RAPID TRANSIT AND MIXED-USE DEVELOPMENT

Case study:
Two end-of-the-line metro stations
Longueuil-Université-de-Sherbrooke and Montmorency stations, Montreal

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I hereby declare that I am the sole author of this report.

I also declare that my work, “Mixed-use Development and Transit-oriented Development in North America,” an assignment for Urban Design Seminar-ARCH 604, was partly used in first two chapters of this report.

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List of abbreviations

AMT: *Agence métropolitaine de transport*

BAnQ: *Bibliothèque et Archives nationales du Québec*

BRT: Bus Rapid Transit

CBD: Central Business District

CMM: *Communauté Métropolitaine de Montréal*

FAR: Floor Area Ratio

HR: Heavy Rail

LR: Light Rail

LRT: Light Rail Transit

LRRT: Light rail rapid transit

RRT: Rail Rapid Transit

STM: *Société de Transport de Montréal*

TAD: Transit-Adjacent Development

TJD: Transit Joint Development

TMR: Town of Mount Royal

TOD: Transit-Oriented Development

UdeM: *Université de Montréal*

UdeS: *Université de Sherbrooke*

UQAM: *Université du Quebec à Montreal*

Abstract

According to the United Nation's report (World Urbanization Prospects, 2014), by 2050 sixty-six percent of the world's population is expected to live in urban areas. North America already leads this trend with forecasts rising to 81.5 percent of urban dwellers by 2050. Architects and planners have to offer new ideas on how to react to this urbanization course by making cities more sustainable and carbon neutral. The promotion of mixed-use development, transit-oriented development, and affordable transportation for everyone can play a significant role in reducing the CO_2 contribution of cities. In this process, it is important to learn from past urban design projects. This could help in avoiding past mistakes and guide designers in seeking new and improved solutions.

Since the 1990s, mixed-use development and transit-oriented development (TOD) have emerged as popular approaches among urban designers, planners, and architects. However, even before the arrival of TOD terminology, new developments around terminal metro stations appeared in correspondence with the basics of a compact urban node. With new transportation technologies cities grow faster, and it has become crucial for the designers to consider urban spaces, specifics of a site, achieving mixed-use balance and creating vibrant and socially diverse places.

This research paper examines development of the areas around two end-of-the-line terminal metro stations in Montreal: Longueuil-Université-de-Sherbrooke and Montmorency which were built forty years apart. The report investigates the influence of the metro stations on the areas where they appeared, analyzes the mix of uses and urban design. The report concludes with lessons learned from these two TODs and explores differences and similarities in their development, land-uses, and urban design.

Abrégé

Selon le rapport des Nations Unies (World Urbanization Prospects, 2014), on estime que jusqu'a 2050 66% de la population mondiale vivra dans les zones urbaines. L'Amérique du Nord conduit déjà cette tendance, avec les prévisions atteignants 81,5% des citadins jusqu'a 2050.

Les architectes et les urbanistes doivent proposer de nouvelles idées sur la façon de réagir à ce cours d'urbanisation en rendant les villes plus durables et neutres en carbone. La promotion d'une mixité d'usages, du développement axé sur le transport en commun et sur le transport abordable pour chacun peut jouer un rôle important dans la réduction de la contribution CO_2 des villes. Dans ce processus, il est important d'apprendre des projets passés de conception urbaine. Cela pourrait aider à éviter des erreurs passées et à guider des concepteurs dans la recherche de solutions nouvelles et améliorées.

Depuis les années 1990, le développement d'une mixité d'usages et l'Aménagement axé sur le transport collectif (TOD) ont apparu comme des approches populaires parmi des concepteurs, planificateurs et architectes urbains. Cependant, même avant l'arrivée de la terminologie de TOD, les nouveaux développements autour des stations de métro terminales apparaissaient en correspondance avec les bases d'un nœud urbain compact. Avec les nouvelles technologies de transport, les villes grandissent plus rapidement, et il est devenu crucial pour les urbanistes de considérer les espaces urbains, les spécificités d'un site, la réalisation d'un équilibre mixte et la création de lieux dynamiques et socialement diversifiés.

Cet article examine le développement des zones autour de deux stations terminales de métro à Montréal: Longueuil-Université-de-Sherbrooke et Montmorency, qui ont été construites à l'intervalle de quarante ans. Le rapport étudie l'influence des stations de métro

sur les zones où elles ont apparu, analyse la mixité d'usages et de conception urbaine. Le rapport se termine par les leçons tirées de ces deux TODs et explore les différences et les similitudes de leur développement, leurs utilisations territoriales et leur conception urbaine.

Chapter 1 INTRODUCTION

The research report on rapid transit and mixed-use development consists of four chapters. This chapter first introduces the research topic, the rationale of the study, and gives some background information on it. Then, it poses the research question, research aims and objectives, and the methodology.

Chapter 2 is the literature review with the outline of past and current practices in transit-oriented development, rapid-transit-development and mixed-use development with a focus on the North American experience. The examples of North American cities and their policies regarding transit and mixed-use development around train stations are examined. These examples give a good background for understanding the success of Montreal case studies.

Chapter 3 deals with two case studies of Montreal metro terminal stations: Longueuil-Université-de-Sherbrooke and Montmorency. The chapter describes the sites, their history, land use development, etc. The case studies are observed by using the guilds of *Communauté Métropolitaine de Montréal* (CMM) and TOD Institute[*].

Chapter 4 summarizes lessons learned from case studies of Montreal stations and other developments in North American cities mentioned in chapter two. It concludes by showing how strategic urban design of metro stations may affect the development around it, and discusses what is needed to ensure its success. It also discusses what could urban designers and architects learn from these case studies, and how important it is for urban design projects to have a clear concept, convenient building pattern, and good mixture of functions.

[*] CMM is a planning, coordination, and financing organization, that practices and has competence in the fields of regional planning, economic development, social housing, public transport, and the environment.

TOD Institute is a planning organization working to promote walkable, mixed-use, sustainable communities around rail stations.

1.1 Background

Transportation systems have a powerful ability to shape cities; and hence, planners widely use them as a policy instrument to guide cities' growth (Huang, 1996). While some policies encourage suburban sprawl, others can promote sustainable development. Modern transportation systems by increasing people's mobility within cities can make our cities more compact and improve their ecological footprint.

Compact urban form with a wide range of mixed uses was a part of traditional cities' development before the arrival of the industrial period which established single-use zoning (McBee, 1992). This separation of functions forced people to travel to their workplaces. The automobile era, suburban sprawl, and arrival of big box stores, furthered this separation (Cervero, 2013).

Jane Jacobs, in her book, *The Death and Life of Great American Cities (1961)*, introduced the basis of a mixed-use community. According to her, to make a city livable, we have to design diverse, mixed-use and dense neighborhoods.

Since the 1970s, the ideas of compact urban form have been further developed, and mixed-use zoning started to grow. In the 1980s, The New Urbanism and Smart Growth movements promoted their approaches in city planning and mixed-use developments. Peter Calthorpe (1993) introduced the basics of transit-oriented development in his book *The next American metropolis: ecology, community, and the American dream*. His book, a guide on how to design communities, was also like a manifesto to rethink the structure of future cities.

Both New Urbanism and Smart Growth consider mixed-use development and public transit as one of the core elements for achieving sustainable communities. The creation of a neighborhood that is compact, walkable, diverse, and well connected with transit is a common goal of both movements. The Smart Growth movement and mixed-use and transit-

oriented development (TOD) are solutions to the huge economic, social and environmental costs of sprawl (Goetz, 2013). New Urbanism as well as Smart Growth infer that public transit can improve the ecological situation in cities. Also, well-developed TODs promote walkability, which can help create good social atmosphere and healthy neighborhoods.

1.2 Problem Definition

As more and more people opt to live in cities it is important to create vibrant and livable mixed-use communities. According to the United Nation's report (World Urbanization Prospects, 2014), 66 percent of the world's population is expected to reside in urban areas by 2050. North America leads this trend with forecasts rising to 81.5 percent of urban dwellers by 2050.

Despite the general trend of urbanization North America is still highly dependent on cars, and a large percentage of urban populations still live in suburban settlements. Furthermore, detachment of big-boxes and retail centers from residential areas requires people to travel many kilometers to shop, forcing people to use cars and keeping them dependent on oil and car-related industries (Cervero, 2013).

The car was once introduced as an instrument of freedom. However, this freedom comes at a price of costly maintenance, construction of highways, worsening ecology, etc. This car-dependency has so strongly penetrated into the lifestyle of many people that a lot of us cannot imagine living without it. However, not everyone can afford a car and not everyone can drive. Moreover, elderly people or those with reduced mobility, who live in suburbs where everyday services are not located within walkable distance from their homes, become fully dependent on their family members or social support. Also, for children suburbs

become areas where they are in a safe but not challenging environment. In addition, mothers are forced to drive them to school (Grant, 2006).

Finally, our ecological situation is far from perfect. The history of North American cities in the 20th-century shows how unstable, economically inefficient and ecologically harmful sprawling cities which are dependent on cars can be. “Parking covers more acres of urban America than any other one thing” (Speck, 2012). Moreover, the governments’ investments in the design and maintenance of roads are four times higher than those in public transportation (Duany, 2010). Growing car dependency, specifically in suburban areas, forces researchers and designers to find ways to increase the density of urban areas and discover ways to improve public transit.

1.3 Research Question

The concept of transit-oriented development was widely implemented in North American cities and still continues to be the main approach in urban planning. The present study discusses transit-oriented development with a focus on rapid heavy transit (metro) and mixed-use development around these transits.

According to Speck (2012), only rapid transit has the power to transform cities. History reveals many successful examples of urban design and planning regarding mixed use and public transit. Previously cities were compact enough, but with the development of new technologies in transportation, such cities started to grow. Vehicles like trains, trams, automobiles, and metro help people to travel kilometers in a modest period of time. Suburban trains, for instance, linked distant communities with downtown areas. Thanks to them such districts of Montreal as Town of Mont Royal (TMR), West Island, North and

South Shores developed and got access to the city center. The opening of Montreal's metro in 1966 is a great example of strategic urban thinking which helped develop the city significantly. Thanks to this development many more parts of the city became easily accessible, and people from suburban areas could come to the downtown via public transit.

How did two end-of-the-line metro stations in Montreal affect mixed-use and transit-oriented development of the area around them? How did their urban designs evolve? And what can designers learn from these two stations built 40 years apart?

1.4 Research Argument

The alternative to sprawl seems to be obvious: designing of mixed-use compact communities around a transit stations. Opened more than 50 years ago, Montreal metro is now Canada's busiest rapid transit system and the third busiest by daily ridership in North America. Metro of Montreal was opened in 1966 with early stations of the green and orange lines in the downtown area and in the northwestern part of the city. One year later the yellow line was opened with its terminal station Longueil. This station was renamed Longueuil-Université-de-Sherbrooke in 2003 to reflect the fact that it has a campus nearby. The line connects the Montreal downtown area with the city of Longueuil. Currently, Longueuil-Université-de-Sherbrooke is one of the busiest stations with an average of 7 523 080 passenger entrances per year, making it the 5th busiest metro stations in Montreal. In 2007, the orange line of Montreal metro was extended to Laval. Currently, Montmorency is one of the two terminal stations of the orange line. Stations Longueuil-Université-de-Sherbrooke and Montmorency are strong examples of rapid transit-oriented developments. Both of these stations are terminals, and they share many similarities, for instance, housing, a presence of

bus terminals, the opening of higher education and universities' campuses after the opening of the metro stations, and, finally, a direction from being car-oriented into transit-oriented development. Moreover, Longueuil-Université-de-Sherbrooke and Montmorency metro stations are unique transit nodes which accommodate multiple transit modes at one point and play a role of a transfer between them. The developments around the stations offer a variety of amenities to its users and residents. These examples show how significant the opening of a metro station can be for city development.

Since 1966, Montreal's rapid system continues to affect the general development of the city. The Montreal metro exists and works well after fifty years of use. Having streetcars as predecessors, it shows us how significantly the transit system has shaped the city. Montreal's metro was imagined and constructed before the term TOD appeared in the literature; however, this metro system contains the essence of a TOD. All main functions, education centers and other points of destination are well connected with the metro stations. Urban projects continue to appear near existing stations.

This report traces urban design evolution of Longueuil-Université-de-Sherbrooke and Montmorency metro stations. The study of the development of these areas could help to understand how the synergy of functions works and how the land uses intensified after the opening of the station. These two stations were built forty years apart. Therefore, the study of these two different TODs can also help urban designers to see evolving approaches in mixing functions, traffic separation, and general attitude to urban design of open space areas, and so on.

1.5 Research Objectives

The main study objectives in this research are:

- To explore developments around rapid transit.
- Analysis of promotion of mixed-use development around rapid transit stations.
- Analyze projects, developed around end-of-the-line Metro stations (Longueuil-Universite-de-Sherbrook and Montmorency).
- Investigate factors and urban design decisions that contributed to the positive effect that the construction of the metro stations had brought to the development of the area around them.
- Drawing of comparative lessons from two case studies of Montreal metro stations.

1.6 Methodology

Firstly, the literature review regarding transit-oriented development was conducted with a focus on rapid transit development. Mixed-use development and developments around transit stations are examined from North American cities.

Then, information regarding case studies of Longueuil-Université-de-Sherbrooke and Montmorency metro stations was collected from McGill Library, *Bibliothèque et Archives nationales du Québec* (BAnQ), *Société de transport de Montréal* (STM), and the Cities of Longueuil and Laval and then analyzed. Old maps and current maps are compared to track the development of the area in terms of appearance/changes of old and new buildings, general infrastructure, road outlines, and general organization of the site and the buildings of the analyzed area. By means of collected maps together with additional sources of information the buildings are arranged according to their appearance on the site. This helps

to understand the land use changes that followed the appearance of new functions in the area, brought by new buildings. The areas of the case studies are examined with respect to their size, shape, form, activities, functions, density, diversity, etc. Future development plans of the sites are analyzed in order to understand their future potential.

The sites of the case studies are observed and evaluated following the guides of *Communauté Métropolitaine de Montréal* (CMM) and TOD Institute. This field observation consists of several points: well defined public spaces, mixes of uses, quality pedestrian experience, human scale architecture, active ground-floor retail, tree-lined streets, easy access by bicycle, reduced and hidden parking, affordability, expandability, station's access points, density, sustainable development. The observation is complimented by the author's photographs, sketches and notes.

Chapter 2 LITTERATURE REVIEW

This chapter overviews the literature related to the topics of transit-oriented development, rapid transit development, and mixed-use development around transit nodes.

2.1 Mixed-use development

The mix of uses made a traditional downtown active and vital (McBee, 1992). Hence, contemporary development projects employ mixed-use as a popular approach to revitalize urban areas. Mixed-use development both suggests creation of commercial areas via pedestrian accessibility and optimizes social equity by mixing different types of housing.

Mixed-use projects vary in types of uses mixed, but they should possess certain common features. Three features have to be included into mixed-use projects: three or more revenue-generating uses; physical and functional integration of project components, including pedestrian connection; design of a coherent plan, which has to consider the possible stipulation of the scale of the project and number of users (McBee, 1992).

According to Jill Grant (2002), there are three ways of mixing uses: a) increasing intensity of land uses; b) increasing the diversity of users; c) integrating formerly segregated uses. An example of "increasing intensity of land uses" can be a mixture of housing types, allowing affordable housing to be mixed with other kinds of housing. This practice can be found, for instance, in the suburbs of Toronto. The second type often occurs in waterfront redevelopment or entertainment areas. The third type is a less common one (Grant, 2004).

The ideas of mixed-use development have met a positive response in Canada. Toronto as well as Vancouver followed mixed-use principles and adopted them in their planning

policies and urban design practices. Gentrification, moving working class residents to suburbs, as well as improving the tax base changed the neighborhoods of Toronto significantly (Grant, 2002). Moreover, residential and commercial areas replaced aging industrial areas. In this urban renewal process mixed-use was promoted. During the 1990s, other Canadian cities such as Calgary, Ottawa, Waterloo, Winnipeg and Edmonton also revised their masterplans following new urbanism principals (Grant, 2002). Despite all the policies and positive changes of the implementation of mixed-use development, there is still resistance in implementing these principles into practice. According to Jill Grant (2002), "Canadians often fear high density or affordable housing and remain attached to the cars." Jill Grant interviewed developers and found out why people tend to buy homes in conventional suburbs. "They believe that people make conscious choices in buying homes: Suburbanites want space, a rural feel, and separation from other uses."

Despite public interest and benefits from mixed-use development, it is still challenging for developers and architects to introduce it. Bankers and lenders are cautious about mixed-use projects, as there are financial risks associated with such projects (Grant, 2004). Mixed-use projects take more time to construct than single-use ones (Schwanke, 1987). Moreover, residents do not always want to have certain land uses near them. Obviously, not everyone will be open to having prisons, waste management facilities or halfway houses near their homes (Grant, 2002; 2004). Nevertheless, the mixing of similar functions such as different housing types in a project in a coherent design is not easy in real projects. In addition, it is not always easy to achieve mixed-use principles in every district. For instance, people cannot always live near their work - especially in two-income households (Grant, 2004). Jill Grant (2004) also refers to Lang and LeFurgy's work (2004) saying that "most office space is not built in mixed-use areas, but either in the central city or in amorphous zones around the

urban periphery." Some industries also show little interest in mixing (Grant, 2004: Grant et al, 1994). "Car use makes separation easy for people to accept, and has shifted lifestyles so much that it will be difficult to transform" (Grant, 2004).

The extent to which mixed-use development has to be mixed has been studied by many researchers. Manaugh and Kreiger (2013), for instance, tried to measure to what extent complementary land uses interact with one another and when mixed-use can become efficient. The study was based on three cities' data: Toronto, Montreal, and Vancouver. Despite different output in different positions, such as the presence of old buildings or the income of residents, the study concludes that land-use mix affects walking and travel behavior drastically.

2.2 Transit-oriented development and its connection with mixed-use development

During the twentieth century, "the automobile dominated and shaped the urban landscape" (Huang, 1996). Such trends as New Urbanism and Smart Growth were a response to the suburban and urban sprawl as well as to detoxification with zoning separation. "New urbanism refocused attention on physical planning and urban design" (Grant, 2006). The study conducted by Charlotte Fagan (2012) shows that close location to bus lines, as well as accessibility to facilities and diversity were two of the main selling points for those who wanted to live in the New Urbanist neighborhoods rather then in conventional ones. Her study also indicates that for people living in the New Urbanism projects public and communal facilities help to build a sense of community among neighbors.

The pioneer of the transit-oriented development (TOD) movement was Peter Calthorpe. His book, almost a guide on how to design communities, was a manifesto to rethink future

cities' structure. In his book, *The next American metropolis: ecology, community, and the American dream*, Calthorpe (1993) identifies TODs as "a mixed-use community within an average 2000-foot* walking distance of a transit stop and core commercial area. TODs mix residential, retail, office, open space and public uses in a walkable environment, making it convenient for resident and employees to travel by transit, bicycle, foot, or car" (Figure 2-1).

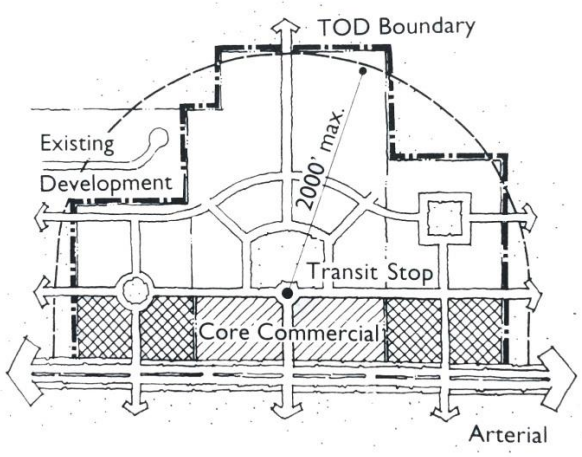


Figure 2-1. Transit-oriented Development (TOD)
Source: Calthorpe, Peter. *The next American metropolis: ecology, community, and the American dream.* (1993).

By definition, there are two main features that characterize a TOD. The first one is proximity to public transit stations. Such researchers as Robert Cervero support and promote the idea of TODs by locating them within walking distance from mixed-use centers. The second feature is compact, mixed-use buildings and neighborhoods that because of their design encourage people to walk or cycle more (Cervero, 2013). Cervero (2013) suggests incorporating other features to make TODs successful, to name a few: direct and easy pedestrian and bicycle access, good signage to attract people, regional accessibility to major

* 2000 foot distance is equal to 600 meters distance and it takes approximately 10 minutes to walk. Henceforward, all measurements in the current report will be transferred to meters. If a distance in citations is measured in feet, equivalent distance in meters will be indicated in brackets.

job and activity centers, safe and secure design, effective parking management. In addition, TODs need to be designed with transportation demand management (TDM) to make them more effective. Examples of TDM can be parking controls, car sharing, and transportation costs. Comprehensively designed TODs with TDM can encourage people to use public transport more (Cervero, 2013).

Calthorpe (1993) also points out that TODs "must have a mixed-use core commercial area located adjacent to the transit stop." And this is of particular benefit to residents from the TODs as they can have direct access to services and retail. Moreover, this proximity of TODs to commercial areas becomes crucial for those with reduced mobility, seniors, and for those who can not afford a car.

But not only do residents need public transit, "transit needs riders" too (Cervero, 2013). Calthorpe (1993) introduces a concept of a secondary area while talking about TODs (Figure 2-2). This area is beneficial both for residents and for the transit system, as the residents not only shop in nearby commercial areas but also are potential riders for the transit system. Moreover, secondary areas have to be well connected with the commercial area, as well as easily accessible by walking or biking there. All industry or auto-related services should be prohibited in Secondary areas or in TODs (Calthorpe, 1993).

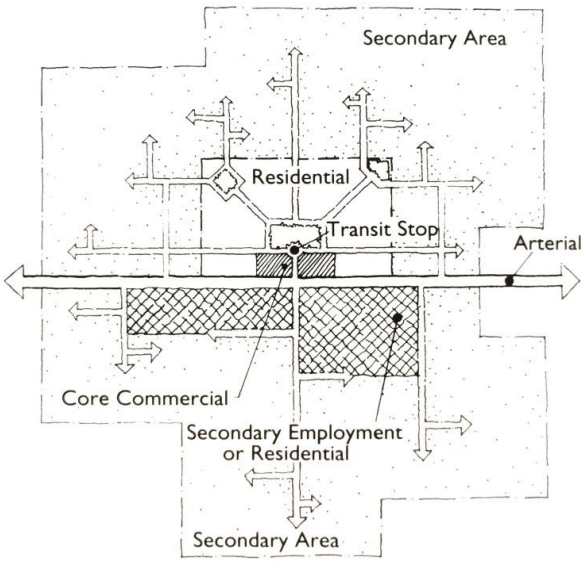


Figure 2-2. Secondary Area.
Source: Calthorpe, Peter. The next American metropolis: ecology, community, and the American dream. (1993).

So, there is a clear link between mixed-use development and transit-oriented development. “Mixed land use is a particularly important element of TOD” (Cervero, 2013). By mixing different amenities, such as housing, retail, offices, etc. in close proximity to transport stations we create walkable cities. “Mixed-use core commercial areas are the primary link between transit and land use” (Calthorpe, 1993).

Another interesting example of a TOD is a project in Nanjing, China. The biggest achievement of this project regarding urban design is the fact that the architects arranged the building in a way so that the public outdoor area was preserved. “The project embraces the central public park, directing the view and attention to the subway and bus riders towards it, as a visual and participatory amenity” (Altoon, 2011).

The redevelopment of Arlington Country is one of the most successful transit-oriented concepts. Close location of TODs works like a transit corridor, helping people to move

frequently from station to station. Since the 1990s, Arlington has preserved the existing affordable houses and has constructed new ones (Dittmar, 2004).

To make TODs work and be successful, one has to consider three dimensions: Density, Diversity, and Design. Density calls for a number of people living nearby the station as potential users of it. It is one of the most essential factors for establishing successful and cost-efficient public transport. Low-density cities are more automobile reliant. However, Jakarta and Paris successfully combine two models: public and private transit (Cervero, 2013). Diversity refers to a mixture of uses, land uses, and housing types. It also includes physical, economic, and social layers. "*Physical diversity results in maximizing the mix of activities, building types, and civic places within community. Economic diversity tends toward places which support a broad range of businesses at different scales. Social diversity produces places that are integrated and inclusive. As a planning axiom, diversity calls for a return to mixed-use neighborhoods that contain a rich range of uses as well as a wide choice of housing types for all economic, ethnic, and age groups*" (Calthorpe, 2011). Finally, Design represents physical and aesthetical features of streets and amenities that may encourage walkability and transit use (Cervero and Kockelman, 1997). Later, Cervero adds two more dimensions – "Distance to transit" and "Destination accessibility." The former refers to the distance from the workplace or living place to a transit station, while the latter refers to how well TODs are connected to commercial and leisure activities. It is important to ensure co-existence of all 5Ds. Density does not guaranty walkability of the area. Atlanta's case is a good illustration of the outcome when the area became dense; however, due to lack of pedestrian connectivity, it is not walkable (Dittmar, 2004). Finally, the area has to be diverse and must be able to accommodate people with various incomes. To do that,

a TOD has to offer affordable housing and give people with low income easy access to transportation.

One of the important outcomes of introducing TODs is that the area nearby TODs increases in its property value, which leads to rising housing costs and rent. This leads to gentrification and pushing low-income families to the periphery. To avoid this, Calthorpe (1993) and Cervero (2013) recommend mixing residential areas as well. Also, there are some steps to be taken by the authority to prevent gentrification such as coordinating low-income housing with transit developments. Granny flats and mixed-use buildings with housing above retail can be a good option for providing residents with affordable housing (Calthorpe, 2001).

Overall, to make the TOD work it should be designed with the urban context of the particular place, the social, economic and cultural issues, and neighborhoods' community needs in mind. TOD is a means, and it serves to deliver people and to improve accessibility, not the opposite (Cervero, 2013). Calthorpe (1993) indicates two groups of TODs; urban TODs and neighborhood TODs (Figures 2-3, 2-4). In these two groups, land use varies significantly. For instance, in neighborhood TODs most of the land use is given to housing, in contrast to urban TODs, where commercial areas and employment share approximately the same amount of space as housing.

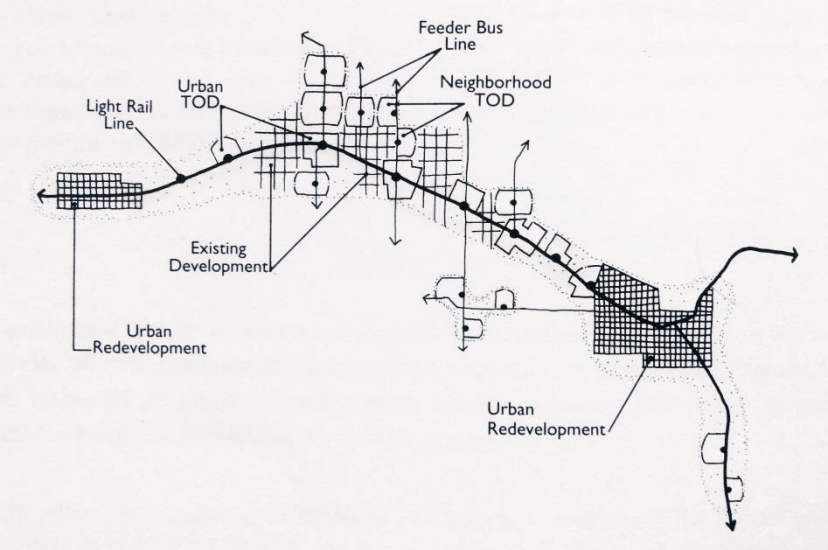


Figure 2-3. Transit-oriented Development (TOD). Urban and Neighborhood TODs. Source: Calthorpe, Peter. *The next American metropolis: ecology, community, and the American dream.* (1993).

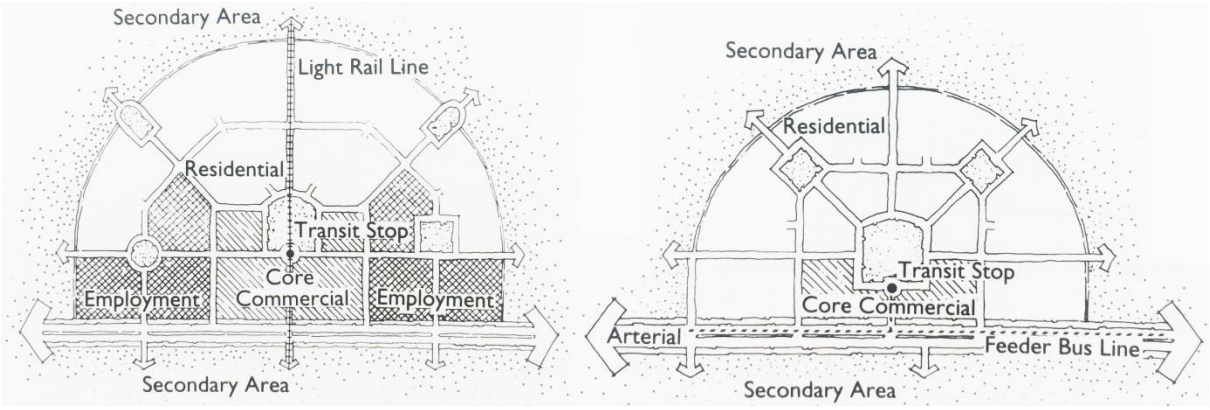


Figure 2-4. Urban TOD (left image) and Neighborhood TOD (right image) Source: Calthorpe, Peter. *The next American metropolis: ecology, community, and the American dream.* (1993).

Correspondingly, different types of mixed uses have to be carefully arranged within walking distance from TODs in order to respond to the local residents' everyday needs (Halbur, 2007). However, the goals of many actors and stakeholders who are involved in the creation of TODs are sometimes in conflict with each other. To prevent a TOD from turning into a transit-adjacent development (TAD) it is essential to balance the goals of each

stakeholder (Halbur, 2007). Halbur (2007) refers to New Jersey (Maplewood) as an example of a TOD where transit became a part of the public realm, providing people with places where they can gather. Maplewood project is a case of transit planning where the transport agency and municipality designing the transit considered people's need and local uniqueness of the place.

Another popular practice of transit in the Unites States is transit joint development (TJD). The idea of this development is based on "quid pro quo - benefitting private developer returns the favor to the transit agency by either sharing costs or sharing revenues" (Cervero, 1992). More specifically this development can be divided into two basic forms: 1) revenue-sharing arrangements, or 2) cost-sharing arrangements. The first group benefits "transit agency by securing a stream of revenue income." The second group aims to "relieve transit authorities of some of the cost burden of constructing, maintaining, or rehabilitating transit facilities" (Cervero, 1992). Despite the general aim to benefit and increase ridership, studies prove that joint development does not generate a significant source of riders (Cervero, 1992). On the other hand, the office development helps to increase overall ridership.

As TOD, transit joint development (TJD) has to be designed regarding particular cities' condition, as there is no typical solution for any situation. According to Cervero (1992), to make TJD successful local real estate market should be active. Schuetz (2014) suggests that before doing investments into the new transit system, planners and policymakers should consider existing neighborhood conditions. Close working of municipalities with public agencies can help make TJD successful. Such close work of planning institutions with governmental municipalities made the joint development of New York City work.

Unfortunately, the implementation of TODs (and TJDs) in practice is not that easy. Mixed-use projects are difficult to finance and complex to build. Besides, our auto-oriented past still has a significant effect on planning. Also, current regulations are one of the biggest barriers to implement TOD and mixed-use development. Levin and Inam (2004) refer to Willson (1995) showing that municipal parking requirements encourage car usage by oversupplying parking. With reference to Talen and Knaap (2003,p.357) they also argue that regulations force sprawl rather than promote "Smart Growth" policies (Levin and Inam 2004). Moreover, the demand-based study (Levin and Inam, 2004) in Boston and Atlanta indicates that people choose the place of living considering transportation and land-use preferences. Boston' residents were more responsive to public transit than those living in Atlanta due to Atlanta's auto-orientation. "Private development market is capable of providing more alternative developments (mixed-use, TODs, pedestrian-oriented development, etc.) than current regulations allow." Moreover, once developers propose such developments as mixed-use and TOD, etc. they either experience rejection of their proposal or they ask to make significant alterations by the planning process. 80% of the developers were by the planning process to reduce density. As a consequence, developers often decide not to promote alternative developments till they are sure that it is worth to do so regarding investments. There is a market interest in alternative developments, however, local government regulations are the primary obstacles for introducing them. This difference is more evident in suburbs (Levin and Inam, 2004).

Cervero (2013) mentions several aspects which can be solved or reduced by supporting development of TODs: automobile-dependent urban form does not give many abilities to move and shop for those who don't have it; a municipality spends on road maintenance as

well as invests in road-related facilities; time spending on trips; wasting time in traffic jams; the effect of airborne pollutants on health.

2.3 Transit and its importance in city-shaping

Obviously, transit plays an important role in shaping a city. However, it is important to consider the impact of transit options and their configuration closely.

2.3.1 Transit options

"Urban form and the spatial distribution of activities depend in large part on accessibility and, hence, on the available transportation options" (Huang, 1996). Until the nineteenth century, cities were compact enough so people could walk to their destination. During the nineteenth and twentieth centuries, transportation technologies gave people the ability to travel long distances. First appearing in the 1880s in the United States, electric streetcars had a significant influence on the development of neighborhoods and cities of America by allowing people to live farther from their workplace.

Constructing and developing of TODs is expensive for cities. However, different cities and their municipalities deal with introducing transit systems along with TODs in different ways. A flexible approach and an ability to react to current cities' problems, as well as to see overall the future development, are key to designing of an effective TOD. While some cities and designers are focused on fancy and modern types of transit types, others introduce cheaper ones such as bus rapid transit (BRT). "Both bus and rail transit increase access for people who do not have automobiles available for travel and can relieve traffic congestion, reduce energy consumption and improve air quality by diverting other people from their cars" (Huang, 1996). According to Huang (1996), "given a choice between bus and rail

transit, cities may opt for rail because of its higher passenger capacity, its cleaner and quieter vehicle, the potentially greater land-use and economic impacts, and the possibility to showcasing the city to the nation. According to Vuchic (1991), rapid transit itself serves as a landmark and gives the city an identity.

Still, in cases where there is no money in the city budget, or if the construction of a light metro will take several years, there is no need to make residents suffer without giving them an affordable alternative and access to everyday services. If there is no money in the city budget, it is easier first to introduce one type of transit which is cheaper and more convenient to all residents and then begin to construct more fashionable and rapid ones. BRT has proved its effectiveness as it is flexible and does not require construction of additional systems and, as a consequence, can be easily integrated into current cities' infrastructure. Ottawa is a Canadian example of a well-implemented bus rapid transit (BRT). Ottawa invested in a BRT system at a time when many other North American cities were constructing light railway systems. Moreover, to improve transit conditions, Ottawa's municipality also introduced such policies as supportive parking and flexible working schedules. To make BRT more visible for residents, Denver and Portland, for instance, have introduce their BRT on one single street rather than on many.

Jeff Speck (2012) believes that only rapid transit system has the potential to fundamentally transform cities. However, by introducing smaller types, for instances nodal ones such as gondolas, or linear types, like streetcars or trolleys, we can also improve transit conditions. This is not a rapid transit but still it works as a "pedestrian accelerator." Seattle and Portland proved that these types of transit do work (Speck, 2012).

Overall, “history shows that transit investments powerfully shape the growth of cities by changing accessibility” (Cervero, 2013: with reference to Cervero and Seskin,1995). Denver, for instance, was developed significantly thanks to investments into TOD (Goetz, 2013).

2.3.2 Nodal approach

According to Cervero, cities tend to take a polycentric form once they grow. Transit becomes crucially important when there is a need to connect high-density centers, for instance, mixed-use centers with business districts or residential areas. By connecting all these “centers” with each other, we may achieve multiple-way travel flows. In this regards the rapid transit helps to solve the connectivity problems.

“A transit corridor that offers an advantageous mix of uses can be used to integrate a number of separate activity nodes, particularly when the various uses are close together, easily accessible, and support each other. It is possible, for example, to live at one station, work at another, and shop at a third, with transit making possible the connections among all three” (Dunphy, 2003).

Pierre Filion (2000) defends the idea of combining nodes with transit-oriented corridors to intensify a metropolitan region. According to P.Filion, a nodal approach can significantly transform the dispersed suburbs into compact transit-oriented and pedestrian-oriented environments. It can be achieved by creating transit corridors with high and medium density residential areas along with high-speed and high-frequency transit. “The meeting point of two such corridors would lend itself to the development of transit-oriented and pedestrian-oriented mixed-use centers” (Filion, 2000).

Filion (2000) did case studies of three suburban centers of Toronto (North York, Scarborough and Mississauga). Despite being successful, these suburban areas lay behind Downtown Toronto in terms of use of transit and employment rates. By clustering offices, retail, public services, and housing along expressways, connection of these areas with the transit system can be increased.

After analyzing the strategies of the six largest Canadian cities, Filion and Kramer (2012) argued that nodal development has a potential to respond to current cities' transit problems, achieve intensification, and reduce car-dependence. Despite the success of some nodes in Toronto and Vancouver, there is still a high chance that nodes can lead to a construction of highway and roads and act as a catchment area for suburban areas as people will use cars to reach them. This reliance on cars discourages the initial purpose of node development in promoting walkability (Filion and Kramer, 2012). Probably, to make the idea of nodes more livable, it is needed to design them with restriction of amount of parking lots. Moreover, with a convenient transit system, we may reduce the reliance on cars. As a consequence, parking areas nearby mixed-use centers can be reduced as well and be transform into more pleasurable public areas.

2.4 Rapid rail transit-oriented development in North America

2.4.1 Light Rail Transit and Light Rail Rapid Transit

The predecessor of the modern Light Rail (LR) system was the streetcar, which had an important transportation role in many European and North American Cities. Currently, this type is either absent from many cities or is undergoing major renovation, as it is in Toronto. Other North American cities like Portland and Washington have constructed new streetcar

lines (Vuchic, 2007). Light Rail Transit (LRT) in the United States and Canada, is the fastest-growing rail transit mode (Vuchic, 2007). LRT systems have on average network operating speed of 20 to 45 km/h. Station spacing for this system is usually 400 to 800 m; however, in many US cities it has longer station spacing, for instance: San Diego at 1650m, Los Angeles at 1900m, and Dallas at 2200m (Vuchic, 2007). Light rail rapid transit (LRRT) is the highest-performance form of light rail transit. In contrast to LRT, LRRT has a higher speed. Vancouver's SkyTrain is one of the finest examples of this system. Vancouver's SkyTrain is the oldest and one of the longest automated driverless rapid transit in the world, which serves three lines with 53 stations in total.

2.4.2 Rail Rapid Transit

Rail Rapid Transit (RRT) is also referred to as Metro and Heavy Rail. According to Vuchic (2007), there are three categories of objectives and goals in building a Metro: the immediate objectives, specific goals, and highest-level goals.

To the immediate objectives Vuchic (2007) addresses:

- Increase in speed of transit level (example: New York)
- Provision of adequate transporting capacity (example: Toronto-Yonge Street Line)
- Decreased operating costs through higher labor productivity on major lines that streetcars and buses (example: Atlanta)
- Relief from street congestion (example: Montreal) and Excessive parking requirements (example: Washington, Cleveland)

- Provision of transit service with much higher reliability, safety, and comfort that surface transit can offer (example: Washington)

To specific goals pursued by metro are as follows:

- Strengthening of the central urban area through improved transit service (example: Boston, Philadelphia)
- Tying together a region separated by geographic barriers (example: New York)
- Stimulating development of major activity centers in outlying areas through their efficient connection with the central city.
- Introduction of a high-quality transit service on a special line serving a residential, business office, medical facility, or university complex.
- Construction of Rail links between center cities and airport (examples: Portland, Chicago)

According to Vuchic (2007), the highest-level goals in building metros are:

- Increase transit ridership, achieving higher mobility of population
- Provide a high level of transit service in individual corridor or throughout an urban area, stimulating its economic viability
- Attract passengers away from private automobiles and provide conditions for application of disincentives for automobile use in cities
- Create a better balance in urban transportation between public and private transportation, which results in an intermodal system with physically, economically,

and environmentally superior performance than the systems relying on one mode only can provide

- Ensure a greater permanence of transportation service required for integration of land use and transportation
- Enhance the quality of urban development and create efficient and livable urban forms, which are a precondition for creation and permanence of great cities

2.4.3 North American experience in rail rapid transit

According to Cervero (2009) the most successful United State's example of the proactive integration of heavy rail transit is Washington D.C.'s Metrorail, and for Canada it is Toronto's Metro.

Toronto's heavy rapid transit is the oldest in Canada. According to Huang (1996), between 1952 and 1962, more than 90 percent of all office construction in the city of Toronto occurred close to Yonge Street (which was the first section of the subway). He also mentions that half of all new apartments constructed from 1954 to 1984 were within walking distance of the subway stations. According to Cervero (2009), the construction of the subway in Toronto pushed development of underused areas and spurred development of decaying in-town commercial areas. Cervero (2009) also mentions that "one of the greatest accomplishments of Toronto's subway was the strengthening of the central business district (CBD) – partly as a consequence of a radial, downtown‐focused subway system, but mainly as the result of strategic regional land‐use planning." He thinks that Toronto's subway success was because of good policies, and good timing (the investments into subway

coincided with a period of rapid growth), and was dependent on transit immigrants. Finally, such public policies as federal tax laws, property taxes and Canada's national government non-sponsoring of freeway construction led to the success of the Toronto case.

"Without question, however, the main factor that best explains the subway's strong city-shaping impacts is pro-active, coordinated land-use planning and management conducted by Toronto's metropolitan government. While zoning has always been controlled by individual municipalities of the region, the metro government retained veto powers over local land-use decisions that were inconsistent with the long-range transportation-land use plan. Among the initiatives introduced by the Metro government to leverage land development were density buses for parcels near rail stations, limits on park-and-ride construction at nonterminal stations, transferable development rights (that enabled densities to be stacked near rail stations), and supplemental land acquisition that enabled local government to lease and sell land near rail stops both to recapture value and ensure high ridership levels" (Cervero, 2009).

Washington is another example of successful investment into a subway system in the period of the city's rapid growth (the late 1970s through 1980s) (Cervero, 2009). According to Cervero (2009), from 1980 to 1990, 40% of the region's office and retail space was built within walking distance of a Metrorail station. Timing, height restrictions, and federal policies that mandate government offices to be located near rail stations further encouraged TOD. Cervero (2009) says that Arlington County is a successful example of the transformation of rural area into compact mixed-use TOD. Promoting mixed‐use development along rail corridors with balanced jobs and housing growth has produced two‐way travel flows (Cervero, 2009).

2.4.4 Debates about construction of rail transit system

"Global experiences show that under the right conditions, rail transit investments can produce significant land‐use changes around rail transit stations" (Cervero, 2009). Despite successful examples, some researchers question investment in rail construction. Huang (1996) refers to studies conducted by Pickrell (1992,1991,1989), Moore (1993) and Kain (1990) regarding cost and ridership of rail transit that show that investments into rail systems did not meet even half of the forecasted number of riders. On the other hand, Huang (1996) noted that such scholars as Pushkarev et al. (1982) and Vuchic (1981) identified mobility and urban development as a product of rail stations.

Constant debates among many scholars exist around whether or not Light Rail (LR), Heavy Rail (HR) or BRT are worth constructing. Cervero and Guerra (2011), for instance, state that for different transit systems a different density is required in order to make it cost effective. For example, for Light Rail transit 30 people per gross acre around stations is needed, while for heavy rail systems this amount is 50 percent higher. They also state that to make the transit system work, better jobs have to be concentrated within a quarter of a mile of the stations, and housing has to be within a half mile. Therefore, for smaller cities BRT may work better. Cervero and Guera (2011) refer to Pushkarev and Zupan's (1977) calculations "the high costs of a heavy-rail investment would require a net-residential corridor density of at least 12 households per acre leading to a minimum 50-million non-residential square-foot CBD. A minimal light-rail investment, by comparison, would require 9 households per acre to a CBD of 20 to 50 million non-residential square feet (of 1,86 to 4,65 million non residential square meters)."

For many people the cost of transit is quite expensive, and they spend a significant part of their income on transportation needs. To promote transit, governments should encourage people to travel by optimization of traveling costs.

2.5 Impact of rapid rail transit on development of surrounding areas

According to Knight and Trygg (1977), a downtown development due to rapid transit is possible only if the development is supported by other powerful factors. The study conducted by them confirmed that in such cities as Toronto, Montreal and San Francisco transit improvements were the forces which pushed development of high-rise commercial development in the CBD. According to them some other factors, which have to be considered to ensure the success of such metropolitan areas, are: demand for new office and retail space, good timing, availability of land, placement of the stations, public investments and formal urban renewal.

Cervero and Landis (1997) in their study examine other studies conducted on BART to understand why the initial idea of construction of BART did not significantly improve and pushed land use development, moreover since its construction in 1973 the population grew faster further from BART. Employment gains grew faster in non-BART areas too. However, they highlight that construction of multi-family housing did increase with the development of BART.

According to Cervero and Duncan (2008), the demand for a transit-based living will likely increase, and groups of people such as retirees are those who will opt for it. Other potential groups are childless households and immigrants. The latter often bring with them a heritage of transit-oriented living.

2.6 Factors of rail transit success

Arguments for why some cities have successful metro systems while others do not - can be found in many studies. Many refer to transit management as one of the main factors for the success of a city's metro. For instance, for New York City subway, which is 113 years old and one of the oldest in the world, a good transit management helped to get out from a period of stagnation, when its ridership was not doing so well. Pusher (2002) believes that impressive growth in the usage of New York's metro is due to fare policy and increased job opportunities. The number of riders increased significantly after introducing the MetroCard system in 1997 which provided riders with free transfers between the metro and the bus. Moreover, higher quality of service and increased presence of police at stations helped increase ridership. Pusher (2002) also says that capital projects such as the restoration of Metro North's Grand Central Terminal helped to increase the amount of passengers. Moreover, additional access to metro stations also helped increase its usage.

Knight and Trygg (1977) examined the land-use impact on rail transit in several United States and Canadian cities: Toronto, Montreal, San Francisco, Cleveland, and Washington. They concluded that rail transit improvements were the result of development near stations that was supported by forces such as local policies, the market attractiveness of the site for development and general economic conditions.

Cervero (2006) conducted research aiming to understand the impact of office development around rail stations on transit mode choice in the largest metropolitan areas in California. He concluded that workers were more likely to rail-commute if such services as feeder buses are available, if their employer helped cover the transportation costs, or if parking was limited. He also concluded that the need for chain trips deterred transit riding, and that a quarter of those who made intermediate stops were those who needed to drop off

or pick up their children. “Child care centers in the vicinity of transit stations - whether at the home - or work-end of the trip - would no doubt promote rail-commuting among many trip-chainers.” Regarding the midday trips Cervero noticed that if services like restaurants were located beyond a mile from the rail station, the majority of workers would take a car. With regards to his previous research (Cervero, 1989) Cervero (2006) highlights the importance of mixed-use environments in and around office developments. Cervero (2006) also argues that policy-makers should not leave the creation of station-area office environments to the marketplace. Different housing programs have to be introduced to encourage transit – oriented housing.

Scholars like Cervero conduct research to know which mixes of uses and developments are more influential on increase of ridership. Cervero (2006) concludes that “Urban TODs typically have more than an office and commercial orientation. Concentrating retail centers and job sites in and around stations is every bit as important to promoting transit ridership as concentrating residential towers.” Cervero (2006) in his studies indicates that mixing the jobs-housing balance offers more promise for reducing motorized travel than mixing retail and residential land uses.

2.7 Mix of uses in urban design of TOD

Mix of uses is a key component in any TOD which helps to make the area walkable. According to Peter Calthorpe, mixed-use in TOD area can be vertical and horizontal. In early 1960s, Jane Jacobs argued that there are two types of mix of uses: the primary and secondary. She addressed such uses as housing, offices, factories, certain places of entertainment, education, and recreation to primary use. According to her, “when a primary

use is combined, effectively, with another that puts people on the street at different times, then the effect can be economically stimulating: a fertile environment for secondary diversity. Secondary diversity is a name for the enterprises that grow in response to the presence of primary uses, to serve the people the primary use draw." Peter Calthorpe (1993) also refers to retail, housing, and public uses as the ones which are required in any TOD to ensure pedestrian activity. As there are no strict recommendations regarding mixture of uses, Calthorpe suggests that "The mix of land uses and appropriate densities should be clarified in a community or site-specific planning process, in order to address site-related issues..." (Calthorpe, 1993). According to TOD Institute, *"A careful mix of uses in close proximity creates synergy and diversity, creates activity day and night, and forms the building blocks for complete communities. Appropriate mix of uses includes commercial, retail, offices, shops, hotels, residential, institutional, and civic. Ideally, the uses are mixed within each neighborhood, block, and building, and are physically and functionally integrated with direct pedestrian connections. A diversity of space and unit size/price offers a wide range of options to an entire community."*

In order to make TOD function better a minimum proportion of functions is need. Peter Calthorpe (1993) recommends balancing uses in urban TOD in the right proportion: public uses- from 5 to 7 %, employment- from 30 to 70% and housing- from 20 to 60%. Public uses include a park, open spaces, and public facilities. The residential mix is encouraged to offer various housing options for people with different incomes. Calthorpe also suggests mixing of uses within one building in a way to locate retail uses on the ground level, offices on the second and third, and residential units on upper floors. Such a scheme can help to supply people with affordable housing. "Allowing mixed-use buildings-with housing over retail- is a natural way of placing affordable housing in such neighborhoods. The benefits include

creating a more walkable environment on a arterial strip that was traditionally auto oriented and creating more affordable housing" (Calthrorpe, 2001).

Land use of TOD has to include services like restaurants, banks, child care facilities, fitness clubs, and so on. Institutional, civic and entertainment uses like schools, universities, libraries, cultural, and recreational facilities have to be included into TOD as well. In order to provide vibrant social diversity, it is important to perform design with respect to each social group and to not underestimate the needs of others. For instance, according to Jo Foord (2010), "…families with children are under-represented in mixed-use environments, particularly in city centres. The absence of family accommodation and the paucity of educational provision in many inner and central urban locations raise doubts about the way in which current mixed-use practice delivers on social sustainability (Silverman et al., 2005; Unsworth, 2007) and, more generally, social inclusion (Bramley and Power, 2008; Graham et al., 2009; Camina and Wood, 2009)."

Fine grained street network, minimization of a block length, creation of easy access to transit stations will lead to higher pedestrian connectivity and mobility, and hence it could increase the success of the TOD. According to Transit-Supportive Guidelines (2012), "residential blocks should be less than 250 m along their longest side, with maximum block lengths of 120 m in mixed-use activity nodes and corridors." With reference to Cervero and Ewing, Transit-Supportive Guidelines also say that the area has higher potential to become walkable if it has good street intersection density. Cervero (2013) highlights (with reference to Cervero and others 2009) that the studies from Bogota; Hong Kong SAR, China; and Taiwan, China showed that urban design elements like street connectivity and block sizes could affect travel behavior more than urban density.

To improve mobility, it is also important to create a proper and safe network of bikeways. Finally, large parking areas should not be located close to transit stations as they would discourage people from walking. According to Cervero (2013), neglecting of urban design in transit-oriented projects can lead to reduction of ridership. A high-quality urban design has to be created to encourage pedestrian access to the station. Moreover, according to Cervero (2013), good urban design with mixed-use TOD attracts outside investments and businesses.

Finally, place identity and place making are important components of urban design. They, however, are ones of the weakest points in many transit-oriented developments. Such scholars as Allan Jacobs and Charles Bohl stress the importance of public areas and vibrant streets in cities' lives. Also, such street design elements as lighting, signage, street furniture, foot path pavement, bike paths and so on, give people not only a sense of human scale, but also assemble an identity for the particular area. Finally, conservation of natural, cultural, historical, and architectural assets is an important factor in the life of any community (Calthorpe, 2011).

2.8 Summary

Mix of uses made the traditional downtown active and vital (McBee, 1992). The industrial era established single-zoning; and the invention of automobile, detachment of big boxes, and zoning policies encouraged suburban sprawl and strengthened this separation. Despite public interest and benefits from mixed-use development, it is still challenging for developers and architects to introduce it. Bankers and lenders are cautious about mixed-use

projects, as there are financial risks associated with such projects; and residents do not always want all kinds of mix of uses near by their place of living (Grant, 2004).

In the 1960s, planners started to react to the suburban and urban sprawl with such movements as New Urbanism and Smart Growth. Mixed use development and transit oriented development became popular approaches in hands of planners. There are two main features that characterize TOD: proximity to public transit stations and existence of compact, mixed-use buildings and neighborhoods, which, because of their design, encourage people to walk or cycle more (Cervero, 2013).

Overall, compact cities are more transit oriented. According to Huang 1996, "Urban form and the spatial distribution of activities depend in large part on accessibility and, hence, on the available transportation options". During the nineteenth and twentieth centuries, transportation technologies were providing people the ability to travel long distances. With new transportation options, cities started to grow faster. As cities grow, they tend to take polycentric form (Cervero, 2013). With transit, it is possible to connect high-density centers. Rapid transit here helps to make this connection even more convenient. Well developed rapid transit may significantly reduce our reliance on cars. History proofs, that investments into transit facilitate accessibility, what helps cities to grow (Cervero, 2009). In order to encourage usage of transit, cities' policies introduce different approaches. Each rapid transit system has its advantages and shortcomings. Nevertheless, by investments into heavy rapid transit, cities may be transformed in the most significant way. According to Vuchic (1991), investments into heavy rail rapid transit have many goals varying from immediate to the highest-level and long-term goals. In particular, rapid transit in particular serves as a landmark and gives the city an identity. Metro in many North American cities, including Montreal, has become a sightseeing attraction. Engineers, together with architects, work

close to create masterpiece of public transportation. In case of Montreal metro, for instance, in order to make each station unique, the authorities commissioned one architect for one station (ici.radio-canada.ca). Rapid Transit has a power to transform a city and attract developments to the location of its stations. Goals in achieving walkability, accessibility, and mobility can be achieved with right strategic thinking of where to design and locate those stations. Such huge investments of the city, of course, should be done in parallel with a general vision of city development.

To ensure success of any TOD, it is crucial to create a mixed-use area with high-quality urban design. A careful mix of uses in proximity creates synergy and diversity (TOD Institute). One has to consider incorporation of diverse housing options in order to create social diversity in transit-oriented development. Finally, for each social group appropriate balance of infrastructure is needed, such as open spaces for children and elderly schools and childcare facilities within the same community. According to Cervero (2013), neglecting of urban design in transit-oriented projects can lead to reduction of ridership. Comprehensive urban design and landscaping could encourage people to walk. In order to create higher pedestrian connectivity and accessibility of transit, it is important to create easy access to stations, to minimize building block length, to design good street network, to create bikeways, and so on. It is also vital to make pedestrian-friendly design and to ensure safety for pedestrians.

A flexible approach and ability to react to current cities' problems, as well as to see the future development of cities overall are the keys to design of an effective TOD. Mixed-use development and high-quality urban design here are the key components of any successful TOD.

Chapter 3 CASE STUDIES OF TWO TERMINAL STATIONS.

EARLY TERMINAL STATION: LONGUEUIL-UNIVERSITÉ-DE-SHERBROOKE

RECENT TERMINAL STATION: MONTMORENCY

This chapter introduces two case studies of Montreal terminal metro stations (Longueuil-Université-de-Sherbrooke and Montmorency) as examples of transit-oriented developments. These two stations were opened 40 years apart. Longueuil-Université-de-Sherbrooke was opened in 1967, when the term TOD did not even exist. In contrast, Montmorency was opened in 2007 when the practice of TOD became a popular approach in the hands of urban designers and planners. Both cases share many similarities and a number of differences in their developments. The chapter describes their respective sites, their history, and land use development. A comparative study of these two TODs can help us to understand the difference in attitudes in the design of their urban spaces, and how the areas changed over time after the opening of the metro stations.

3.1 Longueuil-Université-de-Sherbrooke station

3.1.1 Background information. City of Longueuil.

The City of Longueuil was founded by Charles Le Moyne in 1657. Longueuil is part of the census metropolitan area of Montreal. It is the fourth largest city in the province of Quebec. The city of Longueuil consists of three major districts: Old Longueuil, Greenfield Park, and Saint-Hubert. Its area is 122 sq.km. According to 2011 statistics, the population of Longueuil was 231,409, and its density 2002 resident/sq.km (Ville de Longueuil. Schéma d'aménagement et de developpement, Longueuil-2035). According to the table from

Population.City (Figure 3-1), Longueuil's population is constantly rising; the most significant increase occurred between the 1960s and 1990s. In 2016 the density increased to 2071 people/sq.km, with a population of 239,700. Longueuil's agglomeration is 22 dwellings per hectare (STM, Strategic Plan 2020).

Currently, Longueuil is a fast developing city, with its location between the United States and Montreal, Quebec, benefitting its development.

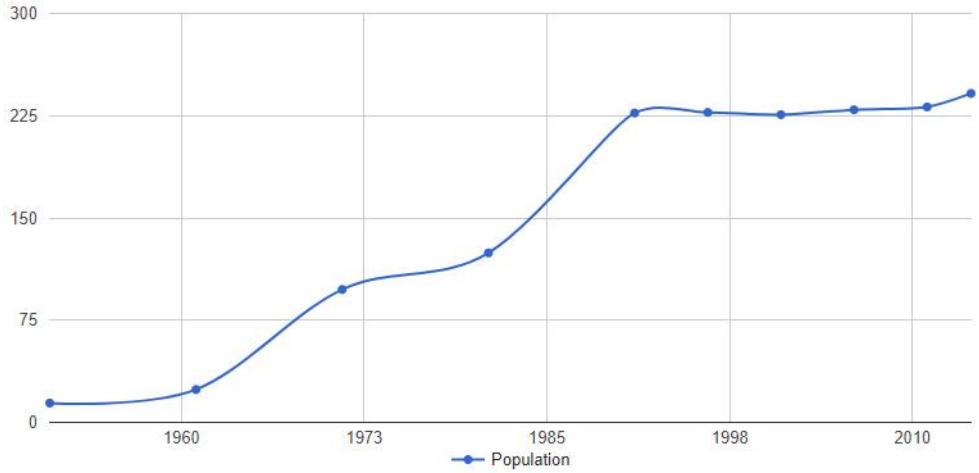


Figure 3-1: Population history of Longueuil from 1950 to 2015
Source: Population.City

3.1.2 Infrastructure before the opening of the station

Place Charles LeMoyne was an important intersection of traffic flows even before the construction of the Longueil metro station. Since 1910 tramways had been connecting the Montreal-Sud and Montreal. Thanks to Montreal Street Railway, the tramway came to Longueuil 18 years after it was first introduced in Montreal. The tramway circulated until 1956 with a terminal at McGill Street in Montreal and Sainte-Hélène in Montreal-Sud via Victoria bridge, which was constructed in 1859 (Pratt, 2014). The opening of the Jacques-

Cartier bridge in 1930 improved transportation connection. The bus 74 of "*Commission de transport de Montréal*" crossed the bridge to serve the area of Old Longueuil (Pratt, 2001) (Figure 3-2).

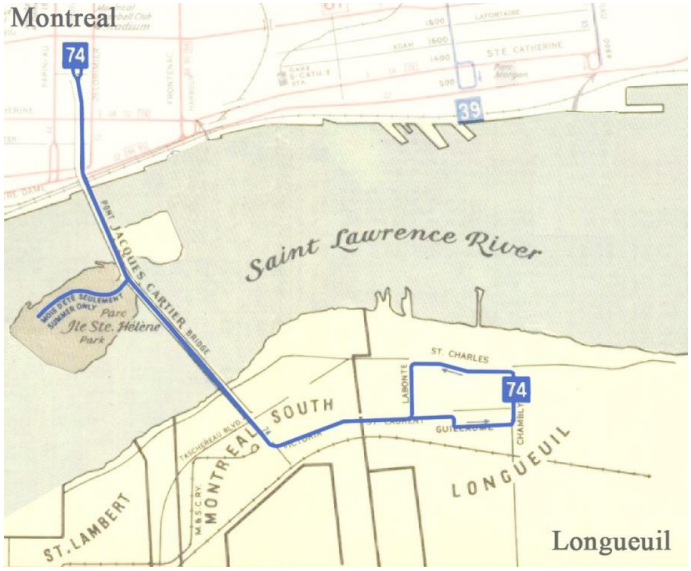


Figure 3-2: A fragment of the Route map, 1941
Source: Bibliothèque et Archives nationales du Québec.
edited by the author

In 1932, Boulevard Taschereau (Route 134) was opened, a 15 km route, lying in parallel with the Saint-Laurent river. The route connected La Prairie with Longueuil and gave access to the Jacques-Cartier bridge. In 1962 the route was expanded to six lanes.

Autoroute 132 was constructed on the bank of the river in 1962. *"Pour la première fois de leur histoire, l'accès au fleuve aux berges est devenu presque impossible aux citoyens de Longueuil. Les villas du bord de l'eau perdent leur vue sur le fleuve et les citoyens ne s'entendent plus parler tellement le bruit des voitures est intense"* (Pratt, 2001).

For almost 18 years, people had not had an access to the river, and only in 1980, the city of Longueuil constructed the pedestrian bridge to let people access the park Marie-Victorin located on the bank of the river. The city also provided people with a bike path along the river.

3.1.3 Longueuil-Université-de-Sherbrooke metro station

The Longueuil-Université-de-Sherbrooke station was opened on March 31, 1967. The creation of line 4, on which the station is located, was not part of the initial plan of the city. The line was constructed thanks to Expo 67 (Archives.radio-canada, 1966). Initially, Montreal authorities opposed the idea of extending the metro line to the city of Longueuil, but they were later convinced by Lucien Saulnier, who insisted that the access of Expo 67 would make this station not only essential but also profitable (Clairoux, 2001). The architect and the artist of the station is Jean Dumontier. The original name of the station was Longueuil, named after the city where it is located. However, in response to the Université-de-Sherbrooke's November 2002 request to reflect the fact that it has a campus nearby, the station was renamed Longueuil-Université-de-Sherbrooke on September 23, 2003 (Metrodemontreal, n.d).

Despite the fact that the station was opened due to Expo 67, the idea to connect Montreal with Longueuil by a tunnel under Saint-Laurent river stems from the initial plan to create a tramway, dating back to 1909. Line 4 lies 37 meters below the river (Legault, 2002). Moreover, initially, line 4 was supposed to consist of 4 stations, but because of technical reasons, that idea was abandoned (Clairoux, 2001). The station's area is 25,083 sq.m. The station cost Montreal $900,000, but it never belonged to Montreal (Rumilly, 1974). The building of the station was constructed by Vermont Construction. The engineers in charge were E. Stefanescu et A. Samikian (Pratt, 2008). In 1972 the second floor was added, constructed by J.-R. Robillard, according to the plans of architect Marc Cinq-Mars. This construction cost $300,000 (Pratt, 2008).

At the time when Expo 67 was held, Longueuil station had 11,000 parking spots around it. During Expo 67, Longueuil hosted nearly 100,000 tourists. 66% of all visitors were using the subway to go to Expo 67 (Legault, 2002).

The station is located at the junction of two major roads (Autoroute 132 and 134). The bus routes serving Longueuil and Jacques-Cartier were modified to provide connection to the metro (Rumilly, 1974). The Longueuil population at that period was not high enough for expansion of the metro line. However, two models of the residential buildings were presented for the municipality with the cost of $5,500,000. At that period, the municipality started to understand that population density is required to support ridership as well as continue to develop the area around the station. *"D'ici cinq ans, affirme Marcel Robidas, l'évaluation imposable devrait doubler. D'ici cinq ans, Longueuil sera méconnaissable!"* (Rumilly, 1974). Indeed, five years after, the number of people living in Longueuil rose significantly.

3.1.4 Site and Maps analyses

The site is located close to Old Longueuil – the central historical heritage area of Longueuil. Its shape is compact and geometrically resembles an irregular circle. The site is formed and surrounded by highways. Its road system is well developed, and its layout of roads and overall shape differs significantly from its surroundings. It is like a traffic island, practically impossible to enter for bicyclists and pedestrians. The site also lacks pedestrian accessibility to its main points of destinations, in particular to the river which flows behind Highway 132, to the shopping center Place Longueuil, and to the historical center (Figure 3-3).

Legend

- Highways
- Local roads
- TOD area- 600 m radius
- Metro station
- Open public areas
- Open semi-public areas
- Lack or absence of pedestrian accessibility

Figure 3-3: Traffic and pedestrian flows, Longueuil-Université-de-Sherbrooke TOD
Source: Google Maps, 2017, edited and analyzed by the author

The Floor Area Ratio (FAR) varies from segment to segment of the site (Place Charles Le Moyne). The highest coefficient of FAR is 12 (Figure 3-4). The scheme shows that with such a ratio the area has high density with many open spaces. FAR is greater for the areas which are closer to the metro station.

Figure 3-4: Zoning and the Floor Area Ratio (FAR), Longueuil-Université-de-Sherbrooke TOD.
Source: The map is drawn by the author and it is based on the data collected from the City of Longueuil. The borders of zones are taken from Zonage.kmz file (retrieved from the website from the City of Longueuil on 2017-06-05). Floor Area Ratio for each segment is retrieved from various documents available on the official website of the City of Longueuil.

According to the ownership scheme (Longueuil, PDADD, 2015), almost all territories with developments on them belong to various owners (Figure 3-5).

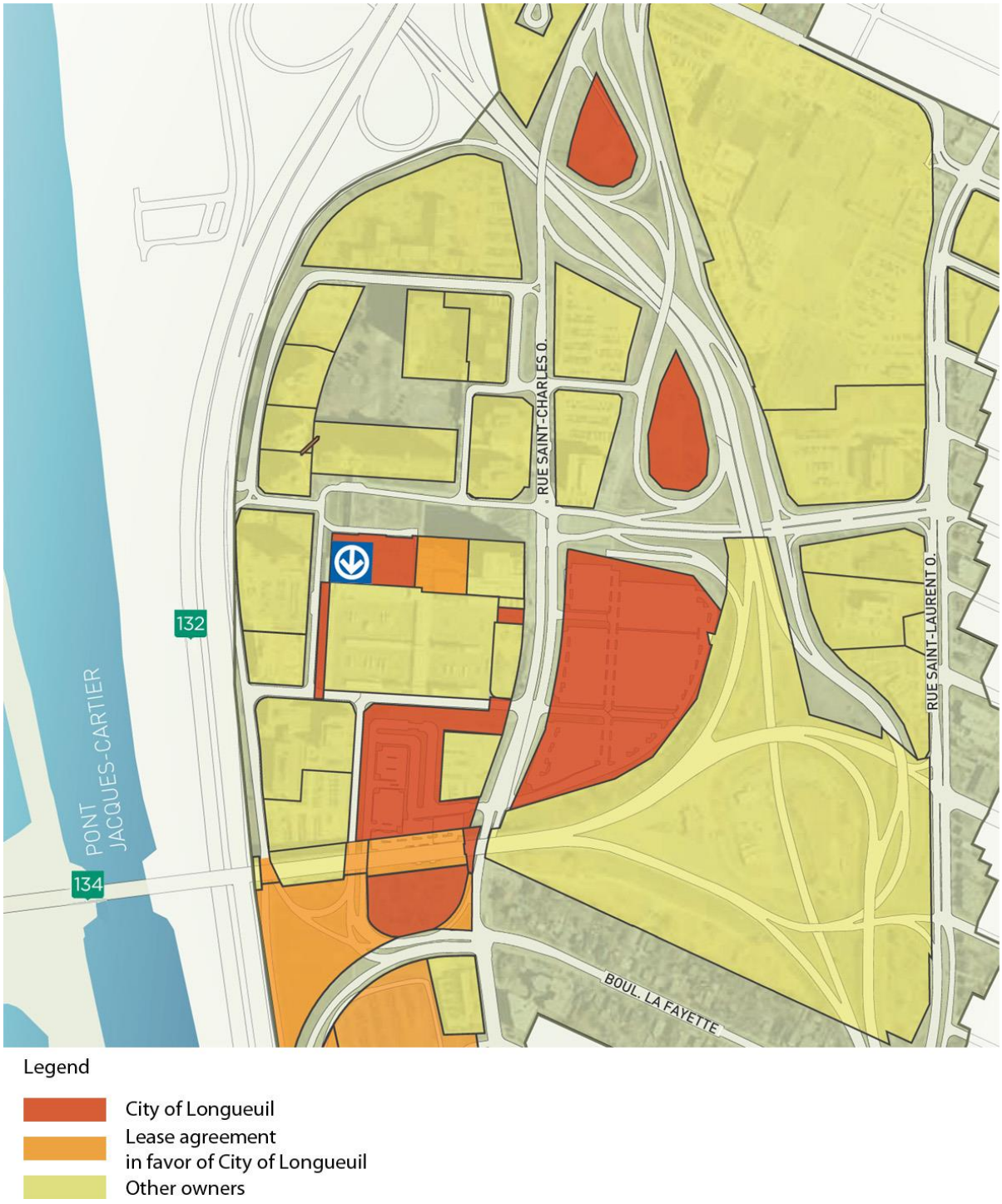


Figure 3-5: Place Charles le Moyne. Scheme of land ownership.
Source: Longueuil, 2015. PDADD

Maps

The map, dated 1963, (a revision of the map was done in 1966), shows that there were no buildings in the area of the future metro station at that time (Figure 3-6). The map also illustrates that an outline of Boulevard Taschereau (Route 134) was slightly different from its location on the map dated 1978. The buildings, located between the forks of the Boulevard Taschereau in 1966, disappeared by 1978. Also, according to the map, the roads, which later divided the area into several sectors, were under construction at that time.

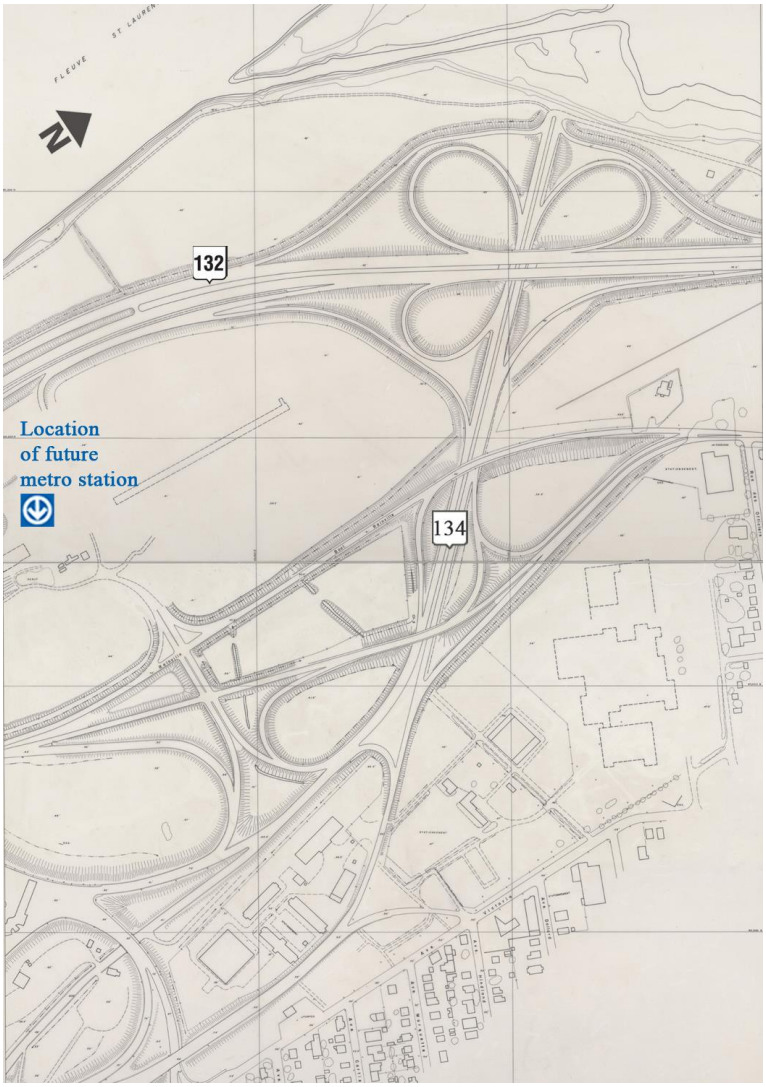


Figure 3-6: Land use map of Montreal, 1963 (revision, 1966)
Source: *Bibliothèque et Archives nationales du Québec*
The map was edited by the author

On the 1978 map we see that new buildings appeared near the metro station. During the following 20 years, new developments continued to appear near the station, and all of them were connected to the station. In addition to several new buildings, the shopping mall Place Longueuil was also enlarged, but by 1998 half of the territory still remained undeveloped. As we see, from 1978 to 1998 there were no major changes in road outlines; new developments were fitted into the existing road network of the large autoroute traffic island (Figure 3-7).

Figure 3-7: Fragments of the maps of Montreal dated 1978 (left) and 1998 (right)
Source: *Bibliothèque et Archives nationales du Québec*
The fragments were edited by the author

Two maps issued by STM in 1994 (Figure 3-8) and 2007 (Figure 3-9) show, that the outline of roads was changed after the opening of the University of Sherbrooke and Bus Terminal expansion. In contrast to the previous location, the current road net is redesigned in a way that offers people more public areas.

Figure 3-8: Longueuil station, 1994
Source: *Bibliothèque et Archives nationales du Québec*. *STCUM,1995. Autour du métro. Plans des environs des stations du métro de Montréal.*
The original map was edited by the author

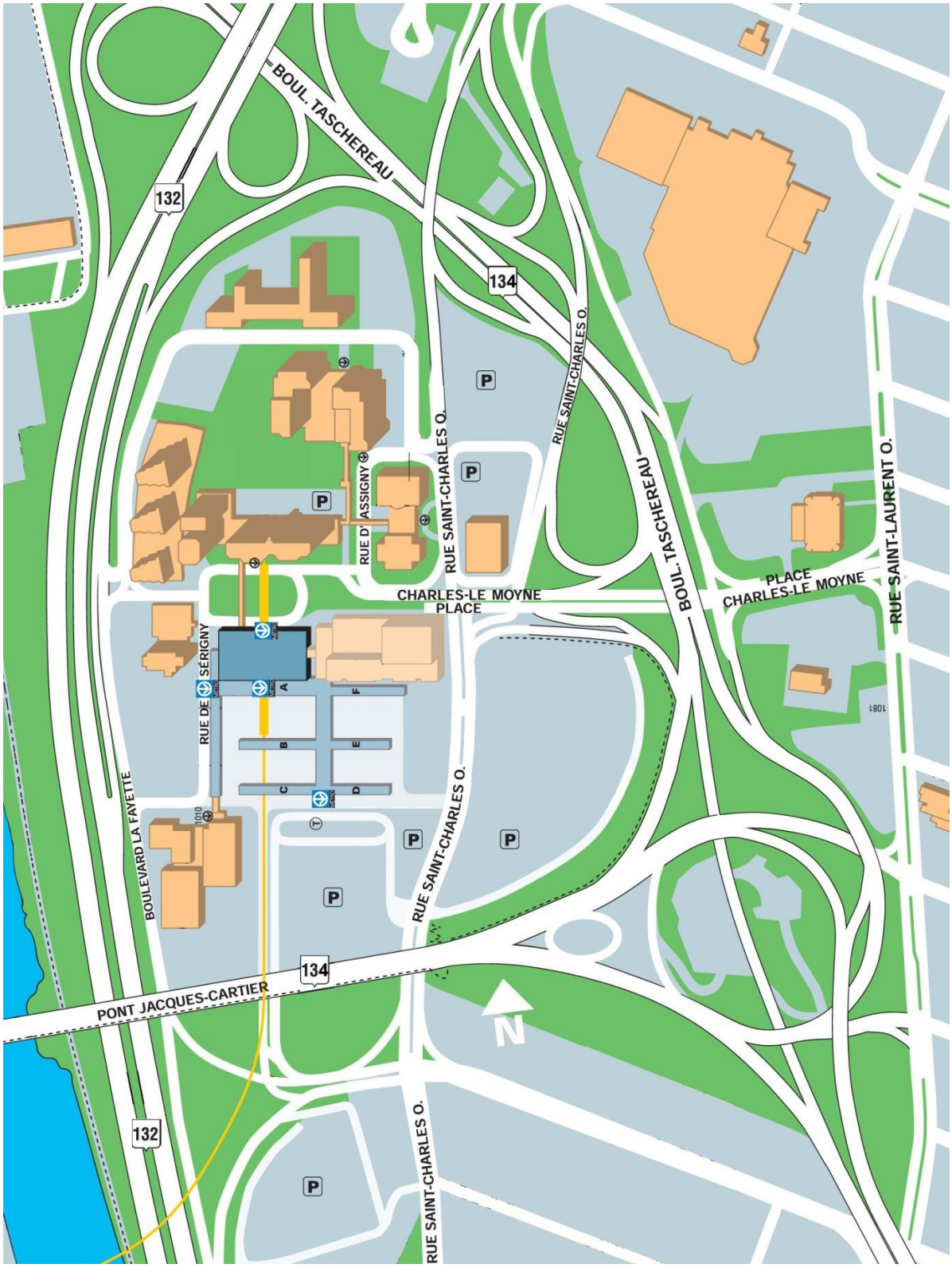
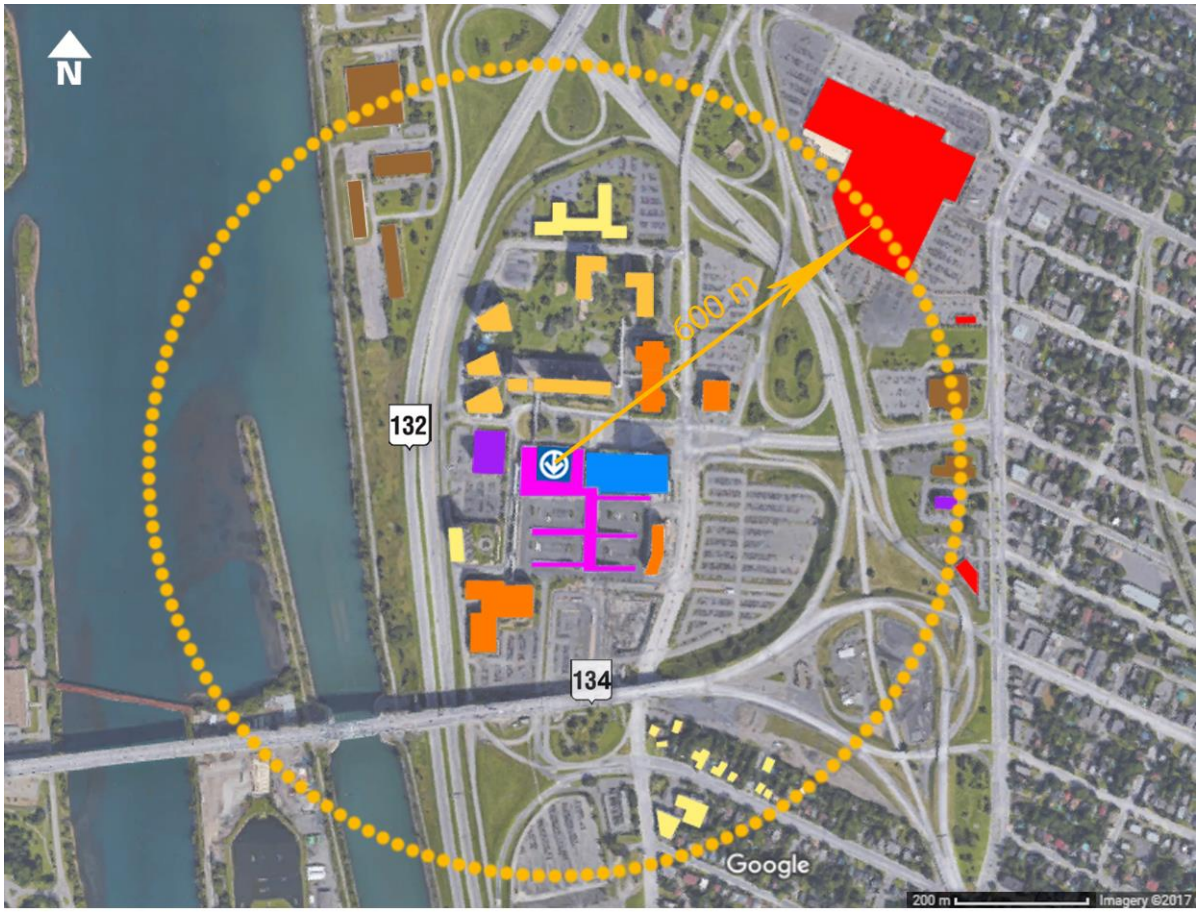


Figure 3-9: Longueuil-Université-de-Sherbrooke station, 2007
Source: STM, 2017. The original map was edited by the author

3.1.5 Developments around the station

The year 1969 marks the establishment of new high-rise buildings. Despite the fact that many residents did not like the way the buildings blocked the view of the rivers, they were a source of revenue (Société historique et culturelle du Marigot, n.d). The opening of the station catalyzed the development of the high-rise buildings. Moreover, this area was the only one available for this type of construction at that time (Ville de Longueuil, n.d). The area is mixed-used and represents buildings with at least two functions (retail and office space, educational institutions, residential functions, other services), often with commercial space on the ground floor (Figure 3-10). Several residential buildings, such as Port de Mer, have more than two functions. Figure 3-11 represents the order in which developments appeared.

The station is located on the traffic island. The separation of pedestrian and traffic flows is a complicated issue for urban designers to solve. From the beginning there was an idea to connect the buildings with the metro station by pedestrian bridges. The concept of bridges brings to mind the modernist idea of separation of flows by creating different levels for each flow. This design concept was a profound and thoughtful solution to separating the streams of movement. Six covered and heated walkways created the longest aerial bridge system in Canada (Ville de Longueuil, n.d). The longest of them is Metro-Bienville bridge with a length of 170 meters, designed by Mario Petrone.



Legend

- Residential
- Residential mixed-use
- Offices
- Retail
- Hotel
- Educational and mixed-use
- Metro and bus terminal station
- Services

Figure 3-10: Land use map of the Longueuil-Université-de-Sherbrooke TOD area
Source: Google Maps, 2017, edited and analyzed by the author

BUILDING	YEAR
Place Longueil	1966
Montval	1968
Sandman hotel	1972
Le Neuville Nord	1971
Services	1972
Port-de-Mer	1972
Canada health	1973
Neuville Sud	1973
D'Assigny Neuville	1974
Offices (1000 Rue de Sérigny)	1976
Offices (25, Boul. La Fayette)	1980
Saint-Charles complex	1986
Offices (1010 Rue de Sérigny)	1988
Complex Estuaire	1989
Habitats Lafayette	1998
Funeral Complex	1998
Terminus Longueuil	2000
Hotel Le Dauphin	2001
Toyota complex	2004
Housing (15, Boul La Fayette)	2010
University of Sherbrooke Campus	2010
Blu Rivage Condos	2010
Axcès Saint-Charles	2015
SSQ Tour	2016

Figure 3-11: A chronological order of construction of the buildings appeared around the Longueuil-Université-de-Sherbrooke TOD area
Source: the table is composed by the author, and based on information collected from various sources

Mixed-use with principal usage of transportation

Terminus Longueuil, designed by MDA-Architects, was opened on September 28, 2000. The cost of the project was $20,0M. Its annual ridership is estimated at around 13,000,000. The terminus provides quick access to the metro and to urban and intercity bus services. It has a large parking area with 1880 spaces. There are drop-off areas, a waiting area for taxis, as well as 370 bicycle racks. Before the opening of the new terminal, people waited for buses

outside. Moreover, the new terminus has 43 platforms in contrast to the previous one with 23 platforms.

Mixed-use with commercial principal usage

Place Longueuil is a shopping mall built in 1966 during the Marcel Robidas governance. It is the first and the only big shopping center in the area of Old Longueuil (marigot.ca). Initially, two stages of construction were planned; however, the second one was never realized. "The inauguration of the Place Longueuil shopping center can be considered as the starting point of the sector's development" (Ville de Longueuil, n.d). After the fire in 1979 the building was rebuilt and reopened in 1981 with 85 stores (Wikipedia, 2017). Place Longueuil offers 1870 car spaces.

In 1968, the building **Montval** was opened. It is a seven- storey office building designed in modernist style. The government of Quebec is the owner and the occupant of it.

The Saint-Charles complex is a seven-storey building. It was constructed in 1986 by Groupe Mercille inc. and designed by an architectural company, Webb, Zerofa & Menkes. This office building includes two underground parking levels with 115 parking spaces. A 30-meter walkway, opened on December 8, 1987, connects the building with the metro station. The complex was completed in 1989 (Ville de Longueuil, n.d).

There are two hotels in close proximity to the metro station: **Sandman Hotel and Hotel Le Dauphin. Sandman Hotel** is a high-rise seventeen-story building with 214 rooms. It was opened in 1972. Different companies owned the building during its existence (Holiday Inn, Ramada Inn, and Radisson chains) (Pratt, 2008). **Hotel Le Dauphin** is a six-story building built in 2001.

SSQ Tour was opened in 2016 after two years of construction. It is a twelve-storey tower with a total leasing area of 23,225 sq.m, where 19,975 sq.m are for office rent and 3250 sq.m for commercial areas. The architects are BMD Architects; Group SSQ is the primary client. SSQ rents the building to different tenants. The ground floor offers various services such as restaurants, clinics, etc. The tower hosts an internal parking lot with 250 car spaces. The cost of construction was $50,200 000. The building is built with respect to all standards of sustainable design and received Gold LEED Certification.

Mixed-use developments with principal usage of education

University of Sherbrooke – Longueuil campus was opened in 2010. It is a sixteen-story building. Its architects are Marosi + Troy, Jodoin Lamarre Pratte, Labbé architectes. It has 22,000 sq m. area and a budget of $115M. According to Ricardo L. Castro, Professor of architecture at McGill University: *"In recent years, the rapid development of online communication technologies has only furthered the possibilities of distance education. When coupled with the swift and intense growth of transportation hubs in urban peripheries, it is not surprising to see a significant boom in branch campuses across North America. The purpose of these branch campuses is to attract students who have difficulty in access to traditional venues that deliver higher education due to geographical, financial, family and other constraints. Peripheral nodes of urban transport provide ideal locations for branch campus developments, given the large numbers of individuals who circulate through them during their daily journey from suburban to more central city areas, and vice versa. Furthermore, there are the economic incentives for private- and public-sector developers*

who consider the opportunity to build satellite universities as catalysts for new developments in outlying urban areas" (Castro, 2012).

There were three invitations for the University of Sherbrooke to come to Longueuil. The first one came from *Conseil régional de développement de la Montérégie* which aimed to obtain a new dynamic catalyst for other institutions to come to Longueuil. The second invitation came from the government of Quebec. Finally, the mayor of Longueuil proposed the University of Sherbrooke to come (Ledevoir, 2013). As part of the metropolitan community of Montreal, it is important for Longueuil also to have the status of a "university's city." From 1991, the University of Sherbrooke has been offering educational programs in collaboration with other universities. In 2002, University of Sherbrooke created a university center with UQAM, *Université Laval* and *Valotech* to ensure coordination and planning of educational activities in the region of *Montérégie*. The placement of the University of Sherbrooke in Longueuil was beneficial for many parties: for the University itself, for the city, for students and finally for professors and employees of Longueuil who worked there.

Since 1989, the University of Sherbrooke has had a campus near the metro in the complex Charles-LeMoyne for around 10,000 students. Both the city and the station benefited from the replacement of the name as the city wanted to be associated with the University (Pratt, 2008).

The University of Quebec in Montreal (UQAM) has been offering education in the building *Port de Mer*. UQAM has provided education since 1980 in *Montérégie*. In 2004 the university moved to College Champlain, located in walking proximity to the metro station (Pratt, 2008).

Institut Nazareth Louis-Braille (INLB) was a co-educational school for blind children, founded in 1861 in Montreal. Music was a part of its curriculum. In 1975 the school was merged with Institute Louis-Braille (Thecanadianencyclopedia, n.d). Institute Nazareth moved to Longueuil in July, 1975 to Institute Louis-Braille where they merged to from Institut Nazareth Louis-Braille. This new organization offers readaptation services such as physiology, mobility, orientation, autonomy, library, service for small children and tutor service, etc. (Inlb, n.d). The building was constructed in 1987 where INLB is currently located.

Mixed-use developments with residential principal usage

Housing types vary in Longueuil. Around the metro station, there are high-rise residential buildings, while further from the station single-family houses appear more frequently. According to statistics from Montrealinternational (n.d) apartment buildings in Longueuil overall account for 43% of the total housing stock, while semi-detached and detached housing together constitute 47%.

Port de Mer is a complex of two buildings, 26-storey and 30-storey, with 386 units. This complex was linked to the metro station in 1971 by a walkway designed by architect Jean Grondin. The building was sold to Habitation Chateau Lincoln in 1989.

Habitats Lafayette was opened in 1998. It has five floors and offers 207 units with different sizes 1,5; 2,5; 3,5. The building serves seniors with and without autonomy, including those who have Alzheimer. Habitats Lafayette is located in close proximity to subway and bus stations.

Le Neuville Nord was built in 1971. It is a seven-storey building with 264 units.

Complexe D'Assigny Neuville Sud is a high-rise, eighteen-floor residential complex with 283 units built in 1973. It has a landscape green terrace with a total of 4180 sq.m, an indoor pool and sauna, a training centre, stores, hair salons, etc. It offers its residents interior and exterior parking.

Complex D'Assigny Neuville is a twenty-two-storey high-rise building built in 1974.

Complex Estuaire was built in 1989. It consists of three towers: 13, 19 and 24 floors. All three towers are mixed use with residential and commercial areas.

Axcès Saint-Charles is eleven-storey complex with 166 units built in 2015 year.

Blu Rivage Condos Complet (at 15 Boulevard la Fayette) was constructed in 2010 and offers 225 units.

3.1.6 Future Development Plan

According to the Longueuil Development Plan (Longueuil centre ville 2035), by 2035 the city plans to add 8500 residential units, 139,354 sq.m of office areas, and 9290 sq.m of retail areas. The development plan divides the area in close proximity to the subway in several development sectors/areas: City center-Place Charles Le Moyne, College Champlain area, Bridge area, Longue-Rive area, Place Longueuil, and Marie-Victorin park area (Figure 3-12). The Floor Area Ration (FAR) varies from sector to sector from the ratio 3 to 20: 12 for Place Charles Le Moyne; 2 and 12 for Longue-Rive area; 3, 4 and 8 for Place Longueuil; 0,3 for College Champlain area; 4 for Bridge area. Place Charles Le Moyne is an area within the TOD radius.

In 2017 new development will be initialized by the start of the construction of a new cultural center of Longueuil, which will host several institutions: *Théâtre de la Ville,*

Orchestre Symphonique de Longueuil, Plein Sud, Centre d'exposition en art actuel à Longueuil, and *Théâtre Motus*.

The city also intends to provide the space with access to the waterfront, which is currently totally blocked by the highway 132. Moreover, pedestrian accessibility to other major destinations, such as Place Longueuil, will be improved.

As we can see from a scheme in their brochure, the municipality makes the area denser by getting rid of parking and by constructing new mixed-use buildings instead. All the parking is transferred underground. The guide also shows what kind of functions each of the buildings in the sectors is planned to have. Despite the fact that all of the buildings are mixed-use, a principal function of each is still guided in order to provide a healthy balance and diversity. New constructions will accommodate various functions: residential, commercial (retail and offices), and cultural. Residential buildings appear more frequently further from the station, while cultural and commercial activities are concentrated around the metro station.

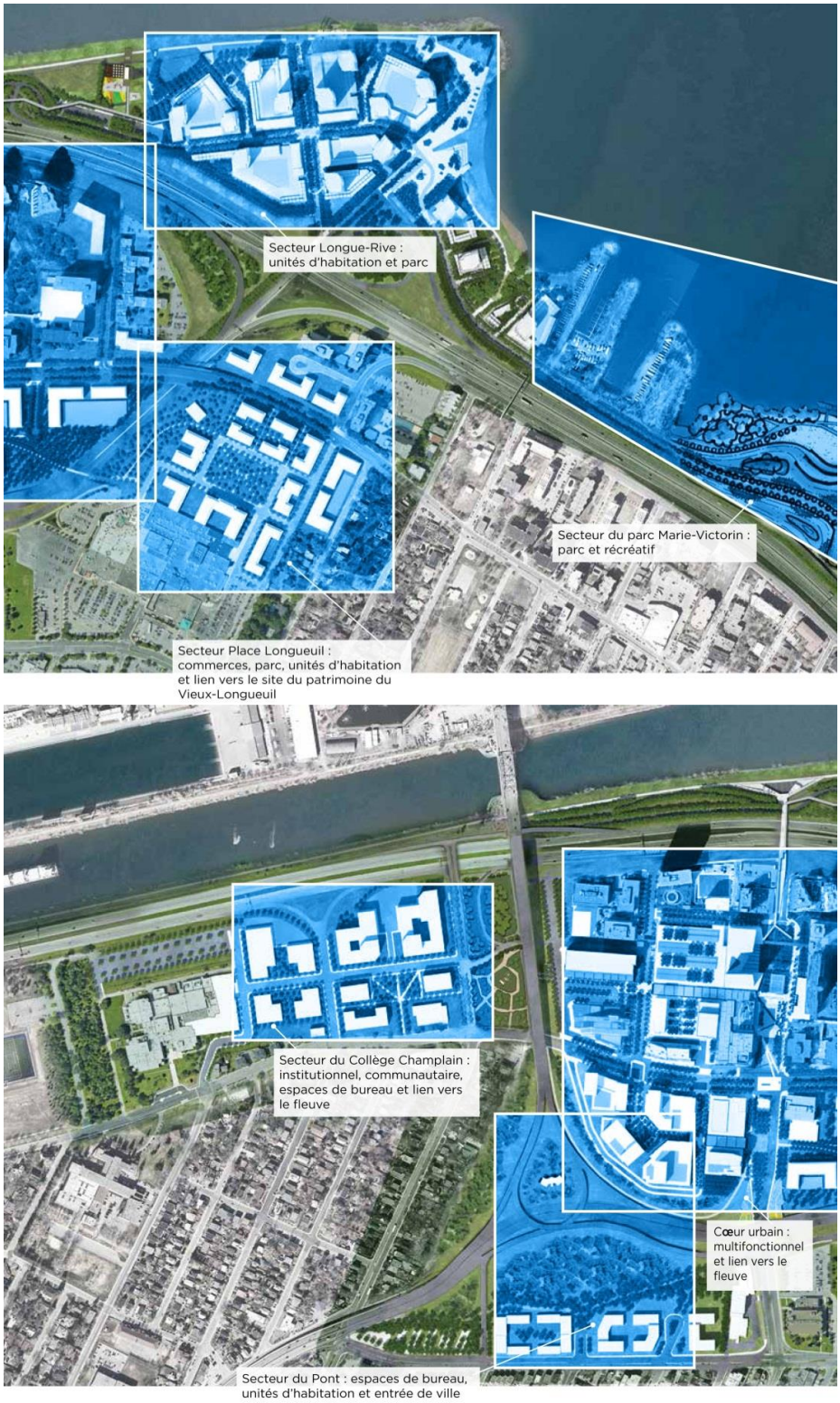


Figure 3-12: Sectors for development in the area around Longueuil-Université-de-Sherbrooke metro station
Source: Longueuil, 2015. *Longueil centre ville-2035.p22,23*

3.1.7 Field observations of Longueuil-Université-de-Sherbrooke TOD

The station area is observed with respect to the guidelines and recommendations of the TOD Institute and *Communauté Métropolitaine de Montréal* (CMM). The principles of two guidelines were merged in a system of 13 categories: well defined public spaces, mixes of uses, quality pedestrian experience, human scale architecture, active ground-floor retail, tree-lined streets, easy access by bicycle, reduced and hidden parking, affordability, expandability, station's access points, density, sustainable development.

Well defined public spaces

The public areas are well defined. There are two main public areas: the first is a square adjoining the metro station. It has lovely street furniture (benches, lighting, etc.), art objects (sculpture) and nice landscape design. The pavement is done professionally with the usage of different patterns and colors.

Metro Garden is another public area, surrounded with office and residential buildings. It offers its users a gathering place with a peaceful atmosphere.

Figure 3-13: A public area adjacent to Longueuil-Université-de-Sherbrooke metro station (left photo) and Metro Garden (right photo)

There is also a public terrace in the University of Sherbrooke. Despite the fact that probably not many people know about the place because the terrace is not clearly visible, it still serves as a gathering place for students and staff. Moreover, University of Sherbrook also offers its visitors a sheltered public area - its cozy and stylish atrium accessible from the ground floor.

Figure 3-14: A public area at ground floor (upper photos) and a terrace (bottom photos) of the University of Sherbrooke

Overall, public areas are arranged within high-rise buildings. This approach resembles Le Corbusier's concept of "towers in the park," where high-rise buildings dominated the plan, and the open space was dedicated to garden.

Mixes of uses

Longueuil-Université-de-Sherbrooke station has various mixes of uses: commercial (hotel, offices, retail, restaurants, etc.), residential, and educational. The latter becomes more and more significant in this TOD. Almost all buildings have at least two functions. The functions are mixed vertically and horizontally. For instance, a housing complex Port de Mer accommodates residential, commercial, and educational functions. The station still has large parking areas which make the area less walkable and pedestrian oriented. The future development plan, which is in process already, tries to improve that situation and make the area more vibrant and convenient for pedestrians.

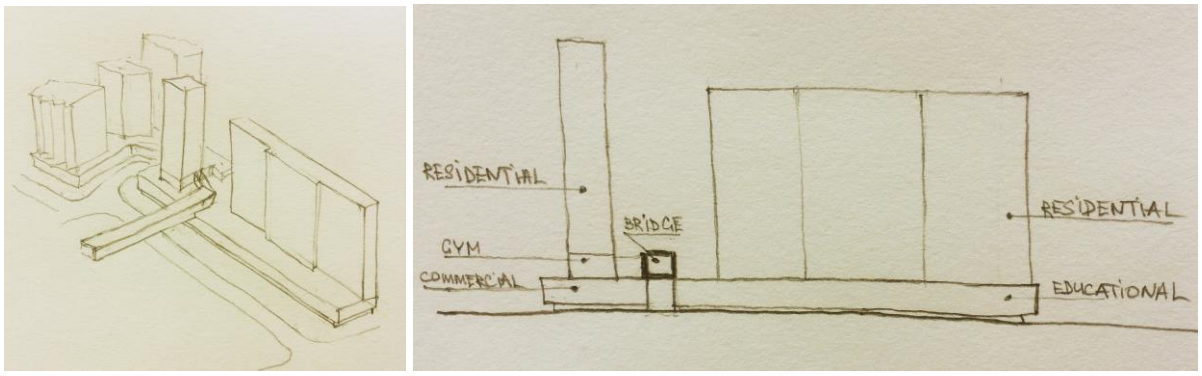


Figure 3-15: High-rise developments with a prominent podium for ground floor commercial activities (left sketch) and vertical mixture of uses in residential complex Port de Mer (right sketch)

Quality pedestrian experience

The area around the station is covered with tiles. It is planted and has nice landscaping in some areas, and this landscape is well designed and has good street furniture. Trees,

landscape design, lighting, street furniture, and signage make the area look pedestrian-friendly. According to Walkscore.com Longueuil-Université-de-Sherbrooke area has a high walk score (more than 70). Despite this score, some areas are not easily accessible by pedestrians. Specifically, in some areas it is hard to cross roads; waiting time for traffic lights is long; and many sidewalks seem not to be designed properly.

Figure 3-16: Pedestrian-friendly design at Longueuil-Université-de-Sherbrooke metro station (left photo) and absence of pedestrian attractiveness further from the station (right photo)

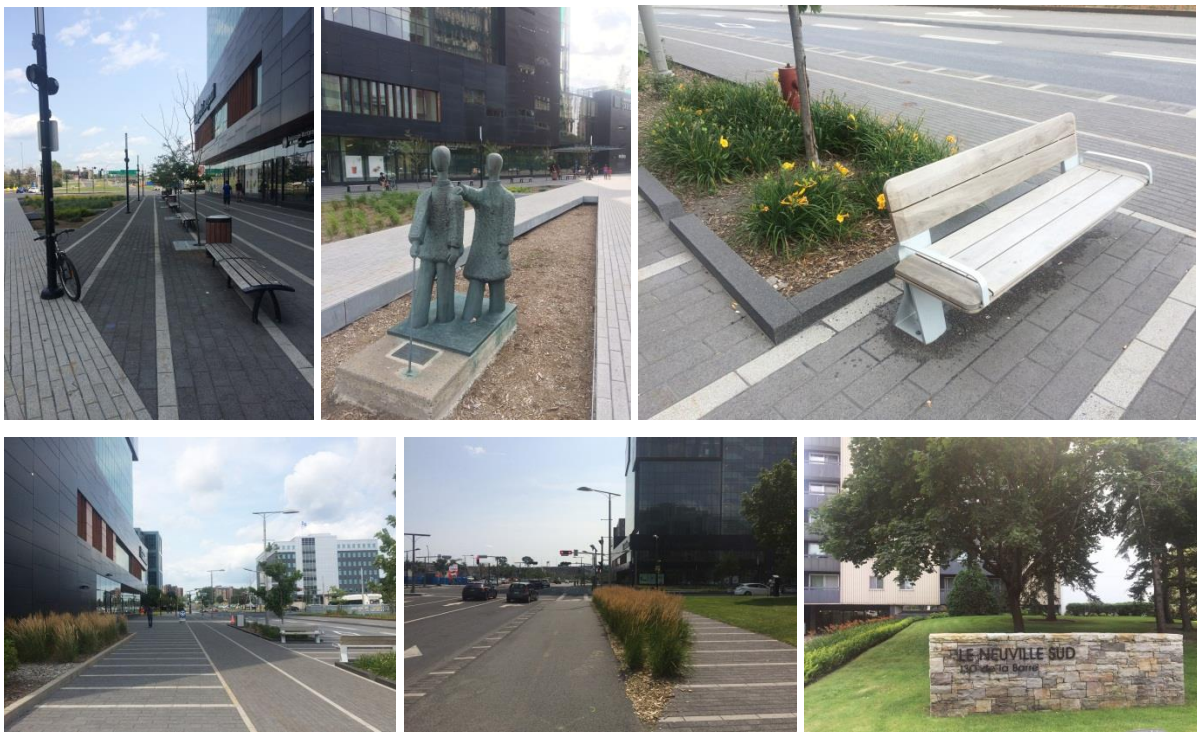


Figure 3-17: Landscape design elements of Longueuil-Université-de-Sherbrooke TOD area

Human scale architecture

There are high-rise buildings inside the Longueuil-Université-de-Sherbrooke TOD radius. Despite the height of the buildings, the first floor is human scaled. The upper floors are designed with a setback to make the perception of the building from the ground floor less massive. The landscape design, trees, lighting, street furniture, and signage create a human scale as well. New buildings such as the University of Sherbrooke use a variety of materials to make the pedestrian experience more pleasurable.

Figure 3-18: University of Sherbrook (left photo); landscape design (middle photo); sketch (right photo)

Active ground-floor retail

The University of Sherbrook offers active retail on its ground floor. However, overall, the station's TOD area lacks the presence of active ground-floor retail. For instance, there are no cafes with terraces, which might make the area more livable and help to expand the interior space outside.

Tree-lined streets

Generally, the area in the TOD radius has tree-lined streets and a lovely landscape design. The kinds of trees and plants differ from area to area.

Figure 3-19: Tree-lined streets

Easy access by bicycle

There are bike racks around the station. Overall, the metro is accessible by bikes. The city currently is improving bike paths and aims to make the area more accessible.

Figure 3-20: Bike stations and paths

Reduced and hidden parking

The development of the area shows impressive dedication to the TOD's idea of hiding and reducing parking. Despite this, there are still a huge number of parking zones. With the appearance of new buildings, most of the parking areas will go underground.

Figure 3-21: Extensive parking areas within Longueuil-Université-de-Sherbrooke TOD radius

Affordability

Overall, the Longueuil-Université-de-Sherbrooke TOD offers a variety of housing options and different retail stores. Different houses offer different options for living. There are various ways for acquiring and renting an apartment, as well as units of various sizes and types. Moreover, there is a senior house near the metro station. As for the retail options, there are many shops which serve people. The stores help create more vibrant life. Finally, there is a lack of convenient stores near the metro station for people with different incomes.

Expandability

The area has the potential to expand which is shown in the city's development plan by indication of the areas of growth around the current TOD.

Station's access points

The station area is visible and accessible by various modes. The buildings, located near the station, are connected to it by pedestrian bridges. The bridges give direct access to the metro station and help people get to the station without leaving the building, something many people would find extremely convenient especially during a cold period. The bridges create a unique interconnection system for all buildings around the station. Despite having different functions, the buildings act as one "urban organism," and the bridges here represent its arteries and connectors. Moreover, the bridges resemble the modernist idea of separation of pedestrian and vehicular traffic flows, the idea that became extremely useful in the Longueuil-Université-de-Sherbrooke TOD. The signage of the metro location is well defined and visible. The square indicates location of the metro station, while the landscaping design highlights the direction to the station.

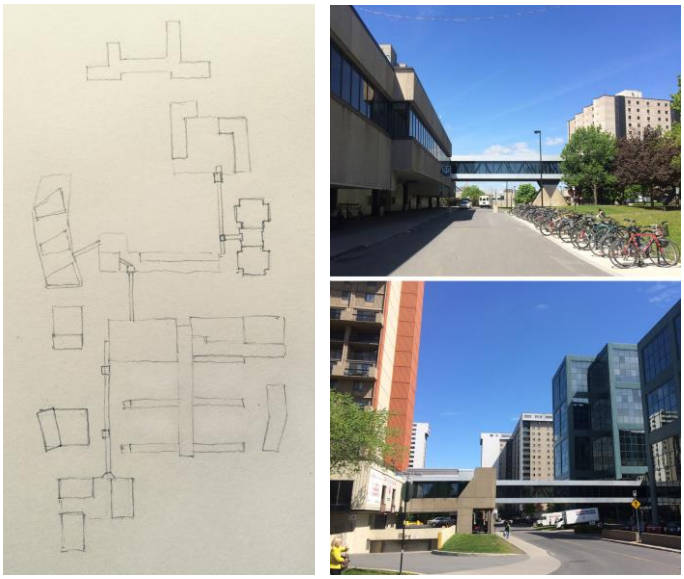


Figure 3-22: Pedestrian accessibility and connectivity near transit station at the ground level and second level (via pedestrian bridges)

Density

High-rise buildings represent the area. The regulation to construct buildings with the FAR coefficient of 12 allows high density and enough open spaces.

Sustainable development

No observations have verified the presence of the ideas of sustainable development. However, some new constructions make an effort in achieving LEED standards. For instance, SSQ tower recently received LEED certification.

3.1.8 Summary

2017 marks 50 years since Longueuil station was opened. Since the opening of the station, the area around it (Place Charle-Le Moyne) was constantly changed. New buildings appear; old ones were modified. The area around Longueuil station continues to urbanize and

densify. From 1967 till the present and taking into account a future development plan, the area will continue to densify, mostly by the construction of high-rise buildings. These buildings along with their functions marked the area as a new downtown of Longueuil. The Longueuil-Université-de-Sherbrooke area offers its residents and visitors a variety of uses and housing options. Those who opt to live in a private house use the car or bus to get to the metro. As we saw in the future development plan, the city constantly balances its land uses, and is now focused on making of the area as an educational and cultural pole.

At the moment of the appearance of Longueuil metro station, almost nothing existed in the TOD radius. The example of Longueuil shows that the right strategic planning of an area for the new rapid transit station, once it was properly chosen, pushes the developments around it. And while some people may argue that urban design is not the best at Longueuil-Université-de-Sherbrooke, it still represents a strong idea of separating pedestrians from traffic in such a thoughtful urban design concept. Moreover, grouping high-rise buildings around the station, pushing the parking further from the station, and giving open space areas for public use make the area around the station pedestrian-friendly.

The location of the station is in proximity to Longueuil heritage –Old Longueuil area strengthens and highlights coexistence of “the city's old part” and the “new one” near one another. Finally, location near the river gives the site a unique opportunity to create a recreation zone for residents. Due to all its advantages the site has the strong potential to grow and develop further. Moreover, visual connection between two cities (Montreal and Longueuil) creates a “conversation” between them and compliments the development of them. As we also saw from the future development plan of the city, the municipality is planning to correct the current unsatisfactory situation of a lack of pedestrian accessibility of major points of destination, such as waterfront or just convenient crossroads.

3.2 Montmorency station

3.2.1 Background information. City of Laval

The city of Laval was founded in 1965. It accounted for 196,000 residents at the time of its foundation. Most of its territory at the time was dedicated to agriculture or was undeveloped. From 1966 till 1989 Laval was developing fast; however, its development was suburban-like and as a consequence car-dependent (Laval, 2017). During the same period, the main highways were constructed, and new residential areas with detached housing types appeared. The population increase pushed the development of various institutions such as Nature Centre (1970), College Montmorency (1976), Hospital *Cité-de-la-Santé* (1978), *André-Mathieu* Hall (1979), *Maison des Arts* (1986), and Symphony Orchestra of Laval (1984) (Laval, 2017).

From 1990 till 2006, the residential areas became more diverse. That period in Laval is also characterized as a period of desire to protect natural areas and agricultural zones. In 2007, the STM extended the Metro Orange line to Laval by opening three stations – Cartier, De la Concorde, and terminal Montmorency. All stations are accessible for people with reduced mobility (Laval, 2017). By 2016, the population of Laval had reached 422,993 with population density of 1,710.9 people per sq.km (Statistics Canada, 2017).

Most of the territory of Laval is occupied with one- or two-storey buildings. As of January 2016, there were only 166 buildings of 6-floor or higher in Laval. The appearance of new types of buildings started to change the look of some of the city's sectors (Laval, 2017).

Laval has several universities on its territory: *l'Université du Québec à Montréal* (UQAM*), l'Institut national de recherche scientifique* (INRS) – *Institut Armand-Frappier*, *l'Université de Montréal* (UdeM) and *l'Université de Sherbrooke*.

3.2.2 Infrastructure before the opening of the station

Autoroute 15

The Autoroute 15 is a highway which starts at the American border in Saint-Bernard-de-Lacolle and ends in Sainte-Agathe-des-Monts in Quebec. Its length is 163 km, and it was constructed in 1958. It was the first Quebec highway, and by 1967 it was 140 km long. The construction of the road was completed in 1974 (Wikipedia, 2017). The southern section of this road connects New York City with suburbs of Montreal, and this is the principal commercial corridor between New York and Montreal (Wikipedia, 2017).

3.2.3 Montmorency metro station

The station is named after the College of Montmorency, which is located near the station. Montmorency metro station was opened in 2007. Giasson Farregut Architects designed the station (STM, n.d). The platform has a 20-meter ceiling. The station was a part of the project of the metro network expansion to Laval. Montmorency is one of seven STM metro stations with access for people with reduced mobility (three out of seven are located in Laval). [*]

With these new stations, the Metro Montreal receives 60,000 more passengers daily (Wikipedia, 2017). Montmorency is a multimodal station. It establishes correspondence with the Terminus Montmorency, served by *Agence métropolitaine de transport* (AMT). The terminus is served by local and regional buses. Buses are served by *Société de transport de Laval* (STL), *Conseil intermunicipal de transport Laurentides* (CITL), and *MRC Les Moulins*. The station has outdoor and indoor parking and bike racks.

[*] Montreal metro system emerged in 1967. At that time little consideration was given to the universal access to public buildings. There is a growing awareness of this issue, and since early 2000 STM has made an effort to introduce elevators to existing stations, while new stations are accessible for people with reduced mobility.

3.2.4 Site and Map analyses

Main local roads divide the site into several rectangular sectors. Autoroute 15 borders the southwest side of the site. Each sector has its principal function. For instance, the area in front of the metro station is formed with two residential sectors, one mixed-use commercial sector, and one sports sector. Colleges and retail areas are placed in their separate lots as well.

In contrast to Longueuil-Université-de-Sherbrooke, Montmorency does not have a complicated traffic situation. The site is easy to enter for bicyclists and pedestrians. However, there are no pedestrian streets on the sites, and pedestrians are forced to walk along main local roads.

Legend

- Highways
- Local roads
- TOD area- 600 m radius
- Metro station
- Open public areas
- Open semi-public areas

Figure 3-23: Traffic and pedestrian flows around Montmorency metro station
Source: Google Maps, 2017, edited and analyzed by the author

Figure 3-24: Land ownership around Montmorency metro station
Source: The scheme is made by the author and is based on the data of ownership retrieved from the City of Laval.

Almost all the land belongs to various owners (Figure 3-24).

According to Councillor Paolo Galati, who represents the eastern Laval district of St-Vincent-de-Paul, at this moment there are no regulations regarding height limitation for buildings (lavalnews.ca). As a consequence, Floor Area Ration (FAR) can not be calculated.

Maps

The maps dated 1978 and 1998 show how significantly the territory has been developed during twenty-year span: detached houses continued to appear, the retail center Les Galeries Laval was expanded, and new detached retail stores and apartment blocks came up. Overall, the area became denser despite the fact that the metro station had not come to the area by that time. The buildings appeared near the infrastructure that existed - roads. Additional roads were constructed to serve new buildings.

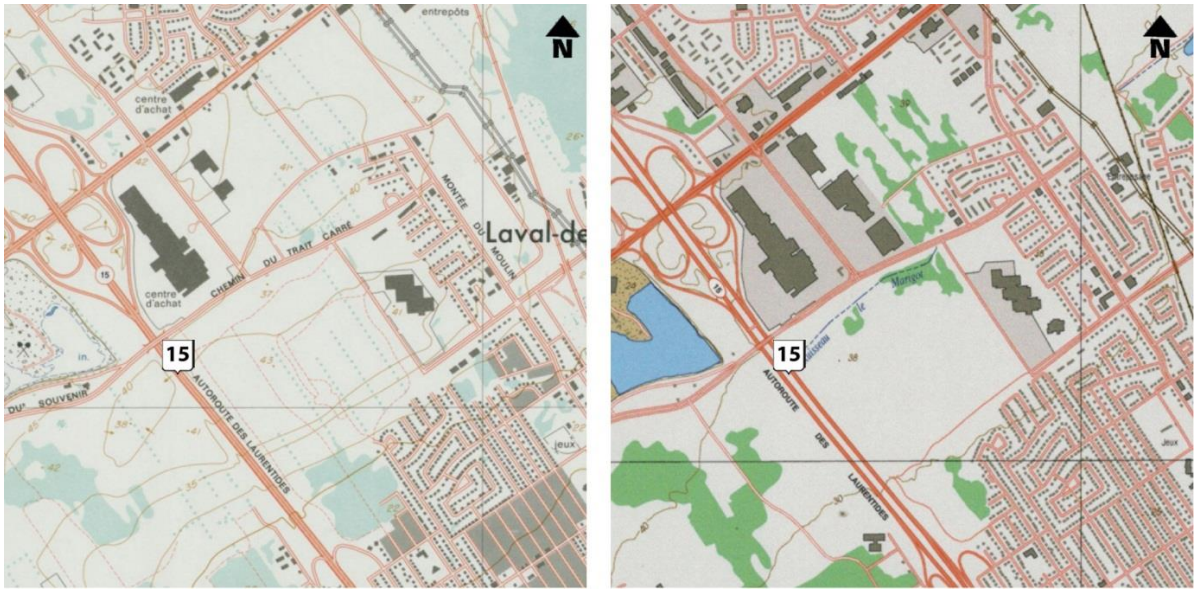


Figure 3-25: Fragments of the maps, dated 1978 (left photo) and 1998 (right photo)
Source: Bibliothèque et Archives nationales du Québec

By 2012 the area in front of the College Montmorency was divided by roads in several sectors - site lots for the further developments. Several major developments had appeared by that moment. New ramps of Autorout 15 gave access to the station and recent developments. During the following five years the area continued to densify, and by 2017 (10 years after the opening of the station) almost all the available land is either currently occupied or belongs to construction projects under way.

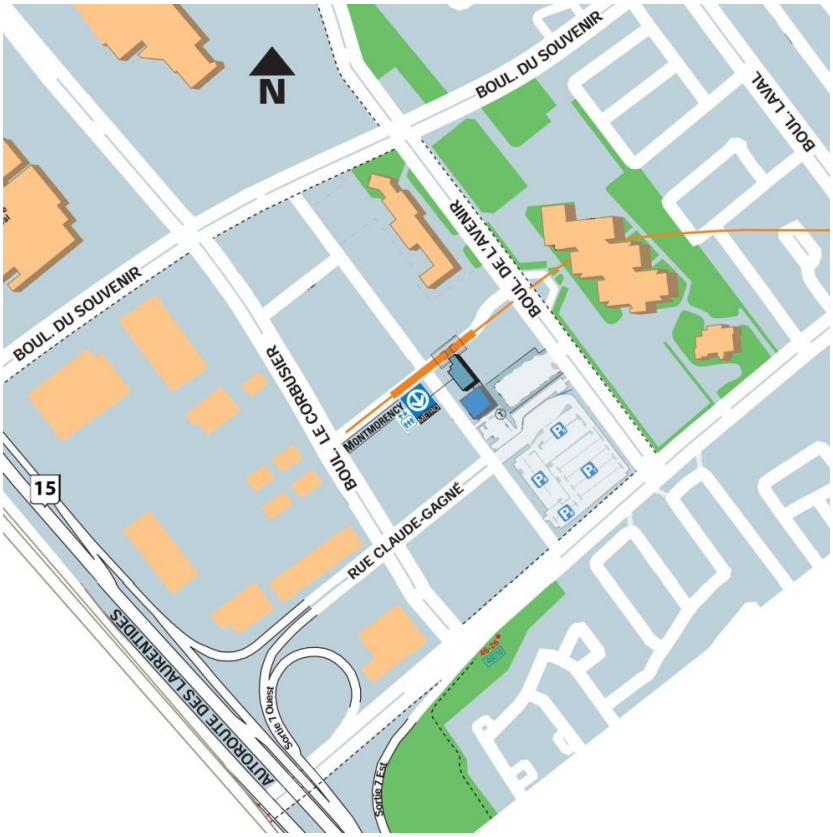


Figure 3-26: Montmorency metro station, 2012
Source: STM, 2017. The original scheme was edited by the author

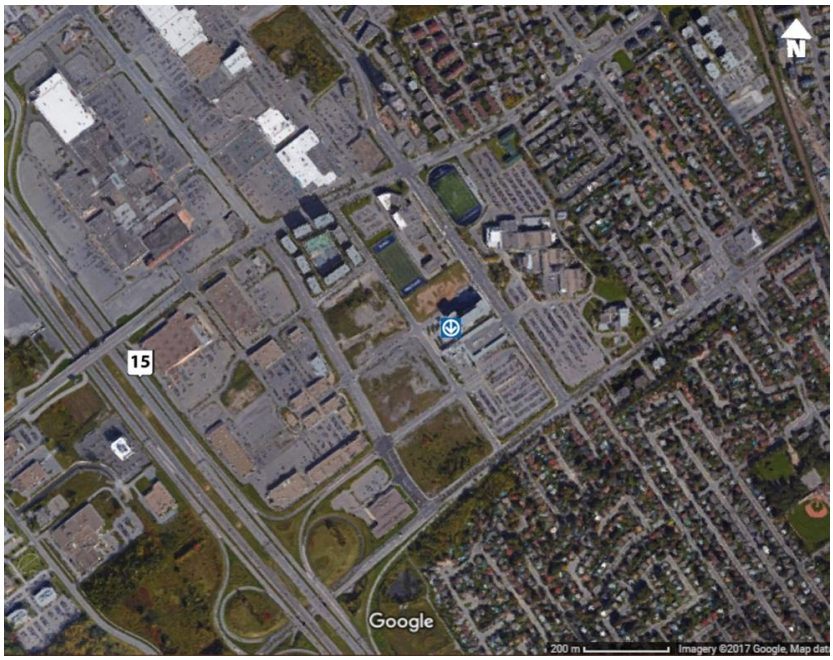
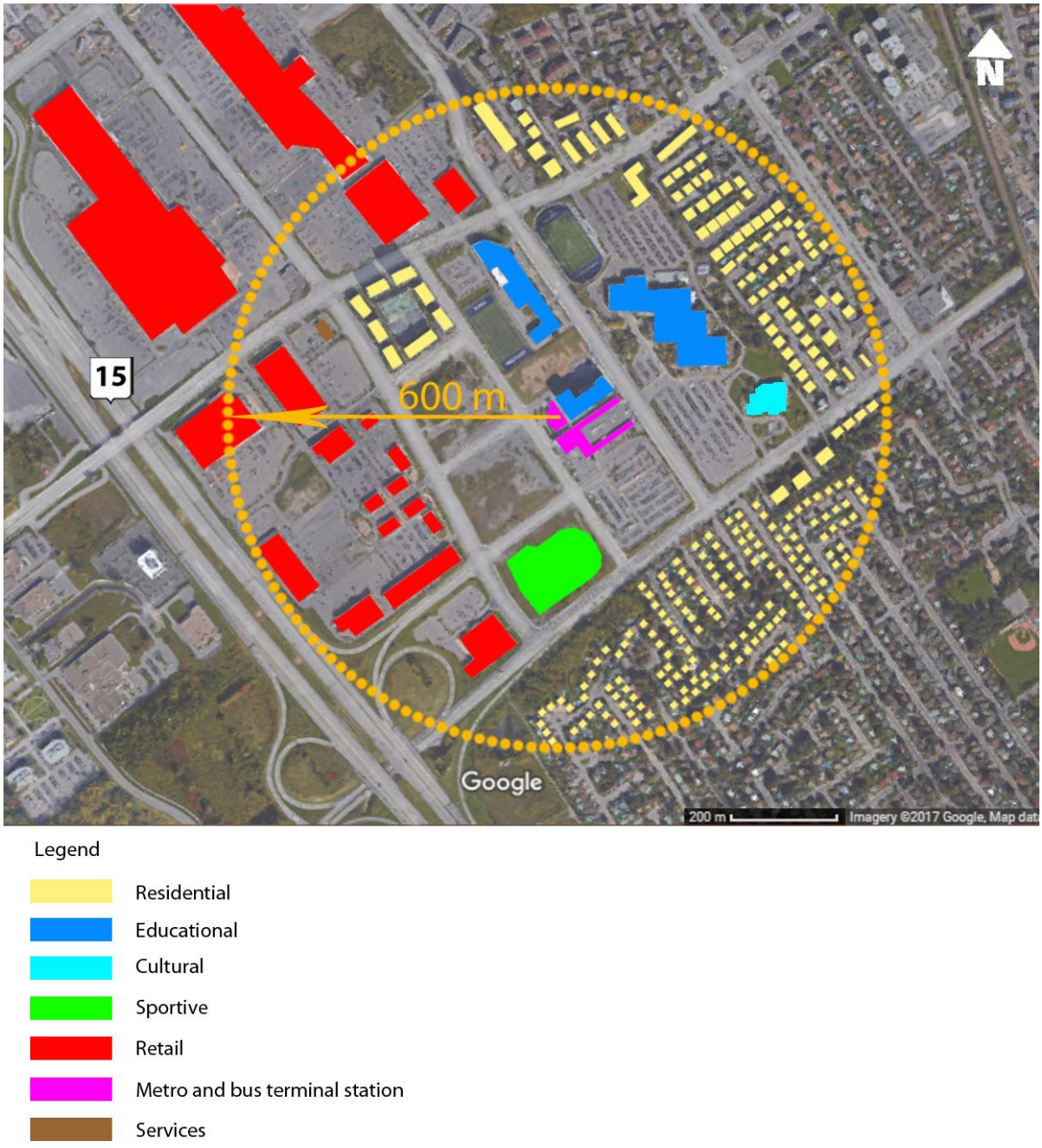


Figure 3-27: Montmorency metro station, 2017
Source: Google Map, 2017, edited by the author

3.2.5 Developments around the station

Montmorency has a significant educational, cultural, and sportive pole. It has several educational institutions such as colleges Montmorency and Letendre, University of Montreal (UdeM). There also are an art gallery Maison des Arts, and a sport center Place Bell. Unlike Longueuil-Université-de-Sherbrooke station development, educational activities arrived here first. College Montmorency was the key for locating the metro station here. UdeM arrived after the opening of the metro.

Regarding urban open spaces, there are several sports areas near the colleges and public spaces with lovely landscape design near the station and Maison des Arts. All public squares are well treated and shaded with various trees.



Legend

- Residential
- Educational
- Cultural
- Sportive
- Retail
- Metro and bus terminal station
- Services

Figure 3-28: Land uses within Montmorency TOD area
Source: Google Maps, 2017, edited and analyzed by the author

BUILDING	YEAR
Centre Laval	1968
Les Galeries Laval	1974
College Montmorency	1976
3 Residential buildings (1380, 1390, 1400 Boulevard De La Concorde)	1978
Maison des Arts de Laval	1986
College Letendre	2000
Home Depot	2000
Service (Essance+)	2000
Residential (1600 Boulevard Du Souvenir)	2002
Urbania 1 (1465 Boulevard Le Corbusier)	2004
Retail Center(1100 Boulevard De L'Avenir)	2005
Urbania 1 (1445 Boulevard Le Corbusier)	2005
Urbania 1 (1425 Boulevard Le Corbusier)	2007
Bus terminal	2007
Les Résidences Soleil Manoir Laval	2008
Retail center (600-1350 Boulevard Le Corbusier)	2008
Urbania 1 (1920 Boulevard Du Souvenir)	2009
Urbania 1 (1925 Rue Emile-Martineau)	2009
Urbania 1 (1420 Rue Lucien-Paiement)	2010
Campus UQAM	2011
Urbania 1 (1440 Rue Lucien-Paiement)	2012
Urbania 1 (1900 Boulevard Du Souvenir)	2013
Place Bell	2017

Figure 3-29: A chronological order of construction of the buildings appeared around the Montmorency TOD area
Source: the table is done by the author

Terminus Montmorency

Terminus Montmorency is a bus terminal with ten platforms. The station counts for 1342 parking spots, where 644 are free outdoor park-and-ride spaces and 698 paying spaces (54 outdoor, 644 indoor). There are 300 bicycle racks.

Developments with institutional function

College Montmorency

College Montmorency is the only institution offering pre-university and technical education in Laval. Due to limited space, the institution is forced to refuse many students' applications. Currently, its capacity is of 5800 students. The college was opened in 1976.

College Letendre

College Letendre is a private secondary school. It was constructed in 2009 and has four stories.

University of Montreal (UdeM)

In 2011 UdeM opened his campus at Montmorency station. It offers various full-time programs: six undergraduate and six graduate in different domains.

Developments with residential function

Residential density near the Metro Montmorency varies from 5 to 16- houses per hectare.

Housing option in the area around the metro station varies from detached houses to multi-story apartment blocks. Not far from the station (slightly more than 600mm), there is a residence for retired people named "*Les Résidences Soleil Manoir Laval*."

Urbania 1

Urbania 1 is residential complex designed by Giasson Farregut Architectes. It consists of eight blocks. The blocks vary from 5 to 16 stories, totaling 750 units (lapresse.ca). The complex has a three-story parking in its central area. The entire courtyard area in this project is occupied by parking. Moreover, its top floor is also sacrificed to parking, what does not

make any sense regarding philosophy of transit-oriented development and residential construction, where courtyard area are normally dedicated to commune use.

Developments with Commercial function

At Montmorency metro station, there are three major retail areas: Centre Laval, Les Galeries Laval, and the area adjacent to Autoroute 15. Despite the fact the Centre Laval and Les Galeries Laval are located slightly outside of the TOD radius, they are still in walking radius from the metro station.

Centre Laval

Centre Laval was constructed and opened in 1968. Since that time the building changed its owners and names several times. The retail center had two expansions and reached its current size in 1988. The building was expanded in 1988. It offers 6474 sq.m of retail spaces, with more than 130 stores (Wikipedia, 2017).

Les Galeries Laval

Les Galerie Laval is a two-story retail center. It was originally constructed in 1974. As we see from the map dated 1978 and 1988 since then it has expanded significantly.

Retail area adjacent to Autoroute 15

The area is a mixed use with various retail stores, banks, cafes, yoga center, etc. The area has a large parking with trees and street furniture. Café's terraces and plants of the parking make the area pleasurable.

3.2.6 Future Development Plan

Metro Montmorency already has a strong institutional, cultural, and sportive pole. The city of Laval tries to achieve the goal to make the metro station a good TOD by making the area dense and diverse. According to PMAD (seuils minimaux de densité résidentielle), the residential density around Metro Montmorency is fixed to 80 dwellings/ha. According to *"Schéma d'aménagement et de développement revise de la ville de Laval"* the city of Laval has a requirement for all buildings in it to have minimum 25 floors near the area of Montmorency station. The city is already working on changing the requirements to heights and land uses for the area. The city aims to densify the central area and currently does not have strict rules on the highs of the buildings. According to Councillor Paolo Galati, who represents the eastern Laval district of St-Vincent-de-Paul: "We're finally going to be dealing with heights…Right now there's no regulation as to how high you can go. But soon each territory will have a limit. And the only place that won't have a limit is the downtown area which is very particular. We're really focusing on rebuilding the city and giving it a distinct image and a new vision for the next 15 to 25 years" (lavalnews.ca).

According to JLL report *"...Land in the Downtown Zone benefits from high-density zoning designated as CV… In the CV zones, the City of Laval does not provide a maximum height restriction nor does it provide site coverage or floor to area ratios. Instead, the site's development potential is governed by the Land Use Intensity System or L.U.I. The L.U.I. for the site is between 6.1 and 6.5 which takes into account specifications for a floor to land ratio, and open space ratio and a recreational space ratio. The city has also designated a minimum height of three stories for a commercial project and five stories for a residential/mixed-use project. Furthermore, the residential component of any development must allow the construction of minimum of 308 residential units and all projects are subject*

to the city's approval of a Site Development and Architectural Integration Plan. Depending on criteria used for construction, a commercial project on the site can attain 535,000 square feet (49703 sq.m) of buildable area or 845,000 square feet (78503 sq.m) of buildable area for a mixed-use project" (jll.ca).

As for new developments, two complexes, Urbania 2 and Espace Montmorency, will appear in the nearest future on vacant territories near the metro station.

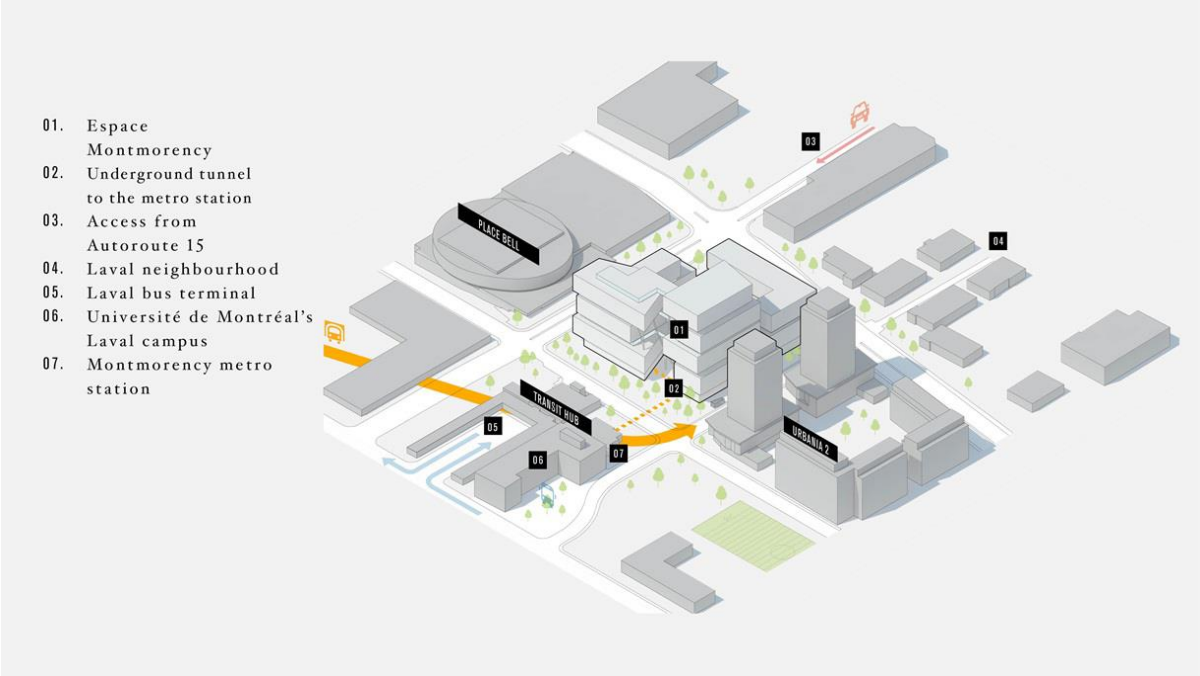


Figure 3-30: New developments: Place Bell, Urbania 2 and Espace Montmorency
Source: sidleearchitecture.com

Espace Montmorency

Espace Montmorency is an ambitious project which will be realized in the nearest future in front of the metro station. Espace Montmorency is a 20-stories mixed-use center which will include hotel, offices, public areas and terraces (Lapress, 2015). The project, designed by SID Lee Architects, was started at the end of 2016 year and is supposed to be finished within five years. The project will also have residential units for seniors. There will be 92903 sq.m of leasable area and 32516 sq.m of public gathering spaces. "The project will deliver a mix of buildings that ultimately will create a new city within the city" (Newswire, 2015).

According to Jean Pelland, senior partner of SID Lee architecture; "*Typically, high-density sites are developed around a series of towers built on a podium. Here, we're looking for something a bit different. In this hybrid project, we will have more public areas spread over several floors. Espace Montmorency will be developed according to a horizontal and vertical phasing principle based on standard 100,000-square-foot (9290 sq.m) blocks. Each phase can be as much as five stories high and to which private gardens will be added. The green spaces will attract different types of users on a daily basis and create a welcoming, bustling area with a diverse offering. The project will also be green in every sense of the word"* (Newswire, 2015).

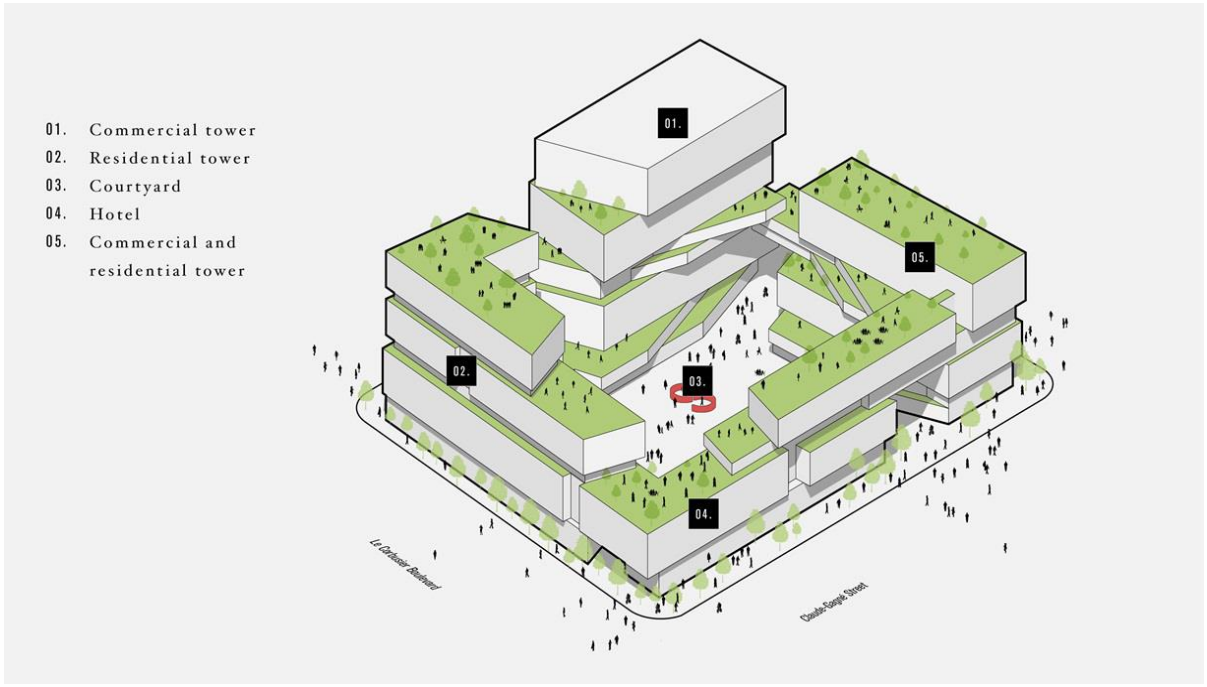


Figure 3-31: Espace Montmorency
Source: sidleearchitecture.com

Urbania 2

Urbania 2 is the second phase of the Urbania complex. The project for phase two was announced in 2014 by *Société de développement Urbania* and the *Fonds immobilier de solidarité* (FTQ). The lot size is 6410 sq.m. The first tower will accommodate 212 condos on 16 floors and 222 parking spaces. Overall, six buildings are planned to be constructed with 1150 condos of different sizes. According to Sébastien Lessard, the president and chief executive officer of the *Fonds immobilier de solidarité* FTQ: "*The units have been designed to meet the needs of different clienteles, from young families to single retirees. We will therefore be offering one to three bedroom condos, two storey maisonettes, and penthouses. We are aiming for a high quality green project that meets the latest environmental standards. For example, electric car owners will have access to charging stations, the building will have a green roof, the plumbing fixtures will be water efficient and a waste sorting system will be available*" (Fondsftq, n.d). Two most high towers will have on their first level mixed-use commercial activities.

Unlike the first phase of Urbania complex, the second phase will have public space with playgrounds and gardens in its courtyard. It will also accommodate the commercial function, which is absolutely excluded from Urbania 1. Overall, it not only looks more friendly for residents with common areas, but also provides pedestrians with commercial activity on the ground floor, what hopefully could make the streets around the complex more livable and active. The construction started in 2016 and will end in six years.

Figure 3-32: Urbania 2
Source: condourbania.com

3.2.7 Field observation of Montmorency TOD

Well defined public spaces

Montmorency has several well defined public areas near educational and cultural institutions. Each area has good landscape design. Nevertheless, the public areas are not interconnected, which makes movement from one area to another inconvenient.

Figure 3-33: Public spaces

Mixes of uses

Montmorency is a mixed area with various functions: institutional, cultural, retail, residential, sportive (Place Bell will be open in the 2017 year). The functions are mixed horizontally. New developments, Urbania 2 and Espace Montmorency, which are currently under construction, will accommodate office spaces.

Quality pedestrian experience

Montmorency has interesting pavement and lovely landscape design. In many places inside TOD area pedestrians may see various plants and trees. Street furniture is done in different designs and materials. Pavement differs from area to area, and it defines on the sidewalk the areas of the usage.

Figure 3-34: Landscaping and pedestrian experience

Human scale architecture

The area of Montmorency metro station has human-scale architecture. The architecture is not repetitive. All facades are different and covered with attractive materials. Despite a big size of the retail boxes, they are, however, designed in a way to correspond to human scale. The

facades of shopping centers are covered with quality materials, and have windows and design elements on the ground floor.

Figure 3-35: Human scale architecture

Active ground-floor retail

Overall, the TOD area lacks active ground floor retail that is concentrated only near metro station and in a huge shopping area adjusted to Autoroute 15. Terraces of shopping malls make the area more vibrant.

Tree-lined streets

There are variety of plants, flowers, and trees on the streets. The streets are not everywhere tree-lined, nevertheless, pedestrians can have pleasure while walking, as many different plans are planned everywhere. Trees are also grouped around the small plazas creating cozy shaded spaces.

Figure 3-36: Landscaping and tree-lined streets

Easy access by bicycle

Around the metro, there are many biking racks. Most of the side-walks and some roads have well-defined bike paths.

Figure 3-37: Bike stations and bike paths

Reduced and hidden parking

Retail centers have huge parking areas, nevertheless, their parking is treated properly with planted trees and several outdoor cafes' terraces.

Residential complex Urbania1 has a three-story parking in the middle of its courtyard. The parking is covered with trees which make the area more alive. On the other hand the top floor of this parking is also occupied by cars. It might be better if this top floor would have a green area to make the area look more pleasurable, especially for those residents who have a view from a window to the courtyard.

Ground floors of some other parking areas are also hidden from pedestrians' eyes. Overall, the area is still car-oriented and parking occupies lots of vacant areas.

Figure 3-38: Parking of Urbania1 complex (upper pictures); hidden parking (bottom left picture) and ground floor parking of retail complex (bottom right picture)

Affordability

The Montmorency TOD area has diverse stores (including food stores) and housing options for people with different income.

Expandability

Catalytic effect of the metro station is already observed. New developments appear within the TOD area. The area has a potential for expansion as there are vacant areas outside of the TOD radius. Moreover, each of the Laval TOD has a potential to work as a transit corridor with one dominant function per station.

Station's access points

The vestibule of the station has several entries with close location to each other. The accesses to the station are well defined, and the square near the station has a lovely landscape design. The pavilion of the metro and the metro signage are easily recognizable and visible from distance which makes navigation simple.

Figure 3-39: Station access points, pedestrian accessibility, and landscaping design at Montmorency metro station

Density

The area within radius 600m does not seem to be dense as there are no high-rise buildings and many areas are still vacant. Nevertheless, at the moment, the area is being actively densified by construction of new condos and mixed-use commercial areas.

Figure 3-40: New constructions. Urbania 2 (left photo), Place Bell (middle photo), and future Espace Montmorency mixed-use complex (right photo)

Sustainable development

No energy saving equipment or any other evidence of sustainable development were observed on the site. However, future buildings are designed with respect to LEED requirements.

3.2.8 Summary

Montmorency station was opened in 2007. Before its opening, the area around the station already had cultural, educational, commercial, and residential functions. However, the land adjacent to the current station was vacant for many years. These unused lands, however, became an interest for developers after the opening of the station, and there are projects under construction now. The land use after the opening of the station started to change as well. New functions were introduced and previous functions were further developed. After

the opening of the station, Campus of the University of Montreal was opened in Laval, strengthening Montmorency's educational pole. An office function, new for the area, is currently developing and will be represented partly in Urbania2 and Espace Montmorency projects. Sport-complex Place Bell is almost finished which also introduces a new function for this area.

It was a comprehensive decision to prolong the station to the area, which was dense enough, but still had a room for new investments. The area of Montmorency TOD has a big potential. Not many stations have such a mix of uses at one place like this one. It offers its users and residents a variety of functions, lovely landscape design, open urban areas. Finally, this station has a strong intention to become pedestrian-oriented, despite a car-oriented background of the area.

However, Montmorency case shows that in order to create successful TOD it is needed more than the mixture of functions. What is happening currently In Montmorency TOD area, is that new developments arrive and occupy totally their land plots. These big boxes/block developments do not ensure good street connectivity. As a consequence, the area becomes mixed, but people are still forced to walk along massive building blocks. In this regard, comprehensive design of the complete streets and public areas are crucial to create proper public realm. It often happens that new constructions are intended to attract people inside, rather than ensure good vibrant atmosphere around their developments. Hopefully, future developments, Urbania 2 and Espace Montmorency, will pay more attention to design proper active ground floor and ensure human scale design, so that streets could be safe and interesting to walk along. Another big shortcoming of the area is a lack of public spaces. The lovely open space at Maison des Arts and nice landscaping around the station are the only open public areas.

Chapter 4 CONCLUSIONS AND LESSONS LEARNED

This chapter concludes the report by providing a summary of lessons learned from the examination of the case studies: Longueuil-Université-de-Sherbrooke and Montmorency metro stations. These lessons are grouped into several categories: timing, availability of land and demand for new functions, land use shifts, density, diversity, direction to make the area more pedestrian friendly, and attitude toward urban design.

Conclusions and lessons learned

According to Knight and Trygg (1977) in cities such as Toronto, Montreal, and San Francisco transit improvements were the forces that pushed development of high-rise commercial development in the CBD. The scholars also argued that in order to ensure the success of these kinds of metropolitan areas, factors such as demand for new office and retail space, good timing, availability of land, placement of the stations, public investments, and formal urban renewal have to be considered. In the cases of Longueuil-Université-de-Sherbrooke and Montmorency stations, all these factors contributed to their success.

The cases studies of Longueuil-Université-de-Sherbrooke and Montmorency metro stations show how initial situations can be entirely different when the Metro "decides" to come to the area, and what effect then the presence of the metro station can have. Two case studies show that there is no direct interdependence between the opening of the station and immediate appearing of new developments around it. There is also no direct answer to what comes first - the metro to the developed area or developments appearing after the opening of the metro. However, it is obvious that public investment in mass transit can direct urban

development. Meanwhile, the opening of Metro stations affected and continues to influence the appearance of developments around it. This effect, however, may vary from one situation to another. The difference can be, for instance, in initial availability of lands, land use shifts, density, etc. Local authorities could take a more constructive and proactive role in shaping this process.

4.1 Good Timing

The right timing is an important factor of ensuring a success of development of the area that the Metro is planned to reach. Despite the difference in 40 years between the openings of two stations and different local situations, those stations, however, were opened at the right moments which coincided either with current economic and historical situation of the region where the metro came or with enough density and existing infrastructure required for prolongation of the metro further.

4.2 Availability of land, placement of the station, and demand for new office and retail space

Longueuil-Université-de-Sherbrooke and Montmorency stations were placed in the areas which had vacant lands for development. Both areas lacked office developments as well. In the case of Montmorency, the metro came in the area that was to a greater or lesser extent developed by that moment. It had two colleges, a cultural center, and several retail centers. After the opening of the station, however, massive investment projects such as Place Bell, the University of Montreal, and Escape Montmorency started to come to vacant areas. In contrast, Longueuil-Université-de-Sherbrooke station shows what a significant effect the

opening of the metro can have from the very beginning as the area within the 600-meter radius was undeveloped and occupied almost only by parking. The opening of the station was like a seed, which was thrown into fertile soil at the right moment.

4.3 Land use shifts

The opening of metro stations has a significant role in changing the land uses of the area around it. As it is a strong catalyst for development, new functions often emerge after a station appears in the area.

Longueuil-Université-de-Sherbrooke and Montmorency stations are terminals. Despite having different shape and development history, they, however, share several common features. For instance, both of them have bus terminals, university campuses, significant parking areas, detached retail centers and housing as part of their suburban history.

During almost 50 years of its history, Longueuil-Université-de-Sherbrooke land use was constantly changing, aiming to balance it, as well as to respect people's and market needs. Montmorency also experienced land use changes. For instance, more residential (apartment) blocks and offices started to appear after the opening of the station. Unlike Longueuil-Université-de-Sherbrooke, Montmorency had education as the main function when the metro appeared in the area. Moreover, this function was the key to extending the metro to this area. Despite having different initial situations regarding land use, both stations are now focused on establishing cultural and educational functions as the dominant ones around the stations.

The metro has powerful effect on the development of the surrounding area. Development of an area takes a long time, and there are land use shifts during that period. An opening of any new institution may significantly affect further development of an area and act as an

accelerator for it. Developments themselves together with the metro have a catalytic effect on further development of an area.

4.4 Density and how both cases dealt with it

Density is required to support ridership, to make it affordable, and to ensure development of the area around the stations. High-density cities are more transit-oriented than low-density ones.

To ensure sufficient density, Longueuil-Université-de-Sherbrooke and Montmorency opt for higher building construction. In the case of Longueuil-Université-de-Sherbrooke high-rise buildings started to appear immediately after the opening of the station. The plans for the vacant area around Montmorency station include construction which is higher than the average surrounding buildings. The value of the land and property goes up after the opening of the stations and also pushes development of high-rise construction.

The amount of parking areas diminishes during the development of Longueuil-Université-de-Sherbrooke and Montmorency. With new construction, parking goes underground, and this helps to make the areas more livable. In both cases, the metro was a catalyst for making the areas denser. New developments in the TOD area of the metro stations established these areas as new city centers. In case of Longueuil, the area around the station is becoming a new downtown.

4.5 Social mixture

With diverse functions - cultural, educational, commercial, offices, and residential - an area begins to attract various people – students, office workers, residents, visitors. New institutions also give new employment opportunities, making the area even more socially mixed. Longueuil-Université-de-Sherbrooke and Montmorency cases also support social mixture by offering different housing options: single-family houses, townhouses, duplexes, apartments, condominiums, and so on. Residential buildings in the TOD areas of both case studies offer apartments with different sizes, options of renting, and buying. Various housing options accommodate diverse social and age groups: singles, young families, the elderly. The proximity of retirement houses to the metro stations gives seniors mobility. Diverse retail activity and convenient stores attract various people with different income. In contrast to Montmorency, the social mixture at Longueuil-Université-de-Sherbrooke's TOD area exist even within buildings, as each building offers two or more functions. This combination of vertically and horizontally mixed uses thus helps to reinforce social mixture.

Social mixture is also supported by giving people different transportation mode choices. In both case, in the past, there was a strong influence of cars in urban planning of territories. However, with continued improvement of public transit and bike paths, the areas become affordable for people with different income.

4.6 Car-oriented past and direction towards pedestrian-oriented

Urban transformation from being car-oriented into pedestrian and transit-oriented is a long process. The existence of large parking lots and highways makes an area less pedestrian-friendly and discourages people from walking.

Longueuil-Université-de-Sherbrooke's case is a unique and complicated situation for any urban designer to solve – a traffic island that is hard to enter for pedestrians. From the beginning, Longueuil-Université-de-Sherbrooke opted for the construction of pedestrian bridges in order to separate pedestrian and traffic flows. Moreover, due to high-rise buildings, the Longueuil-Université-de-Sherbrooke area has many green open spaces which are well connected. This all helps to make the area more pedestrian-oriented rather than car-oriented.

At this moment, the policies of the cities of Longueuil and Laval encourage densification and diversification of the areas around the stations. The cities also improve accessibility to the metro stations by bikes. Both cases have a transfer with bus terminals, which also encourages people to use more public transit rather than cars. The introduction of pedestrian and complete streets, as well as partial separation of pedestrians from traffic, might significantly improve the situation. Moreover, the stations have the potential to serve as nodes of the transit corridor which were discussed by Dunphy (2003), where in one TOD people work, in the second they live, while in the third they shop.

4.7 An attitude to urban design

Both cases have a car-oriented past, and hence they faced the same problems of separation of pedestrian and traffic flows, crossing of roads, parking spaces, and dealing with open urban spaces. However, they solved them in completely different ways.

Longueuil-Université-de-Sherbrooke metro station appeared in the middle of the "traffic island", which also is hard to enter for pedestrians. This urban situation is extremely challenging for any designer to solve. From the beginning, Longueuil-Université-de-

Sherbrooke has been constructing pedestrian bridges which connect the buildings around the station. This solution recalls the modernist idea of separation of flows by creating different levels for each flow. Some people may take issue with this solution (the construction of pedestrian bridges); it is, however, hard to question its originality and its modern actuality. These bridges gave people a good alternative for crossing roads, allowed them direct access to the transit station, and, finally, benefit them during cold winters. Moreover, the high-rise buildings of the Longueuil-Université-de-Sherbrooke area resemble the idea of Le Corbusier - "towers in a park." Indeed, Longueuil-Université-de-Sherbrooke has a lot of green open spaces between buildings. The parking areas are pushed from the station, which gives more space for pedestrians.

In contrast to Longueuil-Université-de-Sherbrooke, Montmorency does not have such a complicated urban situation. Nevertheless, this did not help Montmorency to create a good urban design. The area does not provide residents with a proper pedestrian network, nor has it any interconnected open spaces. Moreover, in the recent residential construction Montmorency station - Urbania 1- explicitly shows how design, which has to encourage the use of public transit, conversely discourages it by leading to the extension of parking spaces. Moreover, this design distributes all open area for the parking rather than for community use and playgrounds.

Furthermore, despite having the freedom to design and create a plan, which would be coherent and convenient for pedestrians, Montmorency opted for the construction of massive block developments which occupy land plots entirely and, thus, do not ensure good street connectivity. Developments like Espace Montmorency try to improve street connectivity by designing passage through the complex to shorten the building block. This solution, however, may have an adverse effect on the livability of the streets around the complex, as

this passage might become a catchment area for pedestrians - leaving the streets less populated. To avoid this, it is important to ensure ground floor retail activity on the streets in such constructions as Espace Montmorency.

Nevertheless, both Longueuil-Université-de-Sherbrooke and Montmorency show the positive direction towards pedestrian friendliness by designing good landscaping, lighting, pavement, and street furniture. Improvement in urban and landscape design could encourage people to walk larger distances. To do so it is important to design livable streets. The life in any city happens in its streets. A street is a place where one can experience the pleasure of social engagement. Coherent urban design with appropriate design of each building should ensure the safety and livability of the streets. Architects and urban designers have to avoid creating any long and blank facades. Streets have to be complete; some plazas have to be included into the overall street network. It is also crucial to design open spaces which are connected with each other so that a pedestrian network can be created.

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