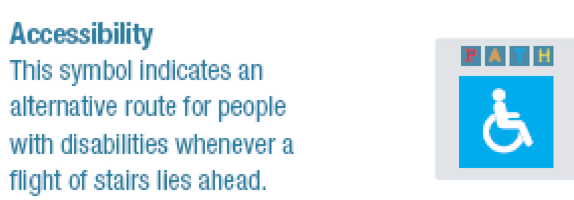

Figure 22: Accessibility signage example from Toronto's PATH. Source: PATH map

Since it is unlikely that every single connection between buildings in the Indoor City can or will be made accessible, the following list of connection upgrades and locations has been prioritized by ease of implementation, mainly in terms of how many ramps and elevators would need to be installed, and by how much it would improve access to retail for persons with disabilities, as determined by GIS analysis of the field study results.

1. Automatic door openers/wheelchair buttons where the doors are the only impediment to accessibility
2. Eaton Centre to Place Ville Marie connection
3. Gare Centrale to Place Bonaventure and to Metro Bonaventure connections
4. Palais des congrès to Complexe Guy Favreau connection
5. Place Bonaventure to OACI connection

As was shown in the analysis section, these upgrades are essential. Even so, many of the buildings comprising the Indoor City were built years before universal accessibility was regarded as necessary and cannot be easily upgraded. For those buildings that can be upgraded, it becomes an expensive proposition to do so as it is far more cost effective to make buildings accessible when they are first constructed, at an additional one percent of construction costs, rather than retrofit them at a later time for an additional cost of 17% [39]. Due to these costs, it can be difficult to encourage the owners of existing private sector buildings to implement these physical improvements, despite all of the benefits that these improvements would bring for building owners, tenants, and their customers.

One potential solution would be for the municipal or upper levels of government to implement a program which would subsidize or even completely fund accessibility improvements within the Indoor City. This would allow the City to achieve its goal of making the Indoor City accessible without creating too great a financial burden on the private sector. Also this process could be phased in over a number of years, allowing improvements to be conducted in stages, and combining these projects with building renovations and other maintenance projects where possible.

Improvements could also be made to the existing wayfinding system. Currently, the Indoor City can be a confusing place, with a labyrinth of passageways leading to all corners of the downtown core. To make wayfinding easier, Montreal should implement digital maps, easily allowing tourists and those unfamiliar with the Indoor City the ability to type in their destination and be shown a map with an option to print out directions. In fact, this feature did previously exist and was located at select junctions within the Indoor City, but was discontinued at some point after its installation in 2001 [40].

Legislative Improvements

Better accessibility regulations and standards are needed for the Indoor City. While the Ville Marie borough is responsible for developing the RÉSO's wayfinding system and publishing an official map, the municipal government currently does little else with regard to the Indoor City. In order to achieve universal accessibility, more centralized planning and coordination is recommended, along with improved legislation specifically targeting the Indoor City to ensure this.

New legislation regarding the Indoor City, to be passed at the provincial and/or municipal levels, could include mandating accessible connections whenever a new building is linked to the Indoor City or when significant renovations are done to an existing building. If private building owners were still reluctant to implement accessibility improvements, legislation could be also introduced to delegate control of the Indoor City's public space to the City of Montreal.

Indeed, the City could look into implementing a type of condominium ownership system in the Indoor City, similar to that recommended by Brown and Sijpkes over 20 years ago. An arrangement of this sort would greatly simplify the process of making the Indoor City universally accessible, as it would allow the city to implement improvements within the public space of the Indoor City, such as installing new ramps and elevators, without the complexity of negotiating with each building owner separately, and would also allow for economies of scale in awarding construction contracts for these improvements.

Organizational improvements

It is recommended that the City of Montreal create a dedicated team specifically to operate the Indoor City. This team could be overseen by the City or the Ville Marie borough and would be responsible for liaising with the private sector to implement a universal accessibility program for all buildings and connections, where feasible. Other responsibilities could include fully implementing the existing wayfinding program by installing signage in all necessary locations, both inside buildings and at the surface; updating the wayfinding signage to show alternate routes where applicable for mobility device users; creating and maintaining a RESO website (discussed further below); and working with Tourism Montreal to promote the Indoor City both here and to tourists from around the world. In addition, ensuring that all RÉSO signage is bilingual, as opposed to the current French-only signage, would simplify navigation for both tourists and the significant local Anglophone population.

Website

In today's world, the Internet is invaluable for providing information on nearly any topic, and the Indoor City should be no exception; however, there is currently no website for RÉSO. For a network that calls itself the largest interconnected retail network in the world, it is strange that the RÉSO has such a small web presence. In fact, except for the relevant sections of Montreal's Master Plan, the only item relating to the Indoor City on Montreal's website is a link to the official map on the home page of the Ville Marie borough. Otherwise, any information on the internet related to the Indoor City must currently be accessed on other websites, such as the STM, Tourism Montreal, or other travel-related sites.

Therefore, it is recommended that the Ville Marie borough develop a RÉSO website. While a website for the Indoor City would be useful on many fronts, it would be especially helpful for persons with disabilities. This website could include information on what parts of the system are accessible to persons with mobility impairments and where accessibility barriers on the system are located, as well as a map highlighting this information.

CONCLUSION

At present, Montreal's Indoor City is largely inaccessible to persons with disabilities. This has been allowed to occur mainly because much of the Indoor City was built before universal accessibility became a mainstream issue, and before accessibility legislation was implemented. Nevertheless, the Indoor City is public space and should be accessible to everyone. A barrier-free Indoor City would help remove the constraint that the current built environment poses to people with disabilities and allow for equality in this segment of the city.

This study has shown the power of creating newly accessible connections within the Indoor City and the great extent that these connections will benefit people with physical disabilities. While future additions to the Indoor City will likely be accessible, given the minimal additional costs to do so, upgrading current facilities is an expensive proposition. Therefore, important connections, such as the aforementioned four key locations, should be prioritized in any accessibility-related renovations, as this will allow for the greatest increase in accessibility at the lowest cost.

It is important to remember that everyone benefits from accessibility improvements, including parents with strollers, shoppers loaded down with heavy grocery bags, and elderly persons who might have difficulties opening heavy doors, and not just people with disabilities. Increased accessibility will become especially important in the near future as the average age of the population continues to rise.

The efforts of the STM in making the metro system accessible will also help in connecting all parts of the Indoor City network, while at the same time saving money in paratransit costs in the long run. Other simple and cost effective solutions to the issue of Indoor City accessibility do exist, however, such as upgrading doors with automatic openers, and implementing new signage to illustrate alternate routes for persons with disabilities. Legislative and organizational improvements, such as laws ensuring that future Indoor City connections will be accessible, and a dedicated Indoor City municipal department to manage the network and ensure that the Indoor City remains public space, will also go a long way towards ensuring that the RÉSO becomes more universally accessible in the future.

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APPENDIX 1

Table of Existing Indoor City Barriers and Recommended Improvements

Building/Connection	Existing Barrier	Recommended Improvements	New Elevators	New Mini-Elevator	New Ramps	New Doors
Tour Scotia to Tour La Maritime	13 stairs, doors	1 elevator (or possibly a ramp); automatic door	1			1
Tour La Maritime	Doors	Automatic door				1
Tour La Maritime to 1001 de Maisonneuve West	16 stairs	2 mini-elevators or 2 wheelchair stair lifts or possibly a ramp		2		
1001 de Maisonneuve West/Peel Metro Entrance NE	34 stairs, doors	1 elevator; automatic doors	1			1
2000 Peel/Peel Metro Entrance NW	45 stairs, doors	1 elevator; automatic doors	1			1
1140 de Maisonneuve West	Door	Automatic door				1
1140 de Maisonneuve West Stanley St. Peel Metro Entrance	43 stairs, doors	None - Elevator in main building entrance can be used				
Cours Mont Royal - Peel Metro Entrance SE	40 stairs, doors	None - Elevator in main building entrance can be used				
Cours Mont Royal - North-west side	6 stairs, doors	2 ramps; automatic doors			2	1
Cours Mont Royal - South-east side	15 stairs	3 ramps			3	
Place Montreal Trust to Tour Industrielle Vie	24 stairs, 2 doors	2 mini-elevators or 2 wheelchair stair lifts plus 2 automatic doors		2		2
Tour Industrielle Vie to 2200 McGill College	Steep ramps	New ramps with a shallower grade			1	
Complexe Les Ailes to McGill Metro	5 stairs, doors	1 ramp; automatic doors			1	1
Promenades Cathedrale - West corridor north	7 stairs	1 ramp or mini-elevator			1	
Promenades Cathedrale - West corridor south	7 stairs	1 ramp or mini elevator			1	
Promenades Cathedrale to The Bay	12 stairs	1 elevator or mini-elevator		1		
The Bay to 2021 Union	Bollards	Remove shopping cart bollards				
2001 University to 2075 University	2 doors	Automatic doors				2
625 President Kennedy - Entrance from 2075 University	5 stairs, doors	New ramped entrance or new mini-elevator, automatic door			1	

2075 University to 680 Sherbrooke West	25 stairs, 2 doors	1 elevator; 2 automatic doors	1			2
Eaton Centre to 733 Cathcart	17 stairs	1 elevator or mini-elevator		1		
733 Cathcart to 1253 McGill College	9 stairs, doors	1 mini-elevator; automatic doors		1		
1253 McGill College	18 stairs	1 elevator	1			
733 Cathcart to Place Ville Marie	3 stairs + 19 stairs, doors	1 ramp + 1 elevator or mini-elevator; automatic doors	1	1		
4 Place Ville Marie - Entrance from Shopping Concourse	Escalators only, doors	1 elevator; automatic doors	1			1
1 PVM - Entrance from Shopping Concourse	26 stairs	Better signage for existing elevator				
PVM to QE hotel	1 door	Automatic doors				1
PVM to Gare Centrale - West side	34 stairs	Better signage for existing accessible connection via QE Hotel				
PVM to Gare Centrale - East side	36 stairs, door	1 elevator and automatic doors, or signage for alternate connection via west side	1			1
Gare Centrale to Place Bonaventure "le passage"	26 stairs + 5 stairs, door	1 elevator; automatic doors	1			1
Place Bonaventure "le passage" to 1001 de la Gauchetiere quai nord	5 stairs, doors	1 ramp			1	
1001 de la Gauchetiere quai nord to Bonaventure Metro	55 stairs	1 elevator	1			
Bonaventure Metro to 1001 de la Gauchetiere quai centre sud	60 stairs	1 elevator	1			
1001 de la Gauchetiere quai centre sud to Street level	30 stairs	1 elevator	1			
1001 de la Gauchetiere quai nord to Street level	34 stairs	1 elevator	1			
Bonaventure Metro to Marriot Hotel	16 stairs	1 mini-elevator; automatic doors		1		1
Bonaventure Metro to Gare Windsor	84 stairs	2 elevators	2			
Gare Windsor - Metro Bonaventure Street Level Entrance	25 stairs	None - Elevator in main building entrance can be used				
Gare Windsor - North side	10 stairs	1 ramp or mini-elevator			1	
Gare Windsor - South side	39 stairs	New stop on existing elevator to serve lower level of Gare Windsor				
Gare Windsor to Bell Centre	35 stairs	1 elevator	1			
Bell Centre - South side	2 doors	2 Automatic doors				2
Gare Lucien L'Allier Street Entrance and link to Metro	4 doors	4 automatic doors				4

Gare Lucien L'Allier to Metro Lucien L'Allier	30 stairs, door	Elevator; automatic doors	1			1
Metro Bonaventure to 1250 Rene Levesque	11 stairs, door	Mini-elevator; automatic doors		1		1
1250 Rene Levesque	6 stairs + escalators only	1 ramp + 1 elevator or mini-elevator; automatic doors		1	1	1
Place Bonaventure "le passage" to Place Bonaventure	38 stairs + 7 stairs	1 ramp + 1 elevator	1		1	
Metro Bonaventure to Place Bonaventure	64 stairs	1 elevator	1			
Place Bonaventure - east side	72 stairs	1 elevator	1			
Place Bonaventure to OACI	32 stairs	1 elevator	1			
OACI - west side	21 stairs + 20 stairs, doors	2 elevators; automatic doors	2			1
OACI - east side	2 Doors	2 automatic doors				2
Square Victoria Metro - Northern Square entrance	22 stairs	None - Parisian-style Guimard metro entrance cannot be retrofitted				
OACI and Centre CDP Capital to Square Victoria Metro	42 stairs	1 elevator	1			
Square Victoria Metro to Tour BNC	80 stairs	1 elevator	1			
Square Victoria Metro to 1080 Beaver Hall	Steep ramp, 116 stairs	None - Too many elevators would be required				
1080 Beaver Hall - Square Victoria North Metro Entrance	24 stairs	None, see above note				
Square Victoria Metro - Southern Square Entrance	54 stairs	1 elevator, or signs directing wheelchair users to the Tour de la Bourse/Place Victoria				
Square Victoria Metro to Tour de la Bourse	1 door	Automatic doors				1
Tour de la Bourse	Lack of signage	Improved elevator signage				
Place Victoria to Delta Hotel	1 door	Automatic doors				1
Square Victoria to Centre de commerce mondial de Montreal	41 stairs, door	1 elevator; automatic doors	1			1
Centre CDP Capital	2 doors	Automatic doors at east and west Indoor City connections				2
Place Jean Paul Riopelle Indoor City Entrance	Stairs	Signs directing wheelchair users to the Palais des congrès				
Palais des congres to Place d'Armes Metro	3 stairs + 9 stairs	2 ramps			2	
Palais des congres to 205 Viger	1 door	Automatic doors				1
Palais des congres to Complexe Guy Favreau	33 stairs	1 elevator	1			

Complexe Desjardins to Place des Arts	23 stairs	1 elevator or mini-elevator	1			
Place des Arts to Place des Arts Metro	8 stairs	1 ramp			1	
Place des Arts Metro to UQAM Science Campus	23 stairs, 2 doors	1 elevator	1			2
Totals			29	11	17	38

Location	Notes
All buildings with mini-elevator recommendations	Mini-elevator is a type of elevator for 2 passengers only - a person with disabilities and an attendant
Tour Industrielle Vie to 2200 McGill College	Access is via a common parking garage between the two buildings
Place des Arts Metro to UQAM Science Campus	The current revolving door to UQAM is inaccessible, but an accessible connection exists by exiting outside and then immediately back inside through normal doors which could be made accessible with wheelchair buttons.
2000 Peel/Peel Metro Entrance NW	Currently must walk outdoors 3m to travel between 2000 Peel and Peel Metro Entrance