

**Zoning in on transit-oriented development:
Understanding bylaw reform as critical policy groundwork**

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ABSTRACT

Problem, Research Strategy, and Findings: Transit-oriented development (TOD) has been widely encouraged as a strategy to limit urban sprawl, increase urban density, and enhance neighborhood diversity. Federal and regional governments have been increasingly promoting such TOD in parallel with light rail transit (LRT) projects to foster sustainable transitions. Little is known, however, about the processes through which municipalities have made changes to existing land use regulations to achieve TOD goals. In this article we trace changes in municipal plans and bylaws surrounding a CA\$7 billion LRT in Montréal (Canada) that opened in summer 2023, 7 years after its announcement. Specifically, we analyzed whether changes in municipal bylaws conformed to TOD plans recommended by the metropolitan government while exploring local barriers to zoning reform. Through policy and spatial analysis, we found that only a limited number of municipalities made sufficient bylaw changes between 2016 and 2022 to support TOD plans aimed at implementing mixed-use zoning, increasing urban density, and reducing parking ratios. Through an analysis of rezoning processes, we see an opportunity for improved multilevel cooperation, public engagement activities, and positive communication strategies in the process of building integrated transport and land use systems.

Takeaway for Practice: These findings can aid planners and policymakers in understanding the importance of reforming municipal zoning bylaws and regional approaches to TOD, strengthening collaboration between different levels of government, and engaging in meaningful public-consultation practices to foster an integrated transport and land-use approach. If LRT projects are to be successful in meeting sustainability goals, greater engagement with land-use regulations across multiple scales is needed to facilitate TOD.

Keywords: Transit Oriented Development; light rail; land-use regulations; zoning; bylaws.

1 In recent decades, Transit-Oriented Development (TOD) has emerged as an influential planning
2 approach across numerous cities investing in light-rail transit (LRT). In the most basic sense, TOD
3 is a strategy that aims to integrate public-transport investments with land-use practices as a means
4 of creating more diversified, dense, and sustainable neighborhoods (Jacobson & Forsyth, 2008;
5 Lund, 2006). TOD depends on suitable and integrated land-use regulations to enable the
6 application of its principles (Dong, 2016; Levine, 2010), especially in suburban areas where
7 Transit-Adjacent Developments (TADs) can arise instead (Staricco & Vitale Brovarone, 2020).
8 To assess these possibilities and constraints, we suggest bringing attention to the processes through
9 which municipalities are making changes to zoning bylaws to accommodate TOD plans around
10 new LRT stations.

11 Several aspects of municipal bylaws make them a useful case for examining barriers and
12 opportunities for TOD. Zoning bylaws govern physical changes to the built environment and often
13 limit building heights and site coverage, which directly shapes development densities (Levine,
14 2010; Whittemore & Curran-Groome, 2021). Municipalities also control the geographical
15 distribution of different land uses through zoning bylaws, dictating the ability to develop mixed-
16 use zones. Additionally, parking ratios fall within the jurisdiction of municipal bylaws and can
17 influence the development of active-living environments (Gabbe et al., 2021), especially in TODs
18 (Willson, 2005). Given the tremendous influence that municipalities have on land-use regulations,
19 greater research is needed on the critical policy groundwork needed to support TOD.

20 Here we provide an understanding of the socio-political processes that underlie
21 municipalities' differential responses to rezoning for TOD and implementing sustainable-
22 development plans. We begin by reviewing research on TOD and zoning reform, bringing this
23 literature into conversation with theorizing on sustainable infrastructure transitions. To provide a
24 situated focus, we analyzed the case of Montréal, Québec, where TOD goals moved to the forefront
25 of metropolitan urban-planning strategies. In line with the development of a new LRT system—a
26 CAD \$7 billion investment in Montréal's transport network—policymakers developed an updated
27 metropolitan plan aiming to redevelop neighborhoods surrounding LRT stations in accordance
28 with TOD goals and thus orient 60% of household growth around mass transit stations (Montréal
29 Metropolitan Community [CMM], 2019). Given the magnitude of these plans and investments, we
30 assessed changes in municipal bylaws in areas surrounding the new LRT stations between 2016
31 and 2022 (the planning and construction phases of the project) to determine whether these changes
32 conformed with related metropolitan TOD goals. Drawing from policy analysis methodology, we
33 assessed the extent to which zoning around each station complied with the TOD principals of
34 density, mixed-land use, and decreased parking ratios. We further assessed two stations as
35 illustrative examples to exemplify variability in rezoning processes and to explore some of the
36 challenges that municipalities face in rezoning for TOD.

37 Finally, we explored how these findings can help to understand the processes through
38 which municipalities are leveraging (or not) investments made by higher levels of government to
39 achieve sustainability goals. Through greater attention to the relational aspects of rezoning
40 processes, we suggest that TOD research can provide guidance for enhancing cooperation across
41 different scales of policymaking, improving public consultation tools, and mobilizing positive
42 communication strategies to support TOD goals. This research can be of use to policymakers as

they plan for new transit systems to understand barriers and opportunities for TOD, and to ensure that adequate land-use policies and incentives are in place for municipalities to advance sustainable infrastructure transitions.

TOWARD A RELATIONAL UNDERSTANDING OF TRANSIT-ORIENTED DEVELOPMENT

Scholars have long recognized the role that transport infrastructure plays in shaping urban-planning and development processes (Calthorpe, 1993; Handy, 2005; Knowles et al., 2020). Considering the role that car-centric transport planning has played in perpetuating urban sprawl (Bae & Richardson, 2017; Handy, 2005), policy makers are increasingly working to implement planning interventions that foster a transition towards sustainable transport modes, diversified land uses, and reasonable density (Gehl, 2013). Public-transport investments, especially LRT systems, are critically important for facilitating these sustainable urban transitions but require comprehensive integration of transport plans and land-use policies (Guthrie & Fan, 2016; Millard-Ball, 2021).

To conceptualize the required land-use adaptations to foster sustainable urban transitions, Calthorpe (1990) proposed the term Transit-Oriented Development (TOD). A TOD is an urban development designed to maximize access by transit and active travel through urban design features such as mixed land uses (Calthorpe, 1990, 1993). This concept has evolved to incorporate the 3Ds (density, diversity, and design), as three built-environment characteristics that promote active travel (Cervero & Kockelman, 1997). Indeed, the focus of TOD as an area that is *dense* (compact housing, employment, and service infrastructure), *diverse* (mixed activities and land-use forms), and that promotes thoughtful *design* (public spaces adequate for walking, cycling and leisure) is now widely accepted (Cervero, 2004; Singh et al., 2017). Still, such development depends on the type of public-transport infrastructure around which it is organized as well as the presence of adequate land-use regulations.

Proponents of TOD often assume that the implementation of LRT can help to increase public-transport ridership, confront urban sprawl, and improve the accessibility, thus encouraging more sustainable land-use developments (Ewing & Hamidi, 2014). Others have called into question the extent to which LRT is capable of structuring land-use development in line with TOD goals (Handy, 2005), especially in suburban areas where TADs often arise instead (Hurst & West, 2014; Roy-Baillargeon, 2017; Staricco & Vitale Brovarone, 2020). These discrepancies could be associated with the fact that a TOD approach can be considered both at the station level – through prescriptive guidelines for development – or at the regional level – as a more flexible orientation to urban growth (Hrelja et al., 2020). Though regional planning is beneficial to coordinate transport and land-use changes across multiple jurisdictions, such approaches can fall short in terms of actual outcomes due to local barriers and inadequate coordination between different levels of governments (Lewis & Margerum, 2020; Sciara, 2017, 2020). As such, the need for greater attention to collaborative processes across local and regional actors—for example, policy makers, planners and transit agencies—has also been highlighted in the planning literature (Allred & Chakraborty, 2015), particularly with regards to TOD (Arrington, 2009; Hrelja et al., 2022; van Lierop et al., 2017).

1 Although an extensive body of literature has examined the relationship between LRT and
2 various TOD outcomes (Chava & Renne, 2022; Zandiatashbar & Laurito, 2022), greater research
3 is needed on the role of municipal bylaws in these processes, as highlighted in the early TOD
4 literature (Cervero, 2004; Curtis et al., 2009; Dittmar & Ohland, 2003; Greenberg, 2004). Although
5 various planning mechanisms enable discretionary approval for development projects (Manville
6 & Osman, 2017), the additional costs, delays, and uncertainties associated with these processes
7 can significantly hinder development outcomes (Millard-Ball, 2021). Past research has shown that
8 developers, who are important actors in the implementation of TOD, tend to favor zoning reforms
9 that simplify regulations and limit discretionary processes (Guthrie & Fan, 2016; Searle et al.,
10 2014). As such, urban planners are working to reemphasize the importance of rezoning to facilitate
11 efforts to increase housing-unit counts, decrease parking minimums, and implement related design
12 initiatives (Atkinson-Palombo & Kuby, 2011; Gabbe et al., 2021). Although rezoning may not be
13 sufficient to cultivate TOD on its own, scholars are increasingly recognizing the importance of
14 zoning for TOD alongside complementary policies, investments, and incentives (Dorsey &
15 Mulder, 2013; Renne, 2008). For example, a study from Los Angeles (CA) found that insufficient
16 zoning reforms can significantly impede station-oriented redevelopment when they limit TOD-
17 related uses (Schuetz et al., 2018). Similarly, a comparative study on TOD in Seattle (WA) and
18 San Francisco (CA) found that rezoning had a significant impact on development outcomes given
19 the controls that bylaws place over neighborhood development, including allowable uses, building
20 height limits, and parking ratios (Millard-Ball, 2021).

21 Here we bring these discussions on rezoning for TOD into conversation with the literature
22 on sustainable infrastructure transitions (Gilbert et al., 2022). Sociologist Susan Leigh Star's
23 (1999) foundational theorizing illustrated how infrastructure such as LRTs are fundamentally
24 *relational*, being embedded in other sociopolitical structures and often inheriting the inertia of their
25 installed base. This conceptualization is useful for understanding TOD as a relational process that
26 does not grow *de novo*, but rather wrestles with conflicting regulatory structures and conventions
27 of practice. Building on this understanding, others have analyzed the tremendous gaps that often
28 exist between the intended outcomes of transport-infrastructure projects and the processes through
29 which those intentions unfold in actual practice (Harvey & Knox, 2015; Soliz, 2021). Lampland
30 and Star (2009, p. 22) emphasize the significance of this "invisible trouble" which can easily
31 disrupt a system's development, but which often remains hidden from view. Our aim in this paper
32 is thus to comparatively analyze station-level bylaw changes and their concordance with
33 metropolitan TOD plans, while also working to reveal forms of invisible trouble that could present
34 barriers to the goals of building more dense, diverse, and thoughtfully designed urban areas. These
35 understandings can also help to identify efforts involved in developing suitable policy groundwork
36 and creating TOD systems that *work* across diverse contexts. It is in this spirit that our analysis
37 explored the multi-level planning, rezoning, and public engagement practices that go into building
38 integrated transport and land-use systems.

STUDY CONTEXT

Réseau Express Métropolitain (REM)

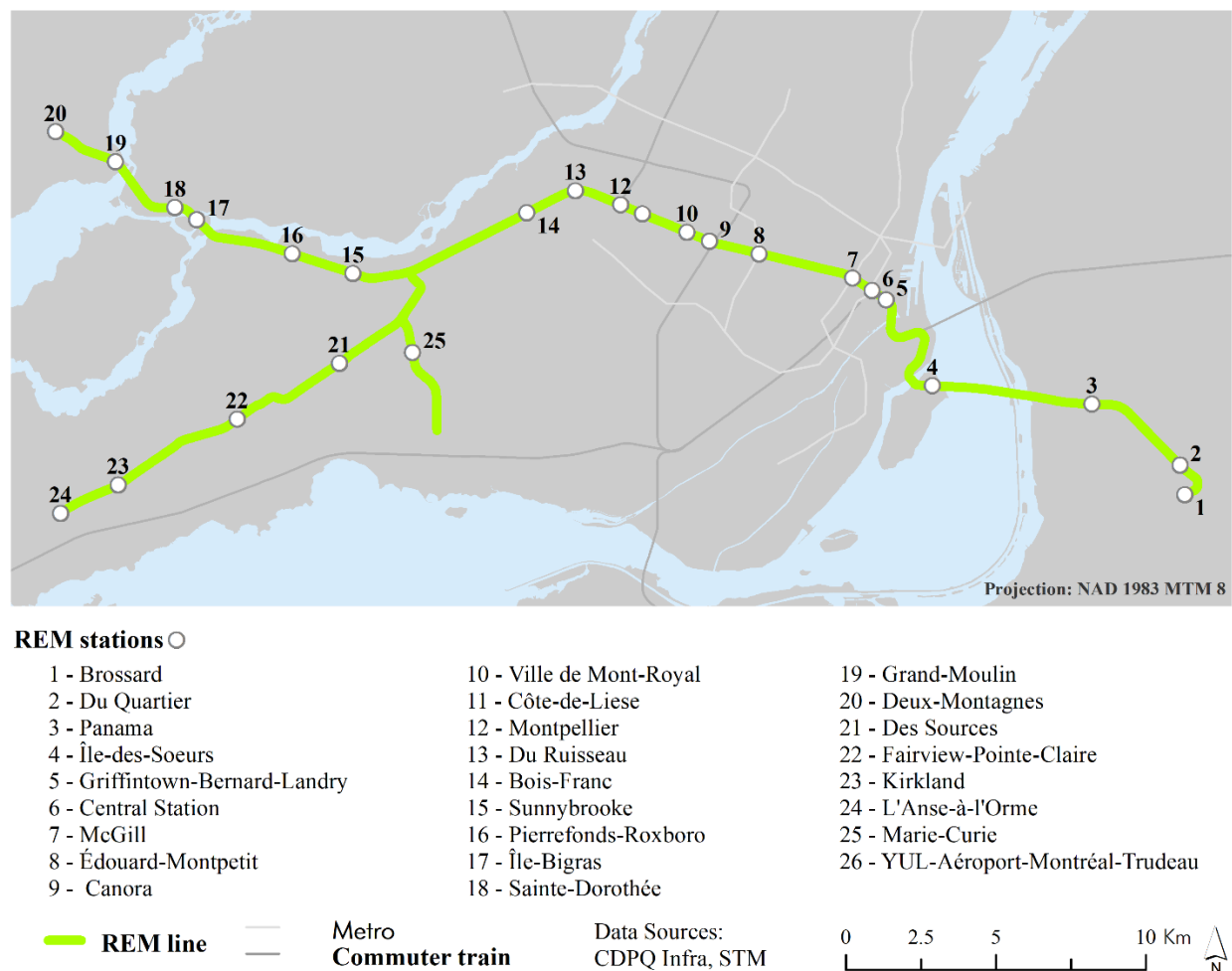


Figure 1 Detailed map of the Réseau Express Métropolitain (REM) in Montréal, Canada

In 2015, the government of Québec announced a collaboration with a para-public investor to finance and build major infrastructure projects in the province. The *Réseau Express Métropolitain*, an ambitious light-rail transit (LRT) project, was the first output of this collaboration (Statistics Canada, 2021). The fully automated, high frequency LRT system includes 26 stations across 11 municipalities and eight boroughs (Figure 1), with the aim of comprehensively improving public-transit service for over 4 million inhabitants of the Montréal region. Considering the transit modal share in the region (16%) and sprawling population growth in Montréal (ARTM, 2020), this CAD 7 billion infrastructure project offered a unique opportunity to implement TOD and address the unsustainable growth of low-density, car-dependent suburbs, requiring attention to the relationship between transport planning and the governance structures controlling local land-use regulations.

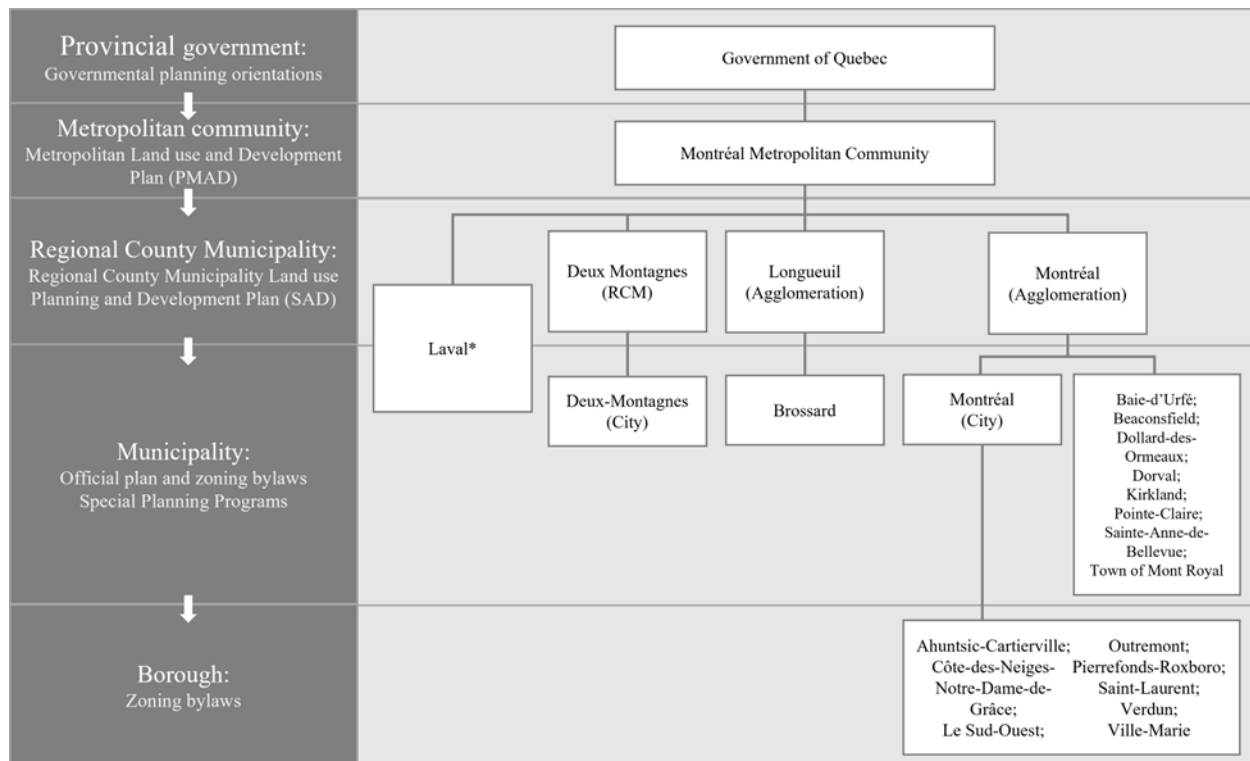
1 *Planning regulation structure in Québec*

2 In Canada, planning is regulated by provincial governments. In Québec, the LAU (*Loi sur*
3 *l'aménagement et l'urbanisme*) regulates planning at the provincial level and dictates the legal
4 structure for urban development (Gouvernement du Québec, 2022). Figure 2 displays how
5 planning is governed in Québec and its implication for our study area.

6 Planning directives are first established province-wide by the MAMH (*Ministère des*
7 *Affaires Municipales et de l'Habitation*), including restrictions for Metropolitan communities that
8 must be integrated in their planning documents known as PMADs (*Plan métropolitain*
9 *d'aménagement et de développement*) (MAMH, 2022). The latter provide guidance and restrictions
10 relating to transport and land-use planning, minimum residential densities, as well as land
11 protections (LAU, c 0.3). The PMAD adopted in 2011 by the Montréal Metropolitan Community
12 (CMM) emphasized TOD as a means of addressing concerns regarding urban sprawl, population
13 growth, and quality of life (CMM, 2012). One of its primary objectives was to direct 60% of
14 residential growth around mass-transit stations by 2031. The PMAD established minimum-density
15 thresholds for TOD zones (60-110 housing units per hectare), defined as a 1km radius surrounding
16 metro, train and, light-rail stations (CMM, 2012). Following the announcement of the LRT, the
17 PMAD was amended in 2018 to apply the minimum-density thresholds to zones around the new
18 LRT stations (CMM, 2018).

19 Following the PMAD's objectives, Regional County Municipalities (RCMs), Québec's
20 version of a regional government, must produce a planning document known as a SAD (*Schéma*
21 *d'aménagement et de développement*), which prescribes the urban boundary, general land-use
22 designations, and minimum densities for all municipalities within the RCM's territory (LAU, c I).
23 RCMs are legally obliged to incorporate amendments to the PMAD into their SAD within two
24 years (LAU, cI.0.1, s IV). That being said, as of June 2022, the Agglomeration of Montréal had
25 not adjusted the minimum densities for TOD zones in their SAD to those in the updated PMAD,
26 opening the door for some municipalities to bypass metropolitan regulations.

27 Municipalities are tasked with drafting an Official Plan that conforms to the relevant SAD
28 presenting land-use designations and minimum densities across their territory (LAU, c III, s II).
29 Municipalities or boroughs (where they exist) are required to adopt zoning bylaws that conform to
30 their Official Plan to regulate permitted land use, Floor Area Ratio (FAR), and parking
31 requirements (LAU, cIII, sII, a113). Municipal Official Plans can incorporate amendments in the
32 form of Special Planning Programs (SPPs), which allow municipalities to impose more stringent
33 planning requirements and to expropriate or finance urban-development projects for a specific area
34 (LAU, c III, s III). However, given that the law dictates that only bylaws can directly govern
35 development projects, a SPP becomes de facto unutilized if the required amendments to zoning
36 bylaws are not made (L'Heureux, 2000). Although Official Plans and zoning bylaws must
37 incorporate any changes found in the SAD within two years of its adoption and must be approved
38 by the RCM (LAU, c I.0.1, s I), municipalities are not legally obligated to incorporate the latest
39 metropolitan restrictions into their Official Plan or zoning bylaws if a RCM's SAD is not up to
40 date with the PMAD. These legal limitations underscore the importance of examining TOD-related
41 zoning changes with attention to questions of multi-jurisdictional governance.



*Laval acts simultaneously as a local municipality and a Regional County Municipality

Figure 2 Governance structure of planning in the Province of Québec and for the study area. Source: LAU (Gouvernement du Québec, 2022).

METHODOLOGY

Policy analysis methodology allows for the systematic study of decision-making across different jurisdictions, focusing on at least one aspect of policymaking: policy content (e.g., variations in policy goals), policy changes (e.g., the evolution of policy content), and policy outcomes (e.g., differential impacts of policy implementation) (Schmitt, 2012; Vogel & Henstra, 2015). Given the recency of the LRT project in Montréal at the time this research was conducted, it was arguably too early to evaluate policy outcomes. Thus, this study focused primarily on *policy content* and *policy changes* to examine the implementation of TOD-related policies across a six-year timeframe and to provide a baseline for future research.

We conducted a systematic policy analysis of changes to municipal bylaws in Montréal following the announcement of the LRT in 2016 to evaluate the extent to which these changes corresponded to metropolitan TOD plans. Twenty-five stations were considered in the analysis (the *YUL-Aéroport-Montréal-Trudeau* station was removed due to its sole purpose of serving the airport). Municipalities and boroughs of interest were identified using a 1-kilometer airline buffer around the LRT stations. For each of the 19 municipalities and boroughs identified (Appendix 1), zoning bylaws in effect when the LRT was announced in 2016 were compared to the latest adopted versions as of June 2022 to assess zoning changes. Whenever information was not publicly available, municipal planning departments were contacted through an access-to-information request.

1 In accordance with TOD characteristics highlighted in the literature, only changes
2 pertaining to density, land use, and parking requirements were considered. Building density was
3 assessed using Floor Area Ratio (FAR) or a combination of Building Space Ratio (BSR) and
4 maximum building heights. Land use mix was evaluated through zoning changes allowing for
5 added residential or commercial land use and/or zoning changes removing non-TOD conforming
6 land uses (i.e., industrial). Parking minimums and maximums were also compared. As the goal of
7 this research was to determine changes arising from the arrival of the LRT, zoning changes outside
8 of the 1-kilometer buffer zones were excluded. For all changes uncovered, the nature of the
9 changes, the applicable territory, and the date of the bylaw amendment were compiled in a
10 database.

11 To provide further contextualization, we analyzed minutes of every municipal council
12 meeting and public-consultation session that took place between January 2016 and June 2022
13 (n=1930) using a keyword approach. When applicable, SPPs adopted for specific stations were
14 analyzed (n=9). We also retrieved land-use (CMM, 2016) and population density data (Statistics
15 Canada, 2016) for 2016 and linked it to each station. The proportion of each land use of interest
16 was calculated as a ratio of total land cover in the 1-kilometer buffers. A developable land category
17 was also generated by aggregating vacant land, parking lots, and golf courses (Appendix 1).

18 Lastly, we analyzed two stations in greater detail as illustrative examples to exemplify
19 variability across stations and to explore challenges that municipalities face in rezoning for TOD.
20 This approach builds on ongoing calls in the planning literature for detailed methodology to
21 evaluate the implementation of plans (Laurian et al., 2004; Oliveira & Pinho, 2010), particularly
22 as related to TOD (Feldman et al., 2012; Millard-Ball, 2021).

23 **ASSESSING REZONING PROCESSES**

24 Through our comparative analysis of zoning changes (Table 1), we conceptualized three
25 categories to differentiate stations in terms of their implementation of TOD-related land-use
26 regulations: (1) *Pre-existing TOD stations*, which already benefitted from dense, mixed-use zoning
27 prior to 2016; (2) *Developing TOD stations*, where significant bylaw changes were implemented
28 between 2016 and 2022 in accordance with TOD principles; and (3) *Non-TOD stations*, where
29 existing zoning did not align with TOD principles, and subsequent amendments between 2016 and
30 2022 were not significant enough to support TOD goals (Figure 3).

1 *Table 1 Presence of zoning bylaw changes pertaining to TOD characteristics per station and TOD*
2 *classification*

Stations	Density		Permitted land uses			Parking		
	Increased density for residential zones	Increased density for comm. zones	Industrial / comm. rezoned to residential	Industrial rezoned to comm.	Industrial / comm. rezoned for mixed	Car parking minimums decreased	Car parking maximums decreased	Surface car parking maximums decreased
Pre-existing TOD	1	0	1	0	1	5	1	1
Bois Franc						✓		
Central Station						✓		
Édouard-Montpetit						✓	✓	✓
Griffintown-Bernard-Landry	✓		✓		✓	✓		
McGill						✓		
Developing TOD	4	4	4	2	4	4	2	3
Du Quartier	✓	✓	✓	✓	✓	✓		✓
Grand-Moulin	✓	✓	✓		✓	✓	✓	
Ile-des-Soeurs	✓	✓	✓	✓	✓	✓	✓	✓
Panama	✓	✓	✓		✓	✓		✓
Non-TOD	2	2	4	2	2	2	2	1
Anse-à-l'Orme								
Brossard								
Canora						✓	✓	✓
Côte-de-Liesse								
Des Sources		✓		✓				
Deux-Montagnes			✓			✓	✓	
Du Ruisseau								
Ile-Bigras								
Kirkland								
Marie-Curie								
Montpellier								
Pierrefonds								
Pointe-Claire	✓	✓	✓	✓	✓			
Sainte-Dorothée								
Sunnybrooke	✓		✓		✓			
Ville Mont-Royal								
All stations	7	6	8	4	7	11	5	5

3 The values in bold represent the total number of stations that have implemented each of the zoning bylaw changes. Sources:
4 Zoning bylaws and municipal council minutes from the 19 municipalities and borough identified in Appendix 1 between 2016
5 and 2022.

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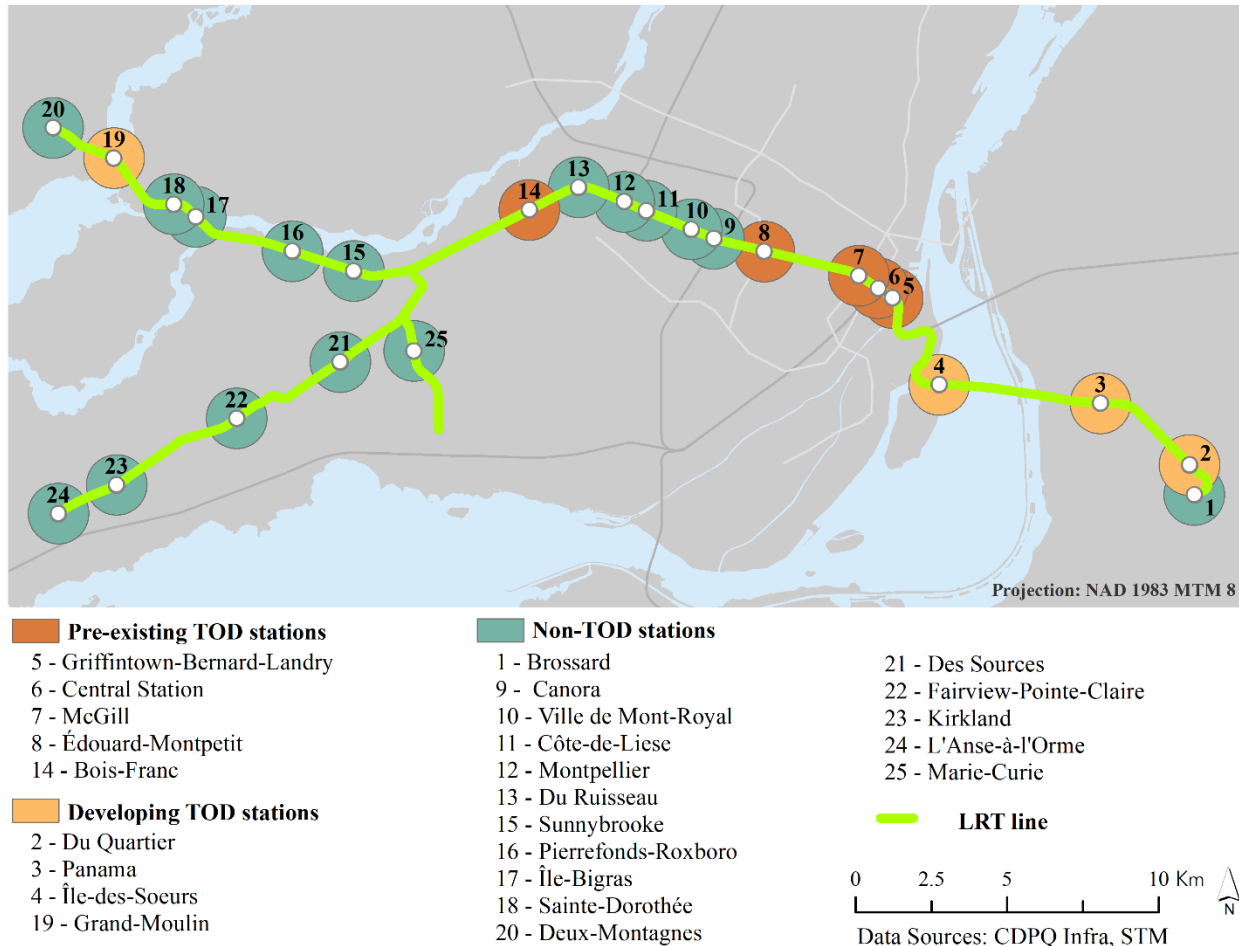


Figure 3 LRT stations by TOD classifications

Pre-Existing TODs

Five stations were categorized as pre-existing TODs. Three of these areas are existing metro (subway) stations located in the center of Montréal that were redesigned to become interchanges with the LRT, and one was a former commuter train station that was converted into an LRT station. As such, the areas around these stations were already well adapted for transit, with highly dense and mixed land use. Nevertheless, one station saw bylaw changes in terms of density and land-use mix. Parking minimums were eliminated in all zones around the three stations located in the downtown core and in most zones around the fourth station. Parking minimums were reduced by 40% in all high-density residential and commercial areas around the fourth station.

Developing TODs

Four stations were categorized as developing TODs, all located in suburban settings. Three stations are located on the South Shore branch of the LRT, which services a corridor targeted for mass transit for over a decade (CMM, 2012). These stations had low-to-medium population densities, with the second-lowest proportion of high-density residential areas (5.3%) and the highest proportion of detached single-family dwellings (24.6%) (Appendix 1).

1 All four stations saw changes to their bylaws to encourage densification. The three stations
2 on the south branch of the LRT saw rezoning of low-density industrial and commercial zones to
3 high density residential and mixed uses. The fourth station saw increases in FAR for medium and
4 low-density residential areas (e.g., from 2 to 4) in a few zones. All four stations saw increased
5 FAR for several commercial zones. Densification was mainly implemented with care for
6 architectural heritage, including the partial scaling back of initially planned density increases in a
7 few zones to better integrate with the existing built environment around two stations.

8 All four stations increased the reach of residential land uses by rezoning to create mixed-
9 use zones, allowing residential development in areas previously zoned solely for commercial use.
10 Integrated commercial and residential zones were implemented both through horizontal mix (i.e.,
11 allowing for different buildings in the same zone to have different uses) and vertical mix (i.e., the
12 implementation of residential and commercial land uses within the same building). Two stations
13 further saw diversification through the rezoning of industrial zones for commercial use.

14 Lastly, all four stations made significant changes to parking ratios. Parking minimums were
15 decreased in some zones for all four stations and completely removed in other zones for three
16 stations. Additionally, two stations reduced parking maximums in zones targeted for densification.
17 To exemplify the implementation of these changes, one of the developing TODs – *Île-des-Soeurs*
18 – is presented as an illustrative example.

19 *Illustrative example: Île-des-Soeurs*

20 *Île-des-Soeurs* is an island neighborhood in the Montréal borough of Verdun. The 1-
21 kilometer buffer surrounding the upcoming station covers primarily the Island, with an additional
22 portion across the river being under the jurisdiction of the Sud-Ouest borough. The highlighted
23 zone of interest had a population density of 2,735 people/km² as of 2016 and was composed of a
24 combination of mixed-density residential areas, car-oriented commercial uses, and office buildings
25 (Appendix 1; Figure 4). Given that the island had long suffered from poor public-transit
26 connectivity, it was identified as a priority area for public-transport investments for over a decade
27 (CMM, 2012).



a) Pointe-Nord sector (North of the LRT Station)



b) Commercial area (south of the LRT station)

28 *Figure 4 Developments built from zoning regulations in place in 2016 in the Île-des-Soeurs TOD area*
29 *(Source: Authors)*

In preparing for TOD, local policymakers conducted evaluations of the island’s potential for residential and economic development, while holding several public-consultation sessions on the development of the area’s SPP. According to Montréal’s public consultation office (OCPM, 2020), over 3,700 people participated in different public-outreach events regarding the redevelopment of the northern portion of the island, which included surveys as well as various in-person sessions. Densification was among the most socially contentious aspects of TOD mentioned in consultation processes, with the OCPM determining that “there is no consensus on the desired density” for this area (2020, p. 18). That said, policymakers were able to draw from the extensive public feedback provided in the OCPM’s 115-page report to tailor TOD to residents’ unique concerns and interests.

Through *Île-des-Soeurs*’ SPP adopted in 2020, the borough defined clear zoning guidelines for different sections of the TOD, with required amendments to the zoning bylaw and grids being adopted in 2021. This included the creation of 16 new zones to allow for added detail in zoning requirements. Zoning allowing residential land use was expanded through the removal of all industrial zoning on *Île-des-Soeurs*. In terms of density, the weighted average FAR for residential uses increased from 2.2 in 2016 to 3.0 in 2022, while the average for commercial uses changed from 3.9 to 6.2 during the same period (Table 2). While the zones located directly south of the station were rezoned solely for commercial land use (Figure 5), a significant portion of this area subsequently underwent a discretionary process in order to allow for the construction of over 1000 residential units in a new mixed-use development (Arrondissement de Verdun, 2022).

Table 2 Zoning changes around Île-des-Soeurs TOD between 2016 and 2022

	2016	2022	Change
Total zoning divisions	45 zones	57 zones	Creation of 16 new zones between 2016 and 2022
Land-use	Percentage of buffer land cover		
Residential land use	31.6%	38.6%	Creation of new dense residential and mixed zones (FAR = 3.5+) from commercial ones.
FAR (Average)	2.2	3.0	
FAR (Distribution)	Percentage of residential zoning		Upzoning was carried out in two mixed zones (FAR = 4 in 2016 to 6.5 –12.6 in 2022; FAR = 1.6 in 2016 to 3.5 – 6.5 in 2022).
0-1	9.5%	8.4%	
1-2	48.2%	35.8%	
2-3	7.6%	3.9%	
3-4	15.6%	18.8%	
4-5	19.2%	13.8%	
5+	0%	19.3%	
Commercial	35.7%	25.0%	Densification of commercial land use in previously mixed (commercial and residential) zones, commercial and industrial zones, and solely industrial zones.
FAR (Average)	3.9	6.2	
FAR (Distribution)	Percentage of commercial zoning		
0-2	35.5%	10.1%	
2-4	0.0%	4.2%	
4-6	54.9%	41.6%	
6-8	0.0%	21.8%	
8+	9.6%	22.3%	
Industrial	49.1%	16.9%	Removal of industrial zoning on Île-des-Soeurs.
Park and green spaces	17.2%	17.6%	Slight increase in size for 2 zones.

Source: Verdun Borough Council (2022) and Le Sud-Ouest Borough Council (2022).

It is worth noting that these changes did not come without significant push back from some residents, particularly home owners, who expressed concerns about the capacity of the island's infrastructure to support an influx of new residents (Cloutier, 2020). Despite the initial opposition to densification, the public-consultation sessions benefited from strong support from local non-profit organizations and housing advocacy groups who stressed the importance of "housing with greater social diversity," particularly for families and older adults (OCPM, 2020, p.20). The island's updated zoning bylaws reflected many of the recommendations from the public-consultation report, especially the importance of green space, urban agriculture, as well as other public and family-friendly facilities. Indeed, visual appeal and the creation of a pleasant living environment remain key goals across the TOD area. The borough worked to incentivize green and accessible roofs while also adding requirements for a substantial proportion of every constructed lot to be dedicated to vegetation. The bylaw also promotes a strategic gradation of building heights and density levels to preserve views of the Saint-Lawrence River.

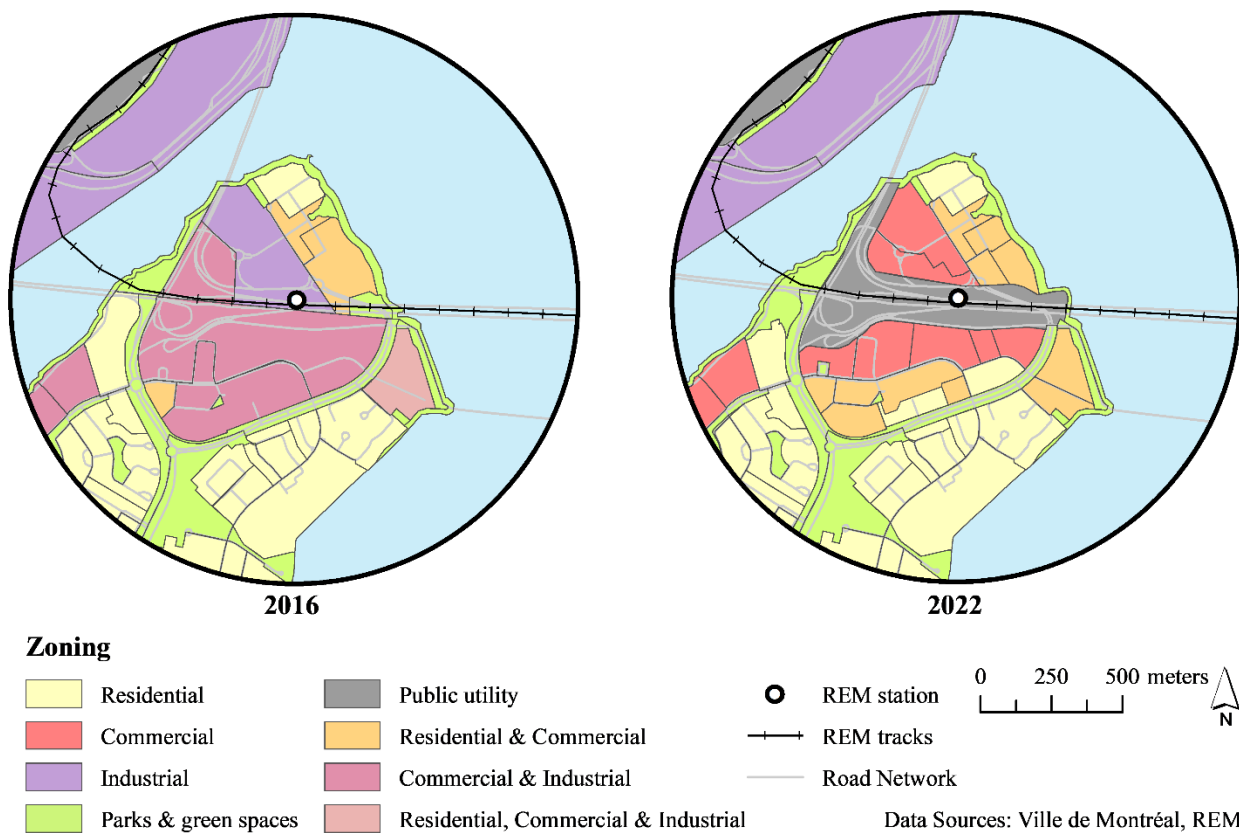


Figure 5 Land-use zoning in a 1-km buffer around Île-des-Soeurs station in 2016 and 2022

Lastly, in terms of transport-related changes, the borough lowered car-parking minimums and implemented a maximum in all existing zones (Table 3). Although opposition to these changes was widespread from residents concerned about car accessibility and potential impacts on local businesses, the public consultation sessions benefited from discussions on the importance of enhancing accessibility for pedestrians and cyclists, particularly in terms of improving road safety for children (OCPM, 2020). Consequently, an article was added to the bylaw to eliminate parking minimums completely and reduce parking maximums in 16 new zones. Surface car-parking spaces were capped at 5% in new zones, whereas the existing 20% limit was maintained for the rest of

the borough. Bicycle parking minimums were also implemented, reflecting an emphasis on active travel, as highlighted in the public consultation documents.

Table 3 Parking regulation changes around Île-des-Soeurs' TOD between 2016 and 2022

Regulation	2016	2022		Change
Residential Car Parking Min - Max (spot/unit)	1.7 - None	Old zones 1.2 - 2	New zones 0 - 0.75	Parking maximums implemented and parking minimums lowered (more so for the 16 new zones).
Office Car Parking Min - Max (spot/m ²)	1/40m ² – None	1/150 – 1/30m ²	1/300 – 1/40m ²	
Surface parking cap (%)	20%	20%	5%	Reduced maximum % of a building's allowable outside parking spaces for the 16 new zones.
Bike Parking Minimum				Minimum bike-parking requirements were implemented for the entire borough in 2021 with the 16 new zones being provided with higher minimums.
Residential (spot/unit)		1/70m ²	1	
Commercial (spot/m ²)	0	1/200m ²	1/100m ²	

Source: Verdun Borough Council (2022) and Le Sud-Ouest Borough Council (2022).

Non-TODs

Sixteen stations were categorized as non-TODs due to little or no bylaw changes in accordance with TOD principals within the 1-kilometer buffers. These stations possessed the largest range in population density as of 2016, while having the highest proportion of developable land at 10.9% on average (Appendix 1).

Across the 16 stations, three benefited from increased FAR for some zones (either residential or commercial), five expanded land use, and two saw slight decreases in parking ratios (Table 1). Still, these changes were done sparingly without the overarching vision that is crucial to TOD. While some municipalities delayed conducting public consultations on zoning changes, others saw clear resistance from residents to potential densification. To exemplify the dynamics at play behind non-TOD stations, the *Anse-à-l'Orme* station is presented as an illustrative example.

Illustrative example: Anse-à-L'Orme

The 1-kilometer buffer around *Anse-à-l'Orme* station was characterized by its high share of industrial land use (35.22%) – the highest of all stations – and developable land (29.89%) – the third highest of all stations. It had the second lowest population density of all stations at 304 people/km² (Appendix 1). The low level of development surrounding the station is depicted in Figure 6. The area around the station is divided by a highway separating the municipalities of Sainte-Anne-de-Bellevue and Kirkland to the north and Baie-d'Urfé and Beaconsfield to the south. Among the four municipalities, Sainte-Anne-de-Bellevue and Baie-d'Urfé cover the majority of the buffer area (Figure 7).



a) Empty land in Sainte-Anne-de-Bellevue (North of the LRT Station)



b) Industrial zone in Baie-D'Urfé (South of the LRT station)

Figure 6 Pictures of the surrounding of Anse-à-l'Orme station (Source: authors)

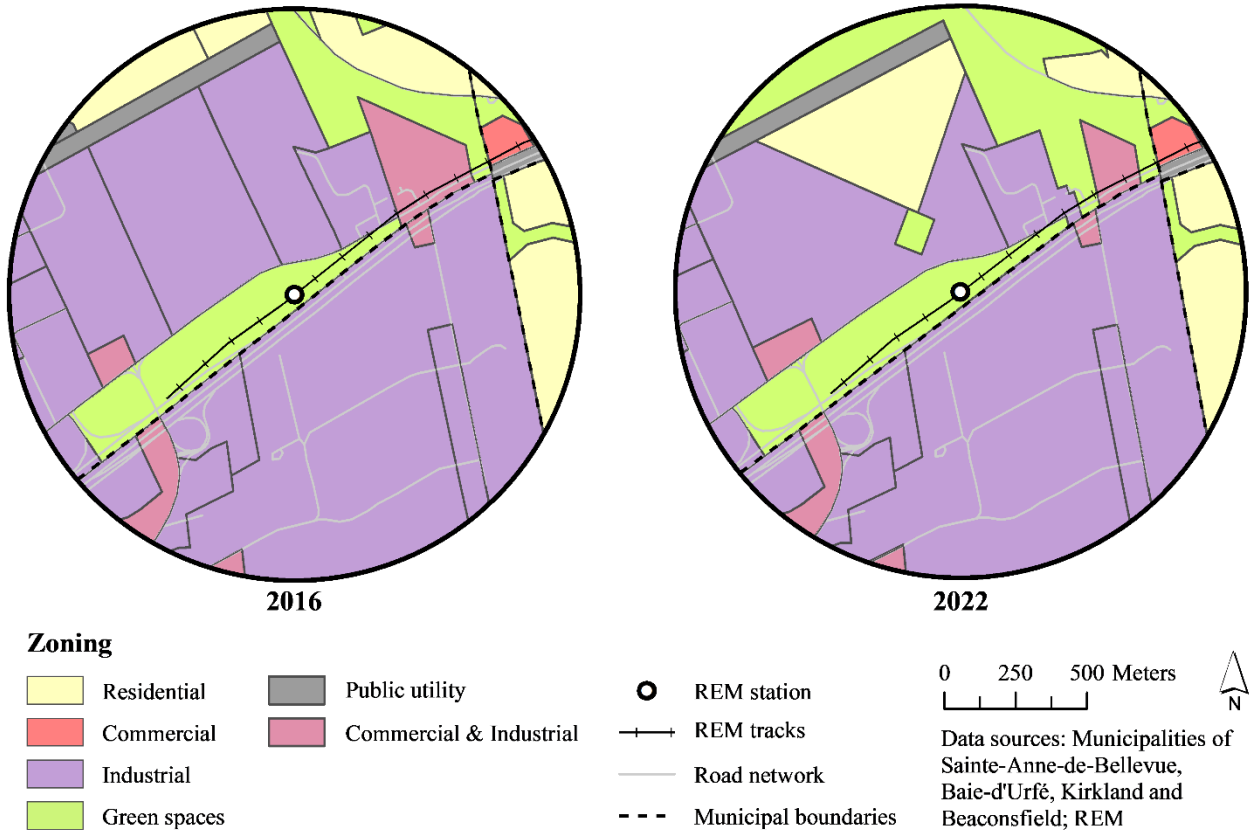


Figure 7 Land-use zoning in a 1-km buffer around Anse-à-l'Orme station in 2016 and 2022

The municipalities of Baie d'Urfé, Beaconsfield, and Kirkland did not make significant changes to their bylaws between 2016 and 2022. In Baie-d'Urfé, low density industrial zoning was maintained across most zones. Discussions of the new LRT in council meeting minutes were limited across all three municipalities.

In contrast, discussion of zoning changes related to the arrival of the LRT were numerous in Sainte-Anne-de-Bellevue. Densification has long been a contentious topic in this municipality, with a previous administration's plans to nearly double the population being rejected outright by residents in 2012 (Greenway, 2017a). Still, the municipality produced an extensive SPP for the area around *Anse-à-l'Orme* station in 2017 focusing on the preservation of green spaces, the expansion of commercial uses, and the implementation of diverse housing types. While the municipality reported holding public-consultation sessions on the development of the SPP, limited documentation on these sessions was publicly available.

Nevertheless, the town's plans received extensive media coverage relating to contrasting lawsuits between the municipality and land developers. The town was first hit with a CAD \$ 36.5 million lawsuit in 2017 from developers planning to build single-family homes and opposed to the municipality's initial emphasis on multi-unit housing. The developers' strategy included a postcard campaign claiming that property taxes would increase if the municipality's vision was implemented. The town's mayor cited this move a "fear campaign," and stressed that the municipal council remained united in its support for the SPP (Greenway, 2017b). This lawsuit was eventually dropped when the Agglomeration of Montréal offered to buy the developers' lots to incorporate them into a natural park (Barbeau, 2021). This acquisition led to the modification of residential zones, which were partially rezoned as protected natural spaces (Figure 7).

In 2021, the town's industrial zoning was challenged by a separate developer seeking to build high-density housing. In contrast to earlier support for the SPP, the mayor was later cited as advocating for an industrial park, claiming that "industrial buildings generate three times the revenue for the city compared to residential projects" (Sargeant, 2021). While the SPP developed in 2017 encompassed the development of diverse housing types, the municipality ultimately maintained its zoning for detached single-family houses across the remaining residential zones. Limited zoning changes were made in terms of land-use mix, with industrial zoning remaining the norm, and no changes were made to parking regulations (Table 4). Public consultation on these changes was limited, with a declaration noting that "no comments were received..." (Bonhomme, 2021).

In terms of promoting access to the LRT, the municipal government placed a strong emphasis on connectivity for car drivers. The mayor called for the construction of a new highway overpass and criticized the provincial government for deciding against the addition of 2,000 parking spaces at the neighboring Kirkland station, claiming that traffic around *Anse-à-l'Orme* station would be a "disaster waiting to happen" (Meagher, 2021).

Table 4 Zoning and parking-regulation changes around Anse-à-l'Orme station between 2016 and 2022

Zoning changes			
	2016	2022	Change
Total zoning division	35 zones	31 zones	Combination of several zones.
Land-use	Percentage of buffer land area		
Residential (FAR = 0 - 1)	10.3%	12.8%	Modification of residential zones due to the rezoning of these areas as protected natural spaces. No changes in density.

Commercial (FAR = 0 - 1)	5.7%	4.3%	No significant changes.
Industrial	74.4%	65.8%	Consolidation of 3 industrial zones into 1. Reallocation of industrial space to allow for the relocation of 1 residential zone.
Park and green spaces	12.4%	18.5%	Rezoning of residential zones to natural park and consolidation of existing zones. Addition of 1 new park zone.

Parking regulation			
Regulation	2016	2022	Change
Residential Car Parking			No changes to parking regulations.
Min - Max (spot/unit)	1 - No Max	1 - No Max	

Sources: Baie-d'Urfé Municipal Council (2018); Beaconsfield Municipal Council (2022); Kirkland Municipal Council (2008); Sainte-Anne-de-Bellevue Municipal Council (2022).

UNDERSTANDING BYLAW REFORM AS CRITICAL POLICY GROUNDWORK

Following the announcement of the LRT in 2016, TOD moved to the forefront of Montréal's urban-planning agenda with the intention of reorienting growth around mass-transit stations to foster sustainable urban environments. Notwithstanding metropolitan objectives, our analysis of over 1900 municipal-council minutes and public-consultation documents revealed that, six years following the announcement of the LRT, there was limited engagement with the zoning reforms required to support TOD goals. Our station-level analysis of bylaw changes underscored a discordance between metropolitan plans and the realities of local municipalities in terms of enhancing design, density, and diversity.

Promoting thoughtful design

Proponents of TOD have long advocated for *reduced parking ratios* as a means of supporting more thoughtful design features to support active travel, making this goal an important aspect of our comparative analysis. Our study revealed that that several pre-existing and developing TOD stations—especially the *Île-des-Soeurs* example—were successful in making careful modifications to parking regulations, which not only reduced car-parking minimums, but better restricted parking to underground areas. That changes to car-parking regulations were scarce surrounding non-TOD stations is perhaps unsurprising, considering that researchers have documented an enormous amount of suburban resistance to policies that limit the mobility privileges afforded to car drivers (Wild et al., 2018). At the same time, the high level of political inertia surrounding parking regulations across most of our study contexts calls into question the achievability of metropolitan TOD plans given that parking ratios have a direct impact on available space for development and active travel behaviors (Gabbe et al., 2021; Shoup, 1999; Willson, 2005).

The rhetorical commitment expressed by some local policymakers toward improving motor-vehicle accessibility around the Anse-à-l'Orme and Kirkland stations suggests that parking requirements remain a major barrier to implementing TOD plans. While the sustainable-transitions literature has explored the topic of "blame games" (Bache et al., 2015), our findings suggest that these issues require greater analysis within TOD research, including the ways that local and metropolitan actors mobilize blame-avoidance strategies within fluid multi-level governance

1 structures, creating a type of accountability vacuum. These findings suggest an opportunity for
2 better multi-level cooperation in mobilizing positive communication strategies for promoting
3 TOD, such as benefits for families and public health, which have been shown to be more successful
4 than negative communication tactics (Gössling, 2020). Our findings on zoning reform strategies
5 from *Île-des-Soeurs* point to the importance of emphasizing the road-safety benefits of reduced
6 parking ratios and improved active-travel infrastructure as a part of broad-based public
7 consultation efforts.

8 ***Fostering density and diversity***

9 Our study context demonstrated the importance of accounting for bylaw changes pertaining
10 to *density* and *diversity*. Our findings for pre-existing TODs illustrated the importance of rezoning
11 considerations, even in areas with land-use regulations that were already conducive to TOD, to
12 allow for the improvement of underutilized areas. Developing TOD stations showed further signs
13 of promise as municipalities underwent significant rezoning to allow for more compact, diversified
14 developments, and the construction of adequate multi-family housing. Some of these
15 municipalities took further steps to carefully design new station areas in ways that integrate with
16 the existing built environment while respecting architectural heritage. The *Île-des-Soeurs* example
17 illustrated the important role that meaningful public-consultation processes can play in addressing
18 residents' concerns about densification and in mobilizing positive communication strategies that
19 emphasize social diversity, access to greenspace, and family friendly infrastructure. These
20 dynamics exemplify the need to consider the relational aspects of infrastructure, bringing public-
21 communication strategies on transport investments and related land-use changes into deeper
22 conservation with the diverse needs and wants of local populations.

23 While some zoning-reform efforts showed signs of promise, our analysis revealed that
24 bylaw changes were overall limited when looking at the entire LRT network. Zoning for low-
25 density development remained the norm in most areas, particularly surrounding suburban stations.
26 These findings suggest that intentional densification and diversification around new transit
27 stations, while less prevalent in areas with fully developed land covers, is not primarily dependent
28 on available land, but rather on a variety of localized factors and wider socio-cultural trends. As
29 other scholars have shown, TOD plans can easily be impeded by issues of NIMBYism (or not-in-
30 my-backyard opposition to sustainable development initiatives) (Cervero, 2004; Renne et al.,
31 2016), which intersect with local competing interests and political pressures. The *Anse-à-l'Orme*
32 example exemplified these tensions. Even though the metropolitan plan required the elaboration
33 of denser residential areas, only minor zoning changes incorporating low-density commercial and
34 industrial development and the construction of detached single-family homes were made. While
35 these issues merit further research, this illustrative example highlights the need to direct additional
36 attention to how competing development interests and legal disputes could have an influence on
37 metropolitan TOD plans.

38 ***Assessing multi-jurisdictional collaboration***

39 This study underscores the tensions that can emerge within complex multi-level
40 governance arrangements, revealing how local municipalities are often unsuccessful in
41 implementing TOD plans developed by higher levels of government. It is worth noting that the

1 general lack of concordance between metropolitan regulations and municipal zoning bylaws
2 remained legal at the time of this research given that municipalities in Québec are only legally
3 bound to incorporate restrictions from the regional plan (SAD). Since the Agglomeration of
4 Montréal's SAD had not been updated to incorporate the revised list of TOD zones from the
5 PMAD as of June 2022, the metropolitan regulations were not applicable to the municipalities
6 within this agglomeration. Despite the 2-years deadline dictated by the law, the CMM reported
7 that only five out of 14 RCMs adjusted their SAD in time following the adoption of the PMAD in
8 2012 (CMM, 2021). Legal enforcement of the metropolitan plan was also minimal, with the CMM
9 only pursuing legal action once to challenge the conformity of a RCM's SAD in court, which they
10 lost (Vaudreuil-Soulanges RCM v CMM, 2021). While this lack of enforcement could be attributed
11 to a variety of factors, issues of conflicting interests and political will require greater examination
12 considering that metropolitan agencies in Québec are overseen by municipal elected officials who
13 may be unlikely to push for increased enforcement over their own municipalities.

14 These findings support previous calls for improved consensus building across different
15 levels of government (Renne, 2008; Staricco & Brovarone, 2018) and more comprehensive
16 regional zoning regulations to avoid the development of TADs in the place of TODs (Roy-
17 Baillargeon, 2017). Our findings also point towards the limitations of coercive metropolitan plans
18 as the sole mechanism for promoting municipal zoning reforms. In addition to improving public-
19 consultation mechanisms, incentives could provide an effective complementary strategy for
20 fostering cooperation from diverse municipal stakeholders, as explored in other contexts (Cervero,
21 2004; Renne, 2008). Our study contributes to the literature by underscoring the need to consider
22 the multi-jurisdictional structure of planning regulations and the relational aspects of TOD when
23 assessing the implementation of sustainable-development plans.

24 *Areas for future research*

25 Collectively, our analysis revealed that while some boroughs and municipalities in Greater
26 Montréal adjusted their bylaws to facilitate TOD around LRT stations, the depth and scope of these
27 changes may not be sufficient to support the targeted sustainable transitions that LRT is built for.
28 Our study is limited to the early phases of the LRT's construction, and was not able to measure
29 long-term development outcomes. Municipalities that failed to modify their zoning bylaws to
30 promote TOD could still do so after the system becomes operational. Follow-up studies should
31 thus be conducted at periodic intervals following the opening of the LRT to analyze the progression
32 of zoning changes in line with TOD goals. Still, major differences and inconsistencies were found
33 in the regulations implemented by some municipalities, indicating that a lack of appropriate zoning
34 policies remains a major barrier to TOD. Our analysis therefore emphasizes that while flexibility
35 in TOD implementation has been discussed as beneficial for adapted developments (Hrelja et al.,
36 2020), additional guidance and collaboration at the metropolitan and regional levels could be
37 pertinent to adequately support TOD goals.

38 Given the need for qualitative research on the tensions surrounding TOD (Jamme et al., 2019;
39 Noland et al., 2017) and especially neighborhood densification (Handy, 2017), future research
40 could integrate in-depth interviews with local policymakers and neighborhood associations to
41 provide a deeper understanding of why some municipalities have been more successful than others

in rezoning for TOD. Considering that past research has highlighted pervasive issues of housing unaffordability in TODs (Jones & Ley, 2016; Renne et al., 2016), future research would benefit from a detailed assessment of affordable-housing challenges to help outline potential policy shortfalls relating to inclusionary zoning, affordable-housing-preservation, and other neighborhood-stabilization strategies, which merit greater assessment in areas targeted for major public investments (Chapple et al., 2022; Zuk et al., 2018).

Analyzing TOD during the construction and implementation phases of new LRT investments provides a critical opportunity to carefully assess development processes, not only to monitor the construction of physical infrastructure, but also to address potential shortfalls in the critical policy groundwork needed to support sustainable-development goals. Through careful attention to the relational aspects of LRT infrastructure and rezoning processes, we hope that future research can help to identify the multi-level governance processes involved in creating integrated transport and land-use systems capable of bringing together the appropriate policy groundwork, incentives, public consultation tools, positive communication strategies, and wider political will needed to comprehensively support sustainable urban transitions.

CONCLUSION

Policy makers in cities such as Montréal have been granted an unprecedented opportunity to use LRT investments as a leverage to transform their sprawling cities into more diverse and livable environments through TOD. Yet major barriers to TOD remain, from the insufficient integration of transport and land-use considerations to inadequate policy infrastructure. While our study was limited to the construction phase of a new LRT investment in Greater Montréal, our findings suggest that only a limited number of municipalities in the region made sufficient bylaw changes to adequately support TOD plans aimed at implementing mixed-use zoning, increasing urban density, and adjusting parking ratios. These findings suggest that local policy makers have not done enough to benefit from one the largest public-transport investments underway in North America. Our research provided evidence of the need for more attention to zoning bylaws as a part of studies aimed at supporting transit-oriented development. Through greater attention to rezoning processes, we see an opportunity for enhanced cooperation between state, regional, and local policymakers; as well as meaningful public-consultation practices and positive communication strategies in the process of building integrated transport and land-use systems. If TOD projects are to be successful in meeting goals of sustainable-urban development, improved understandings of the relational aspects of land-use regulations are needed to support the groundwork of TOD and ensure the maximization of societal benefits from public-transit investments.

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- 3 **DECLARATION OF INTERESTS**

- 4 No potential conflicts of interest were reported by the authors.

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Appendix 1 – Descriptive statistics of the 1-kilometer buffer area surrounding the LRT stations as of 2016

Station name	Municipalities / Boroughs	Population density	Residential Single unit	Residential 2 - 4 units	Residential 5+ units	Commercial & Offices	Industrial	Institutional	Park	Public Utility	Roads	Agricultural land	Developable land
Downtown stations		ppl/km2	Percentage of land area										
Central Station	Le Sud Ouest; Ville-Marie	6,977	1	2	10	31	1	7	2	5	34	0	7
Griffintown-Bernard-Landry	Le Sud Ouest; Ville-Marie	6,750	1	1	8	20	4	6	2	24	25	0	8
McGill	Ville-Marie	6,788	3	4	10	27	0	17	3	3	29	0	4
Urban Stations													
Bois-Franc	Ahuntsic-Cartierville; Saint-Laurent	6,041	19	6	8	8	4	7	4	9	20	0	14
Canora	Côte-des-Neiges-Notre-Dame-de-Grâce; Ville-de-Mont-Royal	6,976	23	10	13	4	5	7	5	4	29	0	1
Côte-de-Liesse	Saint-Laurent; Ville-de-Mont-Royal	3,687	8	2	11	18	11	7	2	18	22	0	2
Du Ruisseau	Ahuntsic-Cartierville; Saint-Laurent	7,358	29	11	6	2	0	6	5	4	35	0	1
Édouard-Montpetit	Côte-des-Neiges-Notre-Dame-de-Grâce; Outremont	4,167	18	8	7	1	0	41	7	0	17	0	0
Montpellier	Saint-Laurent	5,795	10	8	15	14	4	9	2	13	24	0	1
Ville de Mont-Royal	Ville-de-Mont-Royal	3,972	45	4	4	1	0	5	4	3	34	0	0
Suburban stations													
Anse-à-l'Orme	Baie-d'Urfé; Beaconsfield; Kirkland; Saint-Anne-de-Bellevue	304	3	0	0	7	35	0	4	8	12	0	30
Brossard	Brossard	404	1	0	0	16	0	7	0	15	28	33	0
Des Sources	Dorval; Pointe-Claire	372	1	0	1	36	32	1	0	8	17	0	4
Deux-Montagnes	Deux-Montagnes	731	32	3	3	4	5	12	5	3	27	0	7
Du Quartier	Brossard	511	8	1	0	24	0	2	8	3	34	8	12
Fairview-Pointe-Claire	Kirkland; Pointe-Claire	1,119	17	0	3	22	12	8	1	2	20	0	14
Grand-Moulin	Deux-Montagnes	1,811	47	5	3	4	0	4	1	5	21	1	9

Île-Bigras	Laval	1,393	44	2	1	1	1	1	6	3	16	0	26
Île-des-Soeurs	Le Sud-Ouest; Verdun	2,735	7	0	12	17	4	2	7	2	40	0	9
Kirkland	Beaconsfield; Kirkland	1,757	43	0	1	7	3	1	7	0	24	0	13
Marie-Curie	Saint-Laurent	67	0	0	0	15	13	0	0	26	8	0	39
Panama	Brossard	2,931	35	1	4	23	0	1	2	1	31	0	1
Pierrefonds-Roxboro	Pierrefonds-Roxboro	3,531	45	4	5	8	0	4	4	2	24	0	3
Sainte-Dorothée	Laval	932	41	1	1	1	0	2	3	2	16	0	31
Sunnybrooke	Dollard-des-Ormeaux; Pierrefonds-Roxboro	3,668	35	4	18	4	0	5	10	3	19	0	3

Data sources: Statistics Canada, CMM