TROTTOIR BARRÉ: Investigating Montreal construction policy and its implications for the pedestrian realm

Supervised Research Project
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Abstract

This supervised research project attempts to assess the impact of current construction practices on the pedestrian realm and compare these impacts to new municipal policy set to improve pedestrian conditions in construction sites. Current construction practices are audited based on present urban design qualities and underlying public space theories. A conceptual vocabulary is established to assess both the physical construction sites, and the policy landscape that they occur within. This research is undertaken in the City of Montréal, where new policy has been adopted to protect pedestrian and cyclist mobility within construction sites. The policy is comparatively analyzed against similar policies from other municipalities to determine the ability for Montreal's policy to create positive change.

Résumé

Ce projet de recherche supervisé tente d'évaluer l'impact des pratiques de construction actuelles sur le domaine piétonnier et de comparer ces impacts à une nouvelle politique municipale visant à améliorer les conditions des piétons sur les sites de construction. Les pratiques de construction actuelles sont vérifiées sur la base des qualités du design urbain actuel et des théories sous-jacentes de l'espace public. Un vocabulaire conceptuel est établi pour évaluer à la fois les sites de construction physiques et le paysage politique dans lequel ils s'inscrivent. Cette recherche est entreprise dans la ville de Montréal, où une nouvelle politique a été adoptée pour protéger la mobilité des piétons et des cyclistes sur les chantiers de construction. La politique est analysée comparativement à des politiques similaires d'autres municipalités afin de déterminer la capacité de la politique de Montréal à créer un changement positif.

Figure 1: Signage on sidewalk

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Ode to the Cone

The orange construction cone is a reluctant symbol of Montreal. Firstly, a simple tool to demarcate dangers of construction sites, they have transformed into a ubiquitous fixture of Montreal streetscapes. Every year, there are at least 10,000 orange cones dispersed throughout the Island of Montreal. These cones obscure a much deeper issue with Montreal's streets – the messy, confusing, and ceaseless nature of road construction practices in Montreal.

They symbolize the feeling of frustration with seemingly never-ending construction that is all too often voiced by Montrealers, but that frustration has metamorphosed into the creation of an icon. The orange construction cone can be found alongside other symbols of Montreal on souvenirs, art, and (unsurprisingly) memes. Accepting the simultaneously beloved and despised orange construction cone as an embedded element of the Montreal urban form can lead to formalized standards of use that can alleviate the frustration, while celebrating this unique symbol of Montreal.

Figure 2: Stockpile of cones

1: Introduction

On May 12th, 2021, the Montreal Charter of Construction Sites was adopted by the City of Montreal. The Charter of Construction Sites is a non-legislative, non-legally binding document that outlines various improvements that can be made to the current situation of Montreal's construction management. The Charter is a public-facing response to common annoyances that are shared amongst residents towards the city's construction management. The overall aim of the Charter is to improve the design, function, and organization of construction projects to better mitigate the negative externalities of construction work on citizen quality of life.

Abstractly, this Charter had the potential to be a great turning point in the management of Montreal's construction sites, but that is much easier said than done. Construction sites in urban and suburban contexts are complex by nature. To the general public, they are often a messy and noisy inconvenience, but to cities and construction firms they are an intricate balance of public interest, safety, and infrastructure building. Sweeping legislation and extraordinary powers of control would be required to make construction sites meet the needs of all stakeholders. The Montreal Charter of Construction Sites is unable to make those extensive changes, but that's not the intention of the document. The intention of the document does remain unknown but does not hold the legal enforceability to produce reform. Perhaps the purpose of the Charter is purely symbolic – as a gesture of solidarity toward citizens – but does not (yet) have significant legal power.

The Charter consists of four main goals, entitled 'levers,' that aspire to prioritize accessibility, manage negative impacts on affected people, improve ongoing communication, and reduce the ecological footprint of construction practices. These four goals are quite broad and aim to improve a wide variety of common construction nuisances, but there is an emphasis on the ubiquity of the orange construction cone. This emphasis is mirrored in the public response to the Charter, where most news and opinion pieces reference the cone as both a celebrated and despised symbol of the city.

The Charter is a response to the frustrating reality of Montreal's construction practices. Montreal is currently undergoing an intensification in the number of major construction sites, from 32 in 2019, 38 in 2020, and increasing to 48 in 2021 (Mobilité Montréal, 2021). In addition to that increase, the municipality of Montreal and its surrounding boroughs complete more than 500 minor construction projects each year (City of Montréal). These numbers do not include private construction on privately-owned land, so the real number of active construction sites in Montreal is estimated to be much higher, but also increasing. This intensification is caused by two factors, the first being a rapid population increase throughout the Montreal area. Population growth in the central areas of the CMA has increased by 24.2% between 2016 and 2021, with all peripheral suburbs growing at a rate between 2% and 7% (Statistics Canada, 2022). This rapid growth in only five years has caused a hurried need for more housing but is also introducing a strain on existing infrastructure. Like many Canadian CMAs facing the so-called infrastructure gap (Mackenzie, 2013), Montreal has undermaintained its potable water, sanitary and storm sewers, and roads in recent decades, and it is now facing the challenge of mitigating the existing infrastructure deficit and providing service to new residents (City of Montréal, 2021). The COVID-19 pandemic has been an opportunity to revitalize the economy through infrastructure construction and re-launch the construction sector with improved funding (Chamber of Commerce of Metropolitan Montréal, 2020). There is a broad opportunity for Montreal and private construction firms within Montreal to provide reliable and resilient infrastructure to residents through construction, but the temporary spaces of construction often frustrate the very residents that they are aiming to please in the future.

The initiative to improve construction sites grows from the Mobility Squad, a 2018 intervention to ensure the un-impeded mobility of Montreal residents by enforcing mobility legislation in an accountable and public-facing way. While not focused solely on construction sites, the squad does respond to unauthorized or non-compliant construction projects that are negatively impeding pedestrian mobility (City of Montréal, 2021). The squad can issue fines, thus giving this government body much more power to enforce mobility laws. The Mobility Squad has been met with an extremely positive public response, receiving more funding each year since 2018 and was able to expand to all boroughs of Montreal (Global News, 2020). This public support for the Mobility Squad was likely the impetus for Montreal to produce the Charter and demonstrate their commitment to pedestrians' quality of life.

This study, undertaken as part of a graduate degree in urban planning, aims to explore a context-specific issue at the nexus of construction management, infrastructure renewal, and impacts on everyday pedestrian movement. Previous research examining the trends and patterns of construction and maintenance has been focused largely on vehicular traffic. The negative impacts on vehicular traffic in work zones has long been established, and there is a wide breadth of factors that cause those negative impacts. Safety (Tsyganov, 2005; Garber, 1990), management tactics (Graham, 1994; Levine, 1984), and traffic modelling (Hou, 2014) have all been well-studied in the context of urban freeways. Freeways are devoid of pedestrian traffic and minimize vehicle traffic disruptions by the nature of controlled access, therefore missing the messy and complex interactions between pedestrians, vehicles, and their environments. This research explores the ability for pedestrians to move through and understand construction sites located on road typologies where pedestrians are permitted, focusing on Montreal as a case study.

The study of walkability is the basis for pedestrian mobility and preference research. Walkability is a nebulous, multidimensional concept that is used to describe how someone senses a certain space to be 'walkable', as in they enjoy or would enjoy walking in that space. Rather than creating one definition of walkability, an inherently subjective phenomenon, walkability is a concept that is influenced by perceived urban design qualities and the desired accessibility outcomes of pedestrians (Forsyth, 2015). The urban design qualities that influence perceptions of walkability were usefully catalogued and assessed by Ewing & Handy (2009) and have since been both refined and expanded. The qualities studied were imageability, enclosure, human scale, transparency, and complexity (ibid., 2005). Such qualities are prone to disruption in construction zones, but those disruptions are rarely considered in literature. In the specific context of roadway construction, the temporary materials required to separate pedestrians from the active work zone may communicate different information to road users than the information from the usual urban form that is being obscured. The primary information that gets communicated to users

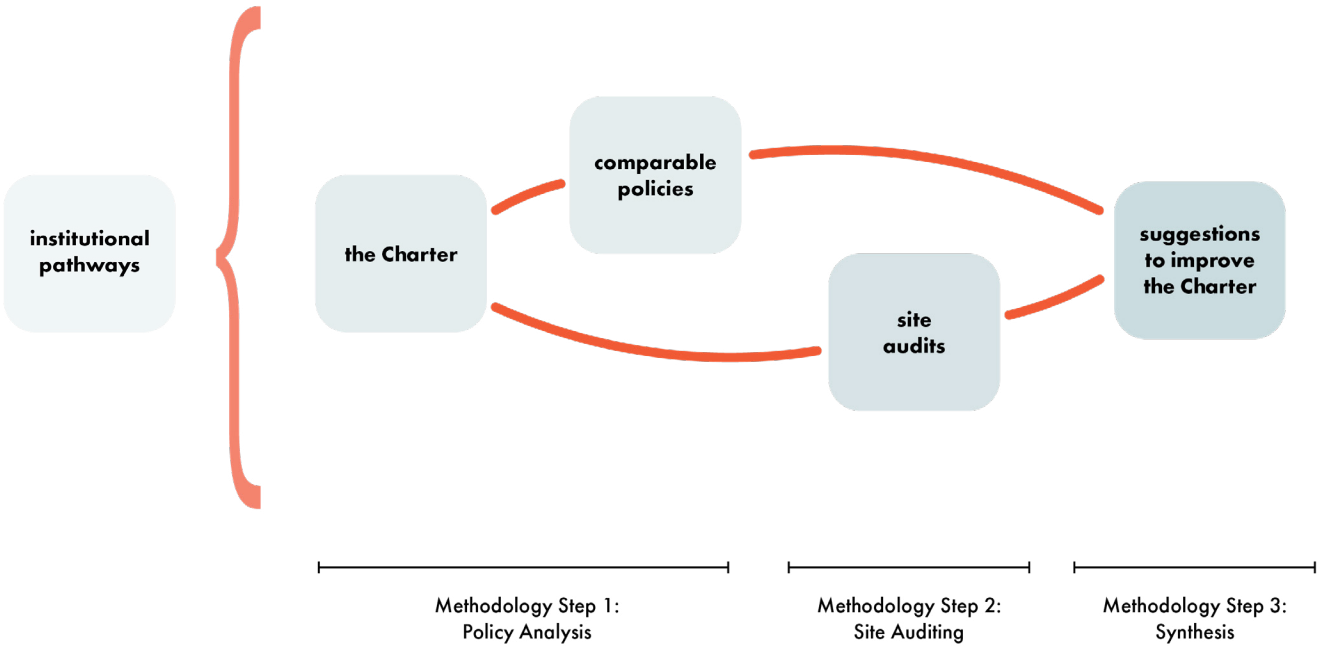

Figure 3: Conceptual framework

is how to interact and use the space, which is the theory of affordances (Chong, 2020). First presented by psychologist James Gibson in 1977, this influential theory proposes that users have a relationship with their environment that is built on what the environment can offer or provide. That disrupted communication is the foundation for assessing construction sites based on their ability to communicate urban design qualities with the end goal of enhancing pedestrian intelligibility of the site.

Pedestrian mobility is another factor of active transportation studies that is inherently disrupted by roadway construction. There is a disconnect between the desired mobility outcomes, noted as a definition of perceived walkability (Forsyth, 2015), and the mobility that can be realized in construction sites. As cities attempt to move away from championing vehicular mobility and introduce planning practices that support and encourage sustainable mobilities as well as improved accessibility (such as public transit, cycling, and walking) (Cervero, 2013), there must be appropriate infrastructure constructed to support this modal transition and maintained through time (Hickman, 2013). Missing from this literature is the study of how to balance the promotion of sustainable mobility while the necessary infrastructure is being constructed. As established above, the practice of construction is complex and the impact on the built environment and residents is not consistent or linear. The formalized and institutionalized practice of construction does not aspire to promote pedestrian walkability or mobility during construction, only after. This research explores institutional pathways that can better integrate positive pedestrian experiences into temporary construction spaces through comparing the goals of the Montreal Charter of Construction Sites with real-life construction practices.

This research investigates the intersection of urban design qualities influencing walkability and pedestrian mobility with real-life construction practices in Montreal. That intersection is the physical manifestation of construction impacts on the pedestrian realm, and this is measured against the goals of the Montreal Charter of Construction Sites. The analysis of the Charter is also compared to similar initiatives undertaken by major cities to mitigate the negative impacts of construction on pedestrians. Finally, the Charter is assessed on its ability to create positive change in Montreal's construction practices.

Municipal affairs, urban governance, and planning are complex fields of endeavour, with various competing goals and stakeholder intentions. Recognizing this complexity, and working with the uncertainty it entails can guarantee that pieces of legislation like the Charter can be improved upon to truly create positive change for citizens.

The city, as both a phenomenon and a concept, is both an institution and a dynamic assemblage of individual institutions (Sorensen, 2017). These institutions interact and operate amongst each other in a complex network of bureaucracy that, over time, becomes so engrained into the function of the city that it becomes challenging to determine the relationship among the individual institutions (Sorensen, 2015). The interdependence among institutions that is cultivated in urban operations is known as 'path dependency,' where the ways in which institutions interact becomes ossified over time and thus increasingly challenging to change (ibid., 2015). This path dependency creates a scenario where immense effort must be put into making changes and small steps are insufficient. These path dependencies become even more engrained in the operation of the municipality by the silo effect, where different institutions take on different yet interconnecting duties, and are faced with issues of coordination and information sharing (Pettit, 2019). The desire to move from inefficient institutional silos toward a network of interdependent and streamlined institutions is at the forefront of urban governance progress, and that change can help bolster the efficacy of minor pieces of legislation (Rasmussen, 2007) . In the context of this research, the challenge of adapting the Charter to make significant changes is framed within the institutionalized, yet siloed, relationship between Montreal's municipal infrastructure, urban planning goals, and construction contractors.

Problematizing the outcomes of urban construction on pedestrians within the framework of the multifaceted institutionalized city requires the recognition that urban planning is a collection of wicked problems. Rittel and Webber (1973) first coined the term 'wicked problem' to describe social policy problems that have no definitive descriptions or solutions . While wicked problems can be analyzed based on the quality of related policies that aim to solve aspects of the problems, they pose a greater challenge for the creation of meaningful and comprehensive policy (Daviter, 2019). Few broad theories are posed to tackle wicked problems, as they are all unique by nature and require a context-specific solution that collaborates between all siloed institutions and stakeholders (ibid., 2019). To address an issue like Montreal's disruptive construction, enormous effort would have to be expelled to tackle the wicked nature of the problem, and no single policy document like the Charter can do that.

Figure 4: Excess signage

Methodology

This research project combines construction site auditing and policy analysis. Comparing the current physical manifestations of planning policy to the goals and intentions of new planning policy can determine the validity of new planning policy, and better ascertain how to improve planning practices. Researching both the individual sites and policy together gives insight into the wicked problem of pedestrian construction management, while parsing them individually ensures the robustness of the research.

First, the Montreal Charter of Construction Sites is carefully analyzed based on its potential to create positive change. The strengths and weaknesses of the Charter are compared to other similar pieces of legislation from other cities to compare strategies employed for improving construction sites for pedestrians. Next, the sites are audited using field visits and non-participant observation of site users. The sites are then comparatively audited based on the Charter of Construction Sites, where opportunities and limitations of the policy are also explored in the Montreal context. Finally, policy suggestions and recommendations are offered to improve the Charter and its application, based on comparative policies and context-specific construction site conditions in Montreal.

Policy Analysis

The first component of this research involved analysis of the Montreal Charter of Construction Sites on its ability to achieve its own goals. This entailed identifying the overt and subtle goals for comparison with the levers of implementation within the Charter. The goals were evaluated on four separate criteria: why those goals were chosen, what effect has the goal caused on the policy outcome, what progress has been made on the goals, and why the goal might not be achievable (Minnery, 1993). The Charter was also assessed based on the tone used to communicate with the public and different stakeholders, as well as the reception of the policy in the Montreal context. The applicability of the Charter in the context of Montreal is the first step in determining the practical purpose of the policy. The analysis of the Charter is discussed based on overarching themes that present themselves throughout the text. Next, the policy will be compared to similar policies from other cities to determine different strategies of pedestrian construction management. The purpose of the comparative analysis is to identify tactics and strategies that other cities are using and assess those approaches based on their potential for implementation in the Montreal context.

Site Auditing

To understand how pedestrians and cyclists interact with temporary construction sites, these sites must first be investigated as if they were permanent components of the urban form. Users of temporary urban areas should navigate them just as easily as if they were permanent to ensure a seamless transition in and out of construction sites. There are several ways to assess qualities of the urban form, but this research draws on the conceptual framework of Responsive Environments (proposed by Ian Bentley and colleagues), which explores a range of design qualities that influence people's experiences in an urban setting. Those design qualities will be expanded upon and augmented to reflect how people interact and experience construction sites.

The construction sites within Montreal were chosen based on their level of impact on the public realm. Five construction sites were audited for their ability to maintain appropriate levels of pedestrian intelligibility, mobility, and walkability. They contain varying levels of public realm impacts and employ different techniques of pedestrian and cyclist traffic management. Three of the five sites are publicly managed and are completing municipal improvement projects. These publicly managed sites were identified using the City of Montreal's interactive map of in-progress construction sites, which is a tool to communicate traffic disruptions to the public. The remaining two sites are a collection of privately managed sites completing residential development projects. These sites were chosen based on their representation of typical conditions in Montreal and the temporal and spatial extent of the intervention. Once the sites were selected, site visits were undertaken to investigate the conditions of the applicable urban design qualities and theories and study the contrasts between the current state of construction and the desired state of construction in the Charter.

The audited sites were not only assessed through the urban design quality lens, but also the nature in which they reflect the goals of the Charter. A case is formed based on how the physical management of the construction site can be improved by enforcing the Charter, or how the physical management can better inform the goals of the Charter.

Synthesis and Policy Recommendations

The purpose of this research is to suggest updates to the Montreal Charter of Construction Sites to ensure that it can cause positive changes to the pedestrian environment of construction sites. These suggested policy updates will be synthesized from the subject policy analysis, comparative policy analysis, and site audit findings. The policy suggestions will be rooted in achieving the established goals of the Charter but are recommended to better achieve those goals. This research fulsomely examines the reality of public and private construction within Montreal but does recognize that this only one aspect of urban form development. Urban planning and policy analysis involves a complex network of stakeholders, and this research will illuminate the understudied and frustrating manifestations of construction policy (or lack thereof) in Montreal.

2: Foundational Analysis

The first step of this research is to establish the foundation upon which pedestrian management in construction sites can take place. In the Montreal context, that begins with the analysis of the Montreal Charter of Construction Sites. Understanding the circumstances that this document operates within, in Montreal and abroad, gives justification for its existence, but also explains why it must be a comprehensive and enforceable piece of policy.

Figure 5: Detour signage

Policy Analysis

The Montreal Charter of Construction Sites

In Quebec, the Building Accessibility Guide (2019) within the National Building Code of Quebec sets out clear and measurable laws that mandate the accessibility of buildings through enforcing design standards (Régie du bâtiment du Québec, 2022). This law informs the Montreal Universal Accessibility Policy, which ensures accessibility to publicly provided buildings, spaces, and planning policies (City of Montréal, 2021). What is missing from these documents is any mention of the temporary nature of construction site accessibility, which is what the Montreal Charter of Construction Sites has the potential to improve.

The overarching goal of the Charter is to improve the quality of life of citizens affected by construction by limiting negative externalities, referred to as nuisances. This is to be accomplished by the four 'levers', or goals, listed in Figure 6. While the document appears to be comprehensive in describing the goals and actions it wishes to accomplish, the document is not comprehensive in practice. Issues in the communication, interpretation, and implementation limit the possibility for the document to create positive change to provide pedestrians with supportive, user-friendly networks for movement where construction is underway.

Communication

An overall theme that guides the Charter appears to be improving communication, chiefly between the proprietors of the work site (if not in the public realm) and the surrounding residents. While there is a strong case for improving the transfer of knowledge from construction companies to those who will be significantly

LEVER 1
Prioritize accessibility, safety, and mobility

- Plan and coordinate the work, considering all the projects of different stakeholders
- Ensure safe and efficient travel for all users of the public domain, especially those with reduced mobility
- Plan and display clear and effective signage and review as the work progresses
- Use adequate safety devices in good condition

LEVER 2
Ensure the needs of affected people are met

- Plan and implement nuisance mitigation measures (dust, noise, vibrations, etc.)
- Pay particular attention to the cleanliness and appearance of the site
- Free public areas of all unnecessary occupation, including superfluous signage ("orange cones"), during and after work
- Ensure the protection of trees on site and in the surrounding area

LEVER 3
Communicate with concerned audiences throughout project

- Take into account the needs expressed by people, businesses, and institutions
- Collaborate more with partners
- Draw inspiration from best practices

LEVER 4
Use respectful and environmentally responsible methods

- Use techniques and materials aimed at reducing the ecological footprint of construction sites
- Reduce transport for all site operations

Figure 6: Policy levers, adapted from the Montreal Charter of Construction Sites

affected daily, we must remember that not everyone who interacts with those work sites lives nearby. The goal of Lever 3 is to communicate and collaborate with the concerned audiences at all stages in the project. The subpoints of this lever, which can be loosely interpreted as a list of action items, are focused on providing notice to external service providers who will be impacted by the construction to ease service disruption to nearby residents. The only mention of communicating with the public is in the goal of providing "clear and precise" information before and during construction.

The Charter limits effective communication as an action that only takes place externally from the site itself. There is insufficient mention of how to communicate on-site with any user, simply stating that there should be information panels that guide the public toward the official communication tools. The official channel that Montreal has set up to handle public works issues is 311, a phone service and online service that fields complaints and questions. This resource is still external from the work site, further removing communication about the construction project from the site at which it occurs. Communicating how to interact with a public space goes far beyond an information panel. The importance of communication in Montreal takes on a multi-lingual context, with two de-facto languages in everyday use that must be incorporated into all communication. There is no indication in the Charter that the readability, legibility, and intelligibility of these complex work sites are considered for improvements.

Interpretation

As the Charter is intended to be a public-facing political document with a high degree of readability, there are many complex concepts brought up throughout the document with little to no definition. The lack of definition obscures the accountability of the City and leaves the interpretation of the term open

to the reader. The first offender can be found in the introduction, where "limiting nuisance" is identified as the goal of the Charter without defining the highly subjective concept of nuisance. The subjectivity of which aspects of disruptive construction are annoying and inconvenient cannot be identified by all users, and there is no indication that this document can improve nuisances in any measurable way. In the context of Montreal's construction patterns and public discourse, it could be imagined that the largest nuisance is the orange cone. But with such complex and varied sites, almost any attribute of a site could be considered a nuisance. This study can aid in the understanding of what inconveniences to which users are being subjected, meanwhile leaving the interpretation of 'nuisance' open adds to the impression that this Charter is going to prove to be ineffective in the future.

The Charter lacks a clear definition for the term 'accessibility', which is stated as a priority in Lever 1, along with safety and mobility. In urban planning and transportation studies, accessibility and mobility are two very different concepts. Accessibility is the ability and convenience of reaching destinations and interactions, while mobility is the ability to travel through the urban fabric (Brookings, 2017). Accessibility to destinations throughout the city is influenced by that ability to move through the urban network, and they must be considered in tandem to provide a quality urban fabric that pedestrians can use efficiently. What is missing from the Charter is the definition of both accessibility and mobility, and how they are being considered separately. The text links safety with mobility, which at first glance, does make sense within the context of construction zones. The spatial mobility of a person moving through the site must be maintained in a safe way, and therefore the pedestrian corridor was altered to ensure that safety. The focus on mobility through the site dismisses the need to have safe accessibility to destinations that can be reached within the construction site or travelled to through the construction. Beyond that physical accessibility, there also needs to be cognitive accessibility to ensure legibility and intelligibility of the construction site. If a construction site is physically accessible with a defined pathway towards businesses in and around the site, but no legible signage to indicate how to get to those businesses, there is little to no effective accessibility. If the current Charter was used to generate a definition of accessibility, the narrowness of this document would produce a definition solely focused on universal accessibility, disregarding the study of urban transportation accessibility and network studies.

Implementation

The combination of shallow communication and ill-defined terms compromises the useability of the Charter – it is a document that is unable to provide explicit context and actions to be implemented. The Charter comes across as vague, weak, and unenforceable. 'Ensure' is the most common verb written in the Charter, but with no measurable metrics identified. When discussing nuisances that need to be acted upon, the only measurable goal to improve upon is to "handle 80% of citizen requests in less that 48 hours and close 80% of citizen requests in less than 10 days". Even this goal seems to be like an obvious improvement if the normal request resolutions extend past 10 days. Nowhere in the text is there evidence of a plan for how to ensure any of the action items are accomplished. If the 'how' of a project is as important as the 'why', then there is a glaring problem with this Charter.

Under Lever 2, the Charter states that the city must set up a 'good neighbour committee' or 'dedicate a liaison officer' to meet the needs of affected people, businesses, and institutions. The wording of "When the particularities of the construction site require it..." is entirely too vague and seemingly places the onus onto citizens to notify the city when those committees and liaison offers are necessary. This Charter only applies to municipally run projects if it is reasonable to implement these efforts to improve construction sites. With no threshold to determine when that circumstance may be present, there are no rules on which construction sites this Charter applies to. This means that the Charter is not legally binding, enforceable, or universal across the city. Through this analytical lens, the Charter does not make a strong case for the clear communication of goals, is unable to be interpreted consistently by construction stakeholders, and has no grounds for consequential implementation.

Comparative Analysis

As the disciplines of transportation planning and traffic management converge while cities worldwide are attempting to promote active transportation, especially pedestrianism and cycling, there has been a greater focus placed on how ongoing construction can impact the pedestrian infrastructure. Many cities are expanding their traffic management and construction norms to include pedestrian provisions, to various degrees of effectiveness. There is a spectrum that has emerged from legal enforcement to optional guidelines. The following examples from Berlin and Vancouver illustrate different approaches to ensure pedestrian mobility, accessibility, and comfort during construction, and these can be contrasted to the Montreal Charter to assess the strength of Montreal's goals.

Berlin Mobility Act

The Berlin Mobility Act of 2018 established a legally binding precedent for the protection of urban mobilities - bus, rail, bicycle, car, and pedestrian traffic. The Law emphasizes the right that citizens have to engage in urban mobility with a high degree of comfort and reliability, regardless of one's mobility constraints. This law considers urban mobility to be all forms of movement through an urban network. Cementing all modalities together into one comprehensive law ensures a cohesive vision for the future of mobility in Berlin and forms the basis for enforceable norms and regulations to be adopted.

In 2021, the Act was amended to include a variety of new improvements to the scope and application of the law. Broadly speaking, many of the new improvements are focused on the pedestrian realm, ensuring further accessibility interventions, considerations for children and seniors, and enhanced intersection infrastructure that favours pedestrians. The most notable amendment is the inclusion of two construction-specific clauses: Section 39 – Planning, traffic management and information during construction measures, and Section 53 – Planning and traffic management for construction measures. Section 39 contains the requirements for information sharing and cohesion:

> "When planning construction measures in road land, it must be checked and documented for relevant projects and immediately published on the Internet to what extent a bicycle traffic system within the meaning of this Act and the other regulations can be created with the completion of the construction measure. In every planning and construction measure of the state of Berlin, the needs of cycling must be taken into account for future planning" (GVBI, 2018, 464).

In Section 53, specific measures are described to secure convenient and safe construction mitigation strategies for pedestrians:

> "... the management of foot traffic should be ensured largely without detours, without changing the side of the road and barrier-free. If a change of the side of the road is essential, a safe crossing must be ensured. Construction site-related light sign systems must be equipped with acoustic signal transmitters" (GVBI, 2018, 464).

Viewing these two sections as a whole, the Act ensures that construction sites are to be managed in a way that promotes the respect of cyclists and pedestrians, no matter their mobility constraints. This respect is set to become legally mandated through the addition of Section 58, which states that the Senate of each district must implement at least one relevant project to promote foot traffic within 3 years of the Act being amended in 2021.

The Berlin Mobility Act differs greatly from the Montreal Charter of Construction Sites in its placement within the urban governance model. Berlin's Act is legally binding, adopted by the City, and highly enforceable. The Montreal Charter is not enacted as a law, and therefore is minimally enforceable. If the Montreal Charter were to be converted into a by-law, no future Montreal construction site would resemble what is now legally normal despite often being impossible to traverse safely and comfortably.

Figure 7: Berlin signage, literally translates to *"sidewalk damage"*

Vancouver Construction on Pedestrian Facilities Guide 2020

The City of Vancouver, British Columbia, has also taken on the task of improving the impacts of construction sites onto the pedestrian realm. Like Quebec, British Columbia also operates within a patch work of accessibility policies and laws (Office of Housing and Construction Standards, 2020) and this is a supplemental guide that compliments the Provincial Traffic Management Manual which was first published in 2015. This guide is necessary to focus traffic management on pedestrian accommodations during construction, especially in the context of Vancouver's robust active transportation movement (City of Vancouver, 2013).

This guide describes planning and design requirements that private construction firms must consider when their work impacts the pedestrian realm. The guide dictates that a Traffic Management Plan must be created for any work, which is the basis for how these requirements can be enforced. While not a formal law like the Berlin example, this guide gives explicit and measurable obligations that must be met to ensure uniformity among public and private construction sites. This guide recognizes that every construction site is different and provides a list of specific situations where pedestrian provisions are required, and when they are not.

> "A pedestrian provision is a temporary pedestrian facility put in place during closure of a permanent pedestrian facility. Pedestrian provisions should generally be used when:
>
> - Pedestrian volumes are moderate to high
> - An adjacent facility is a significant generator of pedestrian traffic
> - Work requires closure of more than one sidewalk or crosswalk at the same time
> - Without a provision, a closure would encourage unsafe shortcuts or encourage jaywalking
>
> A sidewalk may be closed without a pedestrian provision when:
>
> - There is a sidewalk on the opposite side of the street where pedestrians can be detoured
> - There are crosswalks nearby at either ends of the sidewalk closure
> - There are no other sidewalks or crosswalks closed in or nearby the work zone
> - There are no other options to maintain a pedestrian provision
> - A crosswalk may be closed without a pedestrian provision only when there is another parallel crosswalk nearby"

The guide continues by listing design requirements such as width requirements and pedestrian provisions and gives visual and written examples of how to implement the traffic management in everyday situations. Not only does it declare conditions to be met and specific considerations, it also describes ideal standards of site management. This is in direct contrast to the Montreal Charter which is too vague to be interpreted consistently and raises concerns about why the Montreal document fails to offer the necessary details for effective implementation.

When analyzing the Montreal Charter in comparison to the Berlin Mobility Act and the Vancouver Guide, the Charter must make substantial improvements to create positive change if it is to be as useful as these other policies. Progress was made in 2020-21 in the creation of protective pedestrian policies, and the recent rise of these policies gives hope that this is just the beginning of improving the quality of life of pedestrians interacting with disruptive construction.

Urban Design Qualities

The next step in understanding the reality of construction in Montreal is investigating the current conditions of various construction sites and explore how policy is being demonstrated in practice. Creating a common understanding of the urban design qualities that are affected by construction in the pedestrian realm will create a basis for the construction sites to be audited consistently. These qualities are rooted in theories of affordances and walkability, but better explain the physical manifestations of these theories. The urban design qualities that will be investigated through this research are intelligibility, permeability, mobility, and robustness.

Intelligibility

Intelligibility is the degree to which a person who is interacting with a space can understand and grasp how that space should be used. Understanding the potential use of the site is a form of spatial cognition. Spatial cognition is the synthesis of all available information communicated to a user, ideally within seconds, to conclude a mental image of the site. That spatial cognition can be influenced by the real and imagined spatial configuration, as defined by Lynch in his work on mind mapping. This concept of intelligibility, which covers Bentley et al.'s concept of legibility, was chosen as a more comprehensive way to assess temporary construction sites. The spatial cognition and mental image processing of a construction site is heavily influenced by spatial configuration as there is a miscommunication between the expected information and the provided information. So much information is being obscured by construction material, while new information is being provided about the work on-site. The communicated information can be synthesized to create three main factors that influence intelligibility: legibility, imageability, and transparency.

Legibility, as defined by Bentley et al. (1985), is how easily someone can understand the layout of a space. This is especially important in active construction sites where quickly understanding an unfamiliar, temporary, or changing layout ensures safety. The physical conditions of construction sites that can be evaluated based on legibility are the presence of signage and the effect it has on site users, whether people appear to be getting lost in the site, and how the configuration of the pathway influences use of the site. Imageability was introduced by Lynch (1960) as the ability to recall a mental image of a specific experience of a city. In construction sites, the sight of familiar landmarks can enhance a person's intelligibility of a site by placing them in a space they are familiar with and recalling that mental image. Construction sites in this research will be evaluated on the visibility of familiar landscapes and landmarks through construction materials. Finally, transparency in urban design, specifically architecture, typically refers to the ability to see into buildings to determine the indoor and outdoor use (Erkartal, 2019). In the context of construction sites, transparency can be considered as the ability to see into the active construction area, as well as forward facing transparency to see where the temporary pathway leads. These two experiences of transparency will be assessed on their full, partial, or obstructed view, and how that is influencing the pedestrian experience of the site.

As the environment offers affordances to users, more information is communicated to those users. The clearer the affordances, the more intelligible the space will be. But a balance must be struck between a space providing too much information and becoming overwhelming and providing too few interesting details of information and therefore becoming under stimulating to the user. Assessing how many affordances are on offer to pedestrians is key to this research, especially when investigating if that balance has been realized in any real-life situations, and can assist in the creation of explicit and measurable metrics within the Charter.

Permeability

Permeability as a quality of urban form is defined as "the number of alternative ways through an environment" (Bentley et al., 1985). The urban form of paths and buildings automatically restricts directions of movement, but the extent of choice that a person has

over their movement creates more enjoyable spaces. The more connected a network, the more permeable it will be. However, construction sites are inherently less permeable because they exist to restrict movement into unsafe areas. While this restriction of permeability is necessary, it still must allow for some choice over movement patterns. The construction sites in this research will be evaluated based on the number of channelized paths, how many exits are along this path and are they conducive to safe mobility, and the length and need for detours. Since permeability through construction sites is usually completed on a temporary pathway, the quality and experience of that pathway must be considered under the umbrella of permeability. The material that creates the pathway through a construction site is referred to as the "channelization material", and this will be assessed based on the appropriateness of the channelization material, the width of the channel, and the overall sense of enclosure and safety that it provides to users.

Mobility

The concept of mobility has been added to Bentley et al.'s original list of urban design qualities to specifically study construction sites. Mobility is the ability to move from one place to another. The desire to move is spurred on by the number of opportunities that are available to someone at the end of the journey (Stouffer, 1940), and mobility is traditionally hindered only by the time and effort put into travelling to those opportunities (Carrothers, 1956). The nuances of urban mobility have expanded to consider how socio-economic factors and different abilities and goals influences different forms and scale of mobilities. In the context of construction sites, the existing level of mobility should be maintained in a way that provide safe passage through active construction at minimal extra effort and distance and can be used by any person regardless of their level of ability. If the existing level of mobility is not adequate for universal accessibility, then measures improving the accessibility and mobility of the site need to be incorporated. The urban form characteristics that determine the level of mobility of a construction site are the length and design of detours, presence of ramps if the ground has an uneven elevation, and presence of barrier free pathways. The mobility of the studied construction sites will also explore whether any individuals with different mobility needs are able to use the site safely.

Robustness

Robustness in the context of construction sites has two meanings. First, robustness is the ability for a place to be used in multiple different ways (Bentley et al., 1985). Those multiple different uses can be performed on different temporal scales but can be classified by the adaptability of the space to serve the needs of a wide variety of uses at a similar time. When considering robustness within the context of construction sites, a place must have the adaptability to still operate like the place normally would, while accommodating and adapting to the needs of the construction site. That ability for the construction site to satisfy needs from both users is directly related to the quality, durability, and design of the materials chosen to disrupt the public realm and contain the messy construction conditions. That quality, durability, and design is the second meaning of robustness. Robustness of construction sites will be assessed based on the quality of materials that divide the two concurrent uses, the ability for both uses to be successfully and efficiently completed, and the overall sensory impacts that the construction use may be having on public realm uses.

The sites audited in this research are assessed based on how the design and layout of the site encourages pedestrian intelligibility, permeability, and mobility, while providing a robust environment for pedestrians to use. The pedestrian management strategies deployed at each site reflect the prioritization of these urban design principles and determine how pedestrians are interacting with their environment. The next section of this research presents the observed impacts of pedestrian management strategies on this set of urban design principles.

3: Site Audits

The site auditing took place between February and April of 2022, almost one year after the Montreal Charter of Construction Sites had been published. In total, five sites were audited based on their use of different pedestrian management strategies and the ability to promote the urban design principles of intelligibility, permeability, mobility, and robustness. The physical alterations of the pedestrian realm were then compared to the goals in the Charter that relate to the pedestrian realm and urban form. Below are the detailed findings and narratives for each site.

Rue de la Montagne

The Path to Nowhere

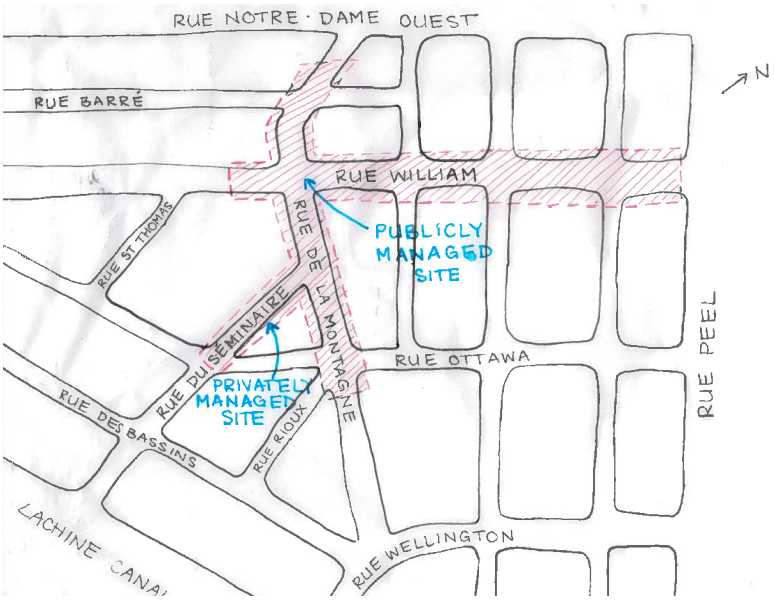

Figure 8: Plan of Rue de la Montagne

The Montreal neighbourhood of Griffintown is undergoing a massive construction boom, due mostly in part to condominium tower development, but also the necessary infrastructure upgrades that need to be completed to ensure service for the growing population. The rapidly densifying brownfield neighbourhood along the Lachine Canal has seen extensive regeneration that is taking hold in the context of a deregulated, developer-driven planning environment (Darchen, 2020). There has been renewed emphasis placed on the integration of social sustainability into residential development as the neighbourhood matures (Darchen, 2020). Major transportation infrastructure projects such as the Réseau express vélo (REV, an expanding cycling network across Montreal) and the Réseau express métropolitain (REM, a new regional rail system) are slated to have long-term construction disruptions, and those will collide with rapid condo construction happening in the same neighbourhood. Griffintown is already feeling growing pains in the common complaint of non-stop construction (Paré, 2021), with no end in sight. The similar perception of construction disruptions affecting vehicle travel only is also present here (Ibid, 2021), where the combination of road work and residential construction has major implications for pedestrian and cyclist trips that usually go underreported.

Rue de la Montagne is a well-trafficked road leading from the major Rue Wellington to Centre Bell, then continuing into downtown Montreal. The built form of the street is dominated by mixed-use commercial and residential buildings, with the newest buildings concentrated on the southern end of the street located in Griffintown. The road is part of the major municipal infrastructure upgrades that have been ongoing since 2017 that include Rue William, Rue Peel, and Rue Wellington (City of Montreal, 2021). Currently, the project is replacing sewers and aqueducts at the intersection of Rue de la Montagne and Rue William. Just southeast of that intersection, new condominium development is also present at the intersection of Rue Ottawa and Rue du Séminaire. This site is privately managed, and construction has been disrupting the pedestrian corridor since late 2020.

The contrast between these two construction sites under different management has been chosen to show the current impacts of construction on pedestrians and cyclists, as well as illustrate the applicability of Montreal's Construction Charter.

The municipally managed site at the intersection of de la Montage and William utilizes pedestrian and cyclist channelization along every sidewalk on both streets. In construction sites, the channelization is necessary to provide safe passage to pedestrians, but the quality of that passage can promote or hinder accessibility. The pathway along the eastern side of de la Montagne ensures the access to businesses, and signage indicates that these businesses are still open during construction. That signage communicates information that is usually perceived by the visual transparency through the site, and those viewsheds are obstructed by the construction work. Consistently communicating information about the site to the user is extremely important, which the site's design does well until a pedestrian or cyclist tries to go deeper into the site. Once the intersection with Rue William is reached, the pathway becomes less clear and becomes a cause of confusion for users. The pathway splits into two different paths, neither of which can continue north along Rue de la Montagne. While observing this site, many users hesitated to continue down the path marked as closed or turned around completely. That confusion could have been mitigated by ensuring that users are more aware that this path only leads to those businesses noted in the barrier and that through traffic must take the sidewalk on the western side of the street.

Figure 9: Looking north on Rue de la Montagne

The quality of this temporary pathway is also negatively impacted by the materials chosen to create it. The chosen barrier of metal fencing requires wide stands to hold it up, which create an uneven surface in the already too narrow path in front of the businesses. The fencing does not feel secure, and that feeling is only increased when the construction work is underway right on the other side. In addition to that metal fencing, there are construction cones placed with little consequence throughout the site, located almost everywhere that wouldn't interfere with the main pathway. The clutter of these cones adds more visual confusion to the site when they are supposed to be guiding pedestrians and cyclists through the site. For such a long-term construction site, more robust materials could have been chosen to provide a safer sense of enclosure to users.

Observing the nearby site on Rue du Séminaire shows the contrast that exists between the site conditions of public sites and their private counterparts. Certain similarities exist between the public and private sites. The metal fencing is the barrier between the public realm and the active construction site. No formal channelization material is present, even though this stretch of sidewalk has been impacted by construction for 1.5 years. The pathway is scattered with orange cones that do not influence movement patterns.

Figure 10: Closed, but heavily trafficked, pathway

Beyond those characteristics, the differences become more visible. The pathway that channels pedestrians and cyclists through the site is created by construction containers, overhead wiring, a construction vehicle, and metal fencing. While the pathway has full forward-facing visibility and avoids a detour, there is a haphazard feeling to the varieties of chosen channelization materials. The material of the sidewalk is loose gravel, which during the March visit was under melting snow, slush, and gravel. The consideration afforded to the pedestrian experience appears to be lower on this site than de la Montagne.

The most notable difference between the public and private site was the affordance of signage that was present at each site. The public site had ample signage, almost too much at times. The signage was responsive to the type of construction work underway, and purposefully created for the commercial context of the site. But this private site was no signage to mark the construction work upon the pedestrian approach from the north, and minimal, misplaced signage facing south. The sign that communicates with pedestrians and cyclists has been moved out of the flow of traffic, therefore not impeding any movement, or informing site users that the sidewalk is intended to be closed. Based on the build-up of snow around that sign, it appears that this sign has been misplaced for at least a few snowfalls. This marked lack of signage does not contribute to a pedestrian or cyclist's perception of the site, or how easily they can understand how to move through the site.

Figure 11: Privately managed site on Rue du Séminaire

While only one site (de la Montage) is subject to Montreal's Charter of Construction Sites, these two sites together can illustrate the reality of construction in Montreal. Neither site follows the goals of Lever 1 to plan, display, and monitor effective signage, or ensure barrier-free pedestrian corridors of adequate width. Lever 2 has a focus on clearing and organizing the orange cones, which these sites also do not comply with. In Lever 2, one goal is to ensure the distribution and application of good site management practices to manage impacts, but the issue of enforceability becomes present yet again.

How, in two sites managed by different entities, one guided by a charter and one not, could these goals be enforced and followed consistently? The fundamental issue of Montreal's Charter being applied to only municipally managed construction sites ensures that there will always be disparities between public and private sites, and therefore creates differing impacts on pedestrians that influence the understanding and intelligibility of these sites. Without consistent enforcement across all construction sites in Montreal, there will be no standardization of management or coordination between sites, and minimal improvement to hectic construction in the city.

Boulevard de Maisonneuve

Orange Cone Overload

Boulevard de Maisonneuve Ouest, between Boulevard Decarie and Claremont Avenue, is a main artery connecting the eastern edge of Côte-des-Neiges Notre-Dame-de-Grâce (CDN-NDG) with the City of Westmount. Claremont Avenue is the boundary between CDN-NDG and Westmount, which are boroughs of contrast. The median income of CDN-NDG is half that of Westmount (CMHC, 2017), CDN-NDG is predominantly mixed-use and residential while Westmount is an affluent residential suburb, and CDN-NDG is an agglomerated borough of Montreal while Westmount is an independent city. Vendôme metro and train station is the nexus of these two areas, between Boulevard de Maisonneuve Ouest and the McGill University Health Centre (MUHC). This stretch of Boulevard de Maisonneuve has a stable residential area fronting onto the street on the north, and the entrance to the metro and train station on the south. One of Montreal's main separated bike lanes runs along Boulevard de Maisonneuve through this section, which saw over 1,000,000 trips in 2016 (City of Montréal, 2014).

In March of 2022, all movement on this street has been disrupted due to construction work to upgrade the underground infrastructure network in CDN-NDG. The Montreal interactive map of in-progress construction sites lists disruptions such as no westward vehicle traffic, which intersections will remain open to cross-traffic, and all restrictions to street parking (City of Montréal, 2022). There is no mention of the widespread disruption to pedestrian and cyclist movement. The entire north sidewalk and bike lane is blocked off between Boulevard Décarie and Claremont Avenue and is haphazardly relocated across two road lanes.

This site is a relatively short-term construction project compared to Rue de la Montagne and Rue Mackay, expected to be completed by May 2022. The analysis of shorter-term projects can provide insight into the impact of temporality on the management, planning and design of pedestrian provisions.

Figure 12: Boulevard de Maisonneuve

Figure 13: Orange cones covering Boulevard de Maisonneuve

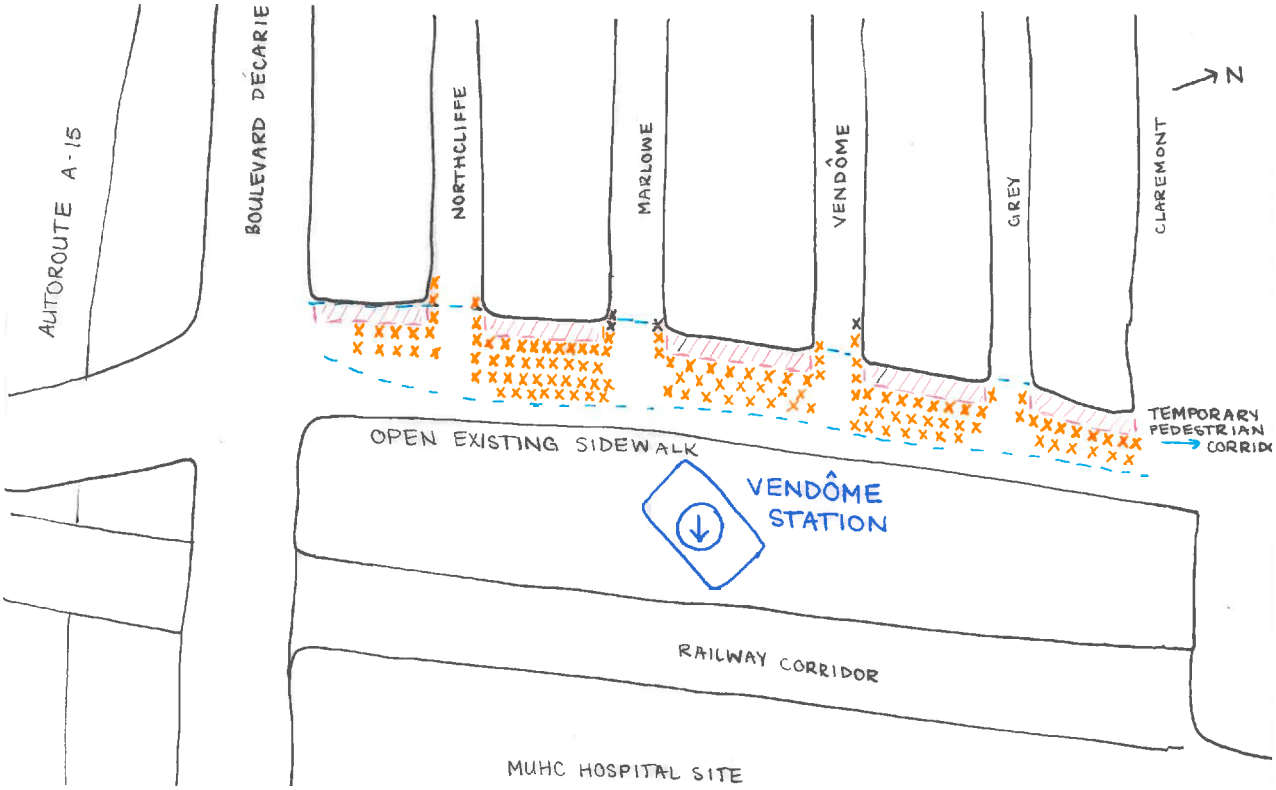

Figure 14: Boulevard de Maisonneuve construction site plan

While the sidewalk and closest vehicle traffic lane abutting Vendôme Station are undisturbed, upon exiting the station public transit riders are greeted with a sea of orange construction cones. The first row of cones is placed parallel to the sidewalk, approximately three metres apart to create a temporary barrier between vehicle traffic and the remainder of the road. The second and third rows of cones are placed semi-uniformly in parallel lines between the first row and the bike lane barrier, also approximately three metres apart but this is not consistent through the site. Lastly, there is a partial fourth row placed either along the bike lane barrier or within the bike lane as a barrier. To supplement those lines of cones, there are cones used for demarcating the driveways that are still accessible during the construction. There are additional cones blocking off the corners of Avenue de Vendôme and Avenue de Marlowe, where existing pedestrian crossings exist. During a construction site visit in March, there were approximately 80 orange construction cones between Avenue Northcliffe and Avenue Grey, where there was absolutely no active construction underway. All active construction was taking place on the northern sidewalk of Boulevard de Maisonneuve between Avenue Grey and Avenue Bulmer.

In this situation, not only are the cones alerting pedestrians, cyclists, and drivers to the fact that this is a construction site, but also, they are the sole channelization material being deployed. The cones do offer the benefits of being easily relocated in the site and allowing for fully forward visibility, but they are positioned in a way that hinders the intelligibility of the site. The spacing between the channelization material, the cones, leaves too big of a gap to successfully control the flow of pedestrians and cyclists. The width between the loosely interpreted 'lanes' of pedestrian and cyclist movement is also approximately three metres wide, much wider than a typical sidewalk, bike lane, or other pedestrian pathways typically present in construction sites. The wide lanes do not offer a secure sense of enclosure to pedestrians but do allow for a high degree of control over individual movement patterns through the site. The relatively equal spacing between the channelization cones and the lane marker cones creates a sort of distorted checkerboard pattern rather than pathways through the site. The movement patterns that a pedestrian should follow when moving through the site are not obvious. Many pedestrians were witnessed hesitating when deciding which pathway to take, and either switching lanes or using the sidewalk

Figure 15: Lanes of cones

which was indicated to be closed. Cyclists seem to self-select to use the lane closest to the existing bike lane, if they were not already using the bike lane, which was also marked as closed. The maze of cones leaves people to make their own decisions about how to move through the site with minimal safety implications, other jaywalking, because there is no construction work happening where there is the highest concentration of cones.

The signage intended to be read by pedestrians and cyclists that is present at the site does not communicate any pathway created by the cones, and any signage only acts as a barrier to using the existing sidewalk and bike lane. There are 'sidewalk closed – use other sidewalk' and 'bike lane closed' signs on the western edge of the site accompanied by a sign indicating that bikes should occupy the lane closest to the existing bike lane. On the eastern edge of the site, the same signage exists but the indicated bike lane is next to the vehicle traffic lane, furthest from the existing bike lane. There is no signage at the pedestrian crossings at Avenue de Vendôme and Avenue de Marlowe, except for a 'sidewalk closed' and 'bike lane here' sign facing each other, and not visible to the respective cyclists and pedestrians they are intended to inform (pictures). The signage, when considered as a whole, does not appear to be deterring many pedestrians or cyclists from using the sidewalk or bike lane that exists on the site and is not currently under construction.

Pedestrian and cyclist mobility through the site continues almost undisturbed, just inconvenienced by all the cones. There are no ramps, but the level crossings at intersections remain and were well-used. Even the mid-block jaywalkers utilized a level crossing at the accessible driveway. The roadway, sidewalk, and bike lane surface materials remain undisrupted, causing no apparent mobility issues. With the sidewalk on the southern side of Boulevard de Maisonneuve remaining

open, the mobility disruptions to pedestrian movement appear to be minor. But one question remains: If the mobility and movement through the site can continue uninterrupted both within and outside the construction site, why would this site require this degree of channelization and this number of cones?

Closing six blocks of sidewalks and bike lanes to upgrade underground infrastructure in one block at a time for months on end appears, on the surface, to be a bit of an overkill. Since the construction site is at the beginning of its mandate and the scale of the active construction could expand, some leniency will be provided in the overall analysis of why the site is managed in this way.

What cannot be forgiven is the sheer number of orange construction cones on this construction site. This is a publicly managed construction site, doing municipal upgrades, and the design of this site is in direct conflict with the Montreal Charter. Lever 2 of the Charter, "ensure impact management and mitigation measures meet the needs of affected people during the execution of the work" describes the overall goals to, "1: pay particular attention to the cleanliness and appearance of the site", and "2: Free public areas of all unnecessary occupation, including superfluous signage (for examples, 'orange cones'), during and after the work". This section goes on to attest that orange cones should be removed if they become useless during active construction. Most of the orange cones present on the site appear to be both superfluous and useless in the majority of the construction zone. Moreover, the spatial and temporal scale of the obstacles are actively opposing sub-point 3 of this section of the Charter, which claims that "obstacles should be limited in both space and time". The Montreal Charter also describes the necessary signage plan required for traffic lane configuration but restricts the definition of 'traffic lane' to vehicle traffic. The Boulevard de Maisonneuve site has a multitude of pedestrian and cyclist traffic lanes without any signage, or indication why there are so many, and signage is currently not required under the Charter.

Figure 16: Pedestrians using closed sidewalk

Pie-IX Station

Transit Traffic

The Pie-IX Station is in the Montreal borough of Hochelaga-Maisonneuve located about six kilometres east of downtown Montreal. The station entrance sits at the intersection of Boulevard Pie-IX, a major north-south artery, and Avenue Pierre-de-Coubertin, a quieter street with the potential to get quite busy as it borders Montreal's Olympic Park. The station was originally built for the 1976 for the Summer Olympics and is being modernized as a hub for suburban transit. There is major work being done to the metro station to improve universal accessibility while a Bus Rapid Transit (BRT) line is being constructed on Boulevard Pie-IX. There area surrounding the Metro Station is the current planned terminus of the line, until it is planned to be expanded south in 2023 (STM, 2022). The new BRT line is being constructed on the same route as a defunct reserved contra-flow bus lane, one that took years of persistent public pressure to accomplish and was only in service until 2002 (Dewolf, 2007). Extensive work is underway to integrate the BRT to the metro system and improve the public realm around the stations. Streetscape improvements are underway along Avenue Pierre-de-Coubertin and Boulevard Pie-IX to promote an accessible and enjoyable environment around the metro station and BRT stop.

Figure 17: Pie-IX metro exit

Figure 18: Render of future streetscape of Avenue Pierre-de-Coubertin (City of Montreal, 2017)

Beyond the major transit projects, the city is collaborating the STM to upgrade municipal infrastructure along Avenue Pierre-De-Coubertin and create a more walkable and pedestrian-friendly streetscape post-construction. This is an example of construction disrupting the pedestrian realm to provide a better pedestrian experience in the future. This site is at the junction of two major transit infrastructure projects and is still managing to ensure that pedestrians and residents are prioritized. The quality and comfort of those pedestrian accommodations are met with mixed assessments.

Construction work has been underway since early 2021 and is being publicly managed by the local transportation operator, the Société de transport de Montreal (STM) (STM, 2022). Avenue Pierre-de-Coubertin has been closed to vehicle traffic since then while there have been pedestrian traffic accommodations to access the metro station, residences, and the Olympic Stadium and surrounding park. Boulevard Pie-IX has been open to vehicle traffic and pedestrians moving north from the metro station have been routed south down Boulevard Pie-IX south of the intersection, and the western sidewalk of Boulevard Pie-IX is open.

The exit from the Metro Station and the main intersection are where most of the pedestrian accommodations are located. The barrier between the public realm and the construction site is created by metal fencing and blue tarps, which are unsightly but channel pedestrians well while blocking the view into the active construction happening below-grade. The issue with this opaque channelization material is when metro riders are exiting the station, there is potential for pedestrians to get confused with which direct they are facing, especially if common landmarks and street signs are blocked. Once pedestrians move further down the pathway, which only has one option they can orient themselves with the view of the Olympic Stadium, which is prominent throughout the construction site. There is also effective signage in this part of the pathway to guide pedestrians to bus connections across Boulevard Pie-IX. The quality of channelization and signage begins to change once Avenue Pierre-de-Coubertin has been crossed. This section of the path relies on the existing sidewalks what have not been maintained during construction and are no longer holding up to the traffic and the elements. There is water pooling at each accessible corner and mud along every sidewalk. The snow that would have been melting drains along the

intersection has been disrupted due to construction and is negatively impacting the quality of the pathway.

Once the intersection and Metro Station area has been cleared, the disruptions along Avenue Pierre-de-Coubertin seem much less significant. There is significantly less construction underway in this area, and it is mostly being used for storage of equipment and parking. The channelization in this area occurs whenever the sidewalk or intersection is disrupted, but they are on-grade and channelized using concrete barriers. The overall quality of the pedestrian management here is superior to the area around the station and main intersection, even though this area receives substantially less pedestrian traffic.

This site is used as an example to illustrate what kind of successful pedestrian accommodations can be provided when some goals of the Charter are followed. While this site is not a glowing example of a well-managed construction site, there are certain things that it gets right. First, these two transit projects and the surrounding area are all being completed at the same time. One reason for that is that the STM is building and operating both transit projects and are extremely well-integrated into the urban development process of Montreal. Secondly, a disruption of this scale would only be conceivable if the work is streamlined and efficient. The second aspect of construction that this site is doing well is the neighbourhood outreach. The STM has set up a program they call Good Neighbours Committees (STM, 2022) to periodically check-in, voice concerns, and receive updates on the project. This collaboration ensures that resident concerns are being met regarding work of this intensity.

These two positive characteristics of this site are being implemented solely by the STM, and it is unclear whether those aspects of this site are subject to the Montreal Charter. This construction site has been underway since before the Charter was passed, and although the STM has signed and agreed upon the goals of the Charter there are no legal grounds for the STM to fall under the purview of the Charter.

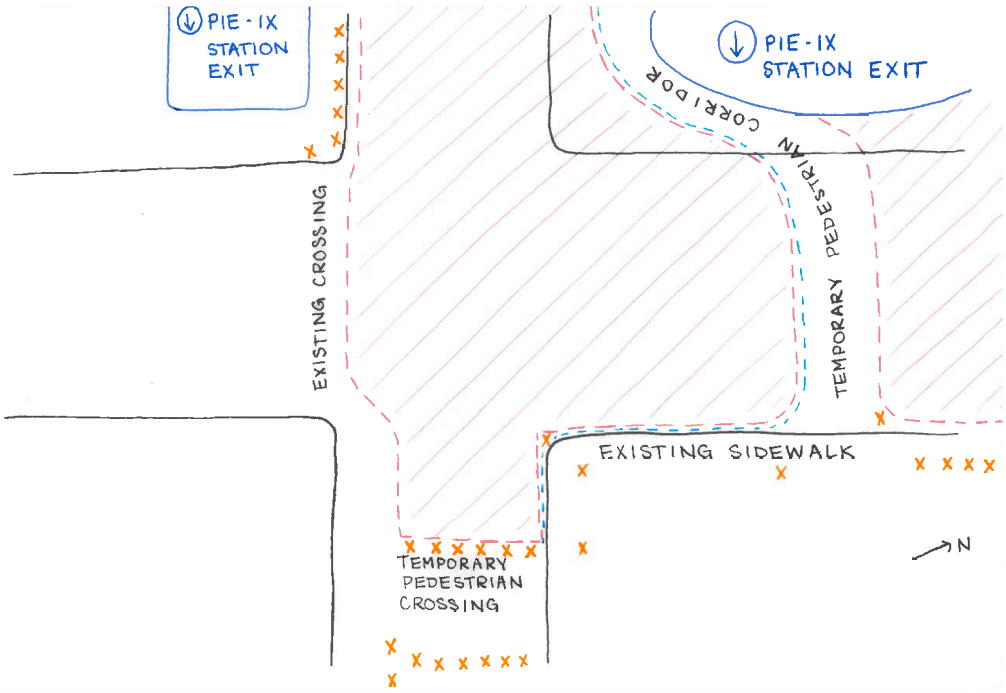

Figure 19: Pie-IX construction site plan

Avenue Viger Ouest

Less is More

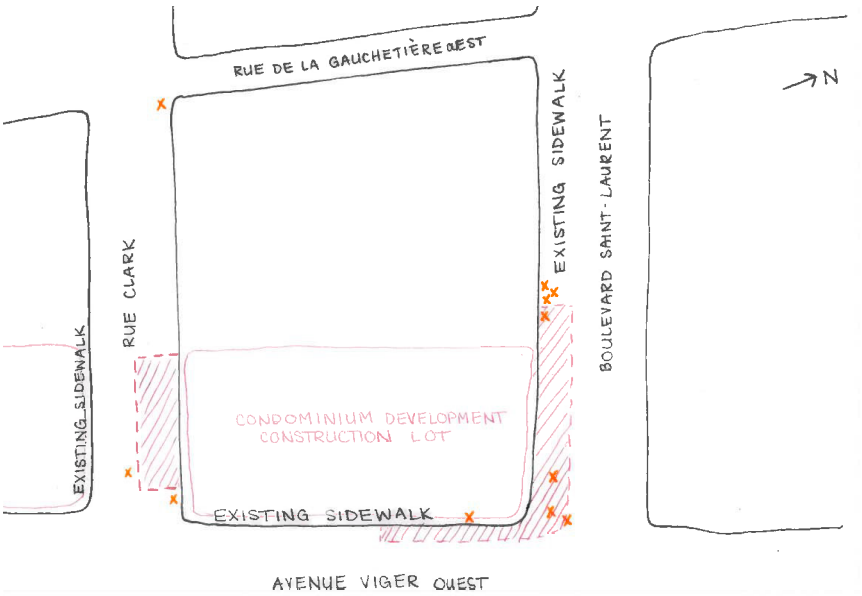

Figure 20: Avenue Viger construction site plan

Avenue Viger is a mixed-use street in Downtown Montreal, nestled between Montreal's Chinatown and Old Montreal, also known as the Vieux-Port. Not only does the street act as a boundary between different neighbourhoods, but it is also one of the main access points for the Autoroute Ville-Marie, and underground expressway that runs underneath Downtown Montreal. The section of the street that was audited for this research is between Boulevard Saint-Laurent and Rue Clark. Boulevard Saint-Laurent is a major commercial artery for the entire city and is a major connection between Downtown Montreal and Vieux-Port. Rue Clark is a more minor commercial street. Together, these streets service Chinatown, a small dense pocket of approximately 700 residents which has been formally recognized as a heritage district as of early 2022 (City of Montréal, 2022).

Chinatown's heritage protection designation was a response to development pressures felt throughout Downtown Montreal, but Chinatown was particularly vulnerable. The unique history of the area is reflected through iconic and symbolic architecture, but also the broader urban form that includes small commercial storefronts and restaurants. Since the mid-20th century, institutional, office, condominium, transportation, and hotel development has caused conflict over space (Lowrie, 2022; CBC News, 2022). While the granting of the heritage status and ensuing pause on new project development allows for more thoughtful protection of Chinatown (City of Montréal, 2021), previously planned projects are still going forward, especially along Avenue Viger between Rue Clark and Boulevard Saint-Laurent.

Figure 21: Excess construction material along Avenue Viger

The stretch of sidewalk along Avenue Viger is being impacted by a luxury condominium building being constructed. This privately managed construction site utilizes much of the existing pedestrian infrastructure at this stage of construction. Chinatown as a neighbourhood is pedestrian friendly within the neighbourhood, but Avenue Viger as a boundary road does not have the same separation between vehicle and pedestrian traffic. The construction disruptions present here leave pedestrians exposed to that existing traffic, as well as construction equipment.

This site is unique in the fact that it can be divided into three distinct zones based on which street is being audited, even though there is only one construction project. Rue Clark is characterized by the absence of any channelization or barriers, Avenue Viger is characterized by the exposed construction material, and finally Boulevard Saint-Laurent is characterized by the narrow channelization along the busiest sidewalk.

The first typology of Rue Clark that is encountered is that there is no indication that the street is under construction. The sidewalk is blocked by construction equipment on the eastern sidewalk, but there is no construction barrier or channelization material present. The only orange construction cones are on the western sidewalk around an exposed manhole, except for a single cone in the vehicle traffic lane at the base of Rue Clark. Pedestrians must cross the street mid-block to avoid the construction materials placed on the street and sidewalk surface, and there are at-grade crossings caused by driveways that pedestrians can utilize. The largest issue with this section is that there is no signage to indicate that the sidewalk is closed, although no pedestrians were observed to have issue with navigating the site.

The second typology is along Avenue Viger, where pedestrians are even more exposed to the construction materials. The western corner of Rue Clark and Avenue Viger is a storage site for construction equipment, and although there is no barrier, all equipment is tidy and off the sidewalk surface on both Clark and Viger. The presence of tidy but exposed construction material continues along Avenue Viger. There is some fencing present, but most of the block uses construction containers and excess material as a barrier between the active construction and pedestrians. The surface of this sidewalk section has been disturbed by the construction

and replaced with loose gravel at a different grade than the existing sidewalk pavement.

Finally, Boulevard Saint-Laurent contains the greatest number of orange construction cones at this site, as well as the only 'sidewalk closed' signage. The pedestrian channelization here is created by, again, excess construction material and the existing boundary of the sidewalk. The construction material causes the sidewalk to be only one metre wide and does not allow for two lanes of pedestrian traffic to pass each other comfortably, especially if mobility devices are being used. Even with the sidewalk closed sign, this sidewalk is the busiest pathway through this construction site. There is conflicting signage with this located at the corner of Avenue Viger and Boulevard Saint-Laurent, which indicates that the pedestrian detour is toward the closed sidewalk area. These signs are located on such a busy corner for pedestrian traffic, but the active construction site is almost completely open to the public realm. This is most likely only during the daytime hours when construction access must be maintained, but the lack of barriers does invite conflict between the public and private thresholds.

Overall, this site shows a different and less prescriptive approach to pedestrian traffic management. By maintaining as much of the existing pedestrian infrastructure as possible, the pedestrians can receive site information and affordances in a familiar way, thus increasing the intelligibility of the site. This is a surprising departure from the publicly managed sites which have tended to overuse channelization and signage in this study and caused overstimulation and increased the complexity of the site beyond what is understandable by pedestrians.

This site contains an interesting comparison to the Charter as it stands currently. This site has accomplished a streamlined use of the orange construction cones, simplified the signage needed to be the bare minimum required, and ensured that the construction material was organized in a tidy way. These were all separate goals of the Charter, and somehow a privately managed construction site that is outside the jurisdiction of the Charter. This site shows that the publicly managed site tactics of overusing channelization materials, signage, and cones is not always necessary to provide an intelligible space, and some city initiative might be counterintuitive to the Charter goals.

The reason for the stripped-back pedestrian management materials is most likely due to the high financial expenditures that must be made to provide all the cones, signage, and barriers. Condominium construction does not have the same costs sunken into pedestrian management that the municipality is able to cover. If the Charter is to be expanded to privately managed sites, the related costs of using the same intensity of pedestrian management material would likely cause friction between the public and private construction stakeholders.

This site can be used as a lesson of discretion for Montreal policy makers. Sometimes, simplicity can win over unnecessary overcomplication.

Figure 22: Boulevard Saint-Laurent sidewalk

Rue Mackay

Mobility Nightmare

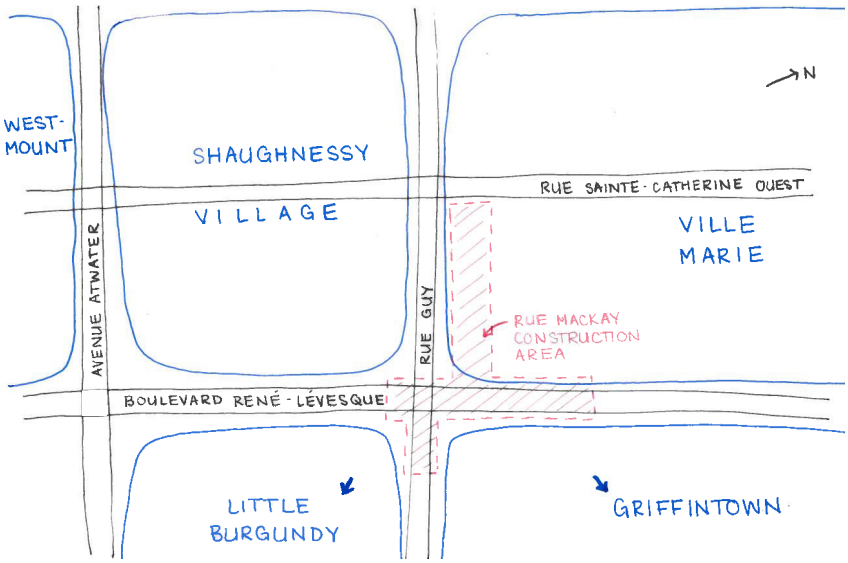

Figure 23: Neighbourhoods surrounding Rue Mackay

Rue Mackay is a mixed-use residential street in downtown Montreal, located between two densely populated neighbourhoods, Shaughnessy Village and the central part of Ville-Marie. This street and the area immediately surrounding it are heavily influenced by the presence of Concordia University. The university is not directly promoting any residential condominium development but does attract a captive group of students to inhabit new residential development. Combined with development pressures from the Ville-Marie borough and the rapidly expanding Griffintown to the South, the area surrounding Rue Mackay has seen a sudden spike in residential development between Centre Bell and Avenue Atwater since the mid-2010s. The area of Downtown Montreal, including Ville Marie, Griffintown and Shaughnessy Village, has experienced a population growth rate of 24.2% between 2016 and 2021 (Statistics Canada, 2022), and that exploding population requires infrastructure upgrades.

There are various privately managed construction sites impacting pedestrian flows along Rue Mackay, as well as the intersection between Rue Mackay and Boulevard René-Lévesque. These residential construction and rehabilitation projects intersect the municipally managed sidewalk and pavement repair project on Rue Guy, south of Boulevard René-Lévesque. Like the Rue de la Montagne and Rue de Séminarie site analyzed above, there are adjacent active construction sites with different pedestrian accommodations present.

Figure 24: Channelization along Boulevard René-Lévesque

For the purposes of this research, a focus will be placed on the privately managed construction environment to illustrate how private construction is managed outside the Montreal Charter of Construction Sites.

The Rue Mackay construction site is where the first of many mobility barriers is encountered. Pedestrians are channelized around a blocked sidewalk and construction vehicles by signage 200m from the barrier, construction tape and orange cones between the traffic and parking lane. While there is signage to use the opposite sidewalk when approaching the site at the corner of Rue Mackay and Rue Sainte-Catherine, no other signage is present closer to the barrier. Furthermore, once that barrier is reached, pedestrians are channelled into a narrow lane created between parked vehicles and construction tape with no ramp to ensure mobility over the curb height. Once in that haphazardly taped- off area, there is no opportunity to cross the street to the open sidewalk, and pedestrians must backtrack and cross the street mid-block with limited visibility toward oncoming traffic. Not only is the mobility of pedestrians negatively impacted by the design of the channelization, the lack of signage also restricts the ability to read the site and access destinations down the street.

Once Rue Mackay is successfully navigated, pedestrians are guided west along Boulevard René-Lévesque where the second ramp-less curb is encountered. The channelization material in this area consists of orange cones, metal fencing, and metal scaffolding. Pedestrians must enter the vehicle turning lane to follow the pathway under the scaffolding, step over a curb, and then manoeuvre over loose gravel. When approaching the scaffolding heading west, there is no signage to guide pedestrians. But, heading east, a sign that warns pedestrians about the active construction work is effectively blocking any circulation room that pedestrians would require while mitigating the curb and funnelling into and out of the scaffolding. This section of the construction site is located between two different privately managed construction projects, and it appears that there is very little or no coordination between the construction norms of each project.

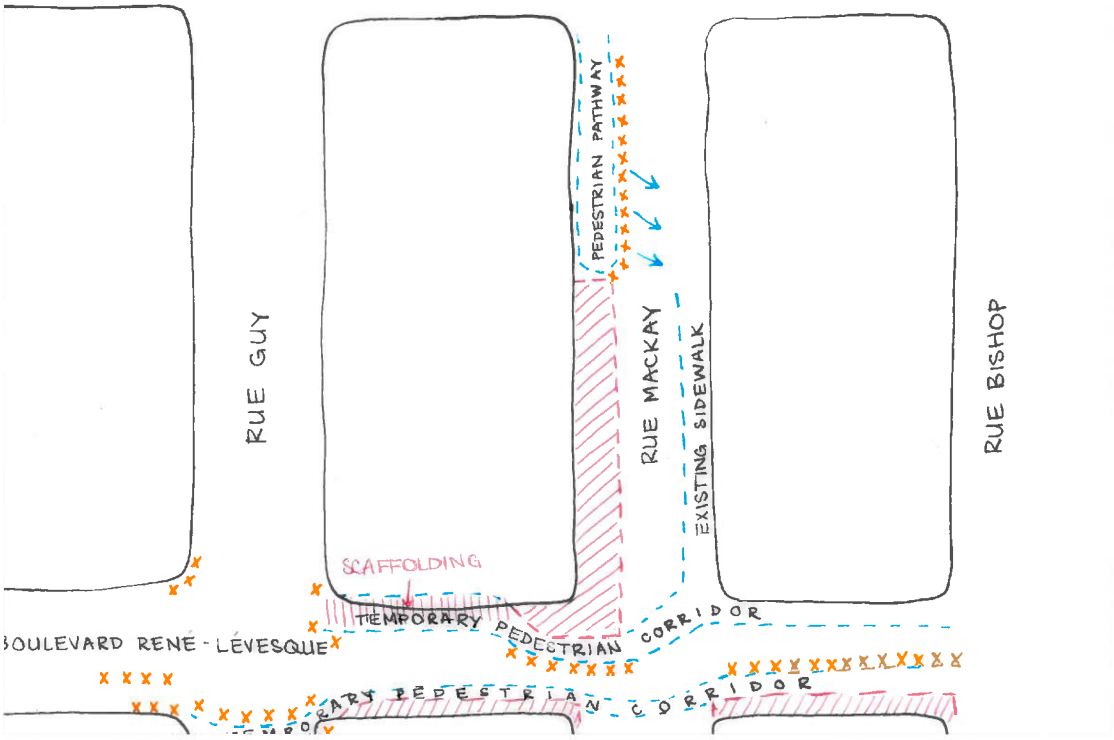

Figure 25: Rue Mackay construction site plan

On the southern edge of the privately managed construction cluster, the southern sidewalk of Boulevard René-Lévesque is where mobility is the most limited. Pedestrians are channelized by orange construction cones and metal fencing with a pedestrian pathway half a metre wide at its most narrow, and two metres wide at its widest. This does not offer enough space for easy bi-directional pedestrian movement, and not enough space for pedestrians using mobility devices. The pathway is on existing roadway pavement, which has a deteriorating surface and cannot be considered a stable surface. This narrow pathway is located right beside heavy vehicle traffic along Boulevard René-Lévesque, and the orange construction cones do not offer enough protection, sense of safety, or enclosure to pedestrians.

This cluster of construction sites along Rue Mackay and Boulevard René-Lévesque showcases the gaps that exist in Montreal's ongoing journey of ensuring universal accessibility in the public realm. Here are privately managed construction sites negatively impacting the mobility of sidewalks, which are intended to the barrier-free as they are located well within the public realm. The Montreal Charter's first stated priority is to promote accessibility, safety, and mobility within construction sites, but only has jurisdiction to pose suggestions for publicly managed construction sites. The goal to "ensure barrier-free pedestrian corridors of adequate width, by promoting the use of street furniture for the installation of signs" does not explicitly give any measurable width requirements that could be enforced, and only states that the pathway should not be occupied solely by signage.

When considering this cluster as a whole, there are five different designs of pedestrian traffic management being deployed. There appears to be no coordination between the private contractors on the channelization material or flow of pedestrian traffic, and little interaction with the publicly managed site when they intersect at Rue Guy. If these sites were better coordinated with each other and the city, then the pedestrian and cyclist experience through the construction would be improved upon, which was an initial goal of the Montreal Charter.

Figure 26: Narrow channelization along Boulevard René-Lévesque

4: Synthesis & Recommendations

This research has observed the current condition of pedestrian traffic management in a variety of Montreal's construction sites. The substance of the site audits created through this research can be explored through the conceptual vocabulary established above to describe spatial and perceived phenomena occurring in construction sites. The two methods of undertaken in this research of policy analysis and site auditing come together to establish a comprehensive picture of current construction practices. The objective of this research is to create a refined vocabulary of theories and physical manifestations of urban design that can describe the condition of construction sites to inform policy suggestions to improve said conditions.

The easy intelligibility of a space is an urban design principle that needs to be maintained during times of construction to ensure that the pedestrian realm will not be negatively affected. The intelligibility of the construction sites was significantly influenced by the level of signage. In publicly managed sites like Rue de la Montagne and Pie-IX, there was an overabundance of signage that did communicate what destinations were accessible via the active work site, but the overuse of signage was overwhelming to interpret in a split second. Public sites also had more conflicting signage, exemplified in the Boulevard de Maisonneuve prescription of cycling and pedestrian lanes. Privately managed sites like Rue Mackay and Rue Viger had a marked lack of signage, and pedestrians were generally left to their own devices to gather information about the site. The intelligibility of how to interact with the construction site was stunted by both the overuse and lack or signage, which caused pedestrians to take more time than usual to conceptualize the site layout and uses. Improvements to efficient and effective signage would need to be made to ensure that the existing level of intelligibility is not diminished.

The concept of intelligibility includes the concept of imageability, which is one building block in the theory of walkability. As noted above, walkability is the synthesis of how imageability, enclosure, human scale, transparency, and complexity, can influence a pedestrian's enjoyment of walking in a particular space. We know that the imageability of construction sites has been negatively impacted by overall diminished intelligibility, but imageability has been particularly impacted by the inability to recognize familiar landmarks. The commercial stores along Rue de la Montagne and the circulation area outside Pie-IX station are familiar landmarks that are obscured by channelization material, hindering the ability for pedestrians to gather spatial information in seconds. These two sites are both publicly managed with an abundance of channelization material which causes a heightened sense of enclosure, the second factor of walkability. That level of enclosure was more inconsistent in the privately managed sites such as Rue Mackay and Avenue Viger Ouest, both which has section of the pedestrian path that were either too enclosed and not wide enough to comfortably walk through, and areas that were far too exposed to construction materials. Both extremes leave little room for balance between exposure and enclosure, therefore never creating a space that is truly walkable.

The final factor that influences walkability is complexity, which is the number of noticeable differences in the environment that a pedestrian can perceive and receive information about without being overwhelmed (Ewing, 2009). There is an extremely delicate balance between being over or under stimulated. In construction sites, there are inherently more unique noticeable differences present when compared to the normal streetscape since the temporary site is required to communicate more information to keep pedestrians safe. These sites are high in their level of complexity, but too high when compared to enjoyably complex streets that are not under construction. The level of complexity has been influenced by the overuse of

Figure 27: Sidewalk closed

orange construction cones and conflicting signage. In the Boulevard de Maisonneuve construction site, the street environment was made unnecessarily complex due to the overwhelming number of orange cones. In the Mackay, Pie-IX, and de la Montagne cases, there are different typologies of construction management present within view of each other, heightening the number of noticeable differences and therefore overstimulating pedestrians.

The physical conditions of the construction sites are meant to maintain an appropriate level of pedestrian mobility, but barriers to mobility are present throughout almost all sites. By far, the most common barrier to pedestrian mobility was the presence of curbs that had not been modified to ensure at-grade pedestrian movement by adding ramps. These curbs are in places where the pedestrian pathway moves from the existing sidewalk to a temporary pathway on the roadway, especially along Rue Mackay and around the intersection of Boulevard Pie-IX and Avenue Pierre-de-Coubertin. These barriers can be traversed by pedestrians with a high level of personal mobility, but present issues for pedestrians with lower levels of personal mobility, such as wheelchair users. The second most common mobility barrier is the presence of uneven pedestrian pathway surfaces, whether it is pavement or loose gravel. A trend emerged here that the privately managed sites were more likely to have exposed loose gravel and uneven pathways, and the publicly managed sites were more likely to cover the uneven pathway. That covering did not always provide a secure feeling underfoot, like when crossing Boulevard Pie-IX, but does mitigate some barriers for people with lower levels of personal mobility. Overall, the intention of providing barrier-free access through the construction sites was present, but the execution requires refinement.

From the site audits, it is clear that the levels of intelligibility, walkability, and mobility of the pedestrian realm are being negatively disrupted during construction. These construction sites do not offer the same level of visual communication, pedestrian mobility, or enjoyment as before the construction was underway, but there is hope that a similar or improved level of intelligibility and walkability will manifest once the construction is complete.

There is an overall trend that the publicly managed construction sites are offering too many affordances to pedestrians. There are too many orange cones, too many conflicting signs, and too much channelization. This overstimulation actually hinders the ability for the publicly managed sites to communicate the same visual and cognitive information to pedestrians, which is the opposite of the intended outcome of providing so many affordances to pedestrians. The flipside of this trend is the privately managed sites offering too few affordances, leaving pedestrians to interpret the sites without assistance. The publicly managed sites lacked signage, proper channelization, and mobility strategies. Information that is being offered by the affordances present at both publicly and privately managed sites is being obfuscated by the inability of the sites to be intelligible.

This trend of publicly managed sites being too complex and privately managed sites being too simplistic is leaving pedestrians uninformed about their surroundings and how to interact with the temporary spaces that surround them. A happy medium between these two extremes must be met if construction sites are going to meet the cognitive and accessibility needs of pedestrians during construction. This balance can be realized through a policy tool like the Montreal Charter of Construction Sites but is improved upon based on the findings of this study. The following policy suggestions are recommended to enact real change, and advocate on behalf of pedestrians.

Suggestion #1:

Expand Scope of the Charter to Privately Managed Construction Sites

The Charter is only a suggestive guide for how municipally managed construction sites should be planned and designed. This means that the guidelines and goals of the document will only apply to a portion of the construction in Montreal that impacts pedestrian movement, and it is optional to implement. Writing the Charter about the city's own (public) construction sites does create a basis to hold themselves accountable but has no grounds to improve privately managed sites. The narrow scope of construction sites under the purview of the Charter limits the efficacy of this document. When comparing the Montreal Charter to the Vancouver Guide, it becomes extremely evident that the Vancouver goals can be more broadly implemented. The Vancouver Guide is recommended for both public and private sites, and explicitly described which criteria need to be met depending on the intensity of the project, instead of which actors are responsible for the site.

The conditions of the Rue de la Montagne and Rue du Séminaire construction sites exemplifies the need to have uniform standards between public and private sites. While both sites require better pedestrian accommodations, the two sites have different strategies for managing pedestrian disruptions. To create a standardized set of pedestrian accommodations during disruptive construction, all sites need to be subject to the Montreal Charter.

The first major amendment that can be easily made to the Montreal Charter is to expand the Charter to cover both public and private construction sites to improve the pedestrian experience uniformly and consistently in construction across Montreal.

Suggestion #2:

Make the Charter Explicit, Measurable, and Enforceable in Law

The Montreal Charter lacks a clear vision of what needs to be improved upon, and how to get there. The vagueness of the goals is obstructed by the fact that these are mere suggestions with no pathway to enforcement. The Charter uses aspirational language to describe the city's goals for their construction sites, and that communicates the lack of clear intentions of the document. Giving no definable goals to meet does mean that the city can claim any improvement is enough, but that does not hold up when comparing the Charter to what other cities such as Berlin and Vancouver have been able to accomplish.

The first issue of vagueness can be considered, again, relative to the Vancouver Guide. This guide suggests explicit and measurable goals to promote pedestrian considerations in construction sites and shows clear examples how to implement these goals consistently. The guide effectively communicates metrics that need to be met by privately managed sites. Montreal's Charter will have limited potential to improve the pedestrian experience of construction sites until the vagueness is converted into explicit and measurable goals. When considering a construction site like what was analyzed at Vendôme, precise standards pertaining to how much sidewalk, bike lane, and traffic lane area should be blocked off for certain types of maintenance work would produce a completely different traffic management design.

The second, and perhaps most blatant, aspect of the Charter that needs improvement is the lack of enforceability. The Charter has no legal grounds for enforcement, in contrast to the Berlin Mobility Law which is embedded into local bylaws to give power to the city to enforce their goals. Cementing the goals from the Charter into a municipal bylaw would symbolically promote pedestrian prioritization, and greatly improve the management of all construction sites in the city.

Suggestion #3:

Ensure Coordination of Sites and Projects

The Montreal Charter omits effective improvements to communication between members of the public and construction managers but is missing any consideration for the communication between different construction managers. In a city like Montreal that has an intense construction season with projects of various size and scale happening within proximity to each other, it seems like an oversight to not include a framework for better coordination between sites.

In construction-rich areas of Montreal like Griffintown and Shaughnessy Village, there are pockets of privately managed construction that are impacting pedestrian and cyclist movement, and those areas are only further impeded by publicly managed infrastructure improvements to support new construction. The conditions on Rue Mackay and Boulevard René-Lévesque show that there is no coordination between how each site is managing pedestrian movement, and how that is at odds with the infrastructure improvements happening further south along Rue Guy.

In situations where there will be a mix of different construction projects underway in the same area, a greater level of coordination is required to deliver pedestrian accommodations seamlessly through the entire project. The City of Montreal already publishes an interactive map of publicly managed construction sites, and this should ideally be expanded to include privately managed sites. Beyond that public communication tool, interdepartmental coordination between construction promoters and municipal service providers should be improved to minimize frustrations of the public.

To be clear, the Charter of Construction Sites is an important step in the right direction to advocate for pedestrian protections in construction sites. Construction is such a widespread nuisance in the city, negatively affecting almost every resident. The policy requires refinement if it is to create meaningful, positive change, and improve the intended goal of increasing quality of life among all residents.

5. Conclusion

Disentangling the wicked problems of urban management is truly a never-ending endeavour. The wicked problem examined in this research is one of jurisdiction and control within temporary urban spaces. Montreal has the jurisdiction to control their own construction sites but has not proposed a fully realized policy to fully manage all publicly managed construction sites. Montreal also lacks the jurisdiction to control the privately managed sites, which are the vast majority of construction projects in the city right now. This wicked problem has two major stakeholders that cannot be consistently managed by a single piece of policy like the Charter.

This research recognizes that no planning policy exists statically. The Charter of Construction Sites exists inside a complex institutional network that has accomplished impressive improvements to active mobility infrastructure. Temporary construction sites are a low priority field of improvement, even in a city like Montreal with notorious construction practices. But Montreal's commitment to active mobility infrastructure means commitment at all times. It is imperative that construction policy be reinforced if any other policy aims concerning active transportation are to be realized. Additional commitment will be needed to create an effective Charter of Construction Sites, but if any city can do it, it's Montreal. Montreal has a rich history of citizen mobilization and advocacy, and this great capacity for collective action has the ability to campaign for stronger management of construction sites to protect pedestrian mobility and satisfaction.

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Figure 28: Excess signage and orange cone