Green Networks in Carless Cities: Reusing Infrastructure as Public Open Space in Sustainable Urban Systems

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***In the entire report photos not sourced were taken by the author**

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This report is the summary of my post-professional studies at McGill, which have provided a break from my ten-year career as an architect and studio instructor in Technion, Israel. The idea to reuse inner-city transportation infrastructures occurred on a *Yom Kippur* day, which is a special day in Israel. On this day, no vehicular circulation is allowed and the streets turn into pedestrian playground.

As for the case study, I was introduced to the area of Bellechasse during the first week of my first semester, as it was the designated area for an urban design studio course. Since then, I have been involved in different projects in the area, including a research position with the *Imaginons Bellechasse* project, which concerned public participation processes in the neighborhood. In getting to know the area, and participating in public procedures and activities I decided to move to the neighborhood and pursue a case study of the Van Horne-Rosemont viaduct a for my report .

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Abstract

As global urbanization increases, cities face the challenge of becoming sustainable. To reduce emissions and traffic congestion, cities must rethink their circulation systems and rely less on private cars. This change would improve one of the urban quality of life aspects by upgrading public spaces, more specifically urban green spaces, by linking them to an urban green network. As the space for private cars will gradually decrease, the existing vehicular system can be reused for pedestrian purposes.

This paper addresses the transformation of existing road networks into a system of public green spaces, one that will connect the urban local parks to the green lungs of the city. Through a theoretical framework and several examples, the report examines four key aspects for completing this transformation: urban sustainability, open space as network, transportation and circulation, and reusing infrastructure. Two Montreal projects, used as case studies, illuminate ways of reusing existing infrastructure. Last, based on the theoretical framework and the case studies, recommendations for further development and implications are suggested.

This report draws from urban design theories that changed cities through counter process design, in order to learn from those experiences and introduce a new contour of sustainability. The paper suggests another layer in the attempt to address the challenges to develop sustainable cities without compromising the ability of future generations to meet their own needs.

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Résumé

Au fur et à mesure que l'urbanisation mondiale augmente, les villes sont confrontées au défi de devenir durable. Afin de réduire les émissions de CO^2 et la congestion du trafic, les villes doivent repenser leurs systèmes de circulation et moins compter sur les voitures individuelles. Ces changements permettraient d'améliorer l'un des aspects de la qualité de vie en milieu urbain par la transformation des espaces publics, et plus particulièrement des espaces verts urbains, en les reliant au sein d'un réseau vert urbain. Comme l'espace pour les voitures diminuera, les voies véhiculaires existantes pourront être réutilisées pour les piétons.

Ce rapport traite de la transformation des réseaux routiers existants en un système d'espaces verts publics, qui reliera les parcs urbains locaux aux poumons verts de la ville. Par le biais d'un cadre théoriques et de plusieurs exemples, le rapport examine quatre aspects essentiels pour remplir cette transformation: la durabilité urbaine, les réseaux d'espaces publics, le transport et la circulation, et la réutilisation des infrastructures. Deux projets à Montréal, utilisés comme études de cas, éclairent les façons de réutiliser l'infrastructure existante. Enfin, sur la base du cadre théorique et des études de cas, des impacts sont discutés et des recommandations pour la poursuite du développement sont proposées.

Ce rapport se fonde sur des théories de conception sociale qui sont nées en réaction au processus urbains existants. Il apprend de ces expériences pour présenter aspect supplémentaire de la durabilité urbaine. Le document suggère une nouvelle couche dans la tentative de relever les défis de développement des villes durables sans compromettre la capacité des générations futures à satisfaire leurs propres besoins.

CHAPTER 1 – INTRODUCTION

1.1 Study Rationale

A recent United Nations' Department of Economics and Social Affairs report states that though urbanization has stabilized in Oceania, and that Africa and Asia are slightly behind in the percentage of their population living in urban settlements, the overall global population is becoming increasingly urban (Figure 1.1). In fact, by 2050 almost 89 percent of North America will be urban.[1] As cities will dominate the landscape, their nature will have to change and planners will have to adapt designs for new needs of dwellers. Leading this process is public interest and need, which should be addressed immediately, since the shape of our cities will have economic repercussions, which might be overtaken by private influences.

This report suggests one aspect that can lead to better cities, in light of rapid urban growth and sustainability challenges is a series of public green spaces connected as an urban system and available to all. Piet Eckert,[2] an architect teaching at ETH, Zurich, argues that European cities are not adapted to meet future needs, and it is unlikely that the old structures of those cities can change to become truly sustainable. Since it is impossible to abandon the settlements and restart, cities will have to change radically. Similarly, Peter Drodge,[3] a professor at the Institute for Architecture and Planning at the

[1] "World Urbanization Prospects. United Nations, Department of Economics and Social Affairs." United Nations, 2011. Last accessed.11 Nov. 2013. http://esa.un.org/unup/Analytical-Figures/Fig_1.htm.

[2] Piet Eckert, "And next to it, at an appropriate distance, go build the city of our time". *In Urban Futures 2030: Urban Development and Urban Lifestyles of the Future.* volume 5, 39-41. Henrich Boll Stiftung- publication series on ecology. 2010.

[3] Peter Droege, "The Sustainable City: the Energy Revolution as a Key Urban Development Paradigm."*In Urban Futures 2030: Urban Development and Urban Lifestyles of the Future*. volume 5, 16-20. Henrich Boll Stiftung- publication series on ecology. 2010.

Hochschule,Liechtenstein, points out that geopolitical factors concerning the production of energy will result not only in a shift in the technology of producing energy, but also in a different manner of distributing it, and cities will have to rely on "smart grids." Many scholars and architects agree that density will play a significant role in that change. Designing a dense city that will still enable a superior quality of life is a crucial future challenge.

Historically, urbanization processes had a large influence on the lives of city inhabitants and led to serious social problems. The introduction of urban green spaces was considered one way to solve those problems. Frederick Law Olmsted in North America,[4] Ebenezer Howard in England,[5] and James Oglethorpe in Savannah,[6] formulated urban design methods in reaction to problems of density, poverty, and especially separation from nature (Figure 1.2). They believed that nature was close to a remedy. Recently, planners such as Peter Calthorpe,[7] have argued for the advantages of introducing accessible open spaces in cities. Learning from past experiences is an important factor. These design methods coped with the integration of green spaces and circulation systems, which were crucial challenges in the past and will be crucial for future cities as well.

[4] Olmsted and America's urban parks. Rebecca Messner, George DeGolian, Michael White, Kerry Washington, Kevin Kline, Emma Joan Morris, Joel Goodman. DVD. 2012. Speedwell Foundation; PBS Distribution.

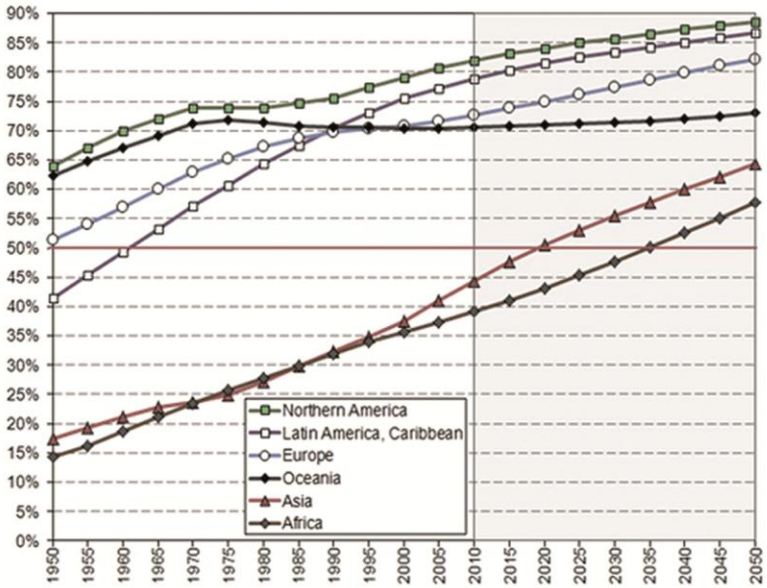
[5] Spiro Kostof, *The City shaped. Urban Patterns and Meanings Through History*. Boston : Little, Brown,1991.

[6] Mark Reinberger. *"Oglethorpe's Plan of Savannah: Urban Design, Speculative Freemasonry, and Enlightenment Charity".* The Georgia Historical Quarterly, Vol. 81, No. 4 Winter (1997): 839-862

[7] Peter Calthorpe. The *Next American Metropolis, Ecology, Community, and the American Dream*. New York: Princeton Architectural Press, 1993.

Percentage of the population living in urban settings

	1950	2010	2050
North America	64	82	89
Latin America	41	79	87
Europe	51	73	82
Asia	17	44	64
Oceania	62	70	73
Africa	14	39	58



Urban by major geographical area (in percent of total population)

Figure 1-1: **The United Nations' Department of Economics and Social Affairs states that the overall global population is becoming more and more urban.** (Source: The United Nations' Department of Economics and Social Affairs).

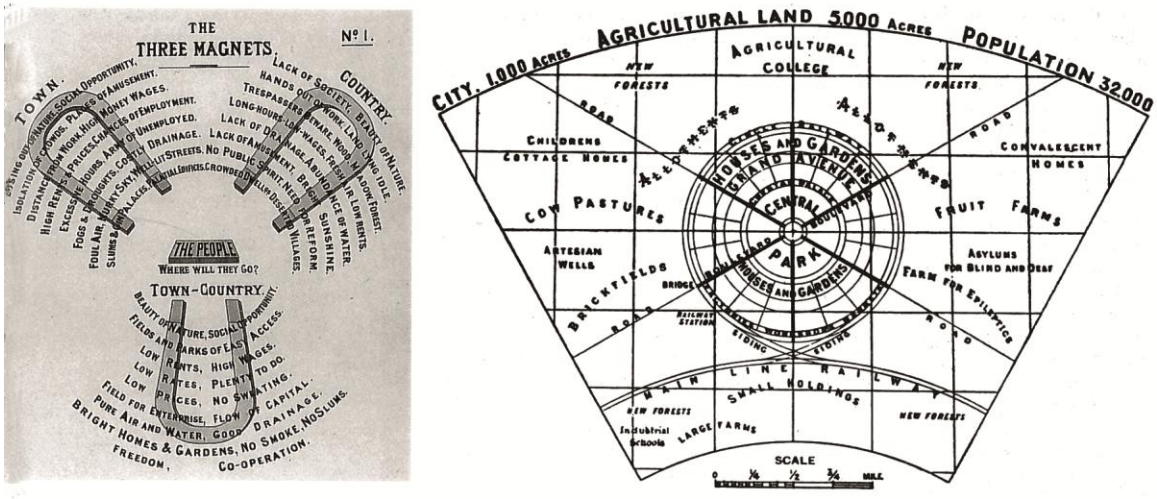


Figure 1-2: **Ebenezer Howard's diagrams of the three magnets (left), the principles that led to the design diagram of the Garden City (right).** (Source Spiro Kostof, *The City shaped. Urban Patterns and Meanings Through History.* Boston : Little, Brown,1991).

Since green spaces have a complicated significance for human nature, as will be demonstrated in the next chapter, there is a need for a variety of green spaces for different activities. Large open spaces, such as parks, remain an important factor in the green urban backbone (Figure 1.3 and 1.4). The need for a diversity of green spaces and specifically for parks is demonstrated in the case study of a neighborhood in Tel Aviv, Israel. The municipality of Tel Aviv developed a principle of emphasizing "depth" rather than quantity. This initiative is likely the result of a lack of public space in central Tel Aviv. Since free public land that can be used for public green space is scarce, the planners utilize busy boulevards as parks, but can those green boulevards present an effective alternative to an urban park? In the last few years, the habitants of the Lev Hair neighborhood have led a fierce struggle to use a future vacant lot on the neighborhood's edge as a local park rather than a parking lot. The municipality recently agreed to dedicate the lot for a park. The future park is no more than 200 meters from one of Tel Aviv's best known boulevards (Figure 1.5 and 1.6) and demonstrates the need for diverse green space in the city, as well as the importance of neighborhood parks (Figure 1.7).

The importance of open spaces as a circulation system is demonstrated in recent discussions of health and daily habits. Many scholars argue that cities should introduce a better environment to encourage people to exercise outside as obesity is becoming a growing problem. Douglas Farr argues that the American lifestyle is on the wrong course, and there is evidence to support these theories: 30% of adults in America are obese. If

Figure 1-3: **The need for a variety of green spaces for different activities can be seen in Tel Aviv's Boulevard. The boulevards are not only a urban green recreation space but also an accessible civic space. The photos were taken in the 2011 civil demonstrations in Tel Aviv. Architect Dani Raz, former head of the dministration of Planning in the Israeli Interior Ministry, introducing planning dilemmas on the Rothschild boulevard, Tel Aviv.**

Figure 1-4: **Park La Fontaine Montreal, in a typical summer day. The popularity of the park within the Montréalais demonstrates its importance in the urban fabric.** (Source: Dean Bere, Wikimedia).

unaddressed, the ailment can lead to a four- year reduction in life average.[8] City planners can cope with this problem by making large green spaces accessible to all.

However, finding large spaces for parks in existing cities is almost an impossible task. Thus, a design approach that makes existing parks, the green lungs of the metropolis, accessible must be considered. Consecutive green systems, like the ones proposed by Olmsted, Howard, and Oglethorpe, offer accessible park spaces to the general public More recent studies demonstrates new advantages of consecutive green networks such as urban life aspects, social bonding or even for botanical corridors. For instance, Jan Gehl's *Cities for People*,[9] considers the introduction of the "human scale" a crucial aspect of urban spaces. Gehl transformed parts of urban spaces, such as Copenhagen, Denmark and Times Square, New York, into public pedestrian- oriented spaces (Figure 1.8). In another book,[10] Gehl suggests methods for enabling and reviving social, street life by differentiating between three categories of outdoor activities— necessary activities, optional activities, and social activities. High quality outdoor areas are needed to initiate these types of activities. Is this only a trend or a beginning of a global process? It seems that a process of reorganizing specific parts of the city (such as historical areas) based on pedestrian circulation has already started, but another step should be made, one that will enable people to circulate in the city without cars.Connecting existing green spaces into one consecutive system is not an easy task. Starting with an empty piece of land, like followers of Ebenezer Howard, is a privilege that is scarcely available now, and using

[8] Douglas Farr. *Sustainable Urbanism Urban Design With Nature. Hoboken, N.J : Wiley, 2008.*

[9] Jan Ghel. *Cities for People. Washington, DC : Island Press, 2010.*

[10] Jan Ghel . *Life Between Buildings: Using Public Space. New York : Van Nostrand Reinhold, (1987).*

Figure 1.5: **Lev Hair neighborhood and adjacent boulevard and the new park.** (Source of map: Googlemap).

Figure 1.6: **Tel Aviv's boulevards, a principle of emphasizing "depth" rather than quantity as a substitute for green space** (Source: Haaretz.co.il).

Figure 1.7: **Gan Kiryat Sefer- 13 years of struggle, when neighborhoods activists are arguing that the re are not enough green spaces for the city.** (Source: http://diklonet.blogspot.ca).

extreme application methods, like the Baron Georges-Eugène Haussmann, is likely impossible today. It seems that current green spaces are not part of the preliminary master plan, rather planners use vacant spaces to introduce neighborhood green areas. How can we introduce a new system today in a dense urban fabric, which will connect all the existing "islands" of public spaces? Does it require a drastic revolution, or can we find a more balanced means of learning from past precedents? The solution could be reusing an existing well-planned circulation system that would become redundant in the future.

As circulation systems in the city are already controversial, we must rethink the use of the existing ones. They should change to be more land-use efficient, and so we must reuse these older system to form a consecutive network of open spaces that will link to metropolitan parks. The reuse of highways as pedestrian circulation systems has proven remarkably successful through projects like the Pompidou highway and the Promenade Plantée, both in Paris, and the High Line project in New York. Similarly, inter-city highways, such as the Big Dig in Boston, the Embarcadero in San Francisco (Figure 1.9), and the Parc-Pins interchange in Montreal are of controversial and city planners are considering altering the spaces to accommodate changing circulation patterns. In many of today's cities, we find remains of the design approach that allow efficient circulation of private cars; vast interchanges and highways can be found even in city-centers. The Van Horne-Rosemont Viaduct, which serves as a case study in this report is one example. Highways that maintain the circulation to and from the city are not within the scope of this study. In this report, the emphasis is on the private car-oriented highways that emerge in the city and can be replaced.

Figure 1.8: **Jan Gehl's intervention in Time Square New York.**
(Source: The Full Piece, Percolated Musings. http://noodlesricedumpling.wordpress.com/tag/new-york/).

Figure 1.9: **The Embarcadero, San Francisco.The transportation infrastructure did not solve the traffic congestion.** (Source (right): Wernher Krutein, http://photovalet.com. (left): Ben Caldwell, http://sf.streetsblog.org).

Lewis Mumford[11] refers to the future effects of private cars in the city: "This is pyramid building with a vengeance: a tomb of concrete roads and ramps covering the dead corpse of a city." As a hypothesis, I argue that in the future there will be fewer private cars in the city. This process will have several stages until our cities are entirely free of cars. The assumption of this report that will be demonstrated in the second chapter is that in the future, even if cars are here to stay for a longer period, as a first stage, they will need less space in the city, and this space could be used for other purposes.

Today, urban highways are barriers in the middle of the city. However, they can be transformed to connect parts of the city. Since this process creates large changes and will significantly influence lives, it should be approached carefully. In Copenhagen for example, in order to diminish the number of cars in the city 5% of the parking lots are removed each year. This slight change allows people to adjust to the radical idea while pushing towards its main target and letting the planners make adjustments.

1.2 Theoretical Framework

This report argues that the future city will have to change in order to meet its sustainable needs. Therefore, the wider frame of this work involves sustainable urbanism, specifically its definition and how its effect on our lives. Planners have learned from history that open green spaces play a crucial role in the sustainable city. Thus, as a sub-topic, open green spaces provide the narrow frame for this report. Finally, open spaces as a public network define the specific subject. In order to analyze the possibility of reusing

[11] Lewis Mumford. The Highway and the city. New York : Harcourt, Brace and World, 1963.

some of the transportation infrastructure in cities, a summary of examples analyzing different solutions is introduced.

Four key aspects are addressed:

- Sustainable Urbanism
- Open Green Spaces as a System
- Circulation and Transportation in Future Cities
- Reusing Existing Infrastructure

These key aspects are widely researched; therefore, they are addressed in a narrow survey concerning the immediate aspect of this report. Since sustainability is an extensive subject, I chose primarily to address it through its definition and reveal some of its current controversial aspects. Recent researchers, such as Diane Saint-Laurent and Jouni Häkli, contemplate the place of the green space in society and in the urban fabric. In order to estimate the possibility of reusing existing circulation infrastructure in cities, two main strategies of innovative transportation systems are introduced. Theories, such as Mumford's and Calthorpe's, that have foreseen the need for a pedestrian friendly environment serve as a background for the circulation section. Finally, the approach towards reusing infrastructures is examined through the approaches of Paul Lukez,[12] William Morrish,[13] and Chris Reed,[14] and the examples of the High Line in New York, the Pompidou Highway in Paris, the Embarcadero in San Francisco, as well as others.

[12] Paul Lukez. Suburban transformations. New York: Princeton Architectural Press, 2007.

[13] William. R. Morrish, "Beautiful Infrastructure." In P. M. Condon (Ed.), Sustainable urban landscapes: the Surrey design charrette (pp. 79-86). Vancouver: James Taylor Chair in Landscape and Liveable Environments / University of British Columbia Press. 1996.

1.3 Research Question

The research question focuses this report since the area of research is extensive. The question emphasizes the practicality of relying on historical precedents for urban planning in order to avoid past mistakes:

How can existing road networks become a system of public open spaces in future sustainable cities?

Sub-Questions

What is the place of a system of public open spaces in a city?

How do cities turn mobility networks into walkable open spaces?

1.4 Goals and Objectives

The primary goal of this report is to reveal an aspect of the city that can improve future urban qualities by introducing an urban green network. Urban procedures are long, so defining the future design of cities should start as soon as possible.

Other related goals and objectives:

- Introduce an aspect of urban planning that will facilitate living in the future sustainable city
- Learn from past examples of urban green spaces and urban fabric
- Enable a systematic approach for introducing a green network and reuse cities' infrastructures
- Influence the decision makers' priorities
- Demonstrate a reuse of a infrastructure in Montreal based on the theoretical framework and the analysis of this report

[14] Chris Reed. "Public works practice. In C. Waldheim (Ed.)", in The landscape urbanism reader, 267-287. Princeton NJ: Princeton Architectural Press. 2006.

- Propose guidelines for future planning
- Suggest an image of a future urban fabric, one that is based on cities with fewer cars, more green spaces, and that is more sustainable.

1.5 Intended Audience

The intended audience of this report is policy makers, planners, and urban designers, but nonprofessionals can benefit from it as well. In most of the examples in this research, such as the Embarcadero, the High Line, and the Pompidou Highway, the public's influence was crucial. Citizens' participation (in a formal public process or through a spontaneous organization) can influence decision makers to take bold actions.

1.6 Methodology

The methodology is based on literature review, interviews by the author, and case studies. The second chapter introduces the relevant literature that serves as a background for the report. Past examples and case studies form the theoretical base, and where possible, interviews with policy makers, academic researchers, and designers illustrate the onsite point of view.

The third chapter explores methods to reuse existing infrastructure in the neighborhood of Bellechasse, Montreal, based on an analysis of the neighborhood and a recent successful project. Based on the theoretical framework and the case study, The last chapter makes recommendations for introducing green networks and reusing infrastructure.

1.7 Scope of the Work

Since our world is increasingly shaped by global influences, the literature review and examples are not limited to a certain culture or geographic location. Therefore, the review is limited to the topics that are directly related to the report's main subject and research question.

The main case study was chosen to address different scales from the macro to the micro. The Canadian Pacific (CP) railroad in Montreal is an example of a potential urban green work, and the Rosemont-Van Horne viaduct is an example of reusing infrastructure to link the urban green network to two neighborhoods: Rosemont and the Mile End.

1.8 Research Outline

In this report, chapter two introduces the theoretical background along with recent relevant examples. Chapter three demonstrates methods for reusing existing infrastructure in the neighborhood of Bellechasse, Montreal, and enabling a comparison with a similar successful project, a short analysis of the High Line, New York, is presented as a preface to this section. In order to make a full analysis of the area, the chapter introduces the context (historical and urban) of the Bellechasse project, notes local initiatives, and finally gives example of designing a green network based on existing infrastructures .

Based on the literature review in the second chapter and on the case study in the third chapter, the last chapter proposes recommendations for introducing green networks and reusing infrastructures for an urban pedestrian network.

CHAPTER 2 - LITERATURE REVIEW

2.1 Introduction

As argued in the first chapter, cities will have to change to accommodate urbanization and sustainability challenges. This chapter introduces the literature background that will enable us to learn from past experiences. This chapter is divided into four sections: (2.2) Urban Sustainability, (2.3) Open Space as Network, (2.4) Transportation and circulation, and (2.5) Reusing Infrastructures. Since future cities will have to become sustainable, first planners must understand the meaning of this term, which is widely used but still controversial. A clearer definition alongside examples of how cities that face this challenge is addressed in the first section. From here, the chapter considers the significant social influence of urban parks. In new denser cities, parks will have to be accessible to all, thus the second part of the chapter lays out a historical context and considers the conceptual meaning of nature in order to integrate a variety of green spaces as a network. The third section examines the future possibilities of transportation in the city in order to evaluate whether it is possible to find vacant spaces in the existing transportation network. Finally, to design a new circulation system, a series of examples of reusing and demolishing existing infrastructure are evaluated.

2.2 Urban Sustainability

While urban sustainability is a widely used term, it is open to many definitions. The range of interpretation is not insignificant, since the phenomenon influences our daily lives. In 2003, architect Edward Mazria reported that buildings consumed 48 percent of the United States' total energy, as well as 46 percent of its carbon dioxide production. This information, as Bergman explains when quoting Mazria, has swayed

experts' opinions to value the construction sector as a way of producing design tools that will enable an objective comparison between projects and search for a quantitative benchmark.[15] These benchmarks are not only tools, the field experience and interdisciplinary politics shape standards that influences the definition of sustainability as a bottom-top design. In this chapter, I address the aspects of sustainability through its definitions, which reveal some of the conflict and dilemmas that are caused by it.

2.2.1 What is Urban Sustainability?

What is urban sustainability? Existing literature usually explores this phenomenon in a manner that fragments it into several subjects. Transportation, for instance, is one important and often addressed aspect of urban sustainability. One well known case of how transforming public transportation effects quotidian life, is evident in the projects undertaken in Curitiba,[16] Brazil (Figure 2.1). Density is another significant aspect that affects the sustainability of a city. The Siedlung Halen project (Figure 2.2),[17] which uses a dense urban typology that combines nature with urbanism based on the Kasbah typology is another frequently cited example of responses to urban growth. Energy production and consumption also constitute a major factor: the city of Freiburg is an example of a city that has shifted to solar power (Figure 2.3),[18] and Copenhagen to wind

[15] David, Bergman Sustainable Design : A Critical Guide for Architects and Interior, Lighting, and Environmental Designers. New York: Princeton Architectural Press, 2012.

[16] Miguel Ruano. *Ecourbanism : sustainable human settlements,60 case studies.* Barcelona :Editorial Gustavo Gili, 2002.

[17] Atelier 5. "Housing Prototypes: Halen." Housing Prototypes. Ed. Roger Sherwood. N.p., 2002. Web. 11 Nov. 2013.

[18] Maria Berrini and Aldo Colonetti. *Green life : building sustainable cities.* Bologna, Italy :Editrice Compositori, 2010.

energy.[19] Other aspects include water treatment, mix use (Freiburg),[20] and circulation (Amsterdam).[21] However, while projects can be sustainable in one aspect, they can also fall short in other categories. Therefore determining objective quantitative factors that enable a basic comparative standard is one of the main problems of defining sustainability.

2.2.2 Perspective and Performance Approaches

"Green" standards are becoming a popular tool, both as a benchmark and as a base for comparison between different projects, If Quantitative they can be a powerful tool that will help reduce the urban ecological foot print. But are they an objective quantitative factor? LEED for example, is a Prescriptive based standard. In order to receive the LEED approval, the design and construction team have to fulfill a list of requirements for the different stages and elements of the design and construction process. This list of criteria is meant to predict a future sustainability performance, but lately the gap between the predicted and actual consumption has been largely criticized as in the case of the Hearst Tower, NYC,[22] in which the gap is created between the predicted energy consumption and the actual one.

As a response, other organizations have embraced the Performance-based approaches that emphasize a quantitative measurement. One example can be found in the

[19] Ibid.

[20] Ibid.

[21] Ibid.

[22] Hearst Tower site, last Accessed April 8, 2014. http://www.hearst.com/real-estate/hearst-tower.

Figure 2.1: **Curitiba, Brazil. An example of urban development based on public transportation.** (Source: flickr).

Figure 2.2: **The Siedlung Halen project, Switzerland. Low rise and dense.** (Source: Marvin Zilm.monocole.com).

Figure 2.3: **Freiburg, Germany. Solar power and mix use. The solar diagrams of the residential complex built on a roof of a commercial building.** (Source: rolfdisch.de)

2030 District organization.[23] The 2030 District is a voluntary organization involving the private sector, the public sector, and the municipality in order to reduce the impact of the district on the environment. It started in Seattle but spread to other cities North American cities such as Los Angeles, Cleveland, Denver and even Toronto. As can be seen in Figure 2.4, the 2030 Districts focus on only three factors: energy use, water use and CO2 emission from cars. It dictates quantitative aims. In energy use, for example, there is a minimum 10% reduction below the National average by 2015 with incremental targets, reaching a 50% reduction by 2030.[24] This performance based approach is more accurate than a Prescriptive based approach but still there are important controversial aspects in those approaches.

Green standards are not yet able to evaluate some important aspects of sustainability, a defect related to the problem of defining sustainability. Recently, a car parking garage in Santa Monica was certified according to the LEED standard (Figure 2.5).[25] The approval of a garage as a green building led to discussion of whether a building whose purpose is to serve private cars can be acknowledge as a sustainable building. This controversial building exposed another major problem with the existing standards and another weakness of the current definitions: ethics. Can we grade values and contexts? Green standards as LEED still do not value built area per capita as a factor, therefore a large scale detached house containing one family can be defined as sustainable even in areas were land is scarce (Figure 2.6). As another example, in desert

[23] 2030 District Site. last accessed March 28 2014. http://www.2030districts.org/

[24] 2030 District Site, Seattle: last accessed March 28 2014. http://www.2030districts.org/seattle/about

[25] "Santa Monica Civic Centre Parking Garage." City of Santa Monica, office of sustainability and environment. last Accessed April 8, 2014.

Figure 2.4: **The 2030 District, Seattle. A Performance approach, focus on three factors: energy use, water use and CO2 emission from cars.** (Source: 2030districts.org).

Figure 2.5: **Santa Monica, CA, Civic Center Parking Garage, LEED approved.** (Source: inhabitant.com).

Figure 2.6: **Fujy House, Madrid, Spain. The 320 sqm, two bedrooms detached house is often described as an example to sustainable design.** (Source: designlike.com).

areas unshaded high-tech glass skyscrapers are approved as green buildings when introducing technology that allows them to consume less energy, but this ignore the basic essence of sustainability. Green standards are an important tool, but they should be derived from a viable definition of sustainability and not determine it. This notion is critical when considering the weight of technology as a solution to sustainable design, especially in large scale structure as cities, where passive approaches and active ones will form the foundation of the design to determine the nature of the smaller scale design, as will be introduced in the next chapter.

2.2.3 Sustainability and Technology

Defining sustainability will not only effect ethics, but will determine design approaches and economic growth, as can be seen in the approach to technology. The idea that technology can cure the "illness" it caused may seem very appealing. But can we rely entirely on technology? The place of technology is often at the center of many debates as shown by Antoine Picon,[26] and by Kiel Moe and Ryan E. Smith.[27] One of the dilemmas theorists contemplate is whether to take into consideration the influence of social effects, which would be obtained by developing certain technologies. While Moe examines the complexity of such links, Picon points out the balance between technology, construction, and its social effects. In a conference held at McGill in 2014 concerning sustainable industries,[28] all three panel members agreed that technology cannot be the essence of the

[26] Antoine Picon. ."Between Technological and Cultural History." *Construction History*, v21, 2005-6 : 5-19.

[27] Kiel Moe and Ryan Smith E. *Systems, Technology, and Society.* London: Taylor and Francis. 2012.

[28] Timothy Gutowski, Julian Allwood, Greg Keoleian. Final panel. Engineering our prosperity, sustainable cities and industries in the 21 century. March 18, 2014.

solution to the ecological situation. This debate has a large influence on the different approaches toward sustainability and the ways to implement it.

For practical inspection, traditional sustainable design is often divided into two main approaches: passive and active. Active sustainable design often relates to the systems that are added to the building in order to achieve a level of sustainable performance. Such systems are photovoltaic panels, central heating and cooling systems, water collecting, and sophisticated systems for reduction of energy use— such as sensor-based central lightning systems (hence, technology). Passive design approach is based on the physical conditions of the environment. In a passive design approach, the designer must consider the sun's path and its influence on the design, the natural slope of the site, sun pattern, and the limit of light penetration. This approach relies on reducing the consumption of capital rather than changing the source. The Solar village in Athens, Greece is an example of a design that considers passive approaches from the first layout.[29] The project is designed on a solar, east-west urban grid to allow the planning of low-rise, high-density terrace row houses and low apartment buildings with a maximum exposure on the south side (Figure 2.7). This facilitates a passive solar design. The houses are designed according to classic principles of a passive solar approach from the urban scale to the single window design. The internal design considers the importance of each room, creating a hierarchy and a preference for solar exposure. For example, the main rooms face south, while the kitchen and storage areas face north. There are no windows

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https://www.mcgill.ca/tised/channels/event/engineering-our-prosperity-sustainable-cities-and-industries-21st-century-232742.

[29] Miguel Ruano. *Ecourbanism : sustainable human settlements,60 case studies. Barcelona.* 2002.

on the east or west sides. This project is an example of the importance of a well-designed urban plan, and how affordability and sustainability can be derived from an urban agenda. If large-scale planning and overall regulations will address passive design considerations from the first layout, as a top-bottom design, it will be possible for architects to incorporate sustainability into building design. Passive design should be integrated into the design and therefore implicated from the early stages, and rely on the knowledge of the architect. Relying on technology as the main method will determine which approach should be emphasized, and therefore define another aspect of sustainability's influence.

2.2.4 Definitions

What are the common definitions of sustainability? Farr,[30] for one, emphasizes the need for pedestrian-friendly urban design as one of the main aspects of sustainable urbanism, especially when a healthy urban environment is needed. He defines sustainable urbanism as "walkable and transit served urbanism integrated with high-performance buildings and high-performance infrastructures".[31] Brown and Ulgiati[32] propose a new method of analyzing and conceiving the economical system, based on a broader point of view. Emergy (with an "m") is a new quantitative technique analysis, taking into consideration the whole Biosphere's "flows of energy and resources," both renewable and non-renewable. Its main evaluation unit is the Emjouls. A common definition of sustainability refers to the balance between three forces: nature, humankind, and economics. Friedman emphasizes the importance of culture and defines sustainability as

[30] Douglas Farr. Sustainable Urbanism Urban Design With Nature. 2008.

[31] Ibid.

[32] Mark Brown.T. and Sergio Ulgiati. " Emergy Evaluation of the Biosphere and Natural Capital." Ambio - Stockholm- 28, no. 6, 1999: 486-493

the balance of culture, environment, economy, and society.[33] Personally, apart from the non-quantitative definitions, I prefer the definition of sustainable development as a "development that meets the needs of the present without compromising the ability of future generations to meet their own needs"[34] since this concept emphasizes responsibility and the understanding that we should think carefully before acting on partial information.

Defining sustainability is not an easy task, Yet, it cannot stay vague, since its influence is wide. The definition has evolved over time and is still not definitively understood. It is not only an academic or semantic debate, since the definition will have a physical influence on our environment. Standards try to introduce objective, quantitative factors, but sometimes fail in the performance aspect. Ethics and values have not yet been fully addressed. In its basic sense, sustainability refers to the environment and people. Since so much is unknown, the balance between these factors should be treated with responsibility. One of the means to understand this balance is to integrate people and nature in the most popular settlement: the city.

[33] Avi Friedman. Town and Terraced Housing for Affordability and Sustainability. Abingdon, Oxon ; New York : Routledge, 2012.

[34] "Our Common Future, Chapter 2: Towards Sustainable Development." The United Nations. Last accessed July 14, 2014. http://www.un-documents.net/ocf-02.htm.

2.3 Open Space as Network

Since nature in the urban context is a broad and multi-layered subject, this section focuses on the importance of public access to large green spaces. Therefore, this section summarizes the larger context of open green spaces, —the importance of nature in different disciplines, and nature's relation to urbanism.. The evolution of the urban park, the green lungs of the city, and its social aspect is explored through the influential urban theories by Ebenezer Howard, and design methods of Olmsted and Oglethorpe. Building from these models, I examine the importance of consecutive systems of urban open green spaces, a design that can serve as a backbone of future sustainable cities.

2.3.1 The Larger Context: Nature and the City

The relationship between nature and urban settlements has many aspects, which have been researched and analyzed as having many layers. One layer of this research that can contribute to understanding the rich background of green spaces is the importance of green corridors and parks as part of the urban ecology. Diane Saint-Laurent, for example, examines the importance of uncultivated open spaces from the flora and fauna perspective.[35] Jouni Häkli, as another example, discusses the importance of green wedges in cities and demonstrates it in the case study of two abandoned lots in divided Berlin.[36] Häkli refers to Neil Smith when describing the three categories of nature: virgin nature, agriculture, and parks/gardens. Häkli also introduces his fourth category of nature: "There should also be space in the cities for spontaneous natural processes ... the fourth nature

[35] Diane Saint-Laurent. "Approches Biogéographiques de la Nature en Ville Parcs, Espaces Verts et Friches." Cahier de Qeographie du Quebec, vol.44, n 122 .2000: 147-166.

[36] Jouni Häkli. "Culture and Politics of Nature in the City: The Case of Berlin's "GreenWedge.""Capitalism Nature Socialism, 7:2, 125-138. 1996.

would reflect the intertwinement of cultural and natural environments, and would spontaneously grow into a truly urban bio-and geo-diverse area."[37] Referring to the ethos of wilderness, William Cronon, discusses the notion of nature and human beings through the definition of wilderness.[38] He interrogates our perception of the term that "wilderness is far from reality"[39] and contemplates the place of human beings vs. nature vis-à-vis stereotypes and traditional narratives. These layers represent different aspects of the importance of urbanized nature, especially the symbolic ones. Nature, as conceived by Cronon, Saint-Laurent and Häkli has a strong and layered importance in the human world. Since cities will become the main human elements, they should incorporate those different layers in the urban design of green spaces.

2.3.2 A Need for Parks

Examining the history of urban parks leads to an understanding of the strong relationship between parks and social needs. The roots of public parks can be traced to the English commons, first as gardens for the nobility that were later opened to the public.[40] In other cases, the North American urban park finds its roots in cemeteries.[41]

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[37] Ibid.

[38] William Cronon. "The Trouble with Wilderness; or, Getting Back to the Wrong Nature." in the Uncommon Ground: Rethinking the Human Place in Nature, 1995 edited by Cronon, William, 69-90. New York: W. W. Norton & Co.

[39] Ibid.

[40] Avi Friedman *Town and Terraced Housing for Affordability and Sustainability*.(2012), Susan Davis "Another World: Theme Parks and Nature." In Spectacular Nature: Corporate Culture and the Sea World Experience, 19-39. Berkeley: University of California Press, 1997. Paul F. Wilkinson "The Historical Roots of Urban Open Space Planning." Leisure Studies, 7:2,125-143, Published online: 18 Sep 2006. http://dx.doi.org/10.1080/02614368800390121

[41] Olmsted and America's urban parks. Rebecca Messner, George DeGolian, Michael White, Kerry Washington, Kevin Kline, Emma Joan Morris, Joel Goodman. DVD. 2012. Speedwell Foundation; PBS Distribution.

Some known examples of integrating nature in urban plans are Ebenezer Howard's Garden Cities and Frederick Law Olmsted's designs. Charles Beveridge, an Olmsted scholar, claims that Olmsted was influenced by Andrew Jackson Dawning, who claimed that the aesthetic of gardening (especially of gardening and landscape) was a crucial element in creating civilization.[42] In the 19th century, while wealthy dwellers in New York City could escape to their country estates, the workers were trapped in the unhealthy urban environment. Olmsted aimed to "effectively create palace grounds for the common people."[43] In his mind, parks were not only important for people's health but also a conceptual notion of a place where "the worker who works six days a week in a factory can bring his family and says this is our estate."[44]

In today's planning, parks have still an important function. In his book, *Town and Terraced Housing for Affordability and Sustainability*,[45] Friedman refers to public open spaces not only as a respite from the city but also as places that provide fresh air and sunlight to the dwellings around them. He maintains that they "provide opportunities for informal interaction between residents"[46] and when referring to Cooper Marcus and Sarkissian (1986) he demonstrates that green open spaces have a large influence on the general impression and desirability of a community. Friedman argues that "public space is central to fostering a sense of community identity and creating opportunities for social

[42] Ibid.

[43] Ibid.

[44] Ibid.

[45] Avi Friedman *Town and Terraced Housing for Affordability and Sustainability*.

[46] Ibid.

interaction", and refers to Lynch (1990) when pointing that parks should be conceived as closed but yet accessible. It seems that parks have a great significance in the urban settlements, they have an importance for the fragile social network and there for, learning from past experiences, should be accessible to all.

2.3.3 A Consecutive Network

Green networks are not a new idea; they have been conceived as a main part of the design in several urban planning strategies, especially ones with a strong link to social theories. Olmsted and his design partner Vaux, for example, introduced a network of green spaces in a few of their urban plans, such as in Buffalo and in Riverside.[47] Parks could reach into the city and became green streets (Figure 2.8). For them, the idea of parks to parks was a concept for building a city.[48] In his Regional Planning for Boston, Olmsted has encountered an irrigation problem. He embraced a solution to upgrade the area with an hierarchy of connected green spaces: "large and medium size parks for rural relaxation and picnicking, smaller landscaped areas with ponds for recreation, and linear parkland for pleasure drives, riding and hiking."[49] For Olmsted, circulation was a main concern, and he insisted on separating the green network from the main circulation system. But not only Olmsted, other urban theorists have accorded green networks a main part in their planning.

[47] Julius Fabos GY, Gordon Milde T, and Michael Weinmayr V. Frederick Law Olmsted, Sr. Founder of Landscape Architecture in America. Amherst: the University of Massachusetts Press, 1968.

[48] Olmsted and America's urban parks. Rebecca Messner, et all. DVD.

[49] Fabos et all. *Frederick Law Olmsted, Sr. Founder of Landscape Architecture in America.*

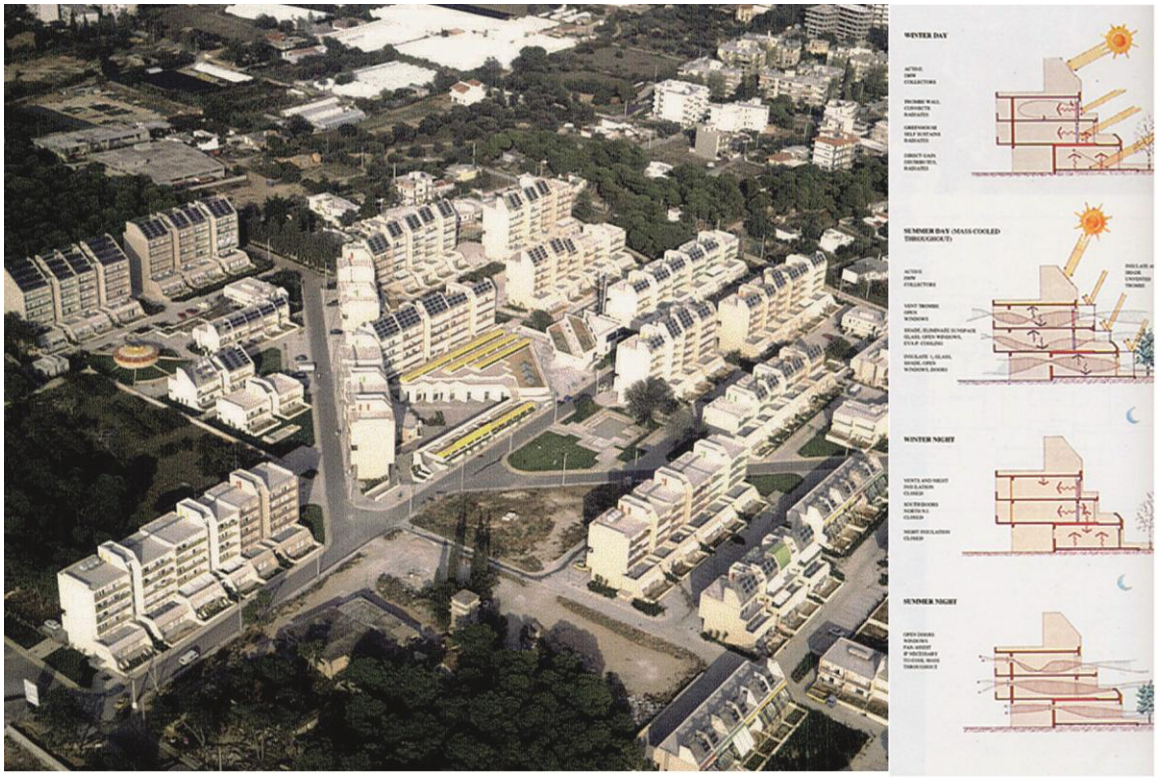

Figure 2.7: **The Solar village in Athens, Greece. The urban solar grid enable a passive-solar design of the residential houses.** (Source: Ruano, Miguel. *Ecourbanism: sustainable human settlements,60 case studies).*

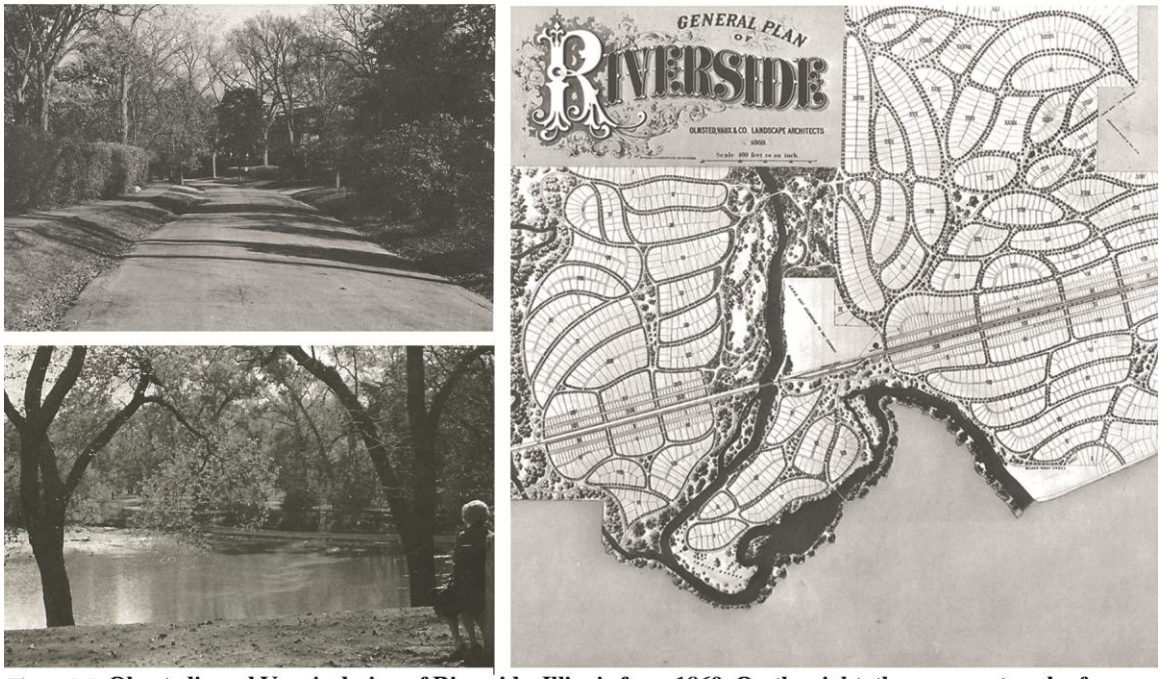

Figure 2.8: **Olmsted's and Vaux's design of Riverside, Illinois from 1869. On the right, the green network of Riverside in the 60's that made the park along the river accessible to the public.** (Source: Julius Fabos GY, Gordon Milde T, and Michael Weinmayr *V. Frederick Law Olmsted, Sr. Founder of Landscape Architecture in America).*

In his Garden Cities theory, Ebenezer Howard emphasizes the importance of the connection between nature and humankind. For him, the new city will be circled by green spaces enabling day to day activities. Kostof, for example, mentions Howard as a main influential social reformer: "where the social classes will live in harmony and the bond with nature would be reaffirmed."[50] Howard was reacting against the notion that the country was driven back from the reach of citizens. His solution was a series of small towns of 30,000 people connected by railways around a larger town of 60,000. A greenbelt will enclose the community and limit the physical growth. This planning was intended to have both the advantages of the countryside and the city. In Howard's plan, the fields and parks will be accessed easily, yet these greenbelts are still not the central circulation system of the new cities but rather a separation to dominate the final growth.

For Calthorpe, the Parks are one of the cornerstones of a pedestrian-oriented community, along with sidewalks, squares, and plazas.[51] In 1993, Calthrope stated that, although cars will not be replaced by pedestrians in the near future, we should still plan for people.[52] He describes a town center where every business and public building is accessible by walking: "And the parks and recreational facilities could be used by shoppers, on site workers, transit riders and of course neighborhood kids."[53] Like Howard, he construes parks as a social ingredient of the city, as an "essential ingredient of the common." Parks should not separate buildings from the streets, and should have

[50] Spiro Kostof. *The City shaped. Urban Patterns and Meanings Through History*. Boston : Little, Brown,1991.

[51] Peter Calthorpe. *The Next American Metropolis.*

[52] Ibid.

diversity so that all parts of the population can enjoy them. Like Howard before him, he embraces green open spaces as clusters, but in his theory it is one of the tools to control density.

The plan of the city of Savannah is another example of a design that integrates a consecutive network of green spaces. Oglethorpe conceived a hierarchical system of planning. He designed a repetitive hierarchical system consisting of a primary and secondary division. In each unit, the division of the roads formed four blocks of ten dwelling lots, which were referred to as "tythings".[54] In the center of the unit, a public strip became a large public square enclosed by trustee lots to be used by the public. Reinberger points out that this urban planning was a result of the need to reject the past and start from scratch.[55] The repetitive square ward, along with the vast allotting of public spaces, forms a unique landscape. It emphasize the importance that Oglethorpe conceived for the social aspect. Quoting Bacon, Wilkinson demonstrates the power of the design: "When one is within any of these squares one feels entirely removed from the rushing traffic of the surrounding streets, which crosses, but does not parallel the lines of sight.".[56] Wilkinson refers to Savannah's units system as an example of principles of a case study for effective urban growth.

As a local example, Saint-Laurent theorizes the need for green corridors from a perspective of biodiversity.[57] She observes that from 1970 to 1990, the City of Montreal

[54] Mark Reinberger. Oglethorpe's Plan of Savannah.

[55] Ibid.

[56] Ibid.

[57] Diane Saint-Laurent. Approches Biogéographiques de la Nature en Ville.

investigated the opportunity to implement a network of green corridors as part of its urban planning.[58] The opportunity to introduce a new network relied on the fact that some industrial areas in the city became vacant after becoming polluted, therefore freeing new spaces in town. A social need for reusing those areas for the community's needs has led to recycling it as green parks. This Green network was considered primarily as a safe green circulation area, linking the existing green spaces to the larger parks such as the Park of Mont Royal. Unfortunately, the plan did not succeed: "... Malgré beaucoup de bonne volonté, le réseau vert de Montréal demeure encore largement inachevé par rapport à son plan original" (Sénécal et Saint-Laurent, 1997)- relating to the original plan and in spite of many good intentions, the Résau Vert of Montreal is still widely unfinished (the author's translations).[59] This green network will be further discussed in the third chapter as a base for the case study of the Canadian Pacific railway and the Van Horne-Rosemont viaduct.

Nature and society have a layered relationship; it is not accidental that theories that respond to social needs have emphasized nature as a main design factor. Nature has a conceptual place in society as demonstrated by Cronon, but also an ecological importance as Häkli and Saint-Laurent argue. Calthorpe and Friedman refer it to a main part of the urban design. Urban agriculture is a factor that nowadays should not be ignored, and recently it has been argued that consecutive systems can upgrade this field as well.[60]

[58] Ibid.

[59] Ibid.

[60] André Viljoen; Katrin Bohn; Howe.J. CPULS. Continuous productive urban landscapes:designing urban agriculture for sustainable cities Publisher: Oxford ; Boston : Architectural Press, 2005.

Designing a consecutive system for green space can upgrade one of the city's multiple layers. In light of past experience, it seems that considering the relationship of nature and the city, urbanism is developing as a response to a previous situation, and therefore moving from one extreme to another. Olmsted was in favor of separating the business and pleasure traffic. Calthorpe suggests that Urbanism and Naturalism went "a step too far" and totally separated the green spaces and the cars. In his opinion, communities should be diverse and compact, integrating the urban and the natural, and reflecting a balanced design.

2.4 Transportation and Circulation in the Future City

Today, privately owned cars are the basis of the developed world's transportation system. The car industry has vast affect on our lives and our urban environment and sustainability. Will this transportation system change in the future? And if so, can we reuse the large transportation infrastructure, which will become redundant? This chapter, introduces the problems caused by private transportation, along with a potential solution, and the issue of whether planners can start designing cities that will rely less on cars. As a basis for this assumption, two main future transportation system will be introduced in order to verify whether future transportation will need less space. Using less public space will liberate infrastructure for other uses, such as pedestrian networks and will make the reuse of urban circulation infrastructures possible.

2.4.1 The Real Price of Privately Owned Cars

According to the U.S.'s EPA (U.S. Environmental Protection Agency), transportation " is the second largest source of CO2 emissions, accounting for about 31% of total U.S. CO2 emissions and 26% of total U.S. greenhouse gas emissions in 2011."[61] According to the Union of Concern Scientist, "60 percent of U.S. transportation emissions come from cars and light trucks."[62] But cars are not the only contributors to energy consumption and CO2 emission. Leaving aside the car industry-- manufacturing, transportation, assembling and storage--There are also the complementary services: the automobile production industry and especially the infrastructures: roads, highways, interchanges, and parking places.

What is the real price of cars? According to Farr,[63] we have become "addicted to driving". Roughly 2/3 of oil consumption in the US is processed into fuel for transportation, and the average cost of owning, operating, and maintaining a new car was $7,000 per year. The high expenses of the infrastructures for this need can be seen in Maryland, where parking spaces cost $2,500-$,5000 above ground, and $30,000-$50,000 for underground spaces. Though very popular, cars are a problematic solution to the daily needs of the world's population, and since congestion has become intolerable, their efficiency is questionable. Hopefully there will be a future shift to more efficient systems in energy, material usage, and land consumption.

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[61] "Overview of Greenhouse Gases" United States Environment Agency (SPA), Last accessed July 14, 2014. http://www.epa.gov/climatechange/ghgemissions/gases/co2.html.

[62] "Clean Vehicles." The Union of Concern Scientist. last accessed April 6, 2014. http://www.ucsusa.org/clean_vehicles/why- clean-cars/global-warming/

[63] Douglas, Farr. *Sustainable Urbanism Urban Design With Nature*.

Farr, for example, suggests that policy makers should make the use of cars more difficult than it is today because the car, in his opinion is almost- the enemy,[64]since our lifestyle has become based on comfort. But Farr is not the only one. In 1958, Lewis Mumford already warned against relying only on private cars,[65] and building highways inside cities. He argued that we should make the center of our cities walkable and not rely on private transportation. Mumford foresaw most of the influences that private cars and highways will effect, and he even raised the idea of using electrical cars. For Mumford, cars will destroy the city, whereas the engineers in charge of designing the transportation system see only the need to arrive from one point to another efficiently. Not only will this approach damage other layers of the city, but eventually it will not be able to fulfill the capacity needs. As Mumford predicted and as Farr acknowledges, cars have a major destructive effect on our entire transportation system and on the cities we live in.

2.4.2 An Hierarchal Circulation System

Today, cars serve as the main circulation system in and between cities, but there is no hierarchical planning of roadways, specific circulation systems between cities or cities and suburbs that will connect to inner-cities circulation systems. Some planning proposals suggest that cars can serve as one of the alternatives in an inter-city circulation system, but regulation should follow a varied scaled oriented circulation system, differing between inter-urban, suburbs, and inner-city. Mumford argued in 1958 that the planner should evaluate priorities, laying the groundwork for a combined system. In his opinion, highways could remain as a solution, but a different method should be applied for

[64] Ibid.

[65] Lewis, Mumford. *The Highway and the City*.

circulation inside the city. Each kind of transportation has its own use and there is a need for different interconnected ones to create a good transportation system. Mumford predicted the problem of traffic congestion as a main reason for people to leave the cities for the suburbs, and argued for a combined circulation system of cars, public transportation, and pedestrian circulation: "we have forgotten how much more efficient and how much more flexible are the foot walkers" to use in the open space."[66]

In the last few years, several projects around the world have given priority to pedestrians in the city. Perhaps it is not yet a global planning approach but certainly it is a trend that might lead to change. Jan Gehl, a Danish architect and professor, emphasizes the importance of designing pedestrian friendly environments in cities.[67] In a film and a book *The Human Scale*,[68] Gehl presents his attempt to create pedestrian-oriented areas for the rehabilitation of Christchurch, New Zealand, Time Square, New York, and Copenhagen. But Gehl is not the only one. In Paris, Bertrand Delanoë, the mayor elected in 2001, has gradually transformed the freeway of Pompidou around the Seine river to a pedestrian-oriented area. These efforts join the demolition and re-purposing of car circulation infrastructures for pedestrian use such as the High Line in New York, the Embarcadero highway in San Francisco, Milwaukie's demolished highway in 2000, Park-Pins interchange in Montreal, the Big Dig in Boston and others. The shift from a car-oriented system to a pedestrian-friendly one is not new; the Embarcadero in 1989 was a result of a public vote, and Gehl is emphasizing the public participation process, while

[66] Ibid.

[67] Jan Gehl, *Life Between Buildings.*

[68] Andreas Dalsgaard. The human scale. Documentary-Film. Interview with Jan Gehl. 2012. Denmark.

Delanoë was elected mayor of Paris supporting an agenda which favors public, pedestrian and alternative circulation approaches rather than private car circulation. It seems that the public demands more space for pedestrian activities, and is ready for a change in their daily habits. Perhaps a change in the circulation system inside cities is closer than it seems.

2.4.3 *Woonerf* (Streets of Living)[69]

One way to provide a pedestrian-friendly environment is to combine pedestrians and cars in the same road. In his lecture at McGill,[70] architect Daniel Pearl demonstrated the combined streets (the term used to define those streets is the Dutch reference-*Woonerf*) as a model in an urban renewal project in Barcelona to develop the complexity of the city. The researcher searched for methods to enable different usage of the streets at different hours and on different days, and chose the combined system since it enables urban pedestrian activities while still allowing commercial functions. This method, along with a good public transportation system, can minimize the use of the private car as explained by Pearl. Though a good solution for circulation, Woonerf are first a cheaper solution.

Architect Dani Raz, former head of the Administration of Planning in the Israeli Interior Ministry, took part in developing this method as young architect in Holland.[71] When working in the Architect office of Groosman and Partners between 1969-1973, Raz

[69] Translation from Dutch.

[70] Daniel Pearl. Greening and Densifying our Cities and Campuses: From Regenerative Buildings to Regenerative Communitie. April 18, 2014. http://www.mcgill.ca/mse/events-media/mcgill-net-positive/danny-pearl

[71] Dani Raz. (former head of the Administration of Planning in the Israeli Interior Ministry). Interview with the author. December 12, 2013 at Kfar Saba, Israel.

introduced his plan for neighborhoods combining pedestrian and private cars in the city of Oss (Figure 2.9). A social housing project was designed, and the designers were asked to reduce cost. In order to be government subsidized, the standard of the apartments could not be changed, and a decision was made to change the landscape. The designers decided to combine pedestrian and car circulation and economized both landscape expenses and area consumption (Figure 2.10). The municipality approved the design, and later the circulation department in the university of Tilburg developed this idea to become a design that can be reproduced. Although growing in popularity and evoking a clear statement that streets are a public-pedestrian area, this solution does not challenge the private car as a main transportation factor. It is one way to make the car usage more difficult in order to influence the users.

2.4.4 Future Transportation Systems

What kind of circulation system will serve the future city? Experts cannot be certain but it seems that two main approaches are becoming popular: the Automated cars system, and the Personal Rapid Transit (PRT). The automated car system is also known as a driverless car, self-driving car or robot car (Figure 2.11). In his blog Transportationist, Professor David Levinson, a Professor at Minnesota university and head of the NEXUS research program, suggests that by 2020 automated cars will be available on the markets. Already today, "quietly, both auto manufacturers and government entities are also jumping on the bandwagon".[72] In March 2013, *Forbes* magazine quoted Ford Motor Co. executives that predicted, "Driving will become safer

[72] David Levinson. "CNN 10 Ideas: Self-Driving Cars." December 18 2013.Transportationist (blog). last accessed April 6, 2014. http://transportationist.org/2013/11/07/what-happened-to-traffic/

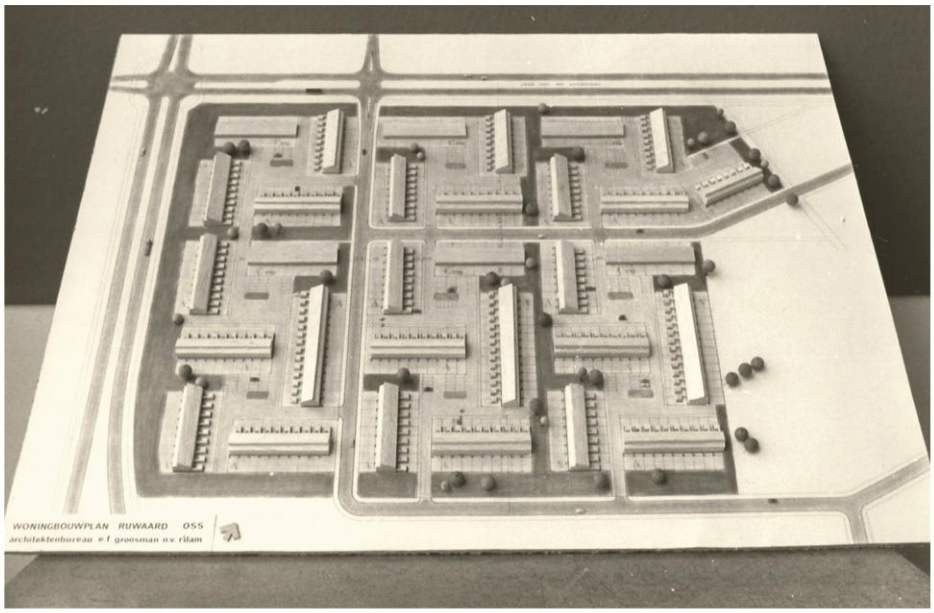

Figure 2.9: **Woonerf (Combined Streets), in the city of Oss, Netherland. Design Architect Dani Raz for Groosman and Partners Architects (1969-1973). A model of the neighborhood.** (Source: Architect Dani Raz).

Figure 2.10: **Woonerf (Combined Streets), in the city of Oss, Netherland. Design Architect Dani Raz for Groosman and Partners Architects (1969-1973). Top-right: A "regular" street. Bottom right and left: Combined Streets**. (Source: Architect Dani Raz).

and congestion will decrease...since cars will be self driving and therefore breaking, turning, speeding etc will be reduced."[73] A few weeks before, Ford presented in Barcelona a prototype.

PRT (Personal Rapid Transit- Figure 2.12), is already functioning in Heathrow Airport, London and was the principle base for the circulation of the future sustainable city of Masdar: "Masdar City, near Abu Dhabi in the UAE, set out to be a sustainable, zero-carbon, zero-waste community. Part of the premise was to exclude automobiles entirely." [74] A PRT system was designed including 80 stations but "Unfortunately, recent (October 2010) announcements indicate that this plan has now been scaled back... (today) Masdar is apparently considering electric cars and/or buses instead of the PRT system."[75]

The future circulation system is not yet defined, but still it seems plausible that the solution will be more economic in space. In his blog, *Transportationist*, Professor Levinson introduces future scenarios for transportation and its effects on our lives.[76] Though a humorous analysis, Levinson suggests that any solution will conclude in diminishing the use per capita of cars (Figure 2.13). Additionally, both PRT and automated cars will reduce the use of the existing infrastructures. The PRT will need a different infrastructure, and the automated car will allow a more efficient way of using the existing infrastructure. Those cars will be smaller, electrical, based on a clean central

[73] Christine Tierney. "Ford's Driverless Car Takes The Wheel." Forbes. Published 30/3/2014. http://www.forbes.com/sites/christinentierney/2014/03/03/fords-driverless-car-takes-the- wheel/. Last accessed April 6, 2014.

[74] http://www.mhi.co.jp/en/news/story/110127.html

[75] http://www.mhi.co.jp/en/news/story/110127.html

[76] David Levinson. "What happened to traffic?" November 7 2013.Transportationist (blog). last accessed April 6, 2014. http://transportationist.org/2013/11/07/what-happened-to-traffic/

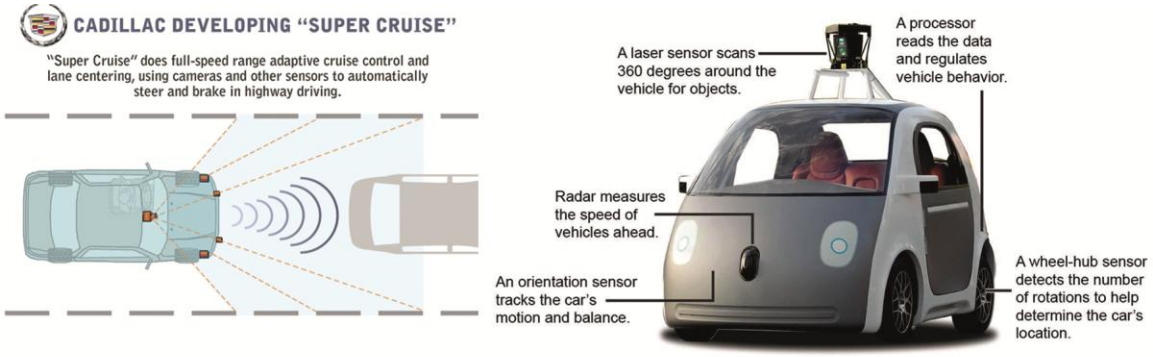

Figure 2.11: **The automated car system is also known as a driverless car, self-driving car or robot car. The automatic systems will be more economic in space.** (Source: (Left) Dailytech from Cadillac. (Right) Los Angeles Times from Google).

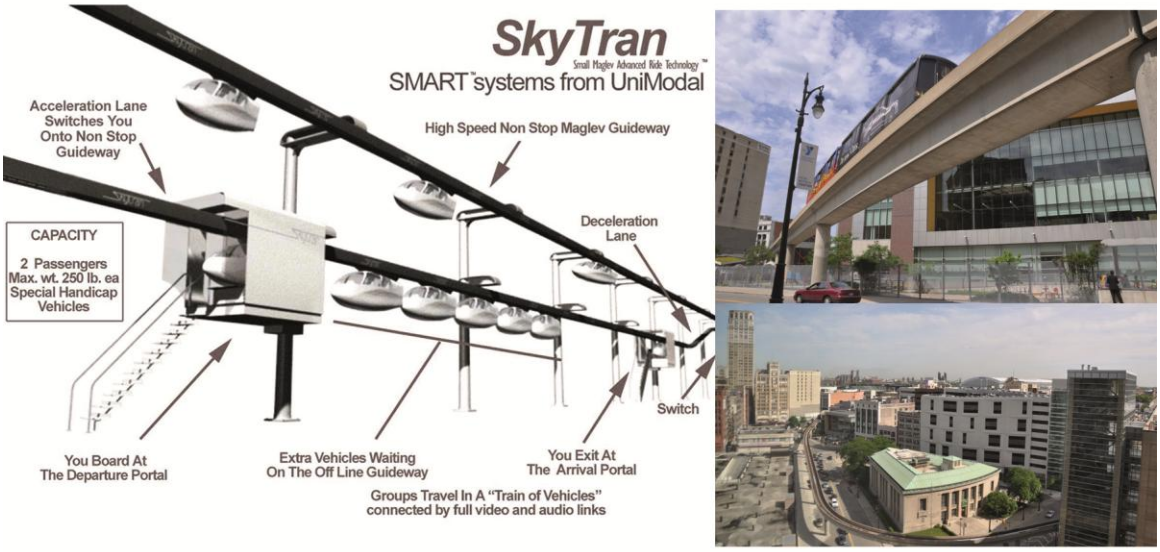

Figure 2.12: **(left) PRT (Personal Rapid Transit), (right) an elevated tram system in downtown Detroit.** (Source: left cobish.com, Right: author).

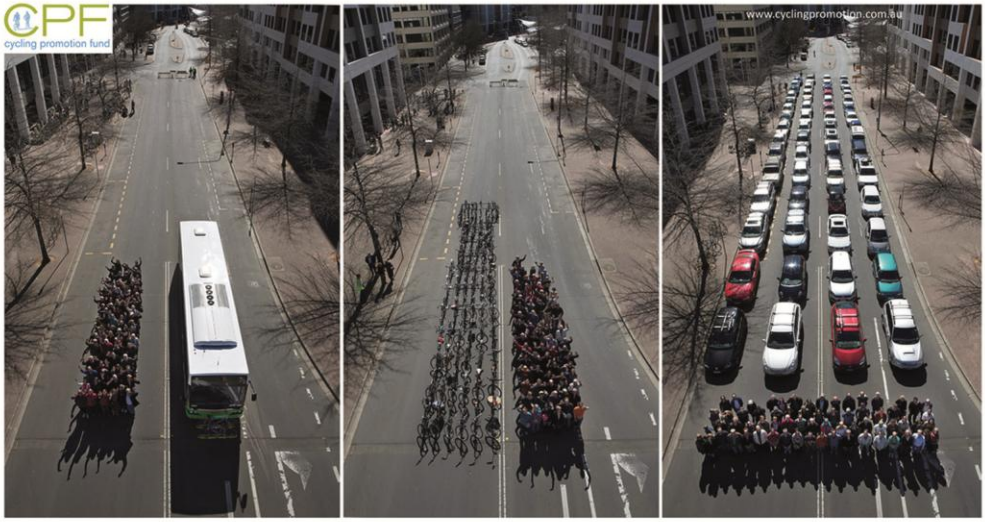

Figure 2.13: **" road space that 60 people require when traveling by bus, bicycle and car."** (Source: Croydon Cyclists).

energy system and since it is a automated drive-based, it will need less space. The space between cars will be smaller; therefore, the capacity of the existing infrastructures will be bigger, and since the cars will be shared between people with no private ownership, there will also be a lesser quantity of cars, and a need for parking spaces will diminish. Therefore, we can assume that in the future, we could use some of the existing infrastructure for other usage.

2.5 The Future of Infrastructures in the City

Inner city high-speed roads are an outcome of a planning strategy that prioritized a motored circulation system, and physically separated it from the city they are built in. Those highways have caused several problems (Figure 2.14), economically (the high financial price of maintaining), functionally (congestions and accidents), and urban (disconnecting parts of the city from the center). During the last few decades, there have been different methods to address the problems caused by highways crossing cities. In his article "Tear it Down,"[77] Norquist, the former mayor of Milwaukee, proposes to follow the example of his hometown, which decided in 2000 to demolish one of its main freeways in order to revive the connection between the city and the Milwaukee River. Should we simply "tear it down" as Norquist suggests, or instead adopt a strategy of reusing those infrastructures with the help of a large professional team as suggested by others such as Morrish?[78] Should we approach infrastructures in a design algorithm as

[77] John Norquist O. "Tear it Down!" Removing Highways- Restoring Cities. Last accessed July 14 2014. http://www.preservenet.com/freeways/FreewaysTear.html.

[78] William Morrish, R. "Beautiful Infrastructure."

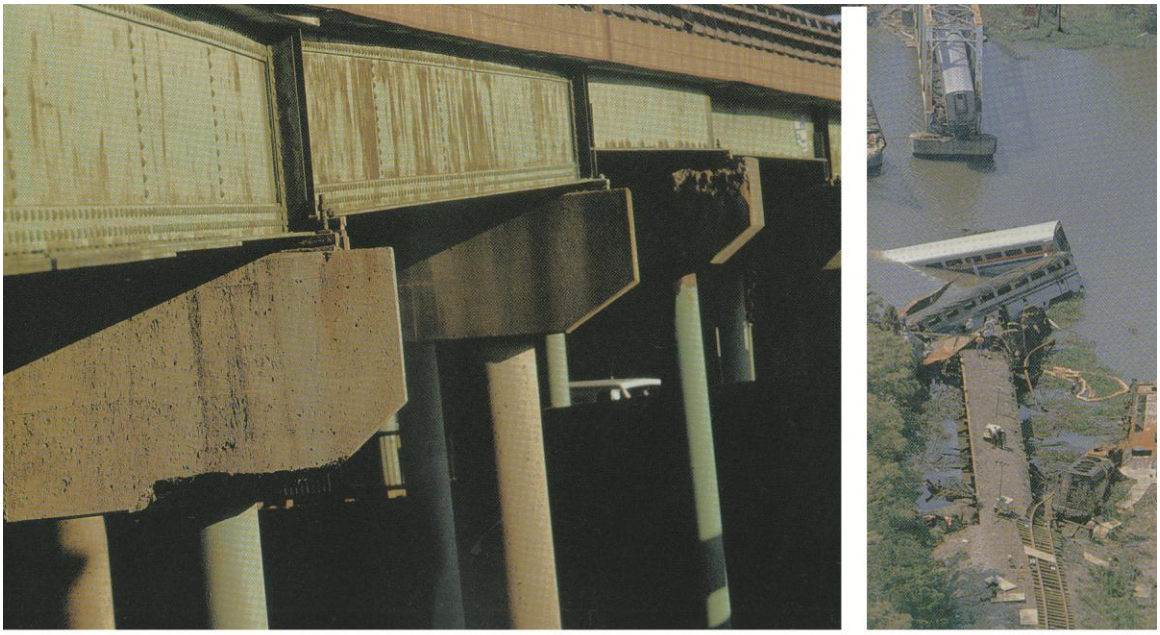

Figure 2.14: **Mallcolm Wells points at the problematic aspect of maintaining infrastructure when quoting Better Roads magazine that 34% of the nation's bridges are substandard.** (Source: Malcolm Wells, and RickFriedman. *Infra Structure., Life Support for the Nation's Circulatory Systems).*

Figure 2.15: **Mallcolm Wells demonstrates an alternative design to an infrastructure.** (Source:Malcolm Wells, and Rick Friedman. *Infra Structure, Life Support for the Nation's Circulatory Systems).*

Lukez[79] proposes? But mainly, should we look for different approaches in order to reveal the true potential and create a sense of community as all three, Lukez, Morrish, and Reed,[80] are suggesting (Figure 2.15)? The definition of infrastructures refers to a wide range of elements, but in this paper I will mainly refer to infrastructures as roads and more specifically highways. The different approaches to treating infrastructures can be demonstrated in several examples.

2.5.1 Demolishing Infrastructures

Parc-Pins interchange was originally designed in the 1950s, when cars where the future dominating transportation way. The new intersection was completed in 1962 (Figure 2.16). In the 1990s, municipally conducted research questioned the efficiency of the interchange.[81] Due to problems related to the interchange such as car accidents, safety hazards, and the fact that it created an unfriendly environment for cyclists, a decision made to demolish the interchange rather than fix it.

In January 2004, the Municipality of Montreal presented the redevelopment to the public. The estimated cost was 25-27 million dollars, and the new design was to improve the space for pedestrians, cyclists, and the neighborhoods around the base of Mont Royal, and to make the mountain more accessible to the public. In May 2005, the demolition work began. The work on the new roads continued until early 2007. It seems that the municipality of Montreal had great expectations for this project, leading a new way of

[79] Paul Lukez. *Suburban transformations*.

[80] Chris Reed. "Public works practice. In C. Waldheim (Ed.)."

[81] Ibid.

The Parc-Pins interchange 1932.
(Source: spacing.ca).

The Parc-Pins interchange 1956.
(Source: spacing.ca).

The Parc-Pins interchange 1962.
(Source: spacing.ca).

The Parc-Pins interchange, before the demolition.
(Source: Source- Low-Civic).

Accident on the interchange.
(Source- ville.montreal.qc.ca)

Demolition of the Parc-Pins interchange, and the interchange as it is today. (Source- ville.montreal.qc.ca)

Figure 2.16: **The Parc-Pins interchange, Montreal.**

designing in the spirit of Jan Gehl, and changing past assumptions and strategies into new concepts of pedestrian and green public open spaces.

As another example, the Embarcadero, San Francisco freeway was at a center of a debate whether to demolish it or leave it be for a long time.[82] Decisions concerning its future shifted from side to side but in 1986, due to traffic concerns, it was voted to leave it as is. In 1989, an earthquake severely damaged the freeway (Figure 2.17), making it unusable and prompting the decision to demolish the highway. The results were surprising: "After the freeway was removed, in 1991, real estate values in adjacent neighborhoods went up by 300 percent. Entire new neighborhoods, oriented to the waterfront, were built and thrived in areas that had been hard to develop when the freeway stood as a wall that cut them off from the waterfront." [83]

The Big Dig in Boston, is probably one of the most expensive national infrastructure in the U.S. In 1959, an elevated six-lane highway was built on the waterfront of Boston, Massachusetts, it served 75,000 vehicles in a day. By 1990, it served 200,000 vehicles a day, and it was expected that by 2010 the highway would not be able to meet the capacity needs. The official planning started in 1982, and the actual work took place between 1991-2006. The project fully opened in 2007 with an investment of 14.6 billion dollars (Figure 2.18). The six-lane elevated I-93 highway was replaced by an eight-to-ten underground tunnel, two new bridges, an extension of the I-

[82] Jasper Rubin. "The Embarcadero Reborn". Shaping San Francisco digital archive @ founds.Web. Last accessed July 14, 2014.

[83] "San Francisco, CA Embarcadero Freeway." Removing Freeways- Restoring Cities. Last accessed December 13 2013. http://www.preservenet.com/freeways/FreewaysEmbarcadero.html.

90, and a new road, mainly replacing most of the new vacant place with a public open space which was supposed to reconnect the city to its shoreline.

Until today there are many critics of this project. Though most of the traffic problems were driven to the underground tunnel, large traffic remains in the three-lane road still existing along the park, and "a study by the Massachusetts Turnpike Authority found it cut the average trip through Boston to 2.8 minutes from 19.5 — residents are looking to the $100 million worth of aesthetic changes for more proof the agony was worth it. Advocates of the project, meanwhile, are pleading for more patience."[84]

2.5.2 Reusing Infrastructures

"Les Français aiment leurs bagnoles," (the French love their cars- authors translation) said former French PM and President Georges Pompidou. In 1966, while Pompidou acted as PM, Paris transformed the roads in the *Rive droite* of its river *la Seine* into a two-way fast road. It was called *Voie Georges Pompidou* and was completed in 1967. In 2001, Delanoë was elected mayor of Paris supporting an agenda that favors public, pedestrian, and alternative circulation approaches rather than private car circulation. Delanoë has pushed forward a plan for Paris based on sustainable principles and introducing green open space in Paris for pedestrians and bicycles. The transformation of the freeway into a pedestrian one took several stages, the first one in 2002, a few months after Delanoë was elected. It was a temporary action for one summer month, which started a public debate (Figure 2.19).

[84] Abby Goodnough. "Boston Has High Hopes Now That the Dig Is Done." The New York Times. February 24,2008, Accessed December 13 2013. http://www.nytimes.com/2008/02/24/us/24dig.html

The next step was to reserve bus lanes in main streets of Paris such as Rivoli. Some 66% of Parisians have voted to close the freeway of Pompidou, and the city has closed it in the summer and transformed the river banks into *Paris Plage*, a pedestrian beach surrounded by palm trees and sand but without a sea. It attracted 600,000 people for the first day and 2,000,000 in the entire time it was open.[85] Since its success, the municipality has repeated this event each year. Finally in 2010, after being reelected, Delanoë launched a plan to transform the North and South banks from car-oriented to pedestrian and mixed circulation roads. The plan has suffered from postponement but finally was launched again in 2012.

The High Line is a mile-long public park reusing an elevated railway along the lower west side of Manhattan. The railroad was operated between 1934-1980 as a freight line to the factories and mail office in the west side. In 1847, a rail was authorized in this part, but due to frequent accidents, a public debate was held in 1929 resulting in an investment of 150 million dollars in order to separate the streets and the trains. Since the mid 1980s, a debate concerning the demolition of the High Line has been taking place. In 1999, two residents of the neighborhoods near the railway formed a non-profit organization, "Friends of the High Line," when it was under threat of demolition, which " successfully worked with the administration of Mayor Bloomberg and the New York City Council to reverse a City policy favoring demolition. The High Line is preserved through a Federal mechanism called rail-banking which preserves transportation corridors and allows them to be used as trails".[86]

[85] Henry Samuel." Expressway roads along Seine to be closed after 40 years." The Telegraph website. Last accessed July 14, 2014. http://www.telegraph.co.uk/news/worldnews/europe/france/7590210/Expressway-roads-along-Seine-to-be-closed-after-40-years.html

The first section was opened to the public in 2009, the second in 2011. About 3.7 million people visited the High Line in 2011, half of them New Yorkers. The High Line has taken its place as a tourist attraction (Figure 2.21), a "must see."

2.5.3 "Greening the Gardiner"

In 1965, an elevated expressway was built on Toronto's waterfront. The expressway bears the name of Frederick Gardiner, the chair of Metro Toronto, who proposed this infrastructure in order to tie the towns around Toronto to the center of the city. Since its inauguration, the Gardiner has been a target of criticism. It is an obstacle to reach the waterfront and a symbol of the vehicular culture. Jane Jacobs commented on this subject: "The fundamental problem of the Waterfront is the Gardiner. What you need there is just a classic city street where you can enter or exit at any point."[87]

In 2001, in order to link the port and the city, 1.3 km of the east section of the Gardiner was taken down and the city intends to demolish the rest of this elevated highway. As a response, Quardangle Architects, a Toronto based firm is proposing to transform it into the "Green Ribbon" (Figure 2.20), a 7 km green roof over the existing elevated Gardiner Highway.[88] In an interview, architect Les Klein, one of the founders of Quardangle Architects, explained that already in downtown Toronto the private cars are only the fourth or fifth means of transportation. In 2009, Klein presented on the possibility of building a new circulation system above the existing highway. Klein did not

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[86] Gansevoort Street to 30th Street. New York: Friends of the High Line, 2008.

[87] Jane Jacobs. Quotation from "Greening the Gardiner" Quadrangle Architects, page 3.

[88] Les Klein. (Partner in Quadrangles Architects). Interview with the author. April 24, 2014 Toronto, Canada. Quadrangles Architects. http://www.quadrangle.ca/

Figure 2.17: **The Embarcadero, San Francisco after the earthquake.** (Source: Wikipedia).

The Embarcadero, the Ferry building, 2003. (Source: Sfgate).

Figure 2.18: **The Big Dig, Boston. Before and after.** (Source: Shawn Adderly. wordpress.com).

Figure 2.19: **Voie Georges Pompidou, Paris before and after. "Les Français aiment leurs bagnoles," (the French love their cars- authors translation) said former French PM and President Georges Pompidou.** (Source: Removing Freeways - Restoring Cities).

propose to demolish or ban the cars, but to use the infrastructure as a base for a layered transportation system. His firm proposes to use the new circulation path as a base for urban renewal, along with its natural qualities—weather protection, improved lightning, and safe pedestrian circulation. The project will provide new opportunities to link buildings close to the expressway.

2.5.4 The Economic Aspect

Economically, what are the implications of building new infrastructures or fixing existing ones? In the Parc-Pins interchange, the city of Montreal has invested over 27 million dollars in the project[89] of demolition and rehabilitation, a very large sum no doubt, but what will be the expenses of maintenance? In Milwaukee, for example, as Norquist explains, "rebuilding the 30-year-old structure would have cost $100 million. Tearing it down and replacing it with a street cost about $25 million"[90].

Lukez argues that as long as economic factors are dominant, a different approach will be hard to achieve, mainly due to the tight economic margins. Morris contends that a new approach which includes different professionals should be adopted, and ecologists and environmentalists should take part in this team of decision makers, introducing more specialists who will probably introduce a more complex approach that might have a larger impact at the first investment in the infrastructure, but might prevent further issues in future.

[89] The city of Montreal website."Redevelopment of the intersection avenue du Parc-avenue du Pins."

[90] John O. Norquist. "Tear it Down!"

2.5.5 Is Infrastructure a Negative Factor in the Landscape?

Infrastructures are a response to physical problems; they aim to improve a current situation, but it seems that by trying to repair one problem they are causing others. Are they essentially a negative influence on the landscape? Morrish argues that infrastructures, if well treated, can be multifunctional. They do not have to be regarded only as "a neutral grey utility devoid of cultural expression or celebration" but can also have the potential to create "community identity and a personal sense of orientation."[91] This can be achieved if the design responds to the local, physical, and community aspects of the specific site (Figure 2.21). Lukez is referring to time as a crucial factor when evaluating the potential of some infrastructures. In his chapter on "Engaging History Traces,"[92] he points out that some infrastructures are "imbued with meaning." The High Line in New York, and the Promenade Plantée in Paris are examples.

Though Morrish refers to the complexity of the new infrastructures as a value, Lukez is referring to the incompleteness of the design when observing that an infrastructure should be flexible and generic in order to meet future changes and demands. Is time the ultimate factor?

Learning from the U.S. Army Corps of Engineers history,[93] and based on traffic engineers such as Walter Kulash and Rick Chellman, Norquist is arguing that highways inside the city not only cause new physical problems, but in long term do not solve the actual problem they were supposed to since the flow of the private transportation is

[91] Paul Lukez. *Suburban transformations*.

[92] Ibid.

[93] John Norquist O. "Tear it Down!"

Figure 2.20: **The "Green Ribbon", a 7 km green roof over the existing elevated Gardiner Highway, Toronto.**
(Source: Quardangle Architects).

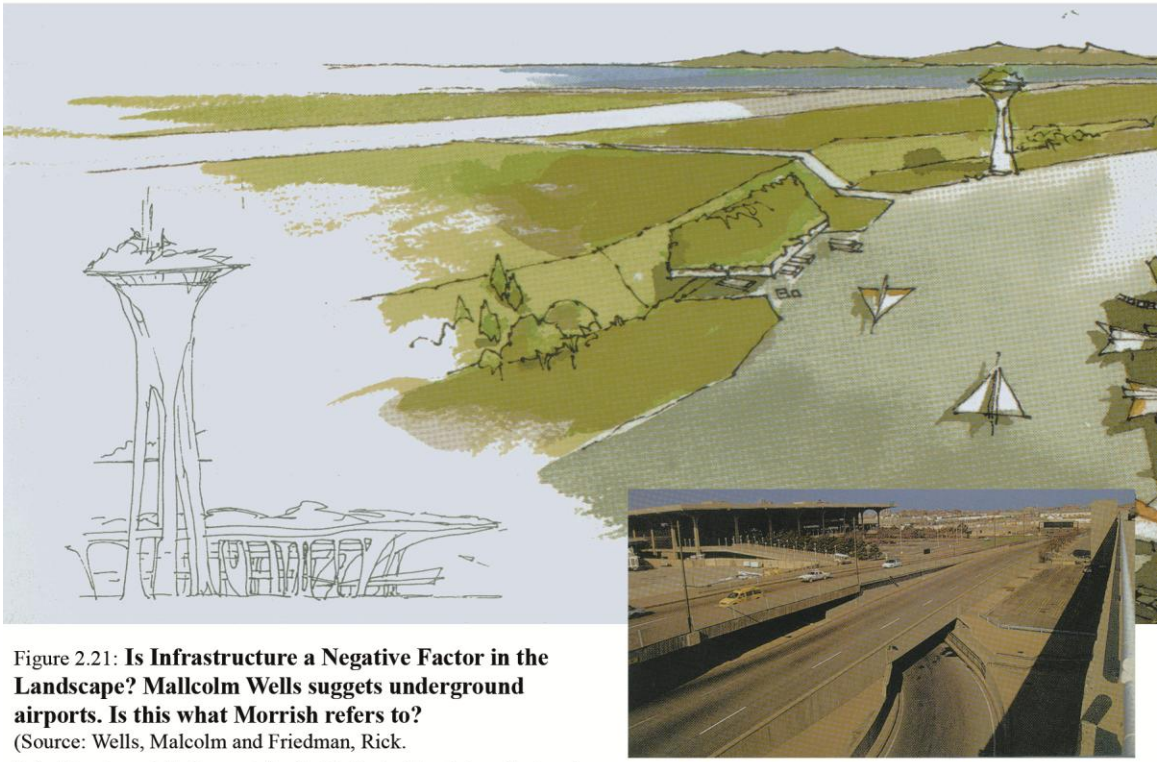


Figure 2.21: **Is Infrastructure a Negative Factor in the Landscape? Mallcolm Wells suggets underground airports. Is this what Morrish refers to?**
(Source: Wells, Malcolm and Friedman, Rick.
Infra Structure, Life Support for the Nation's Circulatory Systems).

growing without control. In both cases of Paris Pompidou Highway and the Embarcadero interchange in San Francisco, it seems that traffic congestions have only diminished after the changes, since as Norquist suggests the drivers have quickly found alternative routes. Should highways and interchange in the city be demolished or are they an opportunity to upgrade the city? Highways and interchanges do not have to be demolished, and as seen in the cases of Highline and Pompidou, they can be reused to upgrade the whole area.

2.6 Conclusions

Louis Mumford[94] points out that in the nineteenth century, the "corridors" were mainly designed for "wheeled vehicles." Up to this time, people used to walk in the cities, even up to two or three miles for their jobs. With the invention of mass transportation, walking distance no longer "set the limits of city growth." When the fares were cheap, the poorer paid workers could afford a degree of mobility. Is it possible to reverse time? Parks are already becoming a popular place in a more and more urban world; visiting a park in Montreal during a sunny weekend is a proof better than any statistic. But not every green open space is a good one. Jane Jacobs refers to personal safety problems in parks and gardens. In her book, *The Death and life of Great American Cities*[95], she identifies several plazas, gardens and parks which have become dangerous to the public. Jacobs demonstrates that public gardens are unpredictable; some are very exciting while others are disastrous. The climatic location should not be ignored either. In

[94] Lewis Mumford. *The Highway and the City*.

[95] Jane Jacobs. *The Death and life of Great American Cities*. New York : Random House, 1961.

Berri interchange in Montreal, a barrier in the city (see also chapter 3)

Student protests in Montreal on the Berri interchange 2012. (Source: Iana Kazakova, Forget the Box).

Figure 2.22: **Berri interchange, Montreal. Today it is a barrier in the city, but if used differently, it will connect pedestrian circulation rather than separating it.**

a cold city such as Montreal, passing near or through an open space is not a pleasant experience. Therefore not every green space is a good one and especially not everywhere.

Consecutive systems are not a new idea, most of the designs have changed through the years to meet new needs, and caused the loss of the original design principles. But today there are new reasons to reintroduce consecutive systems, and if designed with the right principles, they can serve as a new urban system for upgrading the city. The future shift in urban transportation is an opportunity not to be missed, and hopefully unused inner city highways will connect pedestrian circulation rather than separating it (Figure 2.22).

In the CRIEM's seminar,[96] Columbia University's Professor Saskia Sassen, defined the city as a complex and incomplete structure. Urban infrastructures may incorporate this incomplete quality , which will fulfill future needs as outlined in the following definition of sustainability: "sustainable development is development that meets the needs of the present without compromising the ability of future generations to meet their own needs."[97]

[96] Saskia Sassen. CRIEM symposium- creative cities, October 19, 2013

[97] Our Common Future, Chapter 2: Towards Sustainable Development." The United Nations. Last accessed July 14, 2014. http://www.un-documents.net/ocf-02.htm.

CHAPTER 3 - CASE STUDY:
The Rosemont-Van Horne Viaduct, Bellechasse,[98] Montreal

The Rosemont-Van Horne viaduct design proposal is based on the author's work in an urban studio (UDH 2013), a research work at McGill (*Imaginonsbellechasse*) and specific work for this report. Some of the maps and images in this section have been developed for the McGill research project *Imaginonsbellechasse.com,* by the author.

[98] In this chapter- Bellechasse refers to the area north to the PC railway between the streets of Boulevard *Saint Laurent* and S.denis street as defined by the PPU (*Le Programme Particulier d'Urbanisme*) of the area.

3.1 Introduction

In this chapter, I explore methods of reusing an existing infrastructure in the neighborhood of Bellechasse, Montreal (Figure 3.1) based on the ideas introduced in chapter two. A short analysis of the High Line in New York will be presented, then the main part of the chapter will introduce the context (historical and urban). In this design proposal, the Van Horne-Rosemont Viaduct will serve as a link to the green belt around the Canadian Pacific (CP) railway line that in the future can serve as a base for a green network. Moreover, the area of Bellehasse-la Petite-Patrie along the railway offers an opportunity for urban renewal. The Pacific Canadian railway in the Bellechasse area is still an active line. In fact, most of the containers arriving from Montreal's port pass through this railway system,[99] but it is currently possible to use the areas next to it, which are occupied by industry, offices, and service areas, and hopefully one day this railway will become available for further use as a green system. At the beginning of the century, the area was planned as a main hospital campus, but recently the municipality examined the possibility of transforming it to a mixed-use residential neighborhood. In this area, the land beside the railway already functions as a park (Figure 3.3). It is used for several activities, but mainly as a circulation path between Saint-Denis and Saint-Laurent. The Van Horne viaduct, an inner city highway that crosses the neighborhood intensifies the disorder (Figure 3.4). As a result of a public participation process held in the neighborhood, the municipality began to reconsider the viaduct's task as a main vehicular way and transforming it partly into a pedestrian bridge (Figure 3.2), referring to the High Line in New York. The Bellechasse-la Petite Patrie area offers an opportunity to test a case where two urban infrastructures meet: the railway tracks and the Rosemont-Van Horne viaduct.

[99] Jean Décarie, "le Réseaut vert".Lecture for urban planning class, UQAM Mai 2014.

Figure 3.1: **View of the Bellechasse area: A: the CP railway, B: the passage of Saint Denis street underneath the railway, C: the Rosemont Métro station, D: the building of Saint Denis 5800, E: the Champs des Possibles, F: the Rosemont-Van Horne viaduct.** (Source: Apple maps).

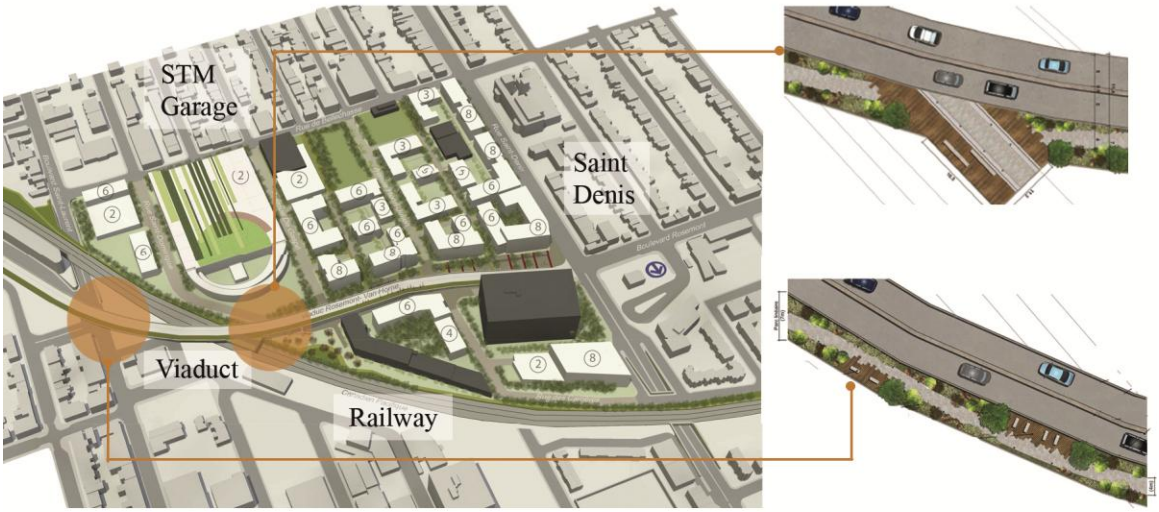


Figure 3.2: **The Suggestion of the Municipality as introduced in the PPU (Le Programme Particulier d'Urbanisme) for the design of the Rosemont-Van Horne Viaduct, Bellechasse.** (Source: PPU Rosemont- La Petite Patrie 2012).

The Canadian Pacific railway that crosses Montreal dominates its surroundings. Although originally on the border of the city, over time, the city grew to encompass the infrastructure that currently physically divides it. In this chapter I introduce the historical and physical contexts of the railway, and suggest a design approach to reuse it as a pedestrian and bicycle circulation path in the existing urban fabric.

When I first arrived in Montreal, I wandered through the city neighborhoods looking for an apartment. I still remember the effect of passing under the railway on Papineau street (Figure 3.5). Without knowing it was a railway, I felt the intimidation of the tunnel and its influence on the immediate surroundings. The railway infrastructure is a border within the city; activity in the streets that cross it diminish as it draws closer. These inner city infrastructures are a dominant part of the urban landscape; they have become landmarks.

Can we define these inner city infrastructures as barriers? The Berri-Sherbrooke interchange (Figure 3.6), for example, is another inner city infrastructure in the center of Montreal. During an Urban Design seminar, I examined the influence of that infrastructure on people's use of the streets and following Jan Gehl's research methods,[100] I counted the number of people: pedestrians and cyclists, in several junctions around the interchange (Figure 3.7). In this field research I found that only people who had no other choice but to cross the interchange would walk through it, while others would try to avoid it (especially when going up the junction). The results showed that though it is centrally located and in proximity to many important communal activities, there is a tendency to avoid this area. It seems that some infrastructures in the city, even if reasonably permeable, act as barriers; physically or perceptually. If people do not use these areas, commercial and public activities will move away and the streets will "die". This process will intensify the "barrier effect" that changes the pedestrian and cyclist circulation in the city.

[100] Jan Ghel . Life Between Buildings.

Figure 3.3: **The existing green belt surrounding the railway in the Bellechasse neighborhood. The green belt already attracts diverse activities and is used as an alternative circulation route.**

Figure 3.4: **The Rosemont-Van Horne viaduct causes a visual and physical disturb that creates unused and unpleasant spaces in the neighborhood**

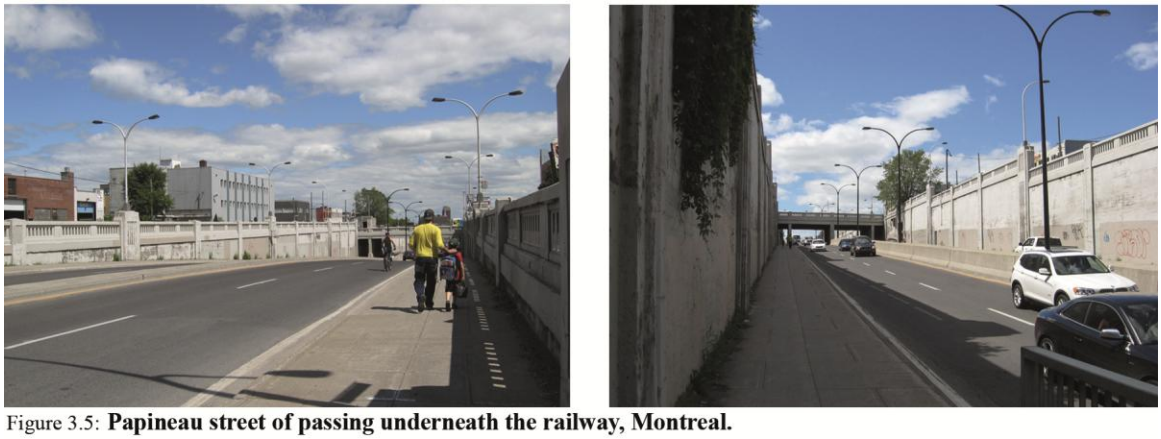


Figure 3.5: **Papineau street of passing underneath the railway, Montreal.**

Figure 3.6: **The Berri-Sherbrooke interchange, Montreal. The dominant infrastructure influences the pedestrians circulation of the surrounding area.**

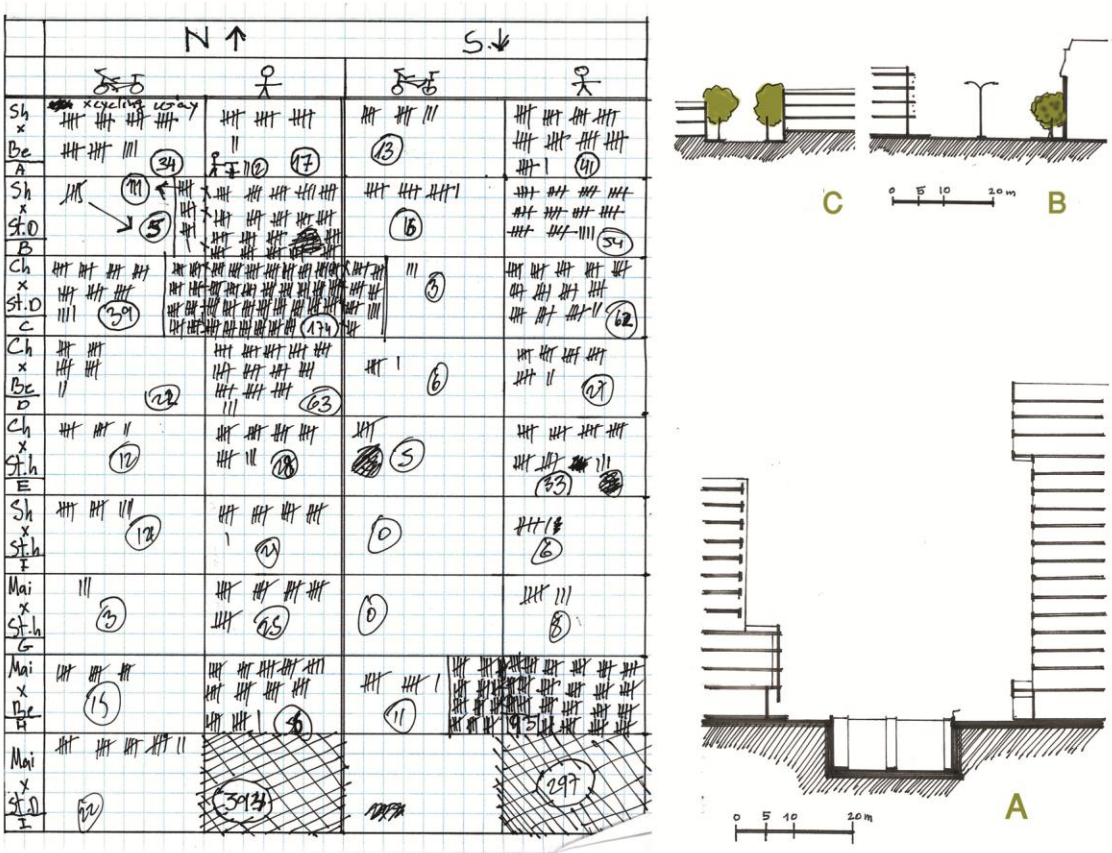


Figure 3.7: **Field reconnaissance sheet with the monitoring of cyclists and pedestrians in nine junctions surrounding the research area. The results demonstrate that pedestrians will avoid going up the interchange and will look for alternative routes. Right: the different sections of the street.**

The railway may be a perceptual barrier when it is crosses main streets, but primarily it is a physical barrier, separated by fences (Figure 3.8). Although it causes a strong negative influence on its immediate surroundings, the railway path has a great deal of potential. As an option for a future circulation path, the railway by its nature is linear, it crosses the town and is accessible from both sides (but not to pass from side to side) therefore, it would make an excellent corridor if designed accordingly. In addition, it is near many existing urban green spaces that are currently physically isolated from each other (Figure 3.9). If these green spaces were linked to this corridor, then they could be transformed into an urban network.

In addition, in the past, the railway attracted specific land uses: activities that could benefit from proximity to the lines, while deterring uses that tended to move away from noise and pollution, such as dwellings (Figure 3.10). Now, when proximity to the railway is no longer an advantage, the buildings around the track are often neglected or only partly used. This situation could serve as an advantage to introduce activities along the borders of the park. The railway might offer opportunity for an urban renewal process, especially in the Bellechasse-la Petite Patrie area where these processes are already under consideration.

The intersection of the viaduct and the railway offers a great opportunity to plan a pedestrian-oriented circulation system. There are many factors that can be used as positive generators in turning the intersection of the viaduct and the railway into a pedestrian circulation system: a Métro station, two main streets, proximity to public activities, the interaction between two busy neighborhoods, the railway, and the viaduct. Projects like the PPU, the municipality's urban plan, as well as informal projects led by concerned neighbors, like the Champs des Possibles, suggest that urban renewal is already underway in the area.

Figure 3.8: **Fences along the railway.**

1_ Parc Carmela-Galardo-Frascarelli
2_ Parc Dante
3_ Parc De Gaspé
4_ Parc Saint-Jean-de-la-Croix
5_ Parc de la Petite-Italie
6_ Parc linéaire du Réseau Vert
7_ Parc Hector-Prud 'homme
8_ Parc Toto-Bissainthe
9_ Parc Édouard-VIII
10_Parc Clark
11_ Parc Laos-Henri -Julien
12_Parc des Carrières
13_Parc Père-Marquette
14_Parc Sir-Wilfrid-Laurier
15_Parc Ludger-Duvernay
16_Parc Saint-Grégoire-Rivard
17_Parc du Carmel
18_Parc A.-T.-Lépine
19_Parc Saint-Michel
20_Parc Berri-Saint-Joseph

Figure 3.9: **The green open spaces in the area of the Belechasse site. The spaces that are in proximity of the railway can be connected into a green network, starting inside the neighborhoods and linked to the green lungs of the city.** (Source: PPU Rosemont- La Petite Patrie 2012).

Résidentiel
Habitation mixte (résidentiel et petits commerces)
Bureaux et services
Équipements collectifs
Industries
Espaces verts
Commerces
Espaces vacants

Figure 3.10: **The Bellechasse site. The land uses map demonstrates that most of the lots next to the railway in that area are either vacant or still occupied by the original industrial and services buildings. Yellow and orange are residential/ mix use.** (Source: PPU Rosemont- La Petite Patrie 2012).

3.2 The High Line, New York

The High Line is a well-known example of reusing a redundant infrastructure. In this case study, the main question was whether to demolish it or to reuse it; finally the decision to transform it into a green public space was a huge success. In the second chapter of this report, this case study's history has already been presented; and Since the High Line is a precedent for pedestrian circulation paths, this part of the report examines the preservation of the original landscape and the areas next to the High Line.

In a private interview held at McGill University, Professor David Newton, who worked on the High Line project at Diller, Scofidio and Renfro (DSR), explained the basic principles of the design. As part of the parametric design approach (Figure 3.11) a geometric system was built, one that creates different design situation by using a designated number of prefabricated elements (Figure 3.12). The usage of the elements creates a tradeoff between green spaces and built areas. This is one of the main parameters that allow the diversity of spaces on the High Line. Though an impressive number of variations are created, with special areas where people stop that create "special moments" (Figure 3.13), as professor Newton defines them, but it is still a closed and controlled system.

"Like others we had fallen in love with the landscape that had reclaimed the monumental structure. We hoped to save this self-sown wilderness, which thanks to Joel Sternfel's photography, had become the defining image of the High Line" said Joshua David and Robert Hammond, co-founders of the Friends of the High Line

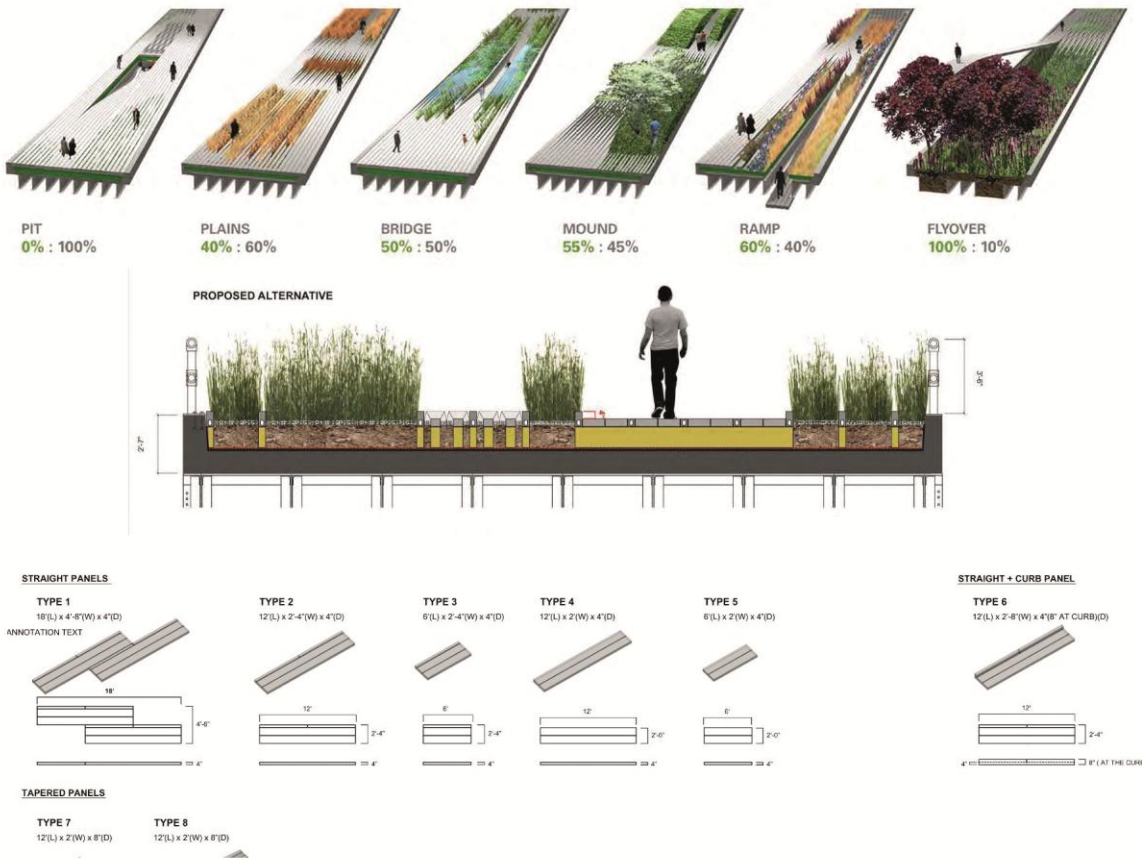


Figure 3.11: **The prefabricated segments of the parametrical system.** (Source: A PDF file sent to the author on May 2014 by professor David Newton. *The High Line, section 1, Public Presentation. February 13, 2006).*

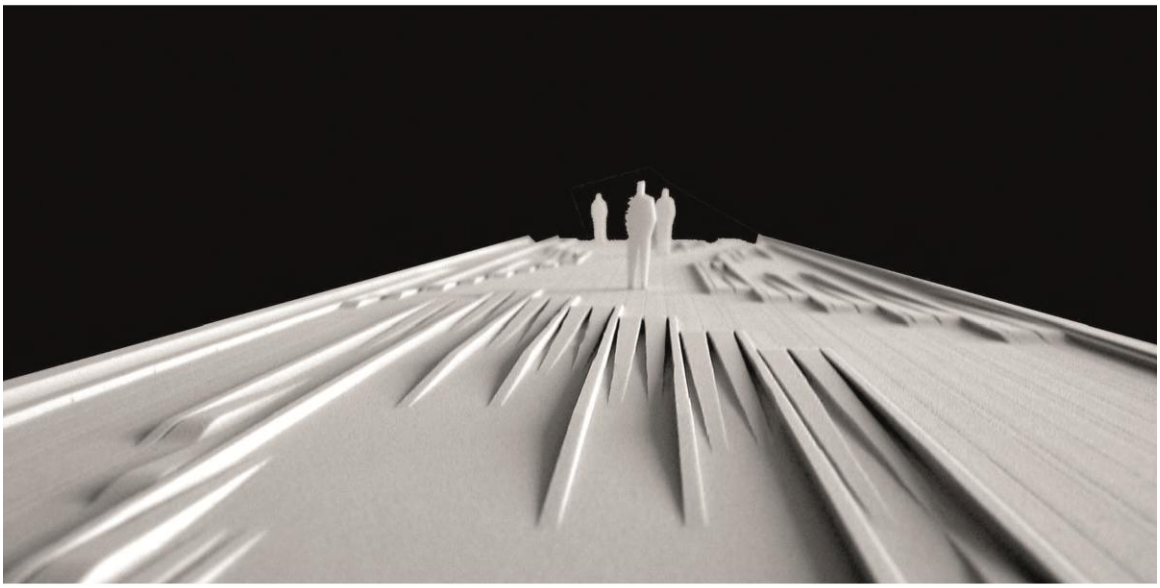
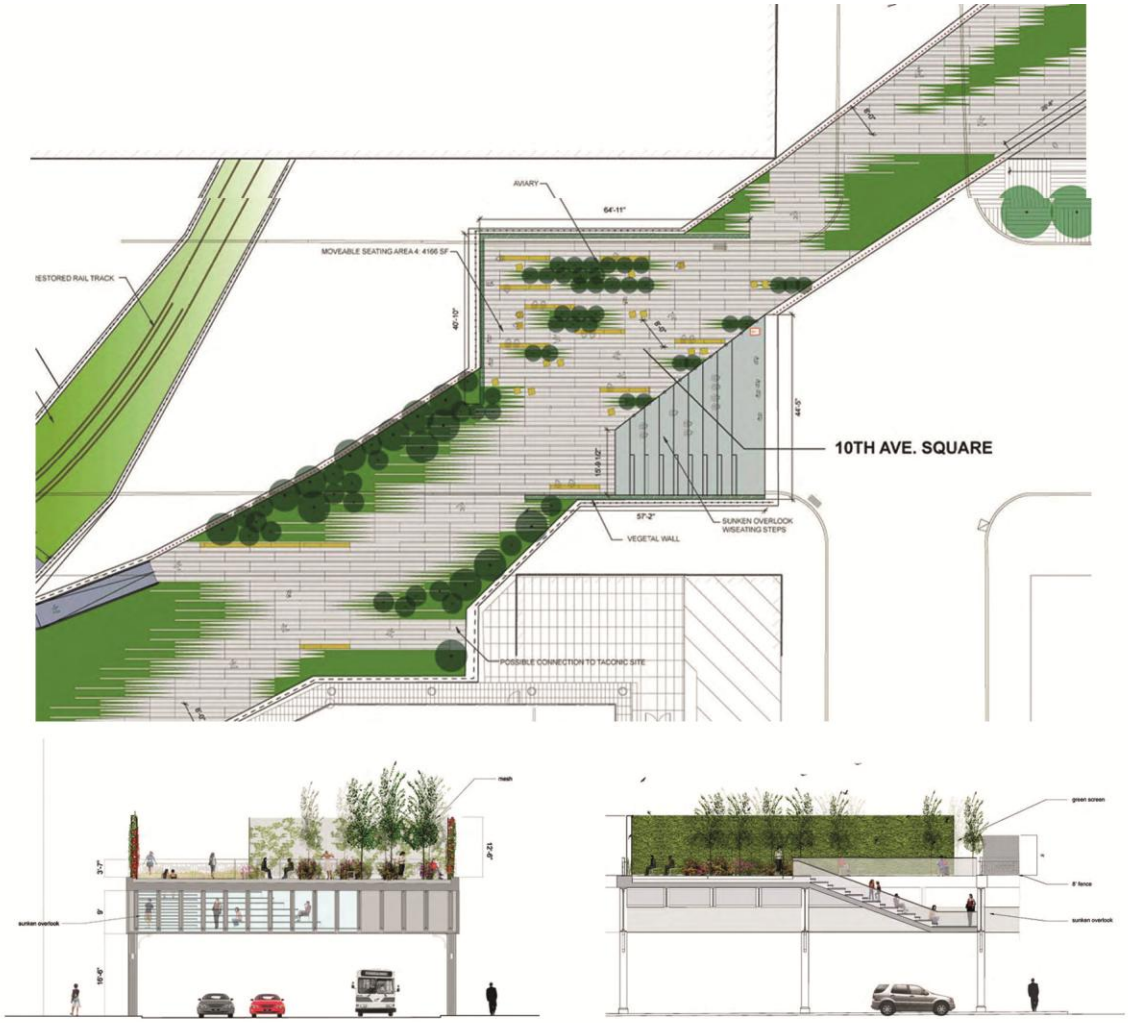


Figure 3.12: **The segments (parameters) defines the balance between built and vegetated.** (Source: A PDF file sent to the author on May 2014 by professor David Newton. *The High Line, section 1, Public Presentation. February 13, 2006).*



The prefabricated segments of the parametrical system. (Source : a PDF file sent to the author on May 2014 by professor David Newton. *The High Line, section 1, Public Presentation.February 13, 2006).*

Figure 3.13: **The segments (parameters) defines the balance between built and vegetated.** (Source (left): a PDF file sent to the author on May 2014 by professor David Newton. *The High Line, section 1, Public Presentation. February 13, 2006.* (Right): Author).

organization.[101] The frustration at not succeeding in preserving the original wilderness is expressed in several texts,[102] especially since the series of the photographs taken by Joel Sternfel played an important role in the process. The photographs taken in different seasons introduced the extensive open spaces and their diversity, which enabled informal activities (Figure 3.15). These photographs and activities were one of the recognizable icons that were identified with the High Line project and enabled the process of reusing it. In fact in this case, it seems that in order to preserve the physical structure, a trade off was made, one that led to a decision to extensively develop the landscape.

Relating to the ideas of the different kinds of nature by Jouni Häkli[103] and Diane Saint-Laurent[104] whose ideas were introduced in the second chapter of this report, it is interesting to wonder whether it was impossible to preserve, if not the original flora, then the original atmosphere. As Jeremiah Moss writes in his article at The New York Times: "Today it's difficult to remember that initial feeling. The High Line has become a tourist-clogged catwalk and a catalyst for some of the most rapid gentrification in the city's history." [105] The dilemma between the need to develop and to preserve is real in this case, and difficult to answer, but one cannot help but wonder if there was not a need to develop

[101] Friends of the High Line, Field Operations, Diller Scofidio and Renfro. Designing the High Line: Gansevoort Street to 30th Street. New York : Friends of the High Line, 2008.

[102] Jeremiah Moss, "Disney World on the Hudson", The New York Times. August 21, 2012.Accessed December 13 2013. http://www.nytimes.com/2012/08/22/opinion/in-the-shadows-of-the-high-line.html.

[103] Jouni Häkli. Culture and Politics of Nature in the City.

[104] Diane Saint-Laurent. Approches Biogéographiques de la Nature en Ville Parcs.

[105] Anik La Farge, On the High Line. New York : Thames & Hudson , 2012. and Joshua David and Robert Hammond, *High Line: the inside story of New York City's park in the sky.* New York : Farrar, Straus and Giroux, 2011.

Figure 3.14: **Joshua David and Robert Hammond, the founders of the Friends of the High Line organization in the extensive open space of the High Line, before the building work started.** (Source: David, Joshua and Hammond, Robert. *High Line: the inside story of New York City's park in the sky).*

Figure 3.15: **Photographer Joel Sternfel's captured the landscape of the High Line during different seasons. His photos helped to build a public support for the preservation of the High Line.** (Source: La Farge, Annik.*On the High Line.* New York : Thames & Hudson , 2012).

another element in the parametric design system, one that could leave nature as it is or enable nature to grow wildly.

Moss continues: "My skepticism took root during my first visit. The designers had scrubbed the graffiti and tamed the wildflowers. Guards admonished me when my foot moved too close to a weed. Was this a park or a museum? I felt like I was in the home of a neatnik with expensive tastes, afraid I would spoil the furnishings. But the park was a hit. Fashion models strutted up and down. Shoppers from the meatpacking district boutiques commandeered the limited number of benches, surrounded by a phalanx of luxury clothing bags. I felt underdressed".[106] Preserving the atmosphere is not only a design issue but also a usage one. Figures 3.14-3.16 demonstrates the original atmosphere of the High Line that charmed the public and its representatives, leading to the long process of preserving this infrastructure. Perhaps if it was possible to dedicate some areas to incompleteness and "untied" ends it would allow a place for everyone in the urban nature scene.

In relation to areas next to elevated infrastructures, a well-known scene from the 1980 movie the Blues Brothers[107] shows the situation in one the brother's apartments (Elwood's) every time a subway passes. The apartment is located next to an elevated railway in Chicago, and the terrible disturbance that is met with Elwood's indifference emphasizes the misery of the situation and the fact that living next to the train is a

[106] Ibid.

[107]John Lands, Blues Brothers, 1980. https://www.youtube.com/watch?v=S65lJGs7YC8

Figure 3.16: **The 2007 portrait project, more than a 1000 portraits of supporters to preserve the High Line. All photos taken with the background of the extensive High Line**. (Source: David, Joshua and Hammond, Robert. *High Line: the inside story of New York City's park in the sky)*.

Figure 3.17: **The advertising signs on the buildings next to High Line emphasize their proximity to the railway line as an advantage, some recent buildings are even appropriated with it as icons. The High Line has a economical-business advantage.**

Figure 3.18: **The area of the elevated subway station in Brooklyn, New York.**

problematic situation. When people are walking on the High Line, the advertising signs on the buildings next to it emphasize their proximity to the railway line (Figure 3.17).

This situation is striking one when examining the areas underneath the High Line. In many places areas underneath elevated infrastructures have a negative impact. What makes the High Line different from other places such as Brooklyn's elevated subway (Figure 3.18)? Is it part of a process of urban renewal that leads to gentrification? Perhaps the width of the rails is important, but likely the fact that the High Line is no longer a source of noise and pollution is a crucial factor. Although the park frames the city and is well designed, there is still a feeling that the High Line is an artificial structure that does not merge with the urban fabric. Using the spaces underneath it, especially the staircases that lead to it, might have helped to better integrate it with its surroundings, as will be shown in the discussion of the Van Horne-Rosemont viaduct.

New York does not lack attractions, yet the High Line is always crowded, and at night when the park is closing the security people of the High Line must chase people out. The High Line is a well-designed project, and a popular public place born from a vision of neighbors. It is a proof that in a dense urban fabric, like that of New York City, even with a large green space, Central Park, there is still a need for green areas.

3.3 The Canadian Pacific Railroad

3.3.1 *Le Réseau Vert*

In the Bellechasse area, along the north side of the Canadian Pacific (CP) railway, a strip of land has been made accessible to the public. This short strip was a part of a wider plan to create a green network for the city of Montreal.[108] In the 1980's Jean Décarie, then a planner for the municipality of Montreal, tried to introduce a green linear network to the city. (Figure 3.19) This strip that follows the CP railway, built in 1876, in the area of Bellechasse is a popular and diverse linear park, but unfortunately it is the only segment that was developed from the master plan. The plan of Décarie was to design a green linear network encircling Mont Royal. The system is based on three hierarchical types:[109]

- *Les ceintures,* circular and narrow strips, mainly following the railway tracks.
- *Les bretelles,* links between the mountain and the *ceintures.*
- *Les boucles,* local-neighborhood passages that will link between the *Bretelles* and the *Ceintures*.

In 1994, when proposing this plan to the city of Montreal, he estimated the cost of developing such a network at $33 million.

As a pilot, Décarie chose to develop a segment of the CP railway linking Montreal to Saint-Jérôme and negotiated with the CP. Finally, in 1993 the 3km segment passing in the Bellechasse area (Figure 3.21) was inaugurated. The CP was highly satisfied, but the

[108] Jean Décarie, "le Réseaut vert".Lecture for urban planning class, UQAM Mai 2014.

[109] Jean Décarie, le Réseau Vert: Système Sympathique de la Ville Postindustrielle, 2002. Sent to the author by email on June 3, 2014.

Figure 3.19: **The master plan of the Réseau Vert (right), introducing the system of the: *Ceintures, Bretelles,* and *Boucles.*** (Source: a PDF file sent to the author on May 2014 by Jean Décarie). **The Réseau Vert 2014 (left).**

Figure 3.20: **The battle for permeability on the railway of the Bellechasse site. On the left. a part of the fence that has been damaged, fixed with reinforcement and damaged again. On the right, the fences are covered with grease in order to prevent passers-by from taking a short cut.**

cost was five times the estimation and elections changed the leadership of the city, which lead to abandoning the next stages of development. Still, this green ribbon is widely used for diverse activities. Although the experiment did not succeed, the popularity of this development is a proof for a need of this urban green network.

3.3.2 The CP Railroad, Analysis- Potentials and Barriers

The railway influences its surroundings, morphology, and urban activity; it has become an island in the city. Looking at the map of the area surrounding the railway, we can see how it geometrically influences the urban grid. The orthogonal rectangular grid changes its shape when arriving to the rails and the surrounding area. In fact most of the streets become a cul-de-sac, which causes a permeability problem**.** But is this not only a geometrical change? Considering the activities along the railway and further into the neighborhoods, we can see how the area is influencing the urban fabric and street activities. Since people are avoiding this area, pedestrian street activities are diminishing. Concerning the buildings next to the railway, it seems that two processes have shaped the built environment. Some industrial activities that benefit from the proximity to the railway have moved to this area. On the other hand, because of the hazards of the trains, many residents have moved away. Accordingly, the area next to the railway is often used for industrial activities, as well as offices and unused open spaces. It has become a no-man's land surrounded by activities that are often on the borders of a city.

In the specific Bellechasse-la Petitie Patrie area, the railway tracks separate two neighborhoods: Mile End and la Petite Patrie. There are only three formal connections between the neighborhoods in this area: Saint-Denis Street, crossing the viaduct (accessed by two staircases), and Saint-Laurent Boulevard. The need for permeability is

prominent. On both sides, the signs of action by the passersby who need to cross the railway are met by the reactions of the authorities who try to stop them. (Figure 3.20) In his lecture,[110] Décarie explains that in one 15 km railway segment, over 25 "pirate" holes were found in the fence. The need for permeability in this area is influenced by several components. First, there is the importance of the Rosemont Métro station as a public transit point. Theoretically, the area south of the railway is within walking distance from the station, but the discomfort of using the viaduct or the tunnel beneath the railway on Saint-Denis makes it perceptually much further. As seen in the Berri-Sherbrooke interchange example, infrastructures, even if physically permeable, can act as barriers in the city. Second, since the fences are a physical border, and the neighborhoods in that area perform as two completely separated entities. Linking them with a comfortable passage would enable a better use of amenities, such as grocery shops, day-care centers, and businesses, thus making them more worthwhile. Last, the linear park that follows the railway tracks in the Bellechasse area is already a functioning linear park. The very popular three km green is widely used, but it is not accessible from both sides and it is short. With an urban approach that promotes a need for a green network, this urban space could become a new backbone for the city, and link the neighborhoods next to it rather then divide the city.

[110] Ibid.

3.3.3 The CP Railroad- Principles for the Design of a Future Green Network

The open spaces along the existing railway tracks can better serve the city's inhabitants. A few basic design principles can transform it into an accessible, useable, and diverse space:

A. Permeability. The railways should offer a reasonable number of crossing opportunities. These crossings should be safe and convenient. Jean Décarie, a retired urbanist of the city of Montreal, who developed the *Réseau Vert*, a plan to use the railways as a green corridor in the city, suggests that pedestrian crossings on the ground level should be built every 500 m so that pedestrians and cyclists would not be further than 250 m from a crossing point. [111] Décarie argues that bridges are expensive to build and are seldom used because of the inconvenience, while underground tunnels that already exist are being closed because of hazards. Décarie points out that ground passages already exist, they are perfectly safe, and have been tested in Montréal.

B. Accessibility. Both sides of the railway tracks should be accessible. Interchanges exist where the railway crosses main streets, but those interchanges are not accessible for pedestrians or cyclists. In areas where it is possible to walk along the railway tracks, often only one corner of the interchange links to the railway park as seen in the junction of Christophe Colomb street and the railway (Figure 3.21). The link to the crossing is not immediate or pedestrian friendly. In addition, in the Bellechasse area, the park is developed on only one side of the railway.

[111] Jean Décarie, "le Réseaut vert". Lecture for urban planning class, UQAM Mai 2014.

C. Adding accessible areas on both sides while linking them with passage ways (as suggests Décarie) will enable the green belt to meet its full potential.

D. The CP railway can link the different green spaces that already exist in the area. (Figure 3.9). The case study of the Van Horne-Rosemont viaduct is an example of a solution to create a link, but simpler solutions can be found as well.

E. Introducing new activities in the network can make the open space friendlier and more attractive:

- Bixi stations should be built along the corridors to make it more accessible.
- Covered stopping points with water fountains and stretching areas would make the space friendlier to users.
- Play areas for Sport activities (sport points as demonstrated in Figure 3.22), placed along the corridor, would make the path more diverse.

F. Placing street-lights along the corridor would make it safe and useable at all times.

The open space along the railway could be transformed into a linear park that would connect the existing green spaces of the area. Developing the connections from the railway tracks to the city, making them more pedestrian and cyclist friendly, along with increasing accessibility and permeability to the park would make the green network more popular, and perhaps transform it into a new backbone for the city. The effect of this linear park can be demonstrated by the Rosemont-Van Horne viaduct.

Figure 3.21: **The interchange of Christopher Colomb Ave. and the railway tracks. The park along the railway is accessible only at one corner, which is car oriented and at a distance from the junction. The single connection to the street is highlighted in yellow. Top left areal image, top right, the way that access the park and bottom Christopher Colomb Ave.** (Source: Google Maps).

Figure 3.22: **A sport point in Park Hayarkon, Tel Aviv. The roof toped sport areas were designed along the main path of the park, attracting visitors day and night.** (Source: The municipality of Tel Aviv).

3.4 The Rosemont-Van Horne Viaduct and La Petite Patrie area

3.4.1 The Rosemont-Van Horne Viaduct, a Brief Historical Perspective of the Neighborhood (Figure 3.27, 1-5)[112]

A. The Beginning of Urbanization and Rise of the Industrial Period[113]

In the year 1875 (Figure 3.27-1), the building of the railway to Saint-Jerome transformed the area from an agricultural area into an industrial one.

From the year 1877 (Figure 3.27-1), the street lines were traced, defining the grid and block that would form the neighborhood.

From the early 20th century (Figure 3.27-2), several industrial and commercial companies were established in the proximity of the railway: the garages of the Montreal Railway Company, which would become the current *Société de transport de Montréal* (STM), Philips Electrical Works (*Les Industries Capitol inc.),* the wooden mill house of Villeneuve, the breweries of Frontenac, and the Coca Cola company.

B. Changing to a New Transportation System and Searching for New Definition[114]

In the 1950s (Figure 3.27-3), the STM garage adapted from trams to buses (Figure 3.27).

In the 1970s (Figure 3.27-3), the viaduct was constructed. Concurrently, the Place de la Mode mega building was built on the corner of Saint-Denis and the railway for the prospering textile industry.

[112] This section is based on the translation of the historical chapter in the PPU Rosemont- La Petite Patrie 2012

[113] Ibid.

[114] Ibid.

In the early 21st century (Figure 3.27-4), the municipality of Montreal designated the area for the future location of University of Montreal hospital complex (CHUM- Centre Hospitalier de l'Université de Montréal). The global economy and the relocation of the local industries resulted in the closure of many textile businesses, including the Place de la Mode which changed its name to Saint-Denis 5800. In 2005 (Figure 3.27-4), industrial sites east to the Rosemont Metro station were evacuated in order to build several mixed dwelling projects and a new public library: Marc Faverau.

3.4.2 The City of Montreal Proposal for Developing the Area- *Le Programme Particulier d'Urbanisme* (PPU)

The PPU (*Le Programme Particulier d'Urbanisme*) addresses the Bellechasse area (Figure 3.23); bordered on the north by Bellechasse, on the west by Saint Laurent, on the south by the Canadian Pacific railway lines, and on the east by Saint-Denis, it forms an approximate 120 SQM of industrial and service areas.

In 2000, the area was assigned as a hospital sight for the UDH (University of Montreal), but in 2008 the municipality started to research a possibility to transform the neighborhood to a mixed used area with a residential character. For that purpose an architecture competition was launched in the fall of 2008, followed by a public participation process.

The designated area is divided by three categories of ownerships (Figure 3.24), with 40% being owned by the STM (*Société de transport de Montréal*, the Montreal public transit society). One of the STM's main garages is located in the area and in the future urban plan, a new modern garage will be developed two blocks to the east. 20% of the area belongs to the city of Montreal, and 40% is owned by three private companies.

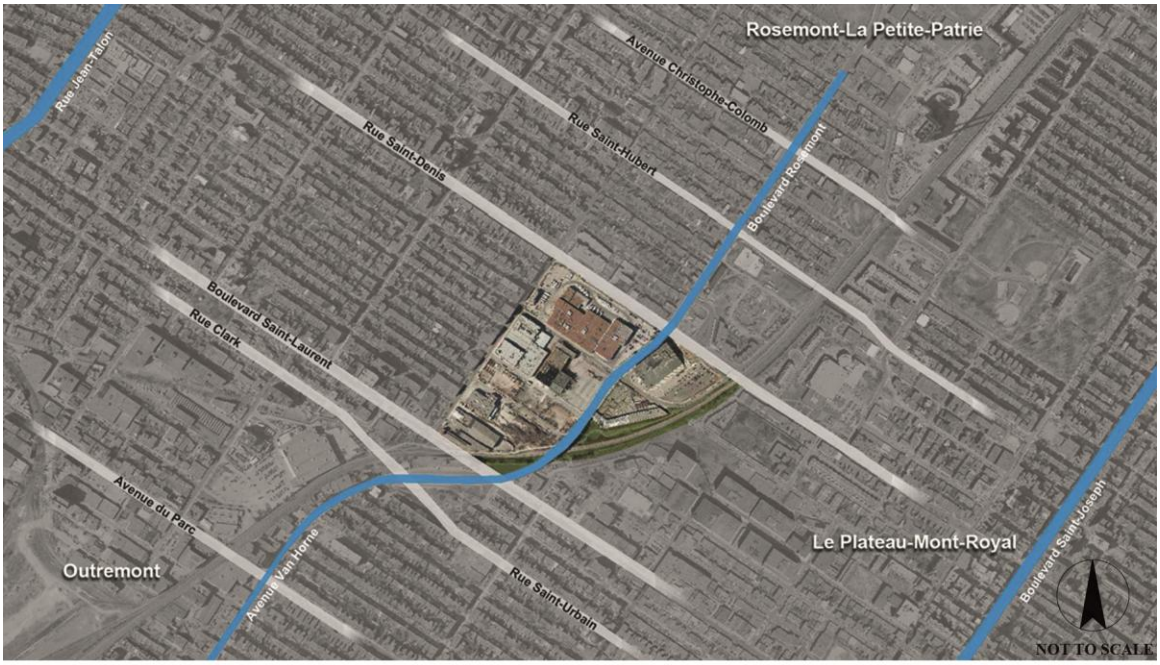


Figure 3.23: **The Bellechasse area (under the responsibility of the Rosemont-La Petite Patrie district). The colored area is addressed by the PPU- the urban plan for the area.** (Source: PPU Rosemont- La Petite Patrie 2012).

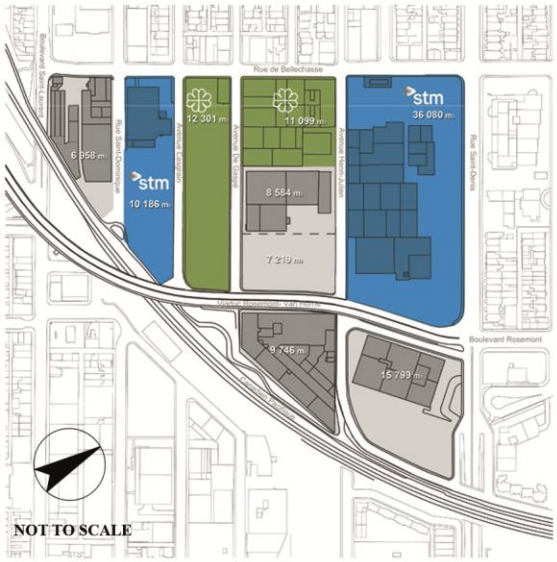


Figure 3.24: **The Rosemont-La Petite Patrie site, ownerships and land uses.** (Source: PPU Rosemont-La Petite Patrie 2012).

Figure 3.25: **The Rosemont-La Petite Patrie site, the future plan.** (Source: PPU Rosemont- La Petite Patrie 2012).

The plan proposes a mixed use residential neighborhood: about 114,000 SQM of residential, 14,000 SQM of commerce, 40,000 SQM of employment, 5,000 SQM of public buildings, 31,000 SQM is designated for the new STM garage, and about 17,000 SQM for green and open spaces.

As seen in Figures 3.25 and 3.26, area A will be composed of dwellings and commerce. Area B will be composed of dwellings, commerce, employment area, and public buildings. Area C will be designated for the new STM garage with commerce at the forefront. Area D will be composed of dwellings, commerce, and employment areas. Area E is primarily for commerce and employment areas, it consists on the Saint-Denis 5800 building (former Place de la Mode). Area F will be used for employment and consist of heritage building, the Capitol Industries building, that was built in 1905 for the Phillips Electrical Cables company.

The PPU proposes to transform the Van-Horne Viaduct, into one of the main attractions in the area. Historically, the viaduct was built as an east-west vehicular road that links between Parc avenue and Saint-Denis street. 675m in length, this infrastructure can become, according to the municipality, a main point of observation in the area, as well as a linear park. Two of the four existing vehicular lanes will be transformed into an urban promenade, linking the Mile End district to Rosemont-la Petite Patrie.

Figure 3.26: **The Rosemont-La Petite Patrie site, diagrams of the future planning by usage. Top left (purple)- employment areas, top right (red)- commercial areas, Down and right (yellow) "collective areas"- the STM garage and public buildings, down and left (blue)- residential.** (Source: PPU Rosemont- La Petite Patrie 2012).

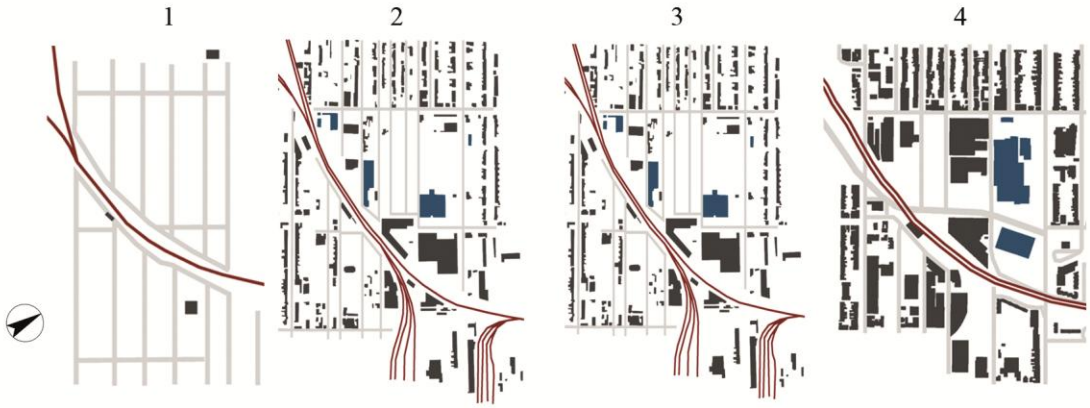


Figure 3.27: **The Rosemont-La Petite Patrie site, (1) 1896, (2) 1914, (3) 1950, (4) 2010.** (Source: PPU Rosemont- La Petite Patrie 2012).

3.5 The Rosemont-Van Horne Viaduct, Design Proposal [115]

3.5.1 The Rosemont-Van Horne Viaduct Analysis: Potentials and Barriers (Figures 328-3.32)

As seen in figure 3.28 the viaduct is a significant landmark in the landscape, but it is only one element in a wider strip that divides the area: the railway tracks and the abandoned areas around these two dominant infrastructures (the railway and the viaduct). Therefore, in order to achieve the full potential of the Bellechasse site, a wider design approach, one that addresses the area as a system should be considered. This approach, does not address the site as part of a specific neighborhood, but considers its role on a larger scale. In this alternative, the Viaduct will play a central role that will link the neighborhoods and offer a functional but pleasant opportunity for pedestrian networks and activities, serving as a circulation of both pedestrians and cars.

The viaduct is currently used for vehicular circulation (Figure 3.29). The presence of this dominant infrastructure causes a physical disturbance both underneath the viaduct and on its edges (Figures 3.4, 3.29 and 3.57). The viaduct is detached from the neighborhood, it is not easily accessible, not comfortable to pedestrians and cyclists (Figure 3.29), and the areas underneath are used for informal activities. Learning from case studies, such as the High Line, the area can become a main attraction for the neighborhood, and link important points in the area, such as the Rosemont Metro station, and the Mile End neighborhood. The viaduct can become a bridge between the two neighborhoods, overcoming the permeability problem caused by the strip around the

[115] The maps and images in this section have all been developed for the McGill research project *Imaginonsbellechasse.com,* by the author. The chapter is based on the author's work in an urban studio (UDH 2013), a research work at McGill (*Imaginonsbellechasse*) and specific work for this report.

Figure 3.28: **View of the Rosemont-Van Horne viaduct and the Bellechase area.** (Source: AppleMap).

Figure 3.29: **The existing condition of the Rosemont-Van Horne viaduct.**

railway. Lastly, if designed accordingly, it can link the future green system along the railway to the city, both physically and visually and become a landmark of the neighborhood.

Becoming a bridge for the main points in the Bellechasse neighborhood and joining the two areas, the proposed linear park along the railway will help the Mile End neighborhood achieve its full potential. Therefore, in this proposal I suggest using the existing qualities of the viaduct as a main pedestrian circulation way and as a place for neighborhood activities.

The Municipality Proposal (the PPU- *Le Programme Particulier d'Urbanisme*)

The PPU is already addressing the viaduct as an important landmark in the area. The municipality has agreed to a process that will change the viaduct into a pedestrian and cyclist circulation path, as well as one for cars. Therefore, in the PPU's proposal, two of the vehicular ways will be transformed into pedestrian and cyclists paths (Figure 3.2).

Based on the analysis in the previous section, these are the key points for the design:

The viaduct has a great potential as an important passageway and as an attraction in itself. As a dominant infrastructure it can attract different activities if well connected to central points in the neighborhood. In order to link the two neighborhoods (Mile End and Bellechasse), it must become accessible from both sides of the railway and easy to navigate. The viaduct can link the main points of the neighborhoods to the future green belt along the railway and make it fully accessible.

As an alternative to the vehicular circulation way the viaduct should be oriented for bicycles and pedestrians. The passage to the bridge and on the bridge should be comfortable and safe to use all year and at different hours of the day and night. In order to

Figure 3.30: **Bellechasse area- existing.**

Figure 3.31: **Proposed master plan for the viaduct. Top-right, in black and white: the existing situation. In this proposition the Viaduct should link the neighborhoods rather then divide it. The viaduct should become a main circulation path for pedestrians and cyclists as it was designed for cars.**

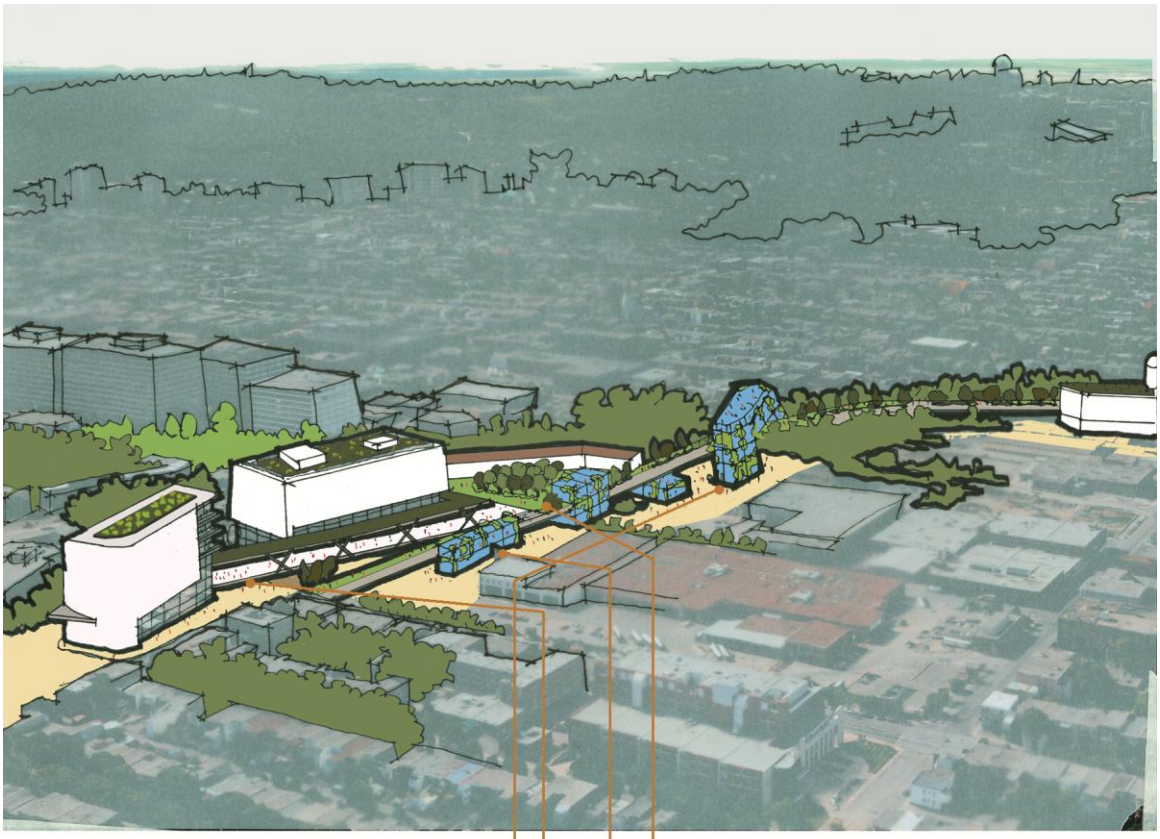
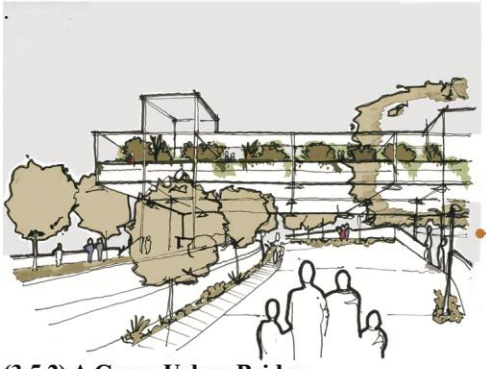


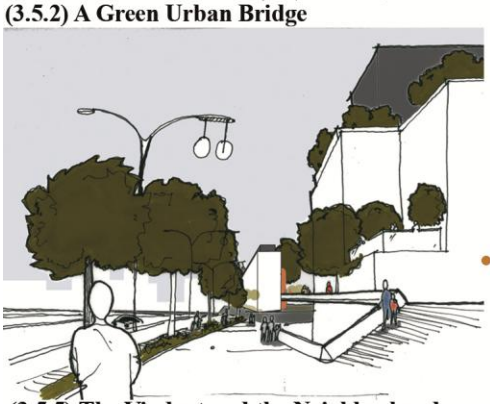
Figure 3.32: **In this proposition it is suggested to use the existing qualities of the viaduct for-**

-the neighborhood: both as a main pedestrian circulation way and as a place for activities.



(3.5.2) A Green Urban Bridge

(3.5.3) Links to the Existing Fabric



(3.5.5) The Viaduct and the Neighborhood

(3.5.4) Life Under the Viaduct

achieve its full potential, both sides of the viaduct should be accessible. In this way, it can also become a lookout point over the neighborhoods. The areas underneath the infrastructure should become safe and comfortable, and include diverse activities. Linking both sides of the viaduct and the neighborhoods can make the linear park along the railway accessible to all. The proposed master plan for the viaduct (Figures 3.30 and 3.31) as well as the images (Figure 3.32) demonstrate the different parts of the design proposition.

3.5.2 A Green Urban Bridge—a Link between the Two Neighborhoods (Figures 3.33-3.8)

Analysis

In its current form, the viaduct has only two staircases that connect the Mile End and the Bellechasse neighborhoods (Figure 3.36). These staircases lead up to a busy vehicular way with only one side of the road having a paved sidewalk for pedestrian use (Figure 3.29). The viaduct poses an opportunity to solve the permeability problem between the Bellechasse and Mile End neighborhoods. This design proposes to use the existing infrastructure of the viaduct for much improved pedestrian access and connections between the two neighborhoods, as well as other uses for the benefit of the community, such as urban agriculture.

Design Respond:

This design is a reaction to the two main problems caused by the strip: accessibility and permeability. The proposed bridge will be partly covered for pedestrian crossing, which will protect against rain and snow. It will be accessible from both sides of the railway by stairs and elevators (Figures 3.33-.35). The elevator towers will serve as

Figure 3.33: **The proposed location for the bridge.**

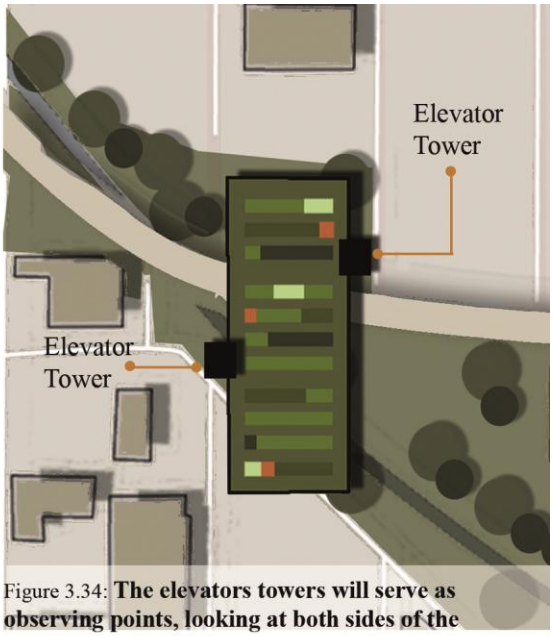


Figure 3.34: **The elevators towers will serve as observing points, looking at both sides of the neighborhood, which now can only be seen from one side of the viaduct.**

Figure 3.35: **The proposed bridge will be partly covered for pedestrian crossing, and therefore protected from summer sun or winter rain. It will be accessible from both side of the railway by stairs and elevators.**

Figure 3.36: **One of the two staircases.**

Figure 3.37: **Existing. In this proposition it is suggested to use the existing qualities of the viaduct for the neighborhood: both as a main pedestrian circulation way and as a place for activities.**

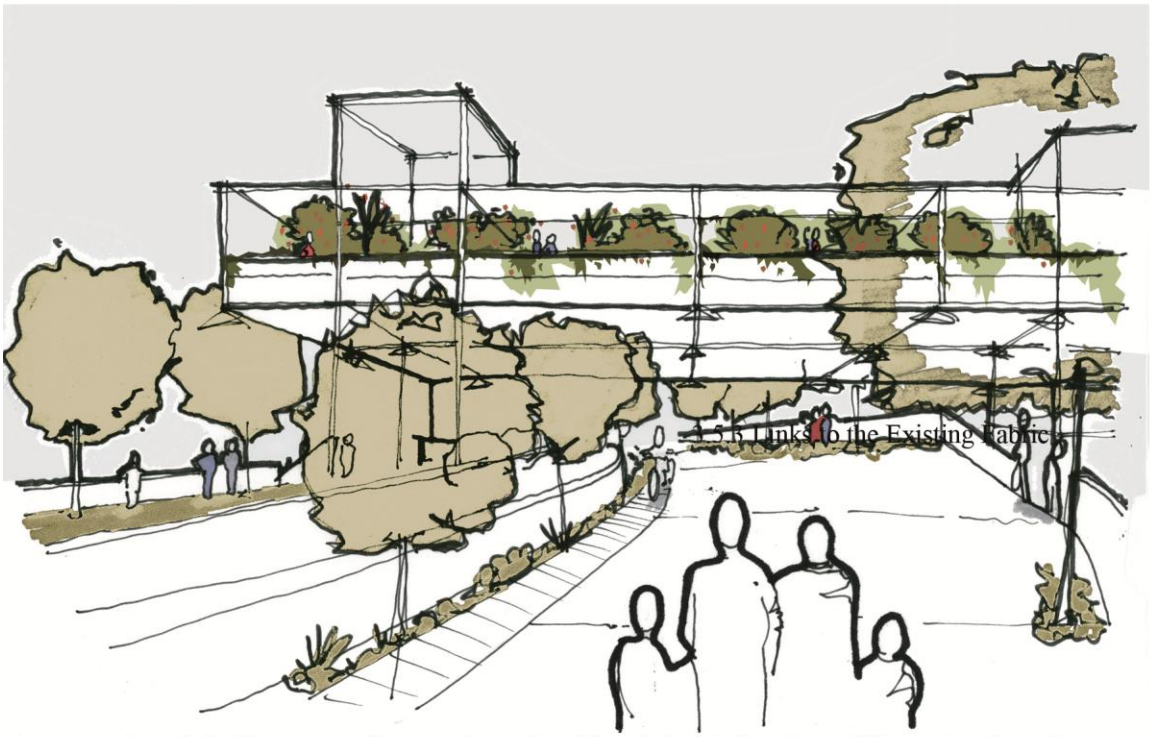


Figure 3.38: **A newly built passage will connect one side of the viaduct to the other, while passing above the existing roads. This structure can serve as an observation point for the walkers. At the same time, it will also increase available space for urban agriculture use. The light structure made of recycled materials will serve as an urban agriculture platform, serving the residents of the area.**

observation points, looking over both sides of the neighborhood, which now can only be seen from one side of the viaduct. This design will allow local residents to appropriate a space over the viaduct and the Canadian Pacific railway for the purpose or better linking the Mile End and la Petite-Patrie neighborhoods, as well as providing public space for community initiatives, such as urban agriculture.

The newly built passage will connect one side of the viaduct to the other, while passing above the existing roads. This structure can serve as an observation point for the walkers. The light structure made of recycled materials will serve as an urban agriculture platform, serving the residents of the area (Figure 3.37-3.38).

3.5.3 Links to the Existing Fabric-- Reusing Existing Roofs (Figures 3.39-3.44)

Analysis

Currently, there are a number of old factories and buildings near the viaduct. When one is standing on the viaduct sidewalk near the factory, some of the roofs are almost within pedestrian reach. In fact, as can be seen in figure 3.42, in some places this has been enough of a safety concern that an artificial barrier is needed to ensure that no passersby will cross from the viaduct to the roof. Some of the existing roofs are flat and have potential for wider community use. As proposed in the design, a small adaption can transform some of the roofs into an accessible public area to be used for community activities.

The Design Proposal:

This proposal suggests transforming some of the existing roofs into urban agriculture areas and making them accessible to all. In some cases some adjustments and engineered reinforcement will have to be made, including new stairways to connect the

Figure 3.39: **Existing plan, and location.**

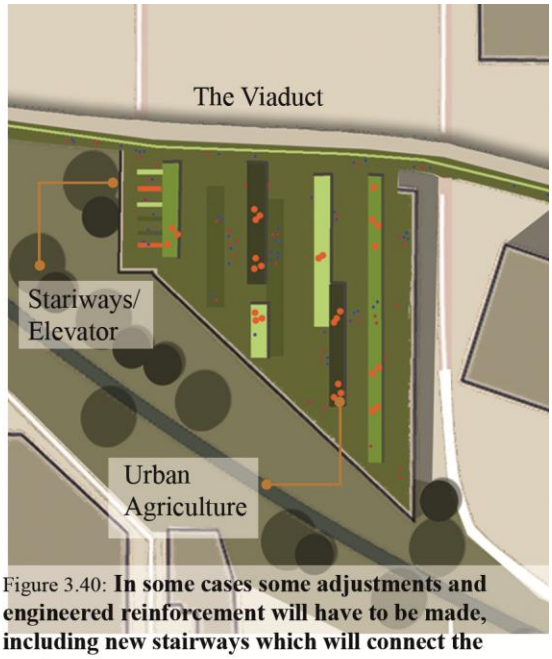


Figure 3.40: **In some cases some adjustments and engineered reinforcement will have to be made, including new stairways which will connect the roofs to the streets.**

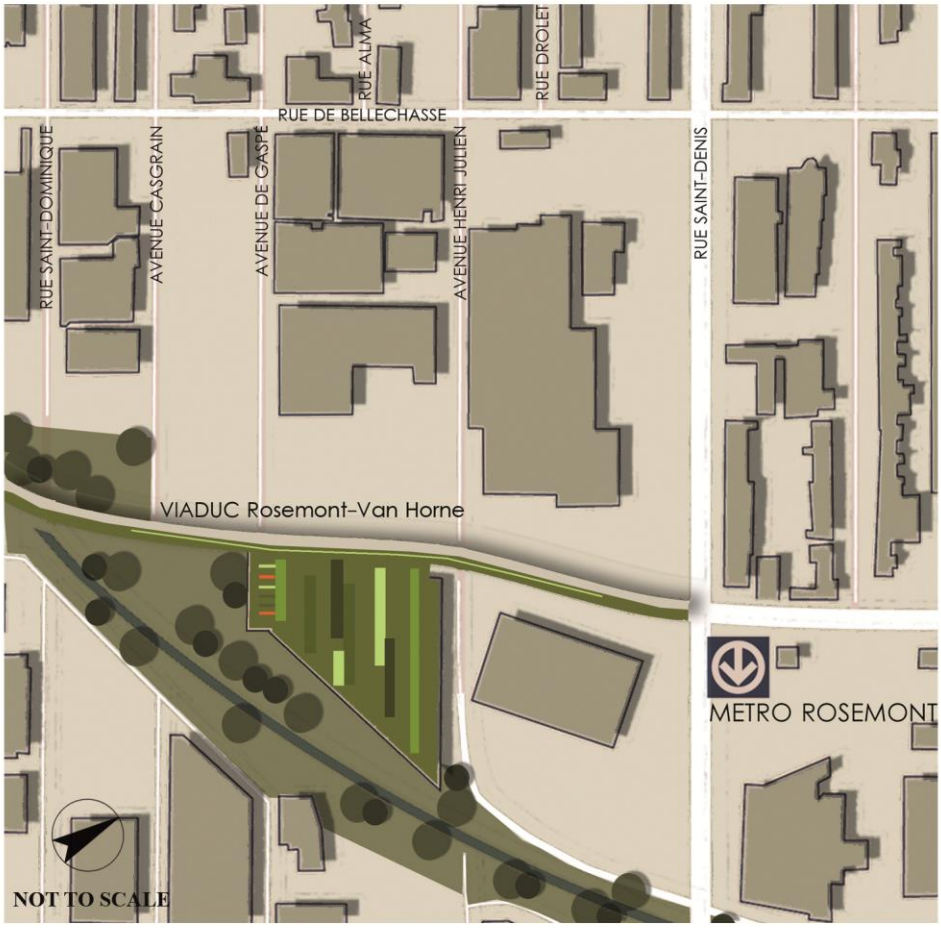


Figure 3.41: **The proposed promenade of the PPU is linked to the roof of the existing building, which is transformed into a public area of urban agriculture.**

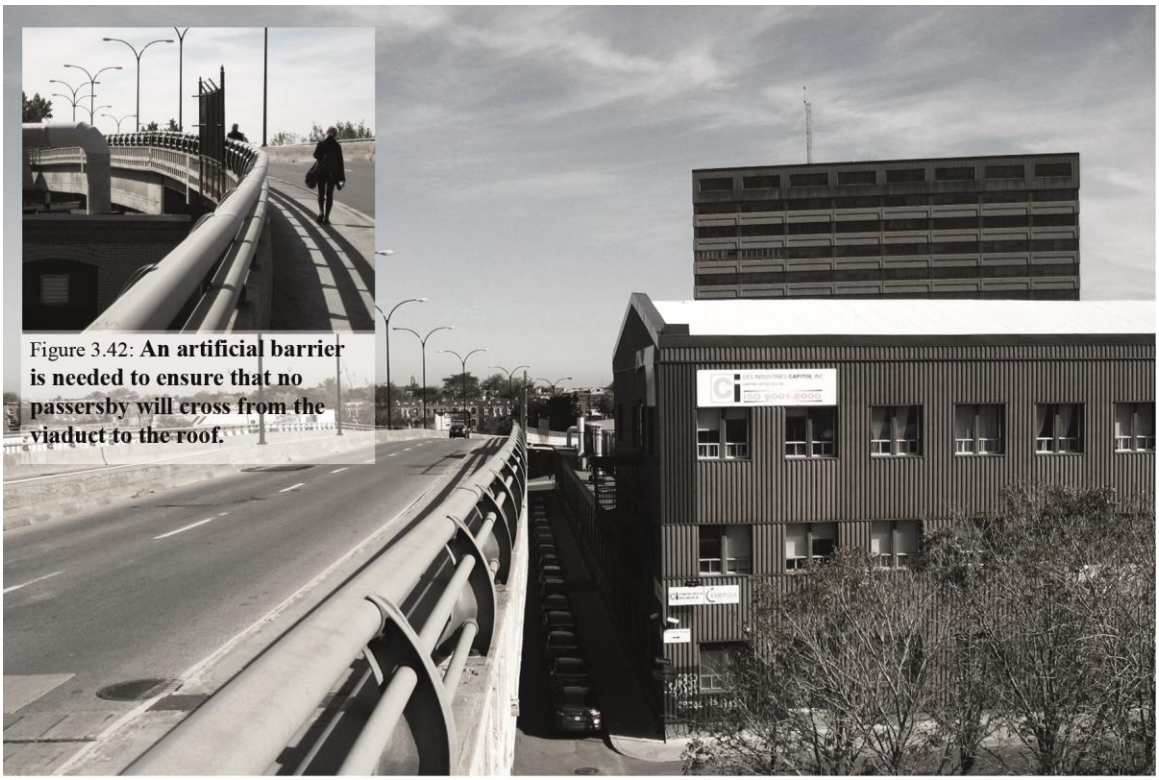


Figure 3.42: **An artificial barrier is needed to ensure that no passersby will cross from the viaduct to the roof.**

Figure 3.43: **The picture was taken from the viaduct looking at the factory south of Saint Denis 5800. On the right is the existing factory. Behind the factory is the office building of Saint Denis 5800 which is next to the Metro station of Rosemont.**

Figure 3.44: **This proposal suggest to transform some of the existing roofs into urban agriculture areas and make them accessible to all. The PPU (Montreal's urban plan proposal) already suggests transforming a part of the viaduct into a pedestrian promenade. In this specific location, it is suggested to link the roof of the existing factory to the viaduct.**

roofs to the streets (Figure 3.39-3.41). The PPU (Montreal's urban plan proposal) already suggests transforming a part of the viaduct into a pedestrian promenade. In this specific location, it is suggested to link the roof of the existing factory to the viaduct and therefore enlarge the pedestrian and cycling area. This design provides the neighborhood with greater amounts of public space and expands public green space onto existing rooftops (Figures 3.43 and 3.44). Mainly,reusing urban spaces for community activities will help the neighborhood to "embrace" the viaduct and its surroundings.

3.5.4 Life Under the Viaduct (Figures 3.45-3.53)

Analysis:

Areas underneath elevated structures are often abandoned and potentially discomforting, especially at night (Figures 3.48 and 3.51). The space underneath the viaduct has a lot of potential: it is already roof-covered, and it is centrally located. The future development offers commercial areas on both sides and the transformation of the neighborhood into a mixed use environment. Today, the areas underneath the viaduct are already used for informal activities. Preserving the character of the existing area, while making it a safer place may preserve some of the diverse activities (Figures 3.45-3.47).

The Design principles:

The new light-weight structure (such as containers) will use the viaduct as a potential rather than a barrier and will enable different activities, seasonal and permanent: a seasonal cafe, sports areas, meeting places for the neighborhood, a weekend garage sale, etc. Since it is a modular, light structure - it can be used on more than one level, wrapping around the viaduct (Figures 3.49-3.53).

Figure 3.45: **Location.**

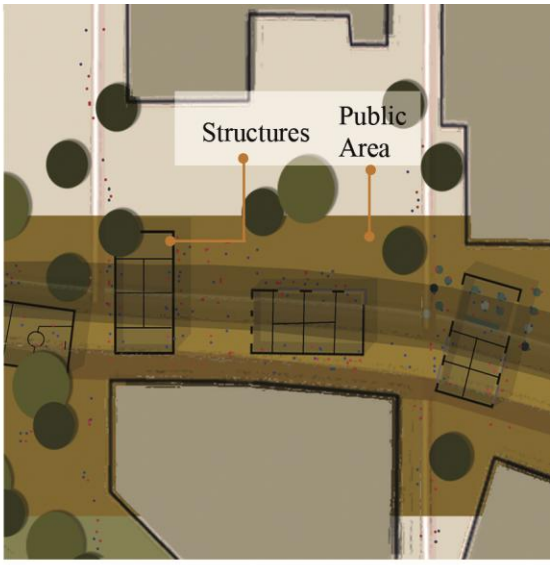


Figure 3.46: **Using the existing viaduct, the reused light structures can serve for different activities- a seasonal cafe, sport areas, meeting places for the neighborhood, a weekend garage sale etc.**

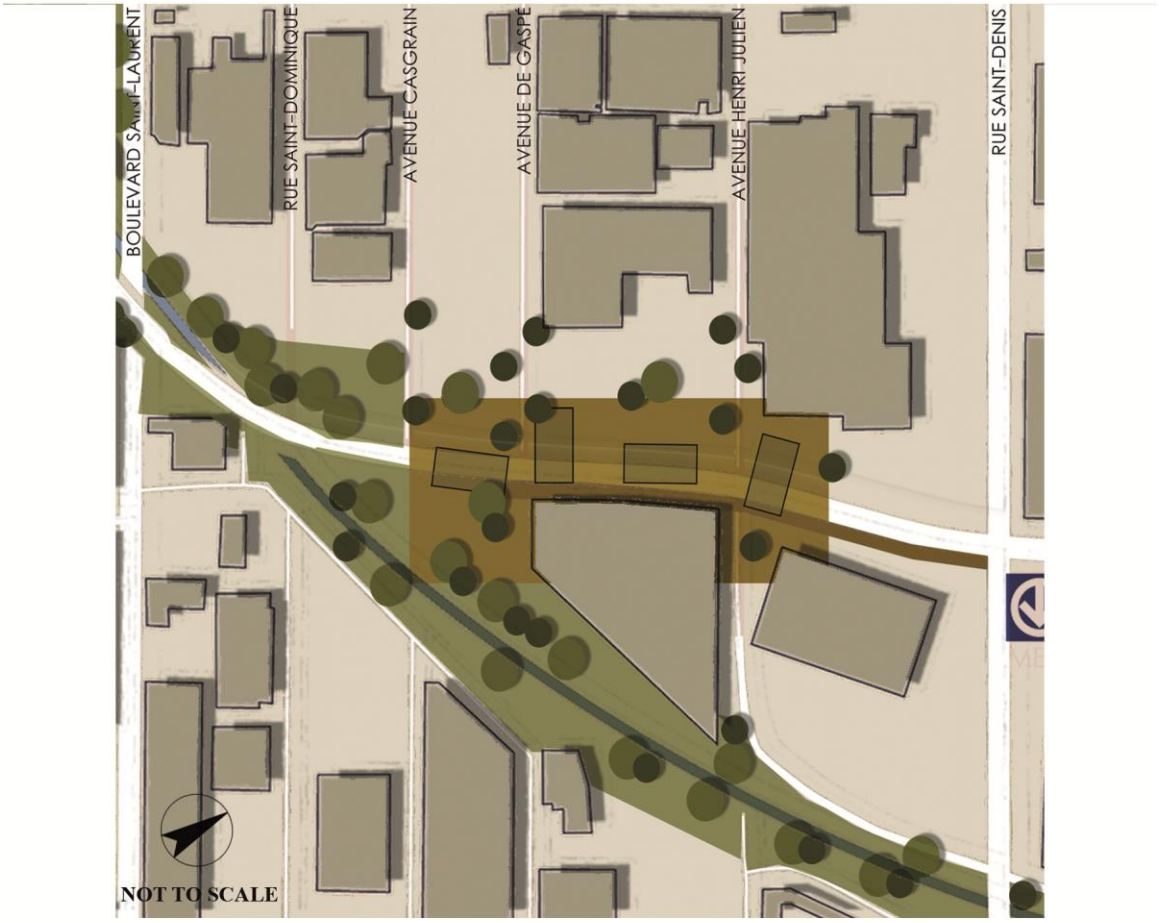


Figure 3.47: **The plan of the proposal: central located and already enjoying a protected environment, the area underneath the viaduct as an opportunity to design a friendly community oriented space.**

Figure 3.48: **Areas underneath the Viaduct.**

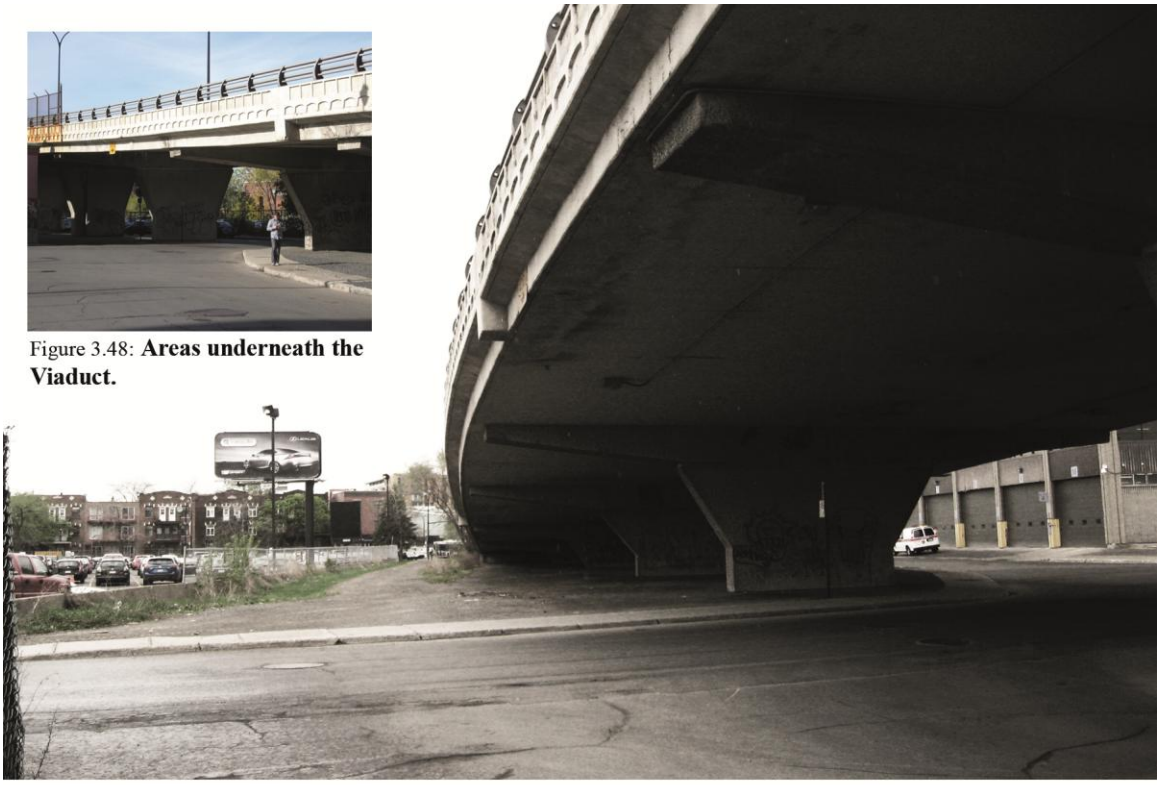


Figure 3.49: **Areas underneath elevated structures are often related to abandoned places and uncomfortable feelings, especially at night hours.**

Figure 3.50: **The space underneath the viaduct can be used for diverse community activities: temporary market, seasonal cafe, sport areas, informal skate park.**

Figure 3.51: **Informal activities underneath the Viaduct.**

Figure 3.52: **The area underneath the viaduct attracts informal activities, the lack of by passers along with the dark and neglected area might produce uncomfortable areas.**

Figure 3.53: **The covered spaces, especially in a place isolated from a dwelling neighborhood, can serve as a place for diverse activities. The area should be light during all time to produce formal areas for the activities- such as basketball courts or a skating area.**

3.5.5 The Viaduct and the Neighborhood (Figures 3.4-3.59)

Analysis:

As proposed by the PPU, in the future, the viaduct will become a main recreation and circulation path of the neighborhoods. Already, there are plans to expand the Métro station as a higher building. Unfortunately, the main link between the viaduct and the neighborhood is the busy junction of Saint-Denis and Rosemont. The crossing of the junction is intimidating and sometimes dangerous (Figure 3.57). the current design of the border of the viaduct does not consider the number of pedestrians who will use it in the future from both sides of Saint-Denis

The Design Proposal:

This design links the future expansion of the Métro station to the viaduct by a direct bridge, without passing through the junction underneath (Figures 3.54-3.56). The new bridge will be accessible through two circulation towers with staircases and elevators for people with special needs. It will be comfortable, safe, and offer a direct link to the eastern part of the neighborhood, including the new public library and the residential areas next to it (Figures 3.58 and 3.59).

Figure 3.54: **The busy junction of Saint Denis and Rosemont detaches the viaduct from the Metro station and the neighborhood.**

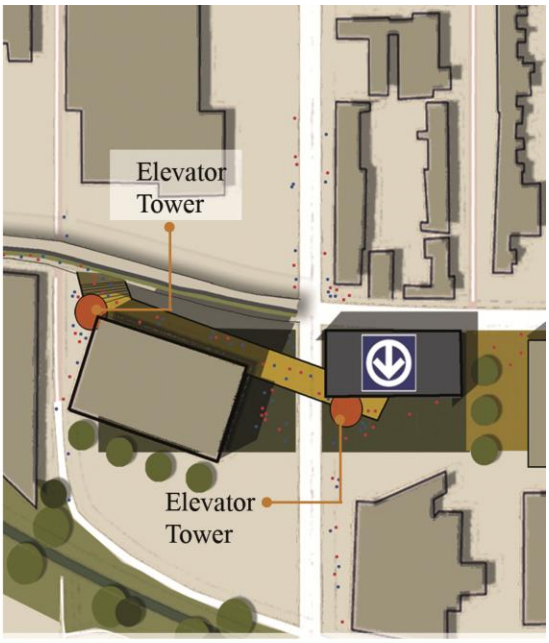


Figure 3.55: **The new bridge will make the passage safer and more convenient. Two towers of staircases and elevators will access the bridge for all pedestrians and cyclists.**

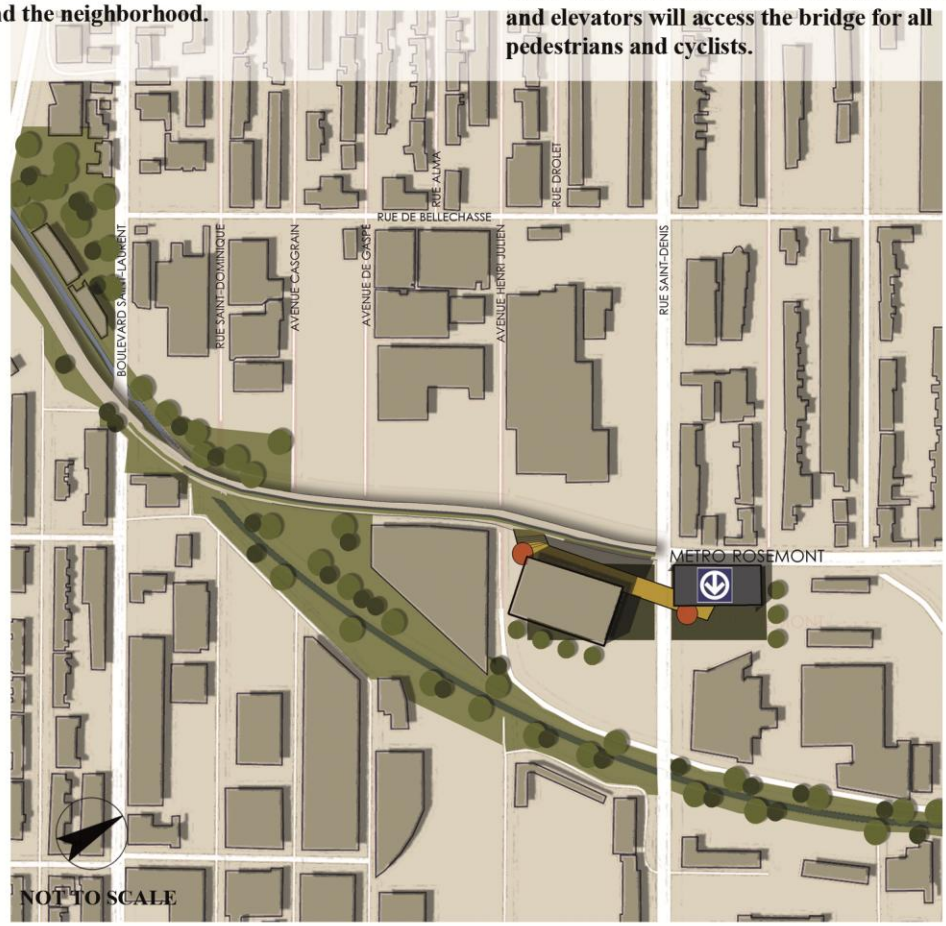


Figure 3.56: **The bridge will link directly the Viaduct and the Metro station.**

Figure 3.57: **View of the junction of Saint Denis and Rosemont.**

Figure 3.58: **Existing view of the area. The sidewalk along the viaduct descends towards the busy intersection.**

Figure 3.59: **The proposition: in the future the viaduct will take a central role for pedestrians. This design links the Viaduct directly to the future expansion of Rosemont Metro station.**

3.6 Conclusions

Infrastructures in the city can have a significant effect on their surroundings, both physically and perceptually. In fact in some cases, as demonstrated in this chapter, infrastructures are barriers in the city: the CP railway and the Rosemont-Van Horne viaduct are no exception. When considering the future of those infrastructures, we should decide if those dominant structures can meet their full potential for other purposes as they did for their original purpose. Can the Rosemont-Van Horne viaduct link the pedestrian and bicycle circulation as it enabled cars to pass quickly through the city? And when reusing it, how can this infrastructure contribute to the forming of a new public space? In some precedents, like the High Line in New York and the Promenade Plantée in Paris, such infrastructures can become an attraction and not only a means of circulation.

In his article "Beautiful Infrastructures", Morrish suggests a different terminology in order to upgrade the planning of the existing and newly planned infrastructures: Rooms, corridors, networks and landmarks will enrich the sense of place. Should this notion refer to existing infrastructures only or should it encourage us to build new ones? Should we just green them? With a strong headline, such as "Beautiful Infrastructures", it might be possible that in time and with changes of context, we might be left with a simple catchy equation: infrastructure=beautiful? The questions should be: do we really need new infrastructures? Should we build more or try to recycle the existing ones? As demonstrated here, these dominant structures have a significant influence on the urban structure, one that in many cases cannot be predicted, therefore greening the bridge will not solve all the problems caused by it.

In the *Réseau vert*, Jean Décarie demonstrates that the idea of introducing a green circulation is not a new one. In the early 1980s it was already an expressed need for the citizens of Montreal. The short linear park in Bellechasse is widely used and serves a variety of diverse activities. Perhaps, as parks become more popular, and cycling and physical activities become basic urban needs, decision makers should rethink policy. Already in the PPU for Bellechasse, the municipality acknowledges the importance of the green belt, and are ready to take this design a step further by transforming half of the viaduct from a vehicular way to an active transportation way. The Rosemont-Van Horne, if well-designed, can transform this neighborhood into a better environment where pedestrians have priority and enjoy public spaces.

CHAPTER 4 - Conclusions

4.1 Introduction

The customary forecast assumes that the world is becoming more urban.[116] It is not the first time that an urbanization process has happened. As demonstrated in the second chapter of this report fast and radical urban changes may affect the social and landscape environment, causing new conditions—in some cases the creation of urban ideologies are linked to social ones that intended to make a better living environment for workers, such as the theories of Howard, or design processes, such as those of Olmsted. In order to provide a future healthy, safe, and useable urban environment, those historical processes should serve as precedents and lead to appropriate design strategies.

It is almost certain that in the future cities will have to change. In the first chapter of this report some researchers who claim that a radical change is inevitable are cited. In the current environmental situation, it is probable that they will have to be more sustainable. One important aspect of sustainability is improving the urban circulation system. Since cities will become more popular and dense, they will concentrate on diverse leisure and functional activities. Therefore, the users will need a diversity of open spaces. Green spaces are already an important part of the public spaces in the city, but it is assumed that they will become a more popular aspect of the urban landscape. As demonstrated in this report, green spaces have a layered importance; nature is not only a functional space but also a perceptual and symbolic one. Since most of the population will live in cities and the accessibility of diverse green spaces will become a need

[116] World Urbanization Prospects. United Nations, Department of Economics and Social Affairs.

(Figure 4.1), healthy cities will have to offer accessibility to a diversity of green spaces. This accessibility can be obtained only by an infrastructure of diverse open spaces.

To design a system of green open spaces, we can start from scratch, which is almost an impossible task in an existing urban environment, or look for an existing system that is becoming redundant. This report argues that this system can be found as a part of the inner-city transportation system. Since the transportation system inside the cities will change, with the future alternative transportation systems, as has been demonstrated in the third chapter of this report, we can assume that some space will become vacant and can be used as basis for the new green space circulation system.

In order to achieve a consecutive network of open spaces, based on the reuse of some parts of the existing transportation system, a hierarchical design should be considered. As shown in the case study of the Van Horne-Rosemont viaduct in the Bellechasse area, some parts of this infrastructure can be deployed for public usage and will link from the central parts of the neighborhood to the larger green system, in this case a future green belt along the Canadian Pacific railroad (Figure 4.2). Although in some places, the process of transforming parts of cities into pedestrian spaces has already begun, the process will still be long. This chapter proposed recommendations based on the literature analysis and the case study in order to achieve a functional system and to avoid past mistakes.

4.2 Recommendations

As demonstrated in the case study of the Van Horne-Rosemont viaduct, the design of the infrastructure is not the only parameter that should be considered. The effect of a dominant infrastructure can be like a stone thrown into the water that causes concentric waves. The infrastructure becomes a barrier, influencing the immediate areas underneath it and next to it, but also more extensive areas—physical influences such as street activities, the street grid, or the usage of the buildings in the surrounding area. Recovering problematic areas is a long and well-planned process. Therefore, in this section, the recommendations are divided to three groups: the process, the design, and the usage.

4.2.3 The Process

4.2.3.1 Tear it Down!

The first immediate design dilemma will be to consider the future of the infrastructure. Should we simply tear it down, as suggested by Norquist, the former mayor of Milwaukee in his article,[117] and as has been done in precedents, such as the Embarcadero in California and the Pins-Parc interchange in Montreal? Or, should we reuse the existing structure for future development of the urban spaces, as a new layer in the city, as has been done in the Promenade Plantée and the Pompidou Highway in Paris and the High Line in New York? There is no direct answer. The economic factor is important, as is the physical state of the structure. But mainly, an appropriate process should be created, one which can balance the need of constant change and updated ideas

[117] John O. Norquist *"Tear it Down!"*

with an in depth, responsible approach based on historical research and an analysis of existing case studies.

4.2.3.2 Time Process

While an immediate intervention may make a difference in a problematic area, professionals should be aware of the effect of radical changes on the day-to-day life of the users. The time process is important at two main levels: the first is to enable the users and dwellers time to react and acknowledge the changes. As demonstrated in the Copenhagen example, the decision to remove cars from the city center is not taken in one step, but in several—each year five percent of the parking spots are removed. In the Pompidou highway example, the municipality temporarily closed the section each year, allowing the public to adapt to the drastic change. The second level is to allow a period to examine the effects of the decisions, permitting changes and adaptations to the new ideas.

4.2.3.3 Achieving a Wide Range of Consent

As seen in the Réseau Vert case, one of the main successes of Décarie was the ability to achieve a win- win situation between the CP, the municipality and the users of the area. When examining examples like the Embarcadero, the High Line, the Parc-Pins, it is evident that the public played a crucial role in supporting the decision makers. Achieving a wide range of consent will not only back up the public representatives, it will also prevent unnecessary objections from angry owners, and allow future users to share in the decisions. One of the main points of success of the High Line case study was the communication between a wide range of sectors—politicians, city clerks, neighbors, and the wider public. Listening to the public needs will allow an understanding of the timing, which as can be seen in the Réseau Vert and Embarcadero cases was crucial.

4.2.3.4 The city context

The green network should not only function as a large green space in the city; its success lies in its ability to link important urban points. The Promenade Plantée, for example, is a well-designed popular green space in Paris. On weekends it is full of people jogging or walking in this charming linear park. Although it starts near the Place de la Bastille, a main square in Paris, it is not an important circulation path in the city since it is not linked to other urban attractions or Métro stations. Analyzing the circulation habits and linking the network to important activities would be crucial for greater success.

4.2.4 The Design

4.2.4.1 The Importance of a Well-designed Green Space

One of the main attractions of the High Line in New York and the Promenade Plantée in Paris is the quality of the design. The "special moments" on the High Line along with the well-designed landscape make it more than just another green space in the city. A balance between diverse open spaces is important, ranging from intensive to extensive, but the quality of the design of the intensive spaces is a crucial factor. When the city grows and the number of green spaces is limited, sometimes it is possible to compensate for the lack of quantity with the quality of the spaces. Therefore, the popularity of this new system relies not only on its functionality, but also on the quality of the design.

4.2.4.2 Links to the Urban Fabric

The intention of the previous section is not to say that any well-designed infrastructure is a contribution to the urban spaces since it does not stand alone, but depends on the urban context and the links that will be achieved to the surrounding areas.

As mentioned previously, in his article "Beautiful infrastructures" Morrish[118] suggests upgrading the planning of the existing and new infrastructures. This report argues that the design is an important factor, but design by itself is not enough for the function of the city, especially in an existing urban fabric, and the future of the area depends on the ability to link the new design to the neighbourhoods and to important points of activity.

4.2.4.3 A Functional Space

Replacing the existing infrastructure with greenery or intensive greening is not enough. The case study of the Pins-Parc interchange in Montreal is a good example of an important process that has started, but has not yet finished. The vast green areas around the demolished interchange are not used. Although this is a much better solution than the vast interchange that existed in this junction, crossing this area as a pedestrian or a cyclist is still not an agreeable experience. In order to achieve their full potential, those areas should be designed for activities, become friendly for passersby and offer shelter from the sun in the summer and from the rain and snow in the winter.

4.2.4.4 Making a Precedent

The importance of the success of the Pins-Parc interchange is not only local. but also has a precedent-making importance. When a new opportunity to transform an interchange into a public space will occur, previous case studies will be used to demonstrate the consequences of such actions and will influence the future projects. The positive influence of successful projects, such as the High Line in New York and the Promenade Plantée in Paris, is important for future projects as well.

[118] William Morrish. "Beautiful infrastructure."

4.2.4.5 Spaces Underneath the Infrastructures

The spaces underneath the infrastructures can influence the success or the failure of such projects. Those spaces have potential as public urban spaces—they are already covered, proximate to the upgraded infrastructure (Figure 4.3), and if well used, they can be linked to the upstairs bridge and can support activities. Unfortunately, in many places those areas are often unsafe and abandoned areas (Figure 4.4). The viaduct Daumesnil that is presented here is one of the examples of using those areas.

4.2.4.6 A Place for the Users

The success of new networks relies on the popularity that it will achieve. If dwellers or passersby will not use it, either as a circulation way or as an activity place, the impact of this system will diminish. Designers should achieve a network that people will enjoy using: it should be safe day and night, consecutive, diverse, easy to reach, easy to use, easy to orient, and include supporting amenities (water fountains and sport areas).

4.2.4.7 Safety

As demonstrated by Jane Jacobs, safety is an important issue in public spaces and specifically in green spaces. It is not in the scope of this report to offer design principles for safe green spaces, but it is crucial for the new network to be safe. Safety should not be compromised. Safety can be achieved by the popularity of the spaces, but also through artificial means, such as lighting, emergency systems, and supervision. The High Line for example has a special security team. Designing approaches can also improve the safety of the users. Linear design that enables eye contact through the park and from the city to the park is one option.

4.2.4.8 A Variety of spaces

Learning from the fourth definition of green spaces made by Jouni Häkli mentioned in the second chapter of this report,[119] and from the Champs des Possibles example in the case study of the Van Horne-Rosemont, variety is important, not only a variety of vegetation, shading, or landscape greenery, but also a variety of spaces—extensive and intensive. Referring to Professor Saskia Sassen's (Columbia University) definition[120] that the city is a complex and incomplete structure, a system of green open spaces should allow different uses of spaces (Figure 4.5). Since in the future the urban population will be less exposed to wild or uncultivated areas, some parts of the city should allow this variety.

4.2.4.9 A Variety of Spaces—Linear and Depth

Variety can also be obtained by design methods. Keeping a majority of linear spaces, in which the user can perceive both sides of the park and always be in contact with other people is an important safety factor. With a narrow and long green space, the efficiency of the size of the green space network is maximized, but a good system is a balanced system (one that enables different activities) and those can be achieved only with a variety of geometrical spaces. As demonstrated in the second chapter, nature has a layered significance and is often related to freedom. Some activities need privacy—a sense of "getting lost", and therefore a balance between linear space and wider ones is

[119] Häkli Jouni. Culture and Politics of Nature in the City: The Case of Berlin's "GreenWedge", Capitalism Nature Socialism, 7:2, 125-138. (1996)

[120] CRIEM symposium- creative cities, October 19, 2013

Figure 4.1: **Bellechasse, Montreal. A need for diverse open spaces.**

Figure 4.2: **The Canadian Pacific railroad as a potential for a green network.**

Figure 4.3: **Underneath the Rosemont-Van Horne viaduct, today an uncomfortable space but a potential for diverse activities.**

Figure 4.4: **The Isemarkt, Hamburg, Germany. Using the potential of the infrastructure for a market place.** (Photo: Avi Friedman)

Figure 4.5: **Different uses of spaces on the boulevards of Tel Aviv, Israel. Delegates of the Israeli Architects A ssociation are introducing an exposition during the civil demonstrations in 2013, as a demonstration for an alternative residential policy.**

crucial. A sense of expansion, geometrical depth, and scope is important in order to maintain these perceptions.

4.2.4.10 A Variety of Spaces- Links to the City

The system should not only link important points in the city as demonstrated in 1.2.3.3**,** but also allow different links to the city. It should not be hidden behind a block of buildings, separated from the main streets, or stand alone, but in some places be directly linked to busy streets and neighborhood activities. These links will not only make the green network more accessible, but will introduce a variety of spaces and activities to enrich the urban public space.

4.2.4.11 Climatic Design—Listening to the Users

Designing cities for citizen use is an important aspect of overall planning, but even taking into account human scale, paying attention to detail, considering privacy needs, or enabling comfortable physical environments, is not enough for functional place making. A public square near King and York streets in Toronto demonstrates how a well designed environment can fail to function because of a lack of climate consideration in a dense urban grid. It is a human scaled break, made for people in the high-rise environment of the downtown. It is differentiated from the busy street by a raised area accessed by stairs. Similarly, bushes and trees enable a different atmosphere from the dense built downtown and benches with tables were designed for the workers' lunch breaks. However, as can be seen in the image (Figure 4.6) taken at lunch hour, few persons use this area. In fact, most of the activity takes place a few meters west in the less designed, more overtly urban area of the street. Many reasons can explain this design anomaly, but one is very obvious when looking at the sun strips on the ground. While the

designed square lies in the shadow of the high-rises, the busy spot is just in front of a break in the urban grid that allows sunlight to filter through. When leaving the climate controlled area of the high-tech building, an environment where having a direct contact with the outside environment is impossible (in most of the high-rise it is impossible to open a window), people seek a natural-comfortable environment, in this case, natural sunlight. Climate passive design is relative to the geographic location and season. In the photo taken in Taxim pedestrian street in Istanbul, Turkey (Figure 4.7) on a warm April day, despite the wide street there is a concentration of people in the south-east shady side, while the sunny part is almost vacant. Photos taken in Aksum in the north part of Ethiopia (Figure 4.8) demonstrate the importance of shadow areas near houses to create public activities, and even animals will make this intuitive decision (figure 4.9).

4.2.4.12 Climatic Design—Winter Cities

Allowing direct links between the new green space networks and the city should be made carefully and in a reasonable amount of spaces, especially in a city with as harsh a climate as Montreal. In winter, open spaces in the urban fabric have a significant influence on the pedestrian and cyclist circulation, and sometimes they are avoided. The links between the new network and the busy part of town should be carefully designed not to cause stops in the urban fabric.

Downtown Toronto, sunlight in the pedestrian area is scarce.

The designed public square near King and York streets in Toronto is empty.

Figure 4.6: **A public square near King and York streets in Toronto. Most of the activity takes place in the sunny part.**

Figure 4.7: **Taxim, Istanbul. The importance of shaded areas are dmonstrated by the people's choice of walking path.**

4.2.5 The Usage

4.2.5.1 The Network as a Place of Activities

As mentioned in the previous sections, the network should become an important part of circulation in the city, but it can also be a place to visit. Vegetated, peaceful, and separated, it can attract visitors looking for an escape from the city. However, it can also be a place for urban activities, festivals, or temporary markets as shown in the design case study of the Van Horne-Rosemont viaduct. If used by a wide range of population, it will be appropriated by the neighbors who will take care of it and make it part of their routine. Introducing areas for urban agriculture, sports activities, or even cafés, will make the network a part of the neighborhood.

4.2.5.2 Informal Activities—A Place for All

A variety of activities will be achieved by an appropriate design, but also with an appropriate tolerance of usages. Allowing different activities in the extensive areas will enable a richer connection to nature. Making a small fire, having a small party, or even spending the night outside are activities that strengthen the informal connection with nature.

4.3 Summary

In this report the main research question is:

How can existing road networks turn into public open space as a system in sustainable cities?

The sub-questions were: *What is the place of a system of public open space in the city?* and *how did cities turn mobility networks to walkable open spaces?*

In order to study those questions, a theoretical framework was introduced in the second chapter, examining the four aspects that can lead to answers to those questions: urban sustainability, open space as network, transportation and circulation, and reusing infrastructures. According to the theoretical framework that was introduced in the third chapter, two infrastructures, the CP railway and the Rosemont-Van Horne viaduct, were chosen to demonstrate the implications of the theoretical background and to change the existing infrastructures into a part of a green urban network.

In summary, it is important to reexamine the wider frame of this report—the place of the green network in the future sustainable city. Again, the approach will challenge two popular definitions of sustainability. As shown in the second chapter, sustainability is often defined as the balance between environment, economy, and society. Parks are often considered democratic spaces, especially when a variety of activities are respected. An economic analysis is not within the scope of this report, but a quick glance around the Mont Royal park in Montreal demonstrates that the areas north, east, and south of the park are characterized by large detached houses and well cared for yards. The importance of green open spaces in the city from the botanical aspect has been demonstrated in the second chapter, both as a green corridor for pollination and migration but also from the

fauna and flora diversity. Opening big spaces in the city is an opportunity to introduce solar grids that will enable passive design, wind corridors, and finally accessible green spaces. This would mean less asphalt and more irrigation areas.

However, introducing a new circulation system will contribute to the emergence of carless cities, cities that are healthy for the public, and produce a smaller ecological footstep, as well as lower carbon emissions (Figure 4.10). The infrastructure that used precious public urban spaces will be reused to serve public's activities. It is not a coincidence that projects such as *The 2030 Districts* focus on only three factors: energy use, water use, and CO2 emission. These are the factors that can be measured and therefore make it possible to introduce quantitative targets. As for the new green network presented here, all three factors will be positively influenced by it.

Understanding the potential of those infrastructures as an opportunity to connect parts of the city can sometimes depend on one's state of mind. In his interview, architect Klein explained that the idea of transforming the Gardiner into a pedestrian way, occurred when he was cycling with his wife in the annual closing day of the Gardiner. On this day, the highway transforms into a cycling path. "Why can't we do it every day- I have asked my wife while cycling." The idea for this thesis occurred on a *Yom Kippur* day in Tel Aviv Israel, a day when all vehicular transportation is stopped (Figure 4.12). Understanding that unused infrastructures can be transformed from inner-city barriers into pedestrian connections is the first step of the design process.

Lastly, relating to a personal experience, when studying architecture in the city of Haifa, Israel, I was involved for many years in a project of tutoring teenagers in environmental education. The city of Haifa is built on a mountain, and due to historical

Figure 4.8: **Aksum, Ethiopia. The importance of shadow.**

Figure 4.9: **Aksum, Ethiopia.**

Figure 4.10: **. Detroit, Michigan. The wide abondened innercity highways detach the downtown from the residential areas (left) and can be transformed into a linking network (right), the Dequindre Cut, a former railway pathway that was transformed into a pedestrian promenade (in Detroit as well).**

Figure 4.11: **A workshop of the team Imaginonsbelechasse with the neighboors of Rosemont-La Petite Patrie. From speculation to evaluation: A digitally--mediated laboratory for local deliberative democracy project. The author on the right.** (Source: Imaginonsbellechasse).

Figure 4.12: **Yom Kippur. in Israel, a day when the streets turn into pedestrian playgrounds. Ayalon Highway on the Eastern Border of Tel Aviv. This perticular situation inspired the idea for this report.** (Source: Daniel Bar On, Haaretz).

processes, the valleys of the mountains were defined as national gardens (Figure 4.17). This special coincidence allowed extensive open spaces to be immediately reachable from almost every part of the city (Figure 4.15). This accessible, informal nature enabled diverse activities with the teenaged group and a bond to the environment, both by myself and by the students (Figures 4.13-4.16). The variety of green spaces will enable a variety of activities, which might represent the incomplete factor in the city's definition as a "complex and incomplete structure".[121] Those extensive spaces would represent the important principle that leaves some parts of the city untouched (Figure 4.18) as in the sustainability definition of a "development that meets the needs of the present without compromising the ability of future generations to meet their own needs,"[122] and therefore will be the link between those definitions. I hope this report will introduce another layer in the process of transforming our cities into better places.

[121] Saskia Sassen. CRIEM symposium- creative cities, October 19, 2013

[122] Our Common Future, Chapter 2: Towards Sustainable Development.

Figure 4.13: **A community activity for the conservation of the Haifa's valleys as extensive open spaces. Haifa, Israel**

Figure 4.14: **A community activity for the conservation of open spaces in Haifa, Israel.**

Figure 4.15: **The extensive green space is immediately reachable. Haifa, Israel.**

Figure 4.16: **The bus station near the neighborhood's primary school is located in a local forest. The photo on the left was taken in 1997, the on the right in 2004.**

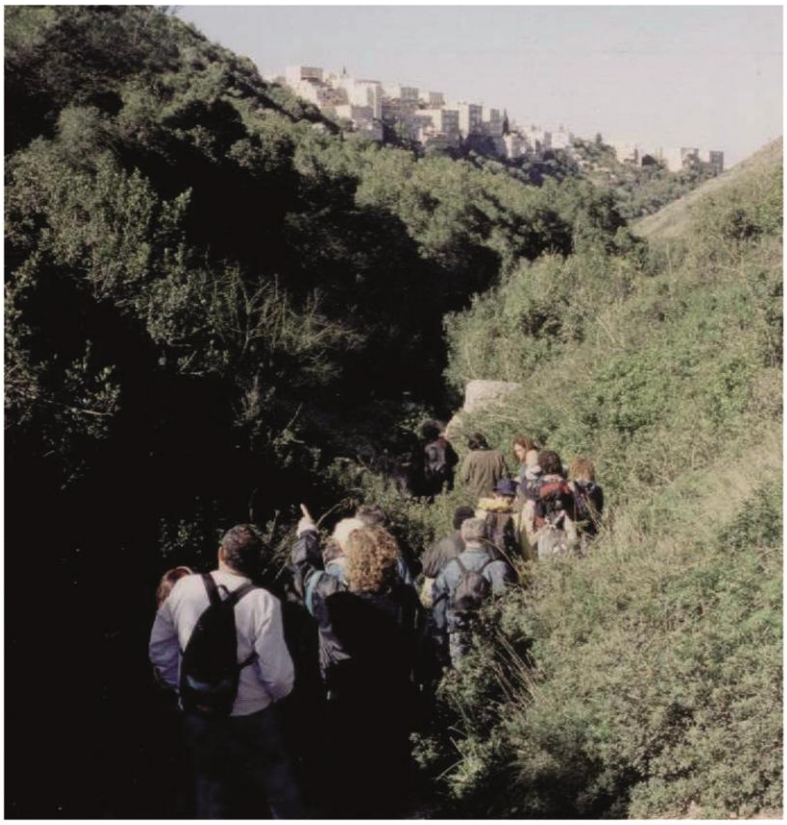


Figure 4.17: **The special condition of the city of Haifa - one of the valleys in the city.**

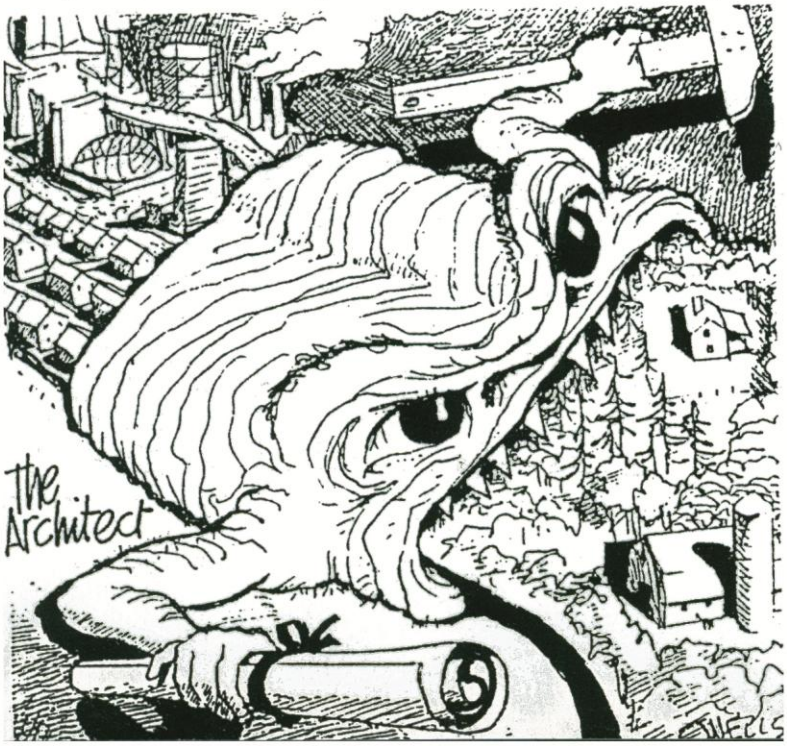


Figure 4.18: **Infrastructures, architects and open spaces.** (Source:Malcolm Wells, and Rick Friedman. *Infra Structure, Life Support for the Nation's Circulatory Systems).*

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