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. Comparable indoor cities also exist elsewhere in North America. While previous studies have examined the network growth and its effects on the levels of accessibility to retail space within the RÉSO, 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 through the RÉSO 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.

INTRODUCTION

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.

Currently, having full access to all services within the Indoor City is challenging, if not impossible, for people with mobility impairments. Renovating the Indoor City to implement universal design is necessary to ensure that it is accessible to everyone in the future. Therefore, this study will examine the current accessibility of the RÉSO for people with mobility impairments and suggest modifications to the existing network.

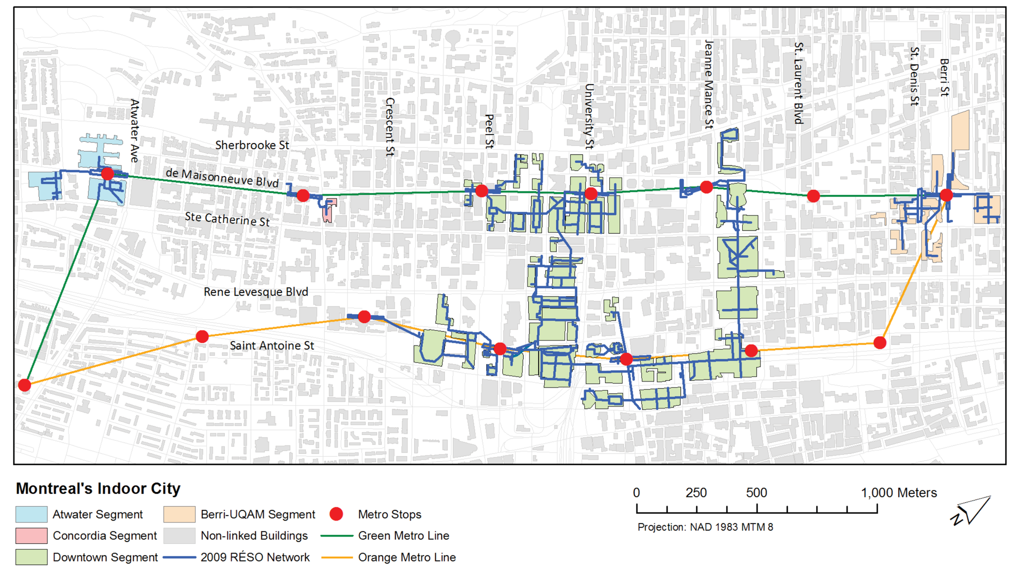

Figure 1: Indoor City Base Map

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. Data that was collected included the locations of all access and egress points, level changes, and any other barriers located on the main path of the Indoor City. 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, a measure of potential opportunity, is measured here using the cumulative opportunity measure. 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 each building within the Indoor City will be measured, but will not be limited by distance.

The network was then analyzed to determine the optimal locations in which to implement new 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 improvements such as automatic doors could make the connection accessible. 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 improvements could greatly increase the network's level of accessibility.

ANALYSIS AND DISCUSSION

A total of 69 buildings have been linked into the Indoor City network between 1962 and 2006, connecting a total of 45,372,176 sqft of office space and 3,907,662 sqft of retail space. While this growth has led to an increase in the number of opportunities that can be reached, this does not hold true for a person with physical disabilities. While almost all Indoor City buildings are accessible on their own, travelling between them without returning to street level is often quite difficult.

Two networks were produced to begin comparisons with: the Baseline Network for persons who are ambulatory, and the Inaccessible Network (Figure 2), reflecting current conditions for people with mobility impairments. Whereas in the existing downtown network, a person with no disabilities can reach any other connected building, in the Inaccessible network, a person with disabilities can just reach a handful of other buildings.

Figure 2: Baseline Network Map

By looking at the "difference map" (Figure 3), which shows current accessibility and the difference in the level of accessibility between a person without any mobility impairments and a person with a physical disability, it is clear that the majority of the Indoor City is not currently accessible.

To make the entire Indoor City 100% accessible for persons with physical disabilities, several barriers need to be overcome. including the construction of at least 17 ramps and at least 40 elevators, along with 38 locations where automatic doors would need to be installed. Implementing all of these improvements would be quite expensive; however, sixteen locations were identified where doorways are the only impediment. Installing automatic doors at these locations would increase accessibility by 24%, compared to the existing Inaccessible Network.

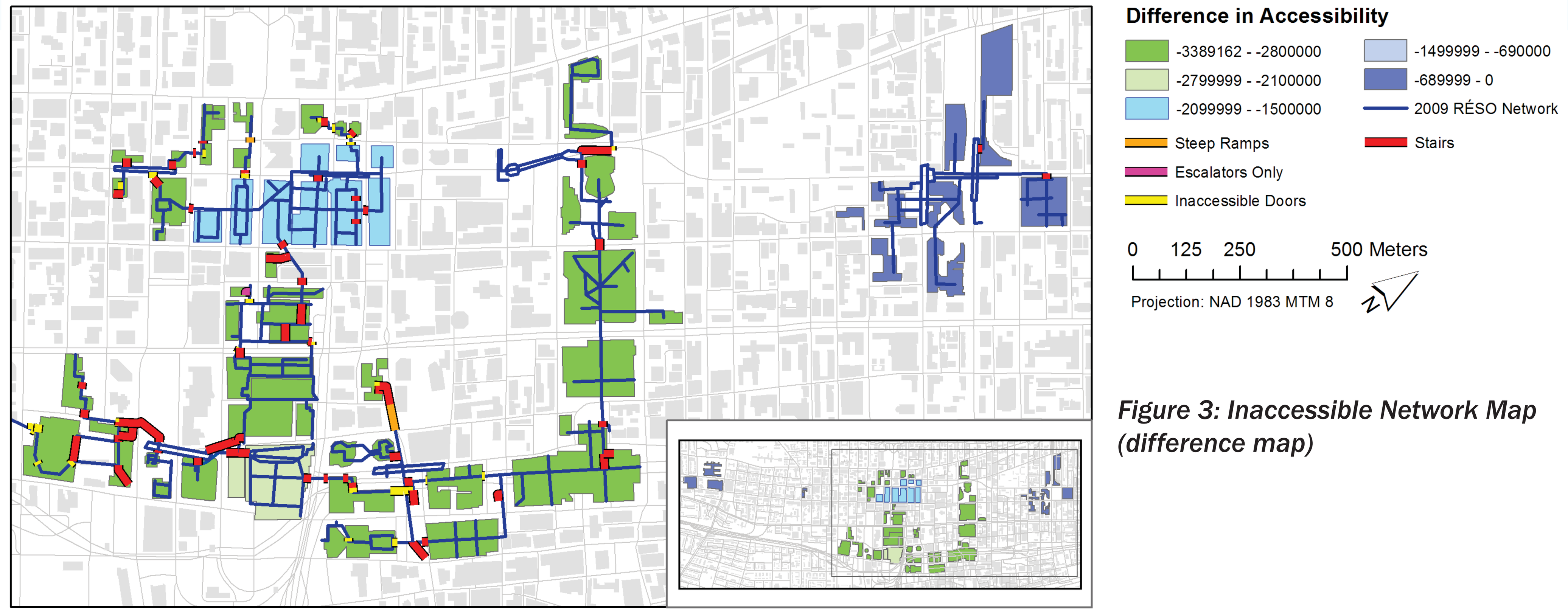

Figure 3: Inaccessible Network Map (difference map)

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, in terms of bringing the Inaccessible Network closer to the Baseline Network. The single greatest improvement in universal accessibility in the Indoor City would be made by upgrading the corridor between the north and south-western segments. Connecting this section of the Indoor City would double the connected space that people with disabilities can access, requiring only the installation of two elevators, and resulting in an accessibility increase of 113% in terms of the total amount of retail space that can be accessed compared to the existing Inaccessible Network.

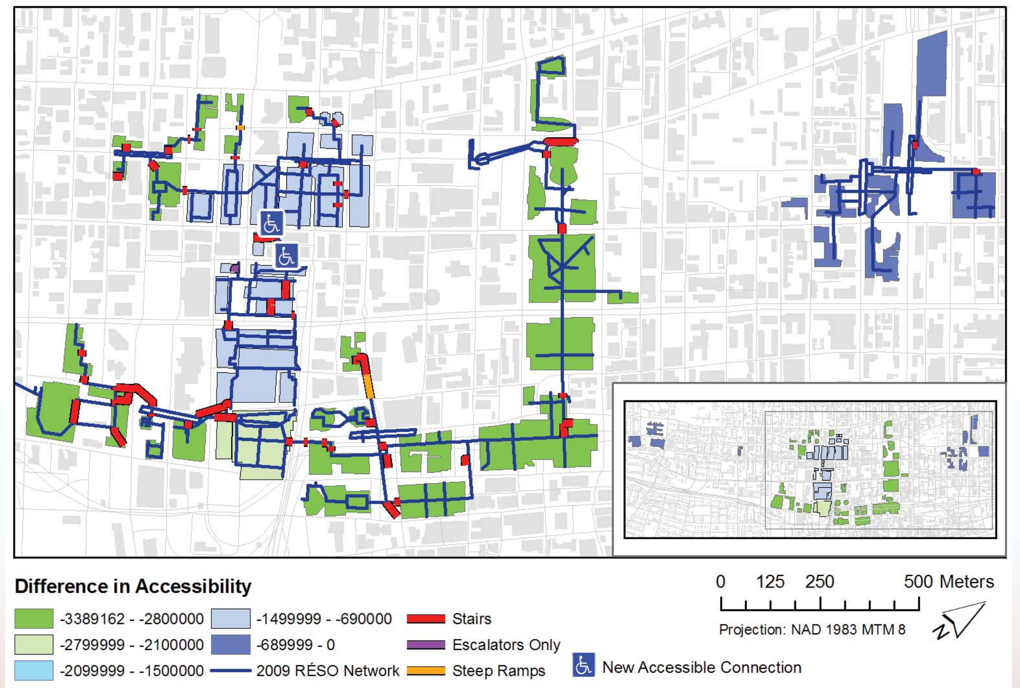

Figure 4: Inaccessible Network w/Eaton Centre-PVM Accessible

There are four key locations in the Indoor City that, if all made accessible, would result in the greatest increase in accessibility. Installing nine elevators at level changes at these four locations, 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 existing Inaccessible Network (Figure 5). 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 everyone, including persons with disabilities, and represents the most cost effective approach.

An ongoing project to enhance the accessibility of Montreal's metro system will also benefit the Indoor City. Figure 6 displays a comparison between two possible changes to the network for people with disabilities, including the metro system. The upper map (A) shows that while making the metro stations accessible will increase accessibility by 141% compared to the existing Inaccessible Network, it pales in comparison to the increase shown in the lower map (B), since many of the buildings connected to each station are not accessible to people with disabilities. 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 connection with two elevators, resulting in a total accessibility increase of 646%.

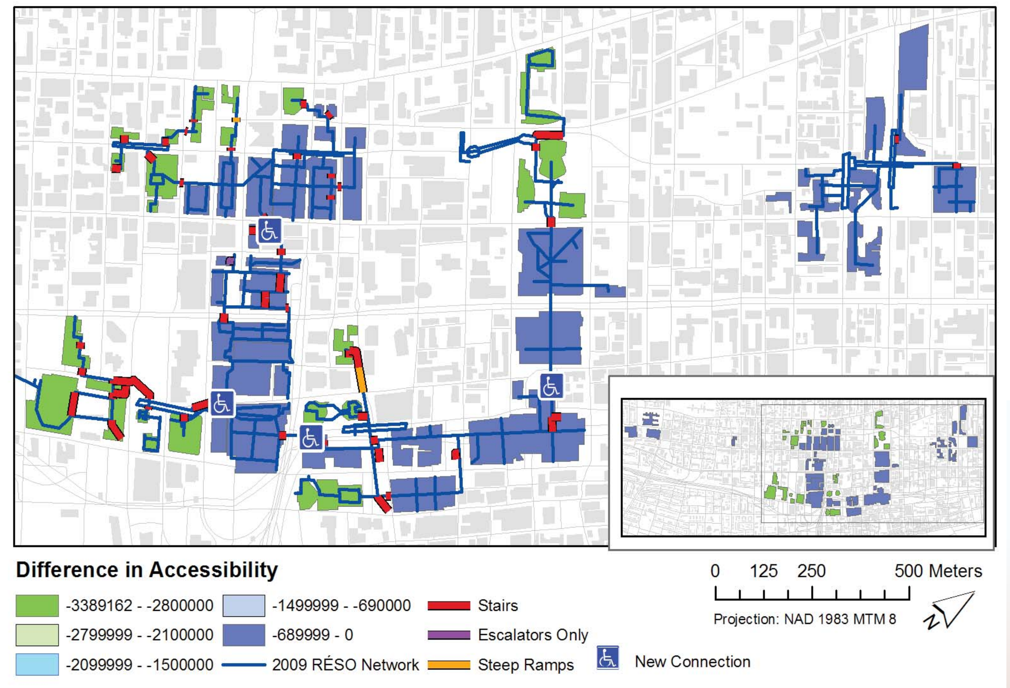

Figure 5: Inaccessible Network w/Four Key Locations Accessible

Figure 6: Inaccessible Network w/Metro Accessible (Maps A&B)

CONCLUSIONS AND RECOMMENDATIONS

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. While future additions to the Indoor City will likely be accessible, upgrading existing facilities is an expensive proposition. Therefore, key connections should be prioritized in any accessibility-related renovations. Other simple and cost effective solutions to the issue of Indoor City accessibility do exist, however, such as installing automatic doors, and implementing new signage to illustrate alternate routes. 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, would also help to ensure that the RÉSO becomes more universally accessible in the future.

TRANSPORTATION RESEARCH BOARD ANNUAL MEETING
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