INFRASCAPES

Multiple interactions & layers in the urban fabric

A thesis submitted to the Faculty of Graduate Studies and Research in partial fulfillment of the requirements for the degree of Master of Architecture (M.Arch) Professional

Carleton University, Azrieli School of Architecture and Urbanism

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Abstract:

Infra-scapes
Multiple interactions & layers in the urban fabric

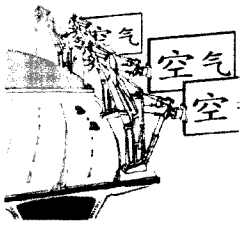
The proper use and re-use of urban space to maximize and promote interest in and growth of the city cores should be a particular focus to architects.

To explore this we should re-order of the way we use and experience our urban spaces by using the vertical spaces adjacent to and above existing urban infrastructure.

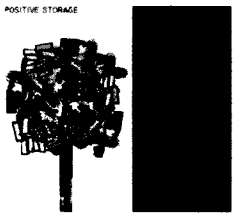
It can be argued that building taller more complex structures translate the interactions present in a horizontal city environment to the vertical. Adding or grafting new programs or structures onto existing buildings and infrastructure spaces to create intermodal nodes, will generate new interactions and spaces that are a benefit to the spirit of the city. The capabilities and benefits of that space, transferred elsewhere if left undeveloped, will only increase the expansion of suburban cities.

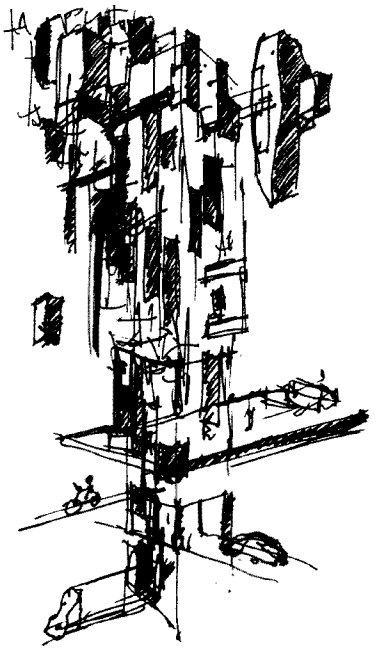
I would continue to argue that this is a final completion of the potential of that particular site, be it a building or infrastructure which is truly not complete until that vertical space is used to the utmost potential.

Frontispiece:



POSITIVE STORAGE





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Preface:

Since beginning my architectural education, I have always been drawn to and keenly fascinated with hybrid and parasitical architecture. Additionally, having grown up during the generation when environmentalism became 'main stream' within our culture – and very much believing in that message – it seemed to me that a hybrid architecture might merge these two very important ideals of efficiency (green and parasitical) to the benefit of society.

London Ontario, where I was raised, is a primary transportation hub for South-Western Ontario. It sits at the crossroads between Detroit, Michigan (a gateway to the western United States), Toronto and Buffalo (both connections to the eastern United States). Being a large manufacturing center – especially for automobiles -- it stands to reason that the planning and municipal policies of London would be largely 'driven' by the car. And they were. London's sprawling mass of suburbs have spread continuously outwards in an ever expanding ring around the original village at the forks of the Thames River – with little regard for green space or mass transit systems.

Being an artistic person, both sensitive to design and fiercely individualistic, I was quite struck by the fact that I lived in a place where everything was the same: houses, cars, and people. And while most experts concur that suburbs are designed for families with young children, suburbia never struck me as being particularly child-friendly. Open spaces were routinely swallowed by sub-divisions and wide arterials bated drivers to travel at speeds unsafe for pedestrians. But the oddest thing was the way people treated and reacted to children. They were not at all nice. I don't know how many times my friends and I lost errant basketballs to neighbours who snatched when they landed on their pristine lawns, how often we were yelled at, or how frequently the police were called if, while playing road hockey during the summer, we were too loud or our ball happened to land on a neighbour's driveway. Beyond this, there was very little interaction with anyone.

Moving to Ottawa to start my architectural education was an eye opener. Finally experiencing a true urban space was amazing, interacting with all the 'differences.'

These experiences have challenged me to use this thesis to explore how one might better harness the myriad resources available within the urban environment. As noted, it began with an interest in parasitical architecture applied to adaptive re-use, not only because I find the image of such architecture compelling in a "sci-fi" sort of way, but because it is a sustainably viable approach to design to the extent that it uses fewer resources and uses them more efficiently than most new construction – especially construction outside the core on previously un-built and un-serviced land. Continued research, however, led me along a

parallel but different path. Having initially chosen to work with a small viaduct along Somerset Street in Ottawa's Little Italy (see below for map), I began to consider the site's connection to the O-Train infrastructure below. Building on what was, until recently, abandoned infrastructure (the rail line was re-commissioned for a short-run transit service a few years ago), I began to explore the potential of the railroad right-of-way to receive new development -- i.e., to put the land along and above it to a better and higher use – and to consider ways of capitalizing on the opportunities it presented for intermodal connections between pedestrian, bicycle, automobile, bus and rail-based movement. Furthermore I liked the poetic resonance of re-connecting the city with a significant piece of its past, namely, the rail system that so strongly influenced the growth Ottawa over the past 150 years. Notably, both the Queensway and portions of Colonel By Drive were built over rail lines.

A truly intermodal exchange requires the meeting of more than two different transit or circulation systems – my thinking at the time. Few points of intersections along the O-Train line involve any kind of exchange or transfer; those that do, accommodate pedestrian movement between buses (along Carling and the Transit-way) and the train. I decided to add to the mix by proposing an elevated bike/pedestrian pathway above the rail line in order to connect the existing paths along the Rideau Canal (at Dows Lake) with those along the Ottawa River.

The written component of this thesis explores the evolution of urban/exurban growth as well as discourses – historical and current – relating to sustainability and the modern city. It was my hope that identifying and articulating these arguments would help me both to better understand and to more effectively develop the terms of reference for the design portion of the thesis.

Introduction:

Cities have developed patterns and identities over time in relation to their various uses and functions. When those functions are disrupted -- whether gradually, over time, or due to catastrophic upheaval and whether the causes are economic, social, natural or political – new patterns evolve in their place. Traditionally, these new systems or forms are built over or parasitically into the existing cityscape, resulting in a layering of built form over time. (Lukez 10)

Throughout their evolution cities have exhibited a wide array of types, forms and adaptations, each the result of interactions between different parties and forces. The interplay of historical forms, geographies and functions with newer ones makes the urban environment unique – imputing an identity that informs the city even as it transforms, becoming richer and more nuanced over time. Such was the state of urban planning (or lack thereof) until the industrial revolution. The impact of industrialization on the city was so profound that planners and architects argued that to save cities, it was necessary to radically re-envision them.

One proposition to alleviate to the squalor and congestion of the inner city was to separate large cities into smaller towns which would be networked together with transportation and communication infrastructure (railways and roadways) and each protected by a green belt. This was the approach promoted by Ebenezer Howard in his influential book, *Garden Cities of Tomorrow.*

Howard's approach may have worked, but for reasons outlined below – most significantly the automobile – the satellites would have lacked the autonomy and self-sufficiency necessary to become a city, compromising the original intention.

> The result has been that, whereas for Howard the protected homes were near the factories and planned in conjunction with them, the entities that are now called Garden Cities are physically isolated from their industry and planned quite independently." (Goodman 26)

This effectively cut off the inhabitants of the existing city from one another, and created mirrored spaces arrayed about the periphery, lacking any cohesive identity. On a tighter scale, within the villages, spaces were parcelled, packaged and separated from each other creating spaces of 'nowhere,' identifiable only by the infrastructure that connected nothing.

"A satellite town, then, is a true city economically dependent on a centre and therefore its highway, but laid out as if integral and self-sufficient." (Goodman 37)

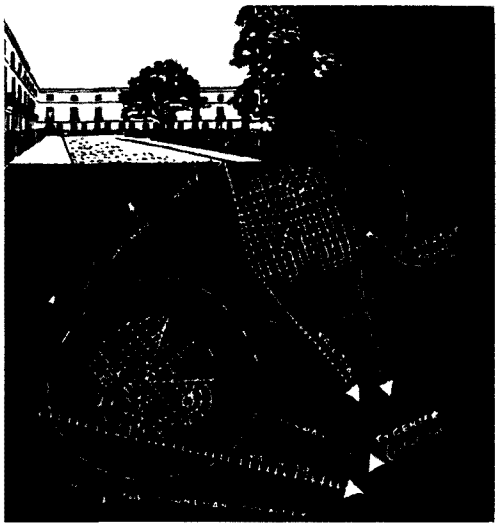

Figure 1: A Culture City. Above: Munster Square, London, a town Style.
Below: Regional Plan according to Thomas Sharp. (Communitas 36)
Identical suburban plans connected to the city only by way of its infrastructure.

In an interesting twist to the way in which urban infrastructure and built space traditionally evolved, we now layer and improve only the infrastructure of the city – horse cart path, to gravel, to railway, to paved roadway, to highway, to superhighway – while spaces within the city centres (housing and services specifically) remain mostly static and newly built form expands ever outward. Built on farmland and green-spaces, suburbs are disconnected both from the cities to which they are appended and the land they consume.

Current political, economic and environmental concerns are coalescing into a new nexus of upheaval within the contemporary urban fabric. Our cities no longer function in a way that promotes better living and social interaction. Perhaps architects should again be at the vanguard of a new approach to design and urban planning, promoting intensification of the city's multiple functions into fewer, tighter spaces. Architects have traditionally been supporters of urbanity (and conspicuous detractors of suburbia) although they have been frequently accused of destroying the city in order to save it

Nodes situated above or attached to existing infrastructure throughout the city can act as catalysts for rich and complex interactions. Properly conceived, designed and priced, they will generate interest, accommodate new functions and attract larger portions of suburbanites back to the city to live and raise families.

Spaces situated above transportation corridors promote movement of inhabitants between other points or functions in neighbouring areas. This vision challenges the typical 'form follows function' argument by organizing form around the movement and actions of people, who become the event around which space is centered, as postulated by architect and theoretician, Bernard Tschumi. When the user, rather than the site, becomes the proper anchor of place and time, the site is less of an issue and therefore the context can really be anywhere. Transient architecture – not temporary architecture – or an architectural form created for the purpose of encouraging and creating movement or connections of people and events throughout the urban environment becomes more relevant.

"Fitting" architecture, people and functions into nodes into and above the infrastructure that penetrates the city (highways, rail corridors, viaducts, bridges, etc.) is a means of reactivating and sustaining the city both by more efficiently using our natural and built resources and creating new and interactive spaces for inhabitants. "Fit can be described as healthy or appropriate" (Lukez, pg.16) , or, also the 'ability to use awkward, unusable or stereotypically unfit space by 'fitting' space or architecture without compromising existing structures/relationships, and at the same time 'generate new complex interactions between physical, ecological, social, and economic systems.

This thesis will attempt to merge a more traditional urban planning approach – recognizing that all cities are a product of collapsing historical layers and reactions – with newer architectural theories of parasitic couplings of form and the unused spaces associated with, or immediately above, and/or adjacent to transportation and/or pedestrian infrastructure. These new insertions of function and space will still honour the typical rules that traditional palimpsests have occurred over time. Such that, a type of landscape will begin to re-emerge: Infra-scapes.

> "[A] grid in which infrastructure – in this case freeway, beltway, conventional and high-speed railway tracks – is interwoven with city and landscape."
> (Lukez 19)

By that, the interactions that were supposed to exist in the extended portions of the city, namely the suburbs or ring settlements, but have never come to fruition, such as in the decline of the Garden Cities, are reinforced in the city core by the introduction of hyper-palimpsests. This will begin to bridge the fractures that are present within the contemporary city through spaces that are designed to attract inhabitants back to the core city areas – halting horizontal expansion by infrastructure induced satellite communities – and allow for interactions of existing neighbourhoods by creating new nodes or spaces in or above the existing city plane

Chapter 1: Palimpsests of the Old World

This chapter will explore the theory that cities are palimpsests and that the history and culture of a city and/or of a culture are written in the layers of the cityscape. These palimpsests are the product of design and adaptation over time, the process by which new construction builds upon and reuses the exiting matter of the urban organism. Instances of these architectural archaeologies throughout history prove that re-use is not just a new idea, but part of a process that has influenced the design of urban geography from the earliest cities. This chapter will explore how an understanding of the traditional ways that cities evolved can be used as a counterpoint to urban design in the 20th century, and in particular to the process of suburbanization.

> "Architecture is the will of an epoch translated into space; living, changing, new' "the new architecture is the inevitable logical product... of our age; 'the architects task consists in coming into agreement with the orientation of his epoch.'" Mies van der Rohe (Rowe, et al 28)

As the human race evolved through its interactions with the natural environment, it collected resources and developed the means to construct shelter to protect itself. As time went on and culture, technology and economies evolved, cities developed into complex forms that supported a variety of interactions. Utility, and therefore function, of spaces was designed in relation to the needs of the city of that time, its systems, its beliefs and activities, and of course the geography and physical landmarks of the area where that city or settlement was located. In other words, those exact people and those exact physical and cultural attributes would create a specific reaction of form that would 'fit' only that specific space. This occurred over many centuries of trial and error – maximization of materials, increasing capacity of labour and technology, growth in urban populations, etc – creating a parallel to the natural or biological world in which the 'survival of the fittest' design would prevail.

It may seem odd to describe the built environment or a building itself in biological terms, but architects must understand that not only does the city itself behave like an organism, reacting and evolving, but so do the spaces and buildings within it. In a similar fashion, buildings grow or evolve over time as well, depending on the varying necessities of the inhabitants or the changing functions of those spaces. As in the evolution of the species on this planet, change occurs at the microbiological level, DNA is manipulated to find a suitable reaction to outside stimuli. This modifies the physical form of flora and fauna, enabling it to adapt which and maintain an advantage in the environment in which it is situated. Adaptation affects not only the species in question but, assuming the modification is successful, will also alter the environment in which the organisms exist. The idea that buildings grow or adapt, follows these very same principles, except that we, i.e., people, are the DNA that affect or change the 'organisms' in which we live.

"First we shape buildings, then they shape us, then we shape them again – ad infinitum. Function reforms form, perpetually." - Winston Churchill
(Brand 3)

This is especially important in understanding how cities and architecture have evolved since the earliest human structures were built – as a long process of experimentation, involving both failures and successes, spanning centuries if not millennia.

As changes occur, the occupants of a specific area or city must react. Cities caught in the catastrophe of political, natural, economic or even cultural upheaval evolve new functions, which the spaces of the original cities may not be able to support or sustain. New systems, forms and identities must be developed to accommodate these new requirements, which take precedence over the existing obsolete forms. (Lukez 10)

Historically, due to lack of resources and space, many structures (buildings, fortifications, etc.) were demolished and their components reused in newer ones. Others were partially or wholly absorbed into newer forms or functions, creating parasites or a layering of typologies in one space. This is evident in many ancient cities around the world, where the infrastructure of one era influenced or engages that of the newer era being built in place of or above it. And, as infrastructure is the longest-lasting element of the built environment, the palimpsests continue to affect and inform the built environment to this day. (Lukez 37)

Figure 2: The Porticus Octaviae, Rome, in the early Twentieth century. View of shops in the Ghetto built into Augustan buildings with a grand Latin inscription and fragments of antique sculpture. Photograph: Conway Library, Courtauld Institute. (Elsner 19)

> "Of the man made things, the works of engineering and architecture and town plan are the heaviest and biggest part of what we experience. They lie underneath, they loom around, as the prepared place of our activity. Economically, they have the greatest amount of past human labour frozen into them, as streets, highways, houses and bridges, and physical plant."
> (Goodman 3)

The embodied energy that is/was present in cities that grew in successive layers, in the manner of a palimpsest, was maintained by the inhabitants through the years of evolution. Effectively a closed system, or as near to a closed system as cities can be, as very little of the energy that was put into the building process was ever lost.

By the laws of physics, dictated by Albert Einstein in the Law of Conservation of Mass/Energy, states that energy can never be created or destroyed, simply transferred or translated (or, in the case of architecture, transformed) by means of a reaction or process. In this case, the catalyst is human reactions to any changes that can occur on this planet – as stated earlier. In other words: "Something new cannot come into being of its own accord, but rather must have something old to build from – something from which the materials are taken." (Ashton)

Historically, the process of continually remaking and reshaping the fabric of cities focused the embodied energy in a tighter space – almost as if it remained dormant, hibernating, and unable to move until people roused it to action. When awakened, and change occurred, the energy embodied in structures deemed obstructive or obsolete would be translated into whichever new form was essential for the evolution of that city. Hence, the embodied energy, or the available energy that was used in the work of making a product, would never leave the city proper and would be always recycled.

Through this interplay of form and change, over time, cities and spaces developed unique identities and differing typologies supporting complex interactions between inhabitants and structures. Spaces that encourage movement about the city, events and moments of intrigue/interest and that all together create a city of vibrant and dynamic elements. This differs from how the suburbs are constructed because evolving cities will "[engage] a site's useful history and [discourage] the ever-present development tendency to erase completely all traces of past 'writings' and landscape." (Lukez 187)

Before discussing examples of cities over time, it may be beneficial to define what is meant by a palimpsest.

> A manuscript, typically of papyrus or parchment, that has been written on more than once, with the earlier writing incompletely erased and often legible. (Oxford Dictionary)

Figure 3: *Codex Ephraemi Rescriptus* from Bibliotheque Nationale de France.
Example of a written palimpsest.

While this is the literal meaning of the term, it has come to be used more broadly and applies a wider set of ideas: art that has been painted over for a layering effect, technology that has evolved – such as computers – for the last century, songs being re-recorded or re-mixed connecting the sounds of previous decades with contemporary trends and artists, etc. (Ashton)

The common factor in all these examples, whether in reference to technology, culture or architecture, is change or layering – manifested as successive strata over the course of time. Palimpsests are more difficult to in contemporary society due to the rapid pace at which culture is changing and adapting, primarily due to the increase in the complexity and the power of technology. But we will return to this in a later chapter.

Obviously, the most important variation, at least in for the purposes of this thesis, is architectural archeology, or the study of architectural palimpsests – "the layered evidence of progression through a series of changes that occur as a result of use." (Ashton)

Examples abound in the city of Rome. Sigmund Freud wrote:

> "[S]uppose that Rome is not a human habitation but a physical entity with a similarly long and copious past – an entity, that is to say, in which nothing that has once come into existence will have passed away and all the earlier phases of development continue to exist alongside the latest one."
> (qtd. in Elsner 19)

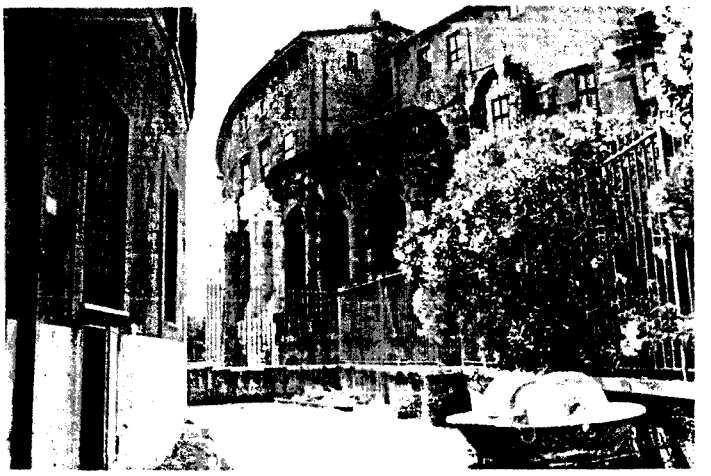

Figure 4: The Theatre of Marcellus in the campus Martius, Rome. View of the ancient buildings adapted into modern apartments. Photograph: Silvia Frenk (Elsner 19)
The evolution of forms or changing of functions over time as evident in many Roman Structures.

Rome is arguably the clearest example of a city comprised of historical strata. Ancient Roman, medieval, Renaissance and baroque elements come together within a shared space much smaller – often within a single building – than seems possible to accommodate all these truly unique differences. Throughout much of Europe, palimpsests permit us to experience history. Fortunately for us, Rome's qualities, both modern and ancient, can be seen, perceived and explored through buildings, some of which have survived or been reconstructed and others of which are only partially intact or excavated. (Elsner 18)

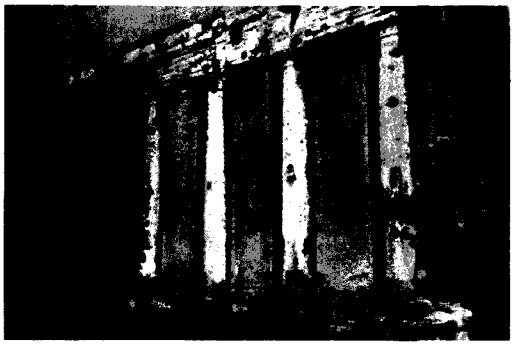

Figure 5: San Nicola in Carcere in Rome (Ashton)
An Example of an Architectural Palimpsest – A Doric Colonnade of an ancient temple included in the Construction of a wall of the Basilica di San Nicola.

Countless examples of Roman – and European – history are evident within the built structures of the city of Rome, which continues to evolve and change to meet the needs of its inhabitants.

> "Perhaps the most impressive aspect of Rome for the modern visitor is the way the still standing ancient monuments blend into their present. The massive bulk of the Pantheon, surely one of the most remarkable buildings in Rome and erected in its current form under the Emperor Hadrian in the second century AD, hardly towers above the apartment buildings which surround it. Its passage from imperial temple to church to museum is almost belied by the informality of the pleasant Piazza della Rotunda situated in front of it". (Elsner 19)

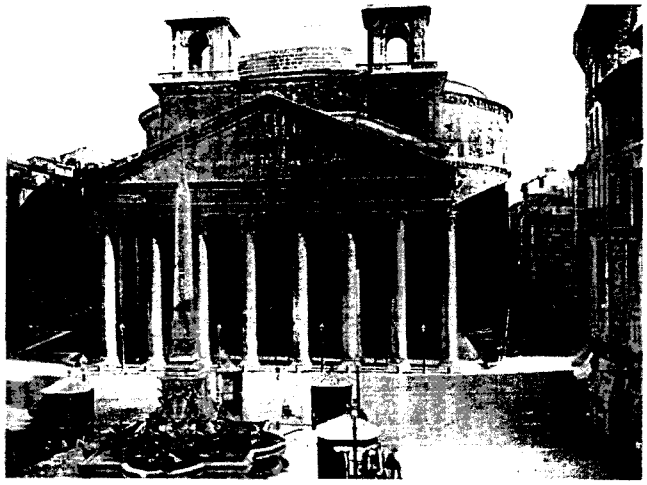

Figure 6: The Pantheon and the Piazza della Rotonda, Rome, in the nineteenth century. Originally erected by Agrippa in c. 27 BC and rebuilt by Hadrian in the AD 120s, the Pantheon is seen here in a view taken prior to 1883 when the twin bell towers erected by Bernini at the behest of Pope Urban VIII were removed. (Elsner 20)

Additionally,

> "The inhabited ruins of a Roman amphitheatre in the city of Florence, for instance, provides the perfect example of how a city can transform over time, how form follows fit over time. These spaces result from extended experiments in adaptations of form and space responding to dynamic economic and cultural forces. Today, the site of the old amphitheater reflects the rich interplay of multiple parties engaging an urban environment over time to create an entirely new kind of urban configuration, defying easy typological categorization." (Lukez 11)

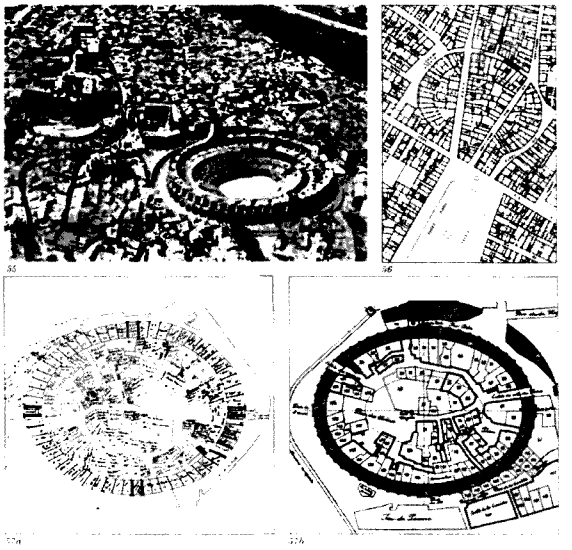

Figure 7:
Roman Coliseum in Florence– Functional evolution over time.
(Lukez. 10) These images show the evolution of the spaces
that were once a Roman Coliseum and are now residential units

Among other cities with Roman roots, the city of Cologne, Germany features evidence of the absorption and adaptation of roman infrastructure. Its location at the meeting of eastern and western European trade routes and its adjacency to a major river made it a valuable strategic location. Founded in 53 B.C., Cologne was protected by 4.5 kilometres of walls, which supported 21 towers and nine gates.

> "Most Roman Cities still contain traces of the original cardo and decumanus (the major north-south and east-west axes typical of Roman town planning) which are still visible on contemporary maps. The lines of these axes may jog and shift from their original laser straight paths. Similarly, the block structures of the Roman colonies were absorbed into the amorphous sets of shapes and geometries that govern medieval city form. Cologne's form has been further enriched with complexity because...tumultuous historic forces, like the destruction of war, punctuate its history." (Lukez 12)

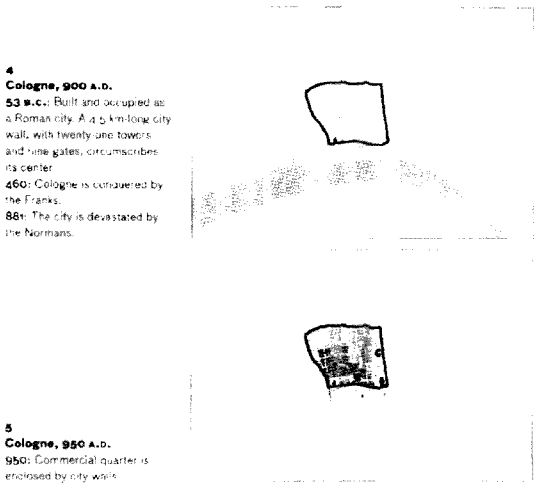

Figure 8 : Colonge as Palimpsest (Lukez 12)

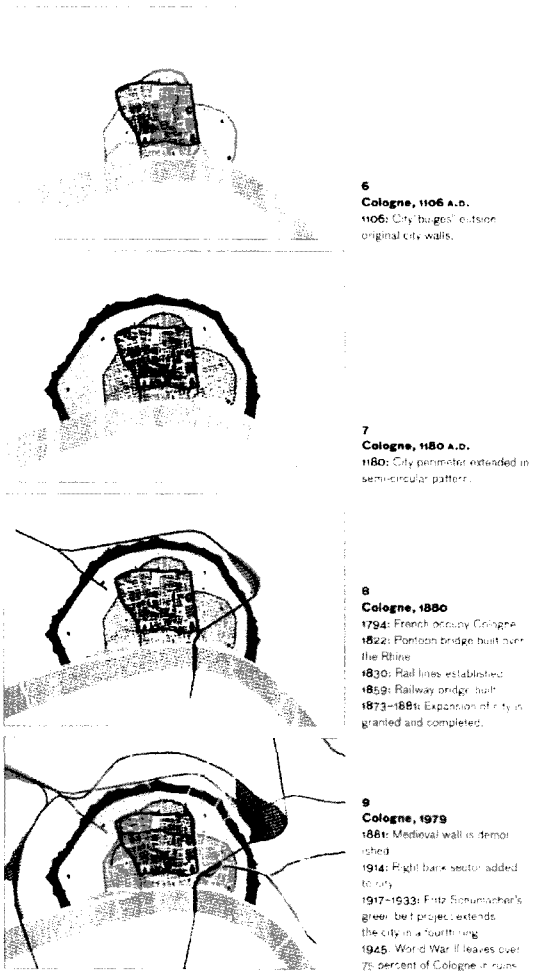

Figure 9 : Colonge as Palimpsest (Lukez 12) Evidence of Cologne historical Layers.

The layering of these histories provides a city like Cologne with the ability to excel; as it is only through diversity that any organism (organic or inorganic) can survive.

> "The medieval marketplace, cathedral spires, and bridge spanning the Rhine serve as landmarks that orient residents and visitors alike and are emblematic of the city's rich past. The developed glaciers surround the city link together old and new. Cologne's robust economy, compact scale, gardens, surrounding landscapes and medieval core make it a dynamic and liveable city." (Lukez 12)

There are numerous examples of palimpsests in the fabric of European cities. In Paris, for example, portions of the Roman grid are still evident: sections of the Rue St.-Jacques and the Boulevard St.-Germain were the cardo and decumanus respectively. In fact, many European cities still show the influence and craftsmanship of the Roman builders and architects. Even newer cities like New York exhibit traces of aboriginal features in the layout of major roadways – more on this in a later chapter. Turning to a more contemporary example we can also observe that palimpsests at a micro scale in the built environment, not just at a macro scale.

Carlo Scarpa's 1958-64 rehabilitation of the art museum, housed within the historical fourteenth-century Castelvecchio in Verona, is one of the most influential pieces of contemporary architectural design. It presents a perfect study of the layering of history within a space through war and occupation. The estate (built in 1354 by the della Scala family, the Lords of Verona) became a fort (occupied by Napoleon's forces) and was eventually rehabilitated under Fascist rule. Its various layers of occupation and use were both revealed and exploited when the architect Carlo Scarpa transformed the building into a museum.

> "When Scarpa was asked to redesign the building, his hierarchy of values was to view the past without nostalgia or exaggerated respect and left a mark on Castelvecchio that is more than the usual functional or stylistic imprint of rehabilitation. Castelvecchio is significant more for its history than for its historic architecture." (Coombs 7)

Additionally,

> "Scarpa draws attention to historical fact – the presence of the Commune, of the French and even of those who left no architectural remnants on the site – and alerts the visitor to the fakery of the 1920s rehabilitation. He visually undermines the Gothic door and window surrounds by backing them with separate windows with discordantly modern mullions."

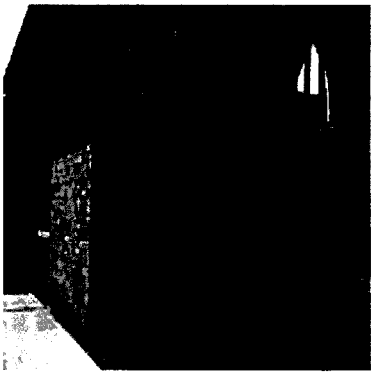

Figure 10: **Museo di Castelvecchio**, by Carlo Scarpa, at Verona, Italy, 1954 to 1967. Photo by Erdem Ungur. © Erdem Ungur. An example of a Palimpsest used by Scarpa as an architectural narrative.

But even his reaction to the fake rehabilitation is justified from the view of the building as a palimpsest, where his choices are another step in the logical evolution of that space – each transformation is akin to the individual choices that each of us makes during our journey through life. Profoundly, even with the modifications made to the existing structure, the moves that were made were used to highlight not only the contemporary situation, but specifically the historical ones as well.

Whether on the scale of the city or of individual buildings, these examples demonstrate that preserving the historical identities of a the built environment is much 'healthier' for the overall organism than clear-cutting the old to make way for the new, as was the norm in the modern era. Furthermore, a comparison with a contemporary suburban city will show how the embodied energy – or one might argue, the 'history' – is lost when people, culture or the physical forms of the city are not selectively reused and other, newer structures with no connection to the earlier iterations of the urban fabric are built instead.

Chapter 2: Evolving Infrastructure and Dispersal Patterns

Dispersion and Contraction

The previous chapter outlined how cities evolve over time and demonstrated that their histories and energy have traditionally been preserved in layers within the strata of the urban fabric. In this respect the past was never lost as cities grew, just transformed. Using Rome as a point of departure, this chapter will continue this exploration by describing patterns of urban expansion and contractions from the medieval era, through the period of the Industrial Revolution and into the modern/contemporary era.

European cities developed to support very specific activities; primarily commerce and defence. At their genesis, walled medieval cities were inhabited mostly by the feudal lords, for whom merchants supplied goods and services in support of the life of the town and the cultivation of the land under the lord's control. (Walled cities would begin expanding outwards in more or less concentric rings due to multiple factors: population, war, etc. until these walls became obsolete.) Within the protective city walls was typically a dense mass of buildings, congested streets, and a rich and highly dynamic urban life offering many choices, at least for those able to afford them. Unfortunately for most of society, relegated to the fields outside the walls, life was slower, the environment less quick to change, and social and political life completely different. (Bruegmann 21)

High densities became a necessary evil as most ancient and medieval cities owed their existence to not only to protective walls but geographic features like rivers and cliffs. Most walled cities developed adjacent or in relation to a feature of strategic importance, such as a vital trade route, access to the sea or river for a harbour, a hill for further protection, etc. and would not have been able to spread out very far for lack of accessibility. (Bruegmann 22)

Moving into the industrial era, production facilities were initially located close to a significant source of energy, be that hydropower or combustibles such as coal or timber. These were generally at some distance from the city. Increasingly, technological advancements in power generation, culminating with electricity, enabled sources of power to gravitate to cities, allowing factories to capitalize on the abundance of labour in urban areas. Factory jobs, in turn, attracted even more people to cities, contributing to the exponential urban growth and densities we associate with the Industrial Revolution. (Goodman 84)

Inadequate infrastructure in larger cities, (drainage, adequate spaces for light, lack of transportation for resources, etc. – something that is still true to this day in less wealthier countries) however, contributed to

the congestion with which most inhabitants lived. Emulating the aristocracy, those with the means to do so, constructed country villas or estates to escape the cramped and brutal affairs of the city, while maintaining residences within the city to attend to court or manage business affairs, as needed.

> "Sometimes these suburban or exurban dwellings served only as weekend houses, but for those who could afford to do so, these weekend houses often became much more than that. Ancient, medieval and early modern literature is filled with stories of the elegant life of a privileged aristocracy living for large parts of the year in villas and hunting lodges at the periphery of large cities." (Bruegmann 23)

Figure 11: Historic exurban sprawl in the Paris region. This detail of a map, created by Abbe de la Rive in 1750, of the Paris region shows the way aristocratic landowners occupied very large parts of the territory west of Paris with country houses, gardens, and hunting parks, all of them serviced by the inhabitants of small villages in the immediate vicinity. (SPRAWL 31)

From their re-emergence in the Middle Ages, European cities grew steadily, increasing first in density then in area. Walled cities, if economically mature, were able to build successive rings of walls, annexing land and protecting even more of their increasingly wealthy citizenry. Because communities on the periphery were

almost always built at lower densities than those at the core, both overall density and density in the core declined as cities expanded outward.

> "It appears that throughout history, at least until recently, as most cities went through their most intense phase of early economic growth, the process of concentration tended to dominate over that of decentralization as residents from outlying areas were drawn into the city center. Then, as the economy matured, the balance shifted as the number of residents who were able to move outward to the suburbs and exurbs exceeded the number coming from the agricultural hinterland to the center." (Bruegmann 24)

Until the 18th century only the aristocracy and wealthiest of merchants could afford exurban villas. As the ranks of the middle class swelled, however, more and more families emulated the wealthy by purchasing land and moving their residences to the periphery. This process of densification and expansion occurred in more or less the same manner from the Middle Ages onward until cities underwent almost catastrophic growth during the Industrial Revolution.

New technology was the catalyst of not only the Industrial Revolution, but also the massive increase in density that cities like London experienced in the eighteenth and nineteenth centuries. Due to the change from manual labour to machine driven agricultural production and textile making, many inhabitants of the English countryside were forced into London to find work on the docks or in one of the many service industries. This had a counter-effect of movement of the affluent or wealthier inhabitants "flush with the profits earned in an expanding economy outwards, [and who were] able to build or lease houses well beyond the walls of the city of London." (Bruegmann 25)

Robert Bruegmann identifies economic and political factors (i.e., the democratization of power), in concert with changes in the structure of industry and technology, as being the forces behind the ongoing expansion of cities – the forerunner of what we today call "Suburban Sprawl." According to Breugmann it is not the phenomenon of sprawl but its scale that's unique to the 20th century, supported both by a rise in the size of the middle class and by transportation technologies. The advent of passenger rail service in the mid-19th century coupled with the obsolescence of urban fortifications meant that cities could spread further than ever before.

> "Throughout this history, as cities have become economically mature and prosperous, they have tended to spread outward at decreasing densities. What was new in the twentieth century was that sprawl at last became a mass phenomenon." (Bruegmann 18)

Suburban Identity and Infrastructure

Although urban growth is by no means exclusive to the era, forces at play during the Industrial Revolution attracted unprecedented numbers of people to cities. In response, wealthier inhabitants established residential suburbs outside of the city to escape the heterogeneity, squalor and increasingly deplorable living conditions associated with industrialization. Facilitated by new infrastructure – notably rail lines and eventually the road networks that support motorized vehicles – increasing numbers of people could live outside the city in a pre-designed house, a parcelled neighbourhood. By the early 20th century, large portions of the middle class managed to separate their families from their places of business by creating residential-only enclaves within commuting distance of the city. The transportation infrastructure that supported this – along with exchange of materials and goods – fostered satellite communities, offering citizens the comforts and pleasures of both worlds when they chose it. As with most technologies, mass production brought with it a number of drawbacks; namely pollution, overcrowding and disease related to inadequate ventilation, sewer and water management systems.

To offset the cost of transporting equipment, labour and resources to residential enclaves on the periphery, and to quicken the pace of construction to meet demand, standardized designs were employed. It is possible, however, that in their haste, developers and policy makers created villages and neighbourhoods that were repetitive and banal by being removed from the diversity and interactions of the city. Newer technologies like indoor plumbing and central heating in suburban housing would also become a factor in attracting inhabitants out of the inner city – where residential units were consistently obsolescing and decaying. Ultimately this occurred with commercial and industrial uses as well, namely, that it was less expensive for industry to relocate to the periphery (presumably along a train line or junction) than to renovate and/or expand an existing factory in the core. The tendency for industry to decamp to the periphery was exacerbated by increased congestion in the core.

It is possible that by building upon and (in so doing) destroying any trace of the traditional usages of lands outside the city; suburbs were denied a connection to any pre-existing identity. Or, in the case of industrial suburbs, they took on the image of the factories around which they sprouted. At the same time the distance of most suburbs from the core – places against which they defined themselves -- precluded much interaction with the cities they surrounded. (Lukez 16) Without an established identity, each suburban enclave became the product of the infrastructure used to reach it; its identity being limited to the notion of mobility. "And since mobility cannot be rooted in place, the suburbs are considered nowhere and at odds with the city which is, by definition, somewhere." (Kunstler 10)

This is a profound statement. How can a place not exist, how can it not be? All of us, having at least passed through a suburban community if not grown up in one, are able identify it as a 'place', we *have* stood there. But this nebulous sense of identity is accompanied by an overwhelming feeling of *déjà vu*, like you have been there before. Well.... maybe you have. If someone were to ask you to describe how the suburbs look or feel, would you would likely respond: "like the suburbs." Immediately that description is enough to trigger the same mental image or memory in the mind of the inquirer. In comparison, you would be hard pressed to accurately describe any city in the same manner.

Identity:

> "The collective aspect of the set of characteristics by which a thing is definitively recognizable or known."
> or:
> "The distinct personality of an individual regarded as a persisting entity; individuality."
> (dictionary.com)

By these definitions, a typical suburban area – with its monotone landscapes, banal housing stock and lack of any historic or cultural icon[ography] – is completely devoid of identity, beyond the number of the connecter highway of course. Just by virtue of proximity, one would think that a portion of the identity of the inner city would have followed the residents outward, but unfortunately this does not appear to be the case. Especially from the point of view of pedestrians, one is almost psychically shocked by the abruptness of the transition from the diverse and multi-functioning city to the suburbs. How is it that suburbs grow out of individual cities without at least embodying some of the qualities of those cities?

Figure 12: At the periphery of suburban Phoenix, Arizona.
Photograph by Robert Bruegmann, 1998. (Sprawl 66) Identical Suburbs.

On the other hand, suburban growth essentially pulls large numbers of the inner city population to the outlying areas of the city proper and beyond. Each community advertises to a specific segment of the population, whether of a certain economic class, age or, unfortunately, racial or ethnic group. One might argue that suburbs are inchoate, that diversity will take root over time. This is evident in traditional ethnic areas still present in many larger cities; Little Italy and Chinatown, for example, have distinct identities, and would have once themselves been suburbs of the expanding city. In other words, suburbanization can lead to a process where whole new cities are created, over time.

Time:

There are a few aspects of time that may be associated with the deficiency of identity in satellite communities.

The first is speed. Specifically, the speed at which the suburbia as we know it was constructed in the twentieth century, since, as Kunstler wrote "eighty percent of everything ever built in America has been built in the last fifty years, and most of it is depressing, brutal, ugly, unhealthy, and spiritually degrading." (qtd. In Lukez 13) While the speed of growth fostered innovations in building technology (and vice versa), leading to such things as modular or standard construction patterns and building rule sets, what it effectively accomplished was a diminishing of the quality of construction and of the materials used. It also surrendered most of the power of building designs and planning into the hands of the developers, who, for a business model, would use the least amount of design variations and the fastest construction method to hastily build as many new houses as possible to maximize profits before moving on to the next project or subdivision.

> "The process of development and construction also contributes to the suburbs' lack of distinguishable identity. Suburbs resulted from a set of policies and bureaucratic controls unparalleled in American history. Postwar housing construction was also a process that resulted in massive demographic shifts, urban to suburban, in a relatively short time period. Question arises as to whether an environment constructed in such haste can serve as an appropriate collective memory representing the work of a civilization." (Lukez 13)

There is an analog here between Time and an individual, as one grows older; an identity becomes much more complex and layered due to the experiences gained in a lifetime.

> "Kunstler goes on to suggest that the quality of "nowhereness" pervades the urban American landscape, and is the result of many factors, including the emphasis on designing objects in the landscape rather than the spaces between them, the focus on mobility, which by definition cannot be rooted to a place, and a banal housing stock. Douglas Kelbaugh, in *Common Place*, claims that the most evident architectural losses include a lack of architectural detail, human scale, authenticity, and varied building typologies." (Lukez 16)

Figure 13: Sprawling Infrastructure. Photograph by Elliot Erwitt, Magnum Photos
(McHarg 23) An example of the complexity of the infrastructural systems used to
maintain the transportation requirements of any major city.

Robert Bruegmann suggests otherwise, i.e., that the attempt to link low-density sprawl directly to the automobile and its associated drawbacks – pollution, increased energy use, congestion or longer commute times – is problematic at best. Especially since the beginning of the dispersal of the upper and then later the middle classes from the inner city to the suburbs began long before the automobile was invented. (Bruemann 109) Access to mobility is a different theory all together; whether with respect to physical mobility, the ability or freedom to access any place when the inhabitant chooses too, or secondly, social/financial mobility or 'Upward Mobility'. Homeownership is a key component to social and economic mobility.

Cities retain their identity through layering and through the selective swapping out of elements over time. This is apparent in their varied buildings and precincts, their culture and icons, their monuments – the collisions of bodies, both individual and social. And it is the myriad connections between the present and the past that gives a place its identity, and identity gives a place its uniqueness – something that all humans strive for.

There are, however, certain contradictions at play here. The lure of leaving the congested and dirty inner city for the suburbs is the quintessential American dream for most families and is probably one of the largest driving forces behind the mass exodus to the outer cities. Mobility is something that most North Americans hold dear. In this respect the detached house and the automobile play key roles, both symbolic and practical.

> "[I]ndeed, a number of American cultural predilections inadvertently work against establishing good urban places to live. Among our yearnings, for example is the desire to be on the move. We want to move up, physically, socially and economically. We want to move away, to start again, to do it better the next time around. We want to spread out, to stand apart, to express our individuality. It is not the quarter-acre that we already own but on one of millions yet untaken that we dream about, believing that on it a good place to live and happiness will be found. Notions of rootedness, stability and permanence of place, which in many cultures are identified with good places to live and with urbanity, have been among Americans a less pressing matter." (Krieger 6)

In other words: the grass is always greener...

As evident in the previous chapter, cities that have survived centuries have attained the status of living monuments to the history and culture of their particular region, country, etc.; they have evolved over time and are the trace of the process of continual adaptation. Most suburbs, on the other hand, have very little in the way of iconic architecture or culturally resonant spaces. In fact, the only monuments and icons present in the suburbs are the commercial chains, parking lots and shopping malls,

> "If the suburbs lack identity, some of it can be attributed to the commodification of architectural typologies associated with corporate entities (fast food, retailers, etc.) and ubiquitous distribution across the country, making places more alike in order to market a consistent brand identity. Community, presently, is less about the relationships fostered and developed in a particular place than it is an image developed by corporations." (Lukez 16)

This can become an issue, and this goes back to the idea of temporality; commercial corporations can be transient in their own right, since their mandate is the generation of revenue – even at the cost of the environment, of stable employment creation and of the welfare of the community in which they are situated. Take the much-maligned Wal-Mart for example. It is almost common knowledge that this company deliberately lowers the costs of the goods it sells to force smaller businesses out of the marketplace, while, at the same time, offering minimum benefits and security to their employees. When that revenue stream ceases, particularly in smaller towns, they cease operations and locate elsewhere, drawing on newer resources yet to be tapped. The profit motive forces corporations like Wal-Mart to be both transient and temporary.

In the second half of the 20th century the infrastructure of the city was substantially updated and upgraded: railways became roadways, roadways became highways, and highways became superhighways. The net effect was the expansion of suburbs ever outwards.

Conversely, while the suburbs grew, the inner city became static, and the growth of functions and spaces that would normally happen in layers over time ceased and that energy was redirected to the continued improvement of the infrastructure and to the growth of the newer suburban community. Suburbs can behave in a parasitic way, siphoning energy and resources from the pre-existing city, debilitating the host while they grow stronger. This is a bit of an exaggeration, but it illustrates the point:

Sprawl is also eating up our wallets. Automobiles and the services and systems required to support their use cost on average about $6,000 per vehicle per year, and this is in 1997 dollars with 1997 fuel prices! Not all of these costs are apparent to drivers. Hidden subsides for highway construction, maintenance, and defense spending required to maintain oil supplies limit the ability of consumers to analyze the true cost of their transportation decisions. Hidden also are the costs of infrastructure (e.g. sewer development, construction of schools, etc.), which are rarely considered when speculative housing developers apply for permits.
(Lukez 14)

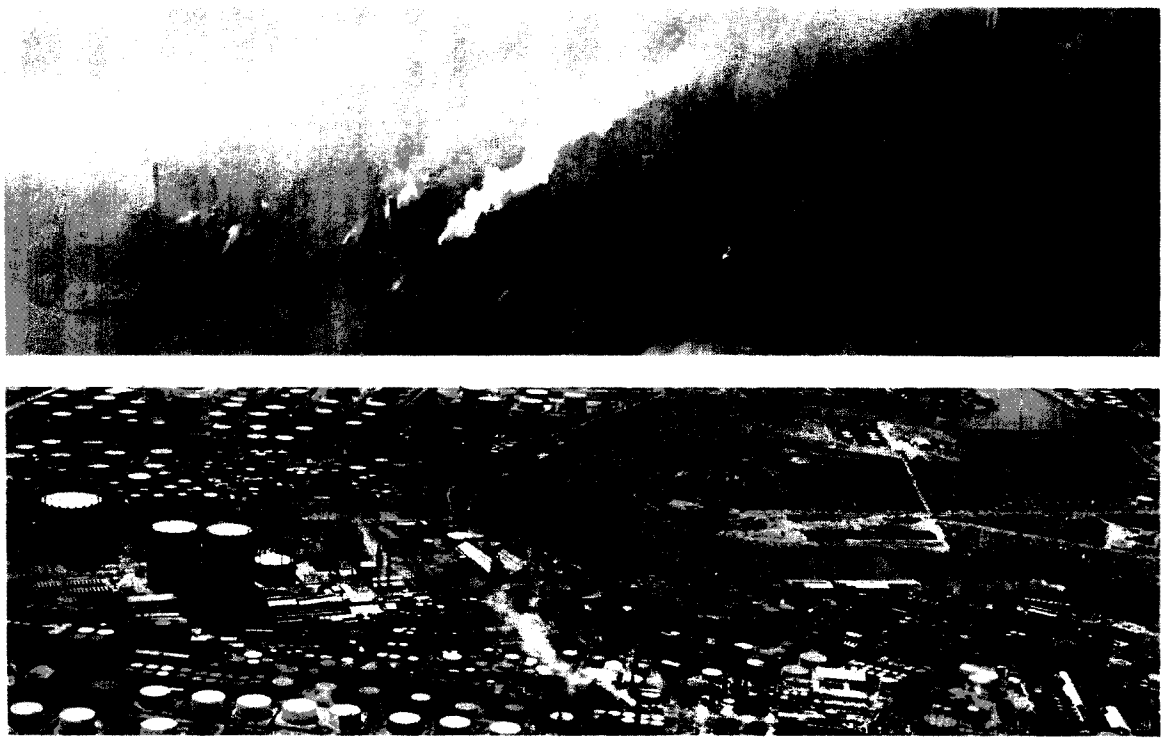

Figure 14: Photo by Aero Service Division, Litton Industries (McHarg 21) Example of the pollution and habitat destruction.

Before off-shoot suburbs are amalgamated back into the cities that sponsored them, suburban residents generally enjoy lower property taxes, better infrastructure (as it is usually newer than that of the city), while still benefiting from the city's amenities and culture.

Over the course of history, populations have dispersed from the urban centers of cities and conversely contracted in an ever cyclical relationship. Human ingenuity and our grasp of technologies are usually the catalysts of these transformations as was the case during the Industrial Revolution and most recently, the advent of the modern day suburbs.

Aided by the advancements in the infrastructural technologies that generated them, the modern day suburb through sheer scale of production has altered this naturally occurring system or cycle. So much so, that

arguably, the suburban areas now increasingly expanding beyond the peripheries of their host cities have been completely severed from a functional connection with the urban centres. In the speed with which the new satellite communities were constructed to meet the demand after world war two, created a number of discrepancies that removed them from the natural evolution of urban spaces – as per the theory of a palimpsest in Chapter 1. The major issue is a complete lack of identity within the newly built spheres since being built on, what is essentially a blank slate - the natural environment being completely scraped clean – disconnecting the suburb from any pre-existing identity.

One must understand that this will continue, this cycle of dispersion and contraction. In fact, it is possible that we are now facing today, the beginning of populations back into the core urban areas, as energy costs are becoming prohibitive to living so far from the business and cultural centres.

Chapter 3: Re-urbanization and the reaction to modernism

Cities in the Late 20th Century

After a brief description of the history of cities as it relates to urban discourse, we turn to more contemporary approaches to urban design. Which attempt to address the conflict between suburbs and the inner city; the mass exodus of people and commerce to satellite communities and the general decline of habitable spaces in the inner city.

Prior to the current wave of gentrification and the larger attempt by politicians and planners to attract suburbanites – and the tax base they provide – back into the core, the dross infrastructure of the inner city became the playground for artists, architects and the homeless. Abandoned buildings and obsolete factories were reused for all manner of abodes, studios and galleries.

> In the mid-1970s small pockets of resistance began to form as architects in various parts of the world – England, Austria, the United States, Japan (for the most part, in advanced post-industrial cultures) – started to take advantage of this condition of fragmentation and superficiality and to turn it against itself." (Tschumi 1)

This, ultimately, was the emergence of the 'urban reuse' ideology, touted a decade earlier by such activists as Jane Jacobs. She wrote:

> To say that cities need high dwelling densities and high net ground coverage, and I am saying they do, is conventionally regarded as lower than taking sides with a man-eating shark. But things have changed since the days when Ebenezer Howard looked at the slums of London and concluded that to save the people, city life must be abandoned. (Hall 255)

Urban re-use would not gain mainstream popularity again until the mid-1990s, under the rubric of sustainability as articulated in the media and the political establishment.

Bernard Tschumi:

Tschumi studied until 1969 at the Eidgenossische Technische Hochschule in Zurich. From 1970 to 1979 he taught at the Architectural Association in London, and from 1976 also at the Institute for Architecture and Urban Studies in New York and at Princeton University. From 1980 to 1983 he was visiting professor at the Cooper Union School of Architecture in New York...after his move from London to New York, Tschumi produced the "Manhattan Transcripts", designs and collages in which he tackles new forms of "architectonic notation", including such ideas as "form follows fiction". (Gossel, et al. 422)

Tschumi's theory was that architectural forms and spaces which had become obsolete could be altered, adapted (but not destroyed) and reused. In this scenario the original shell or structure becomes the catalyst for innovative design approaches by architects and planners in which both the old and new are highlighted, often through a dialogue of contrasts. This may sound familiar, as this wasn't really a new idea, but one the resurfaced from under the failed utopian experiments of mid 20th modernism, which had had little regard for pre-existing physical or social context. The important point made at the time, championed by Bernard Tschumi, was that architectural space need not be so rigid, rational and delineated, but can be more dynamic and successful when multiple functions and formal vocabularies blur and overlap.

> "[T]he complete inter-changeability of form and function...to the advantage of a general rejuvenation of architecture. If architecture is both concept and experience, space and use, structure and superficial image - non-hierarchically - then architecture should cease to separate these categories and instead merge them into unprecedented combinations of programs and spaces." (Tschumi 228)

His concepts include:

> Cross-programming (def.): Using a given spatial configuration for a program not intended for it, that is, using a church building for bowling. Similar to typological displacement: a town hall inside the spatial configuration of a prison or a museum inside a car park structure. (Tschumi, 155)

> Trans-programming (def.): Combining two programs, regardless of their incompatibilities, together with their respective spatial configurations.
> (Tschumi, 327)

Tschumi challenged the modernist architectural discourse of form follows function since the function – and therefore the form – of the city proper had become obsolete and the utility non-existent or translated to other benign forms, elsewhere.

> Just as important is the spatialization that goes with the event. Such a concept is quite different from the project of the modern movement, which sought the affirmation of certainties in a unified utopia as opposed to our current questioning of multiple, fragmented, dislocated terrains. (Tschumi 6)

Instead he proposed more of a focus on the actions or events that occur in urban spaces – or the experiences that drive movement and activity – be the concept for space or structure that would drive the genesis of form. Function not as an end point but as a momentary pause along multiple routes, also generates new events for different sectors of the city. Tschumi encouraged programmatic collisions as older buildings and neighbourhoods collided with new functional requirements. Connection and movement

become the dominant themes; for Tschumi buildings are neither static nor individual, they can become the generators of experience and a frame for constructed situations within the city, pulling inhabitants back into the city core to participate in actions and events unavailable in the outlining communities. In essence, what Tschumi envisioned was the division of the identity of an architectural form from its location, site and history – without negating site and function as considerations – privileging instead the experience of the user. (Tschumi, 193)

> [O]ne should take advantage of such dismantling, celebrate fragmentation by celebrating the culture of differences, by accelerating and intensifying the loss of certainty, of center, of history. (Tschumi 1)

Without the hindrance of a single identity, driven by function – and therefore the form – the urban environment is free to evolve as best befits the user or social situation. This is in direct contrast of the static suburban typologies which, although not overtly modernist in their stylistic aspirations, are modernist to the extent that they enshrine the principle of control (via privatization) and the segregation of uses.

Gentrification

As in all systems – whether mathematical, natural, chemical or otherwise – a balance will be maintained, and in some cases the swing back from an unprecedented waxing can be quite dramatic and violent. The economic boom in North America in the 1950s and '60s, which was a major factor in the growth of suburban communities and the spread of infrastructure that supported and gave rise to them, was followed by a period of horribly destructive economic recessions.

Many factors contributed to this downturn. Some pointed to the increase cost of maintaining the infrastructure of suburban sprawl. Exacerbating this was the rise of OPEC and the attendant shortfalls in energy production during the 1970s, as well the inability of the capitalist countries to adjust to losses in revenue from de-industrialization due to the massive losses in employment to competitive overseas manufacturing. But, perhaps, the most important factor was that cities could no longer support the services and citizens under their care (welfare, subsidized housing, transit programs, etc.) due to the loss of its middle-class tax base to suburban communities. This compounded the already declining state of the inner city, which was suffering under inflated land prices, de-industrialization, and a surfeit of poorer residents. It sent many cities into a downward-spiral that continued into the new millennium.

But the balance would eventually, after many years, start to swing back.

> "The magic recipe for urban revitalization – the American buzzword that began to circulate... - seemed to consist in a new kind of creative partnership...between the city government and the private sector." (Hall 383)

Gentrification of inner city residential neighbourhoods can be directly tied to the sprawl on the urban periphery. As cleared, well-drained land close to the city became harder to find while the cost of suburban housing rose as did the length of the commute to downtown. At the same time the decay of the central city was alluring to young people, many of whom were raised in the suburbs and came to the city to attend university and/or work. In and among the decay were pockets affluence, institutions (museums, theatres, universities) and a cadre of intellectuals and artists who never embraced the suburbs. Moreover, with the introduction of birth control in the late 1960s, many young people were able to wait longer to have children and were less immediately in need of the well-funded schools and multi-bedroom houses with large backyards that families with children so desired. As the pace of gentrification intensified and the cost of living in the center rose, single, childless professionals or yuppies displaced not only artists but many lower-income families living there. (Bruegmann 56)

By attracting 'Yuppies" or Young Urban Professionals into core or downtown areas with restored commercial and entertainment amenities, and a lifestyle more equivalent to a European one, the city could expand its tax base. It was on this basis that cash-strapped cities helped to finance portions of the projects. Themed urban destinations also attracted tourist dollars from upper and middle class suburbanites who visited the city to experience the upscale attractions and vibrancy that was lacking in the suburbs. (Hall 384)

Some of most notable examples, and among the first of their kind, were the Baltimore's Inner Harbour, the Boston Waterfront, and London's Covent Garden redevelopment. Each of these combined new sequences of activities, recreational, cultural, commercial and mixed-income housing in larger, historically and culturally significant areas in an effort to attract tourists to the city. It was quite successful; at one point Baltimore's harbour front development was attracting "22 million visitors a year, 7 million of whom are tourists, a figure comparable with Disneyland." (Hall 386)

> "[T]he process of creating successful places is only incidentally about property development. It is much more like running a theatre, with continually changing attractions to draw people in and keep them entertained. It is no surprise that perhaps the most successful model of all, the 28, 000 acre Walt Disney World in Florida, is run by a company which has divisions concerned with 'Imagineering' and 'Attractions.'" (Hall 386)

While this may seem like some very simple answers to the cause and effects of modern suburban sprawl and its subsequent reactions, in fact, there are many and complex interactions that may have led to the form of North American cities at the dawn of the 21st century. We have explored the idea that technology facilitated the outward migration of the middle class, particularly in the form of infrastructure that allowed larger and larger segments of the metropolitan population to live outside the core while maintaining access to it for work, recreational and cultural activities.

We also identified economic prosperity as a factor. Financial mobility – a combination of stable salaries and the availability of affordable housing on the periphery – opened suburbia to larger percentages of the population. Home ownership – more accessible on the periphery than in the core – contributed, in turn, to the prosperity and financial mobility of the middle class. Also at play was the shift of many manufacturing and industrial jobs to outlying areas, and the daily commutes to any number of financial or business districts distributed throughout the metropolitan area.

The availability of land is also a key factor. Unlike their European counterparts, Canada and the US are blessed with an abundance of land, which is treated as much as a commodity as a public resource.

Underlying the whole suburban proposition is the American dream, namely that hard work begets prosperity and that prosperity is best manifested in a detached home on a manicured lawn surrounded by a white picket fence, situated in a subdivision with access to plenty of green space and neighbours of similar disposition. This is a variation on the time-honoured tendency of the middle-class to emulate the affluent, who, throughout time, have established villas in the country to escape the congestion of the city. It is the modern manifestation of the longstanding connection between wealth and land ownership.

In the end though, it all comes down to choice. The principle of choice is enshrined in most democratic societies; it manifests itself both politically and economically. Equally, if not more important, is the perception of choice – as is money, freedom coming at a cost. But, the many and varied individuals that comprise a city, will of course make separate and differing decisions in where they will live based on their preferences, however they might be formed or informed. The dynamic interplay between cause and effect promote cycles in the preferences and migration patterns of city dwellers, many of which are not fully understood by urban planners, architects and policy makers.

> "In the case of urban areas and sprawl, as in the case of virtually any vast and complicated human or natural system, there is very little simple cause and effect. Rather, there are innumerable forces, always acting on each other in complex and unpredictable ways." (Bruegmann 112)

The only constant in all of this is the idea of change. One aspect of this is movement, which, in turn, can be manifested in several ways. Literal movement implies physical translation through space. Movement through cities can be accomplished via mass transit, personal transport on one of the many superhighways criss-crossing the metropolis, or, if you consider yourself a 'sustainability conscious' individual, by bicycle or on foot. Another aspect of movement is social mobility; changes in employment or social status can motivate individuals to alter their routines, habits or living environment. Where functional spaces are concerned, movement can dictate or describe how spaces interact and allow the inhabitants to experience the attractions of the city. Whatever the form, movement is both linear and cyclical, begetting returns, overlaps and palimpsests, if you will, ongoing since the first settlements were built by humans and supported or influenced by the infrastructures that tie our cities and neighbourhoods together.

Chapter 4: Tower City, Radiant City, Vertical City

> "Modernism is ushered in by a return of the old Gnostic dream of escaping the all too material prison that is our body, of flying into that boundless openness demanded by our godlike freedom". (Dodds, et al 158)

This chapter will focus on the history and development of the tower or skyscraper. On a purely literal level, stacking spaces is one of the most efficient ways of using land. The ratio of footprint to usable space makes the tower a compelling alternative to sprawl and mitigates the impact of the price of land on the overall cost of built space.

New York was more or less the birthplace of the vertical city. Although, technically, the tower was born in Chicago – engineers there having developed the system of steel frame construction and vertical transportation systems that enabled tall buildings – the physical and social landscape of Manhattan produced one of the most vertical and socially dynamic cities of the Modern Age. As Manhattan grew skyward Le Corbusier developed a variation on the vertical city, grounded in a vision for the future of Paris. By comparing Manhattan with Le Corbusier's *Ville contemporaine* -- essentially two extremes of the vertical typology -- we can better understand how a city that accommodates living spaces in towers might offer an effective alternative to suburban sprawl.

A Brief History of New York City

Manhattan was discovered in 1609 by Henry Hudson; an explorer, in the employ of the Dutch East India Company, who was in search of the fabled 'new trade route to the Indies.' According to *Delirious New York* by architect Rem Koolhaas, there are no accidents with the Dutch, and since there whole country is man-made, they plan the construction of the new colony as if it is part of their fabricated homeland. Thirty families set sail from the Netherlands to Manhattan Island to plant a colony. With them was Cryn Fredericksz, an engineer, who carried written instructions on how the town should be laid out. This desire for order, a Dutch instinct, would occupy the planners and continue to shape the island as a whole for the next 300 years. In 1626 Peter Minuit buys the island of Manhattan for 24 dollars from 'the Indians'. They do not own the island, they are just visiting. (Koolhaas 15)

The New York City grid dates to 1807 when Simeon deWitt, Gouvernur Morris and John Rutherford were commissioned to design a framework to regulate the 'final and conclusive' occupancy of Manhattan. They proposed, a grid system – a crossing of avenues, 12 running north-south, and streets, 155 running east-

west, which separated the inhabited sections of the island from that of the wild and which would, according to its authors, facilitate the "buying, selling and improving of real estate." (Koolhaas 17)

Koolhaas, rightly proclaims the division of New York into a grid as the future: its provided the matrix for the most sustainable city in the world, bringing together 'the land it divides... the population it describes...the buildings it locates...the activities it frames..." (Koolhaas 16) While this point be will expanded below, suffice it to say that the grid provides a the maximum number of choice with the least amount of resources.

The Grid system has been around for millennia, and like the palimpsest it provides a suitable base for a sustainable city:

> "A sustainable city must also be adaptable. This is the case for urban fabrics of small fractal-shaped elements; they seem more apt to resize and evolve since the destruction of an element and its replacement are more easily accomplished, require fewer means, and do not disturb the whole organism. Roman cities persisted over the centuries in this way, changing as time passed, one building at a time. The opposite is true of the hard-to-replace very big elements and the major highways requiring sizable investments that are nearly impossible to transform. (Salat & Celnik 32)

Due to the imposition of a grid system on Manhattan Island, previous urban history and the lessons learned became irrelevant and the architects were required to create a new form of architecture. That said, however, several pre-existing forms survived the abrupt shift from a more organic organization to an orthogonal grid. A palimpsest remains of the original trails and forms that pre-dated the coming of the Europeans, most conspicuously Broadway, which cuts across the Commissioners Grid at a slight diagonal. It is the lack of alignment between Broadway and the north/south avenues that creates many of Manhattan's "squares" (Union Square, Madison Square, Herald Square, Times Square, etc.).

> "And it is striking how many features of the aboriginal layout, topologically determined, persist in the modern city, though the topology itself has been much changed. The original lanes and highways of the Indians and the patron proprietors formed the basis of some of the avenues of later days" (Goodman 40)

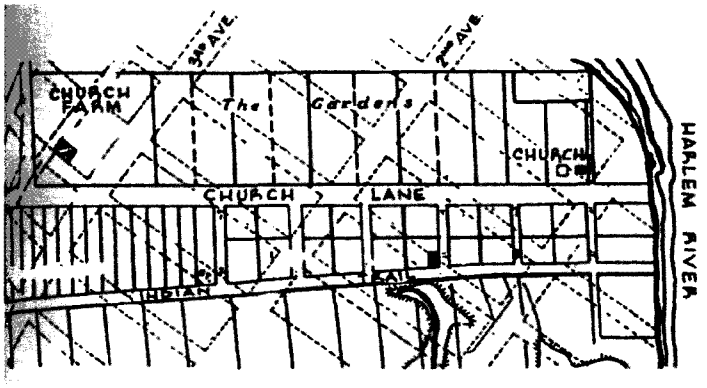

Figure 15: Village of New Harlem, 1670, overlaid by 1811 gridiron. (Communitas 41)
An existing palimpsest in New York

Either connected to the past or not, the new grid of New York created a unique urban setting comprised of individual world contained within identical blocks. Each evolved into a unique environment, creating its identity not through connections with neighbouring forms or space, but from within.

> "[E]ach architectural ideology - each intention- has to be realized fully within the limitations of the block. Since Manhattan is finite and the number of its blocks forever fixed, the city cannot grow in any conventional manner."
> (Koolhass 21)

By 1850, the exploding population of New York forced the city to appoint the Commissioners of Estimate and Assessment, who were tasked with reserving sites that were still available for parks within the city grid. A site between Fifth and Eighth avenues and 59th and 104th streets" was surveyed and acquired for what would become Central Park. (Koolhass 21)

The 1851 International Exhibition in London, and in particular the Crystal Palace, triggered the ambitions of Manhattan into staging a fair of its own and "staking a claim for its superiority...over all other American cities. The fair is marked by two colossal structures which completely overwhelm their surroundings, introducing a new scale in the island's skyline." One was a dome on a cruciform structure, mimicking London's Crystal Palace, while the second, complementary structure was a tower, Latting Observatory, 350 feet high and possibly the world's first sky scraper. (Koolhass 33)

There was one other invention on display, namely the elevator -- arguably the most important invention in the history of the vertical city. Not only did it move passengers skywards, but it did so with speed and safety previously unheard-of.

These concepts, coupled with new technology, inform the trajectory of vertical design in the next two centuries:

The Corbusian Ideal City:

> "The house is a machine for living, the street a machine for circulation."
> ~Le Corbusier (qtd in Hall 219)

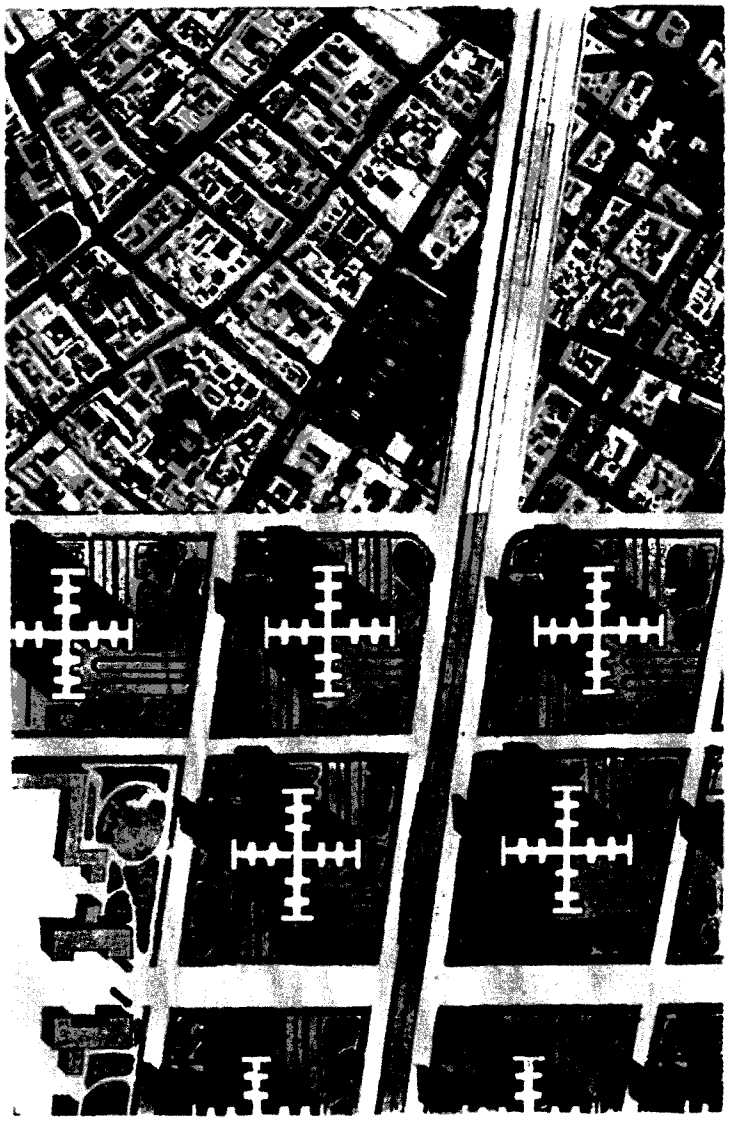

Figure 16: Modernized view of a famous drawing by Le Corbusier comparing traditional Paris with his *La Ville Radieuse* project. The top grid represents the Beaubourg district of Paris today. This image highlights the massive size of the
Infrastructural systems proposed by Le Corbusier for his master plans – well out of scale with the traditional Paris city scape. (From *Urbanisme* by Le Corbusier, 1925)

Figure 17: Perspective view of the *La Ville Radieuse*. (Salat and Celnik, 10)

La Ville contemporaine (a later and more advanced version of La Ville Radieuse) and most of the projects conceived by master architect, Le Corbusier, were an attempt to liberate the City of Paris – and by association all cites that had grown organically on an essentially medieval foundation – from the pollution, over-crowding and darkness of the industrial era. The tenets outlined in the Athens Charter in 1933, by the Fourth International Congress of Modern Architecture (CIAM), became a model for future city organization and Le Corbusier was an avid promoter of these ideas, namely:

> "[A]rtificially separate[ing] four urban functions – living, recreation, working, and circulation – in opposition to the existing urbanism that was characterized by mixed-use and tightly interwoven functions."
> (Salat & Celnik 5)

Le Corbusier's plan was an attempt to achieve a measure of density and control within the urban fabric of Paris. Being a Swiss watchmaker's son, the chaotic and decrepit everyday of the City of Lights was anathema to him – the Swiss being the "model of self-control, of cities with not a stray blade of grass out of place, while the watch is the perfect metaphor for the machine, crowding thousands of minute components into a planned harmony." (Hall 221) So he decreed:

> "The key was the famous paradox: we must decongest the centers of our cities by increasing their density. In addition, we must improve circulation and increase the amount of open space. The Paradox could be resolved by building on a small part of the total ground area." (Hall 224)

But his triumphs became his downfall, for like a machine, precise and lacking remorse, he decided that the only course was to strike from the world the cancer that was the old Paris, remaking it in his pure vision of how the world would be ordered. Separating the strong from the weak, compartmentalizing his creation and the people he sought to free, in an effort to force order and harmony, to free humanity from toil by remaking the built world in a much more efficient fashion.

The Radiant City, a subsequent iteration of the *ville contemporaine,* was organized as follows:

> "The 24 skyscrapers are 220 meters high. Each branch of their cruciform plan has a total amplitude of 190 meters. They occupy square plots of 400 by 400 meters between axes separate by roads. The total area occupied is only 5% and in fact the percentage is next to nothing if one considers that they stand on pilotis. The set-backs, 30 meters high and 18 meters deep, are a repetitive structure virtually limitless in length, running through a rectangular road grid of 600 by 400 meters. The percentage of ground coverage is 12. The closed cellular blocks are 30 meters high buildings, 9 to 15 meters deep, organized in rectangular plots of 100 by 350 meters. The area occupied is 17%." (Salat & Celnik 9) – see page 51 for plan view.

The core of the city, the area with the largest towers would house the administration, governmental and commercial businesses along with their owners and employees. All the amenities associated with living in the urban city, entertainment, restaurants, cultural centres, would be located in the residential towers and cater to those of the elite status. The lower classes, or manual labour, servants, etc would be relegated to the ring 'satellite units' which would also have their associated amenities open to those of the appropriate 'class' with the factories, warehouses and heavy industry farther out still. The Radiant City not only would have had a large impact on the morphological elements of the city of Paris; the plan of the Radiant City would take up a massive amount of the ground plane of the city in an attempt to gain as much green space as possible while maintaining a sizable density and allow for the transportation network to funnel the inhabitants to their destinations. But by association, Le Corbusier was also attempting to alter the sociological fabric as well. (Salat & Celnik 8)

> "Unlike the Paris of the 1920s, where rich and poor tended to live in close juxtaposition *La Ville contemporaine* would have been a completely class-segregated city." (Hall 236)

While the urban vision embodied by The Radiant City has long been discredited, there is little doubt of its influence on architecture and design, particularly in the post-WWII period. Perfected in Villa Savoye (1929 – 1931), Le Corbusier's five points for modern architecture are ideal for sustainable urban construction.

- Pilotis
- Free plan
- Free façade
- Horizontal windows
- Roof Terrace

A structure on pilotis, in conjunction with a roof terrace, makes use of the vertical space within the urban core, allowing both mixed use and residential-only towers to maximize their habitable square footage relative to the footprint. This approach leaves the space around and beneath buildings untouched and available. The roof terrace can be partitioned to accommodate a mix of uses, including energy generating equipment (micro turbines, solar collectors), growing space and public gathering space. Using the roof helps compensate for whatever green space was consumed by the structure itself.

Being raised on pilotis, much of the ground plan beneath the building is available for recreation or, depending on the scale of the structure and its height, for parking, mitigating the need to consume additional land for this purpose. The second two points, the free plan and the free façade – made possible through the use of columns and structural slabs -- affords the architect or designer maximum freedom to arrange interior spaces without the encumbrance of load bearing walls (except for the odd shear wall) and permits virtually unlimited fenestration of the building envelop. Combined, these points allow a structure of comparable size to suburban homes to be built with less material, a more spacious interior, connections with the exterior spaces and arguably a better living experience.

Critical Comparison:

It is evident that Le Corbusier's vision for a city of towers was influenced by what was occurring in Manhattan in the early 20th century. In addition to the towers, the grid figures prominently in all of Le Corbusier's early urban proposals. His belief that "where order emerges so does well-being" also carried over to his choices of form and materiality – at least prior to WWII. Similarly, the Commissioners' grid ignored and replaced the existing geography of Manhattan with an abstract and artificial ordering system to structure the sale of land and form of the built environment.

> "Le Cobusier sought to decongest city centers, augment their density, increase means of circulation, and increase open spaces. Purism informs his architectural choices. It is evident in the simplicity of form, organization and rigor." (Salat & Celnik 4)

But, where Manhattan's gridded organization ultimately gave the city its life and future, the grid overlaid in Le Corbusier's *ville contemporaine* actually caused more problems than it solved. This was due, in part, to the amount of space required to accommodate the large matrix of towers and green spaces that Le Corbusier hoped would lead to a decrease in congestion and an improvement in the overall quality of urban life. This space separated and physically segregated people into silos, doing, in the vertical dimension, what suburbia does in the horizontal. And even more land needed to be expropriated to accommodate the large

transportation corridors required to move the three-million inhabitants of this city back and forth from their workplaces.

> "Statistics show us that business is conducted in the center. This means that wide avenues must be driven through the centres of our towns. Therefore the existing centres must come down. To save itself, every great city must rebuild its centre." (Hall 224)

Since he had situated most of the employment for the city on the outskirts, far from the habited zones – which is referred to as functional zoning – the size of infrastructure needed to accommodate all the transport would be extensive. As he saw fit to remove all the 'redundant' existing urban streets, he had effectively cancelled his notions of reducing congestion. Explained by:

> "Connectivity – Some of today's most frustrating rush hour snarls occur on the perimeter highways, which pass through the un-crowded suburbs. Arterial highways channel traffic and, therefore, limit choice. A network of streets, narrow, crooked and even redundant, provides actual choice and, more importantly, the promise of choice." (Krieger 8)

Le Corbusier's choice would eventually have created a domino effect, as wider and faster highways would only make driving more efficient, attracting drivers back to the roadways as is evident today in most sprawling suburban cities. And once the density of the inner city had increased beyond the point of the infrastructure to sustain it, the city would expand and the infrastructure would follow suit. In this case though, the new infrastructure would be using the aforementioned green spaces that were destined to be a benefit of the project in the first place. In the end, the *ville contemporaine* would have ended up sprawling just like more contemporary suburban cities as the matrix that he envisioned lacked any real adaptability. This is evident in the influence that his theories have had on modern planning and the results of those policies, which will be listed in a subsequent chapter.

> "The problem of longer commutes was never resolved by Le Corbusier who continued to separate working and living areas, whereas the traditional Parisian fabric offers a mixed built environment of offices and dwellings that make it possible for people to live close to work and helps prevent the desertification of areas at certain times of the day." (Salat & Celnik 8)

This is a quite different outcome when you compare the *ville contemporaine* with New York. The grid structure of Manhattan enables each node to grow independently of its neighbours and sustains a diversity of functions. New York accommodates a high population density in a compact area while providing a measure of flexibility and adaptability. "Density, as distinct from congestion, promotes engagement. Interaction, made possible by proximity, is crucial and far more difficult to sustain when things are spread

out across great distances." (Krieger 8) Almost by definition Le Corbusier's cities lack diversity in form and morphology; they are planned to safeguard against mistakes rather than to accommodate adaptation and promote flexibility.

Compactness can mean a variety of things although, in general, smaller objects of any scale are more efficient than larger ones to the extent that they require less material or energy to construct. In urban planning, there are benefits to density, i.e., the kinds of densities to which Le Corbusier aspired. One such benefit is the ability to support a wider range of functions and forms, but there are others.

In construction technology, compactness refers to a compactness parameter. The more compact a building is, the less heat loss there is through envelopes." (Salat & Celnik 18) As buildings are built closer together they will start to share constructed forms, walls, roofs, heat, things that will confer a measure of efficiency to the related buildings.

When comparing the energy needs of the Manhattan block – and even the more traditional Haussmannian Block of Paris – versus the isolated towers of Le Corbusier's Radiant City, even at first glance, one can assume that the towers will use more energy to provide the services and infrastructure needed for the inhabitants. This is the trade-off for light and air. Within the blocks of cities like Manhattan, contiguous structures and units share heat amongst each other. Isolated buildings, by contrast, irrespective of insulating technologies employed, will require more energy to operate. But, if one were to take a single block/row -- a typical Haussmannian block, for example – unfold them – and were to stack it onto the next block, effectively creating a tower, then you would have the exact same number of exposed sides. The reason that Le Corbusier's matrix of towers would not benefit from compactness like that of these two typologies is the space between the towers required for the infrastructures and green spaces. In either case though:

> "Tall buildings have much less exposed exterior surface per square foot of interior space than smaller buildings do, and that means they present relatively less of themselves to the elements, and their small roofs absorb less heat from the sun during cooling seasons and radiate less heat from inside during heating season. (The beneficial effects are greater still in Manhattan, where one building often directly abuts another.)" (Owen 53)

At a density of roughly 71,000 residents per square mile (as of 2009) New York provides benefits that far out weight those of the Radiant City matrix. The paucity of horizontal space on the island has forced the city to evolve upwards. Manhattan's residential towers are a boon to the surrounding area, freeing up massive amount of land around New York for sprawl and farmland

The destruction of farmland while still a major tenet of the anti-sprawl discourse, has become much less of an issue in the last few decades. Agricultural yields have steadily increased while the amount of land devoted to agricultural production has diminished. This is mainly due to mass production and factory farms operating in the United States and Canada. The focus of this particular debate has shifted somewhat to idea of preserving the landscape and the natural ecosystems – in tandem with environmentalist arguments – as opposed to the anxiety over loss of farmland. Although, it is important to note, that the amount of land set aside for permanent green space, national parks and forests, etc. has been increasing faster than the amount of urbanized land. (Bruegmann 143)

While cities, in any form, generate plenty of environmental drawbacks (greenhouse gases, solid waste, etc.), increasing densities and reducing the amount of land consumed helps to combat the larger impact on the environment. The carbon foot print of city dwellers is substantially less than that of the average suburbanite. (Owen 47)

> "Spreading people out increases the damage they do to the environment, while making the problems harder to see and to address." (Owen 47)

Cyclomatic Complexity:

> "[is] a useful tool for measuring the city's connectivity and this simply is a function of the layout of its urban blocks...the higher this number is, the more diversified the possible paths and the less congestion there will be. In addition, a wide variety of paths lends itself to diversified modes of transportation." (Salat & Celnik 28)

The towers of the *Ville contemporaine* would have had a complexity of 4 with an average distance between intersections of 400 meters, while Paris had a complexity of 88 with an average distance of 120 meters. As per the Commissioner's Grid, the 281 x 61 meter blocks of New York City impute a much higher complexity than that of Le Corbusier's plans. Which is only fitting, as the grid not only allows multiple avenues of mobility, it provides a stable structure with which to plan and execute an urban mass transit pattern. It also provides inhabitants and tourists a simple method to locating oneself within the city.

> "Streets offer shops, open spaces and places for meeting, strolling and relaxing. In very tall towers, elevators are needed to take people from one place to another. Circulation in such a context necessarily involves a destination – a beginning and an end – which leaves little room for the changing paces, movements and spur of the moment shifts in direction that characterize human circulation." (Salat & Celnik 29)

While there can be no disagreement with how humans investigate and discover new spaces, the idea that shops, spaces for meeting and relaxing can only occur at the ground level is incorrect. Most towers in Manhattan, and other cities, maintain shops, restaurants, and all varieties of functions in the first few floors of a building, not just street level. One benefit of the electronic age is that advertising is not longer relegated to just the window of the shop, but can be located anywhere, therefore maintaining a physical connection to the ground floor is not as important as it once was. And as more and more green spaces are built into the vertical sections of towers, you will find that many of those shops and restaurants will relocate with them, to benefit from the attraction, vistas and open air spaces.

Scale:

New York City, principally Manhattan, may respond to the human scale, with most amenities and functions within easy and walk-able reach, but this is mostly in the horizontal dimension. While, functionality (and land prices) within the urban environment may promote building vertically, using that infinite space as a resource, no one can question the shock that a human can feel when ascending to the nth floor of a skyscraper and witnessing the enormity of the landscape as it approaches the horizon. Yes, our minds can understand or comprehend the scope of the world, learned mostly from representational models spinning beneath our hands, allowing us to place ourselves within the context of what we see but it certainly does little justice to the actual experience – a decidedly spiritual moment. Were/are humans meant to experience space so far from our normal plane of existence? We have attempted to liberate ourselves from the ground plane for as long as we have been able to dream, and certainly since we began building and creating technologies. Vitruvius speaking of the first builders:

> "[Vitruvius] mentions in the first place is not their extraordinary ability to use their hands and fingers, or their capacity to imitate, learn from, and improve on what the observe, but their 'not being obliged to walk with their faces to the ground, but upright and gazing upon the splendour of the starry firmament." (Dodds, et al 150)

There is a reason some humans are afflicted with fear of heights and of enclosed spaces; it is a throwback to a time when instinct was very much the reason we survived our evolutionary history to become the dominate species of this planet. But the fact that for all our technological advances and cultural adaptations these instincts are still a part of the subconscious of some, should at least raise the question of whether or not humans can 'live well' so far from the earth's plane.

Despite the drawbacks, the tower or any vertical space, finally achievable with modern technology, offered designers the opportunity to reorient the city from horizontal to vertical. Each additional floor represents

additional square footage, which not only increases the land value through an increase in leasable space, but does so with a minimum impact and on the smallest possible site. The tower was also a means of increasing the amount of open or green spaces within congested and difficult spaces like Manhattan.

This chapter was intended to highlight some of the extremes of modern urban design, contrasting Le Corbusier's *villes* (*contemporaine* and *radiesue)* – which embodied the tenets of the modern movement in the early half of the last century – with New York City. While New York deployed a grid similar to the one that Le Corbusier proposed for Paris – reordering space will little regard for existing built or natural assets – it has filled out in a more or less organic fashion as compared with what was envisioned for the Ville Radieuse. But both are just that, namely extremes, and probably not literally applicable to other cities. This comparison was not intended to promote one over the other, but to identify extremes by way of suggesting a possible middle ground. One must certainly concede that some of the strategies embodied in these examples could help alleviate planning issues facing cities today.

The grid is one example. New York City's grid of blocks is flexible enough to accommodate virtually any architectural form, while optimizing the use of infrastructure space (e.g., curvilinear roadways tend to use more ground space than orthogonal ones). And while the Le Corbusier's pilotis would probably not work in a northern climate, his towers and *unités* demonstrate how the spaces beneath and above buildings and infrastructure can be leveraged as a spatial resource.

Chapter 5: Intensification/Infrastructure/Infra-scape

> "The more complicated our industrial system, and the greater our population, the bigger and greener should be our countryside, the more compact and neater should be our towns." (Hall 238)

Intensification

Suburban sprawl is considered by most to be excessive and environmentally dangerous. The common conception – for much of the 20th century -- is that to save the city from decay and bankruptcy, the city centers need to be re-ordered, redesigned and re-directed to larger sectors of the middle class, who will accept smaller living spaces in exchange for a more stimulating and sustainable lifestyle. This, however, is more of a challenge than it may seem. As mentioned in previous chapters, gentrification can be a double-edged sword. It also involves a protracted and expensive process requiring co-operation between private and city/local governments, and does not always achieve the desired effect. What may be a fashionable trend at the moment may eventually fail due to the constant cycle of population contraction and dispersal – as described in Chapter 2. Additionally, as interest in an urban neighborhood escalates, the functions that it supported during its period of decline may no longer be able to be accommodated. They shift elsewhere, often pushing poorer residents and social problems into areas less well served by mass transportation and social services. In many cases problems are shifted to inner ring suburbs with inadequate or severely distressed housing stocks.

> "[W]hile housing and industry can often be located conveniently around the edge of an expanding town, difficulties areas with the central area, especially the central provision for business, shopping, and social amenities. The space needed for these purposes naturally increases as the population of the town grows, and increases further with greater family income and national wealth." (Lewis 44)

But compared to low-density sprawl, gentrification, if managed properly, has a greater potential to sustain positive and meaningful growth.

> "Thus it is a major aim in urban design to facilitate the freeing of space for the growth of central area functions." (Lewis 45)

"Freeing of space" may not be the best terminology to use. "Freeing" implies removal of existing structures and/or infrastructure to open space for future inhabitation. As observed earlier, the energy embodied within existing structures is not inconsequential and should be treated with respect, if not reverence. Instead of the word "freeing," we should use the term "transform," as this was the traditional method of

converting or adapting existing built form into newer, more useful ones. Using a process more akin to evolution (see palimpsest: chapter one), we can more efficiently adapt and re-use the spaces and forms that already exist.

Infrastructure

Cities are characterized by abundance of infrastructure (roads, rails, freeways, etc), which, in the worst case, divides the city up in its attempt to connect it together. Infrastructure splits the city into zones, blocks and neighbourhoods and ultimately provides conduits for people and goods to enter and exit the city.

> "As cities grow larger, in population and in geographic size, it is clear that a major element in urban structuring is mobility." (Lewis 14)

Given its size, complexity, massiveness and variety, infrastructure also tends to dominate the spaces and consciousness of the city, causing disconnections of scale.

> "The effects of such formative forces on urban structure are virtually permanent. The huge right-of-way of new highways and interchanges, ploughing through the fabric of existing cities, must be regarded as permanent structure. [A]s powerful in the structuring of an urban region as the river, the Seine or the Tiber, used to be to the historical city." (Lewis 15)

As infrastructure expands and occupies larger amounts of the area within the city grid, it can destroy existing buildings and functional spaces and can also limit the amount of space available for rejuvenating derelict systems and sectors.

Infrastructural systems in cities have often failed to live up to the promises of those who championed them. Like many urban forms, infrastructure can become obsolete, pernicious or anachronistic in how it serves and interacts with the local environment. Highway ramps may no longer provide easy access between the downtown and its suburban offspring. The promise of accessibility may spawn gridlock in the city itself and bumper-to-bumper traffic along to routes into which they connect. This not only diminishes the quality of life in the city but disadvantages those who live in the suburbs -- despite the fact that virtually "every new highway or infrastructural system that is laid down or projected is conceived as an amelioration of inherited problems, and not as a catalyzing agent promoting new patterns and densities of urban growth." (Lewis 17) Fortunately, the very systems that were the midwives of suburban growth and the deterioration of the

urban centers – namely, infrastructure – come become the means for achieving modern and sustainable cities.

Like obsolete forms within traditional, organic cities (baths, stadia, fortifications, aqueducts, etc.), contemporary infrastructure is ripe for an evolution to a form that will not only improve the quality of life throughout the metropolis but can become a catalyst for sustainable growth. The massive amount of vertical space available above much of the infrastructure that serves our cities – highways, rail lines, etc. -- offers a stable site for building. It is stable to the degree that infrastructure is among the best built and longest lasting components of the built environment. Just as rail rights of way have been used for highways (and more recently bike paths) and canal towpaths have been redeveloped as parkways, infrastructure can support multiple waves of development, redefinition, and re-ordering over time. Infrastructure represents an opportunity on which to grow or create new forms and functions, which, if designed effectively, can support the revitalization of cities and efforts to improve urban cores. It is already largely public land. Building onto, into and over infrastructure can generate new types of palimpsests, or 'hyper-palimpsests.' Structures elevated above highways, railways, waterways, existing buildings, etc. can establish new ground planes capable of accelerating the layering process and of creating new and interesting connections between adjacent spaces and structures, both horizontally and vertically.

In a complete inversion, grafting onto and densifying the very vectors that promote the outward growth of the city, will help to keep this expansion in check and mitigate the negative impacts of regionally scaled infrastructure on the fine-grained fabric of the traditional core. Building vertically will promote 'intermodal' spaces, which can be described as an amalgamation of functional spaces for circulation, habitation, commerce, etc. This is similar to what one might find in a typical mixed-use building, but situated within the same vertical corridor are movement or transportation connections, i.e., mass transit, typical highway, roadway or shipping corridors. This can provide a certain efficiency that is otherwise lacking in traditional or even contemporary city planning. On a purely literal level, mass transit corridors/connections represent underused spaces. More efficient use of areas above, beneath and around them will lessen the demand for buildable space outside of the city. The inhabitants or users of those spaces will also be better served by transportation infrastructure, to which they will have virtually immediate access.

Figure 16: P.A.R.A.S.I.T.E. Project
(Korteknie Stuhlmacher Architecten, Rotterdam, The Netherlands, 2001)
An architectural parasitical experiment. This modular house was constructed in the vertical space above an existing factory, making use of the existing mechanical and circulation systems of the site.

> ..., [C]ities are inherently dense, and density can greatly reduce a society's overall drain on natural resources. An apartment dweller who occupies less than 100 square feet, has no lawn to water, shares a heating system with his fellow tenants, and uses public transportation is far kinder to the environment than his counterpart in the suburbs who drives everywhere and lives in a single-family house on its own landscaped plot. (Stang & Hawthorne 18)

Coupled with green roof technology or elevated green spaces, one can 'reinstate' much of the green space that was and is destroyed to create the infrastructure or buildings in the first place. All the green technology, regulations and environmentalism that have become popular in the last few decades will mean nothing if we decide to completely destroy this world's ability to generate energy. There exists within our ecosystem a finite amount of surface area with which organisms can perform photosynthesis (terrestrial plant life, plankton, etc.) – the genesis of all forms of life and systems on earth. Building cities and neighbourhoods in a low-density, horizontal fashion serves to destroy this finite resource, as most single-family homes do not 'reinvest' in recreating that lost footprint of energy generation once their home is built. This is compounded by the number of houses in the suburbs. Truly, only a house that transfers a green layer to the vertical space above the structure can be said to be spatially efficient. This can include not just transportation networks or family homes, but also some of the most destructive built elements, namely big box stores.

> "Dwellings migrate to occupy the vast horizontal roofscape of the big boxes. The repetitive system of open span structure with aisles and storage racks in the big-box store below establishes a linear designation of houses above. Storage structures extrude through the inhabitable roof plane of the big box, delineating property divisions within the alternating pattern of houses and yards above and providing a container for the equipment and commodities of domestic life. In this hybrid of the logic of house and

store, the identities of both are maintained, but in an altered form – now cross-wired to produce unanticipated social and spatial relationships through their mutual influence." (Lewis & Tsurumaki & Lewis 76) – see figures 17, 18.

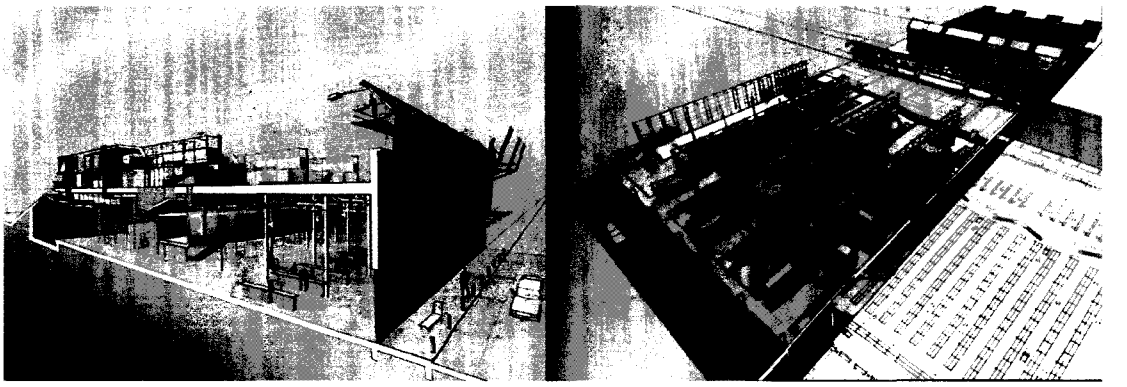

Figure 17, 18: New Suburbanism (Lewis & Tsurumaki & Lewis, *Opportunistic Architecture*, 2008)

There is potential to generate additional lines of movement through the urban fabric with which to create new experiences and connections by bridging between neighbourhoods that have been fragmented by infrastructure. The multi-functional spaces of these bridging structures should be designed not only to attract existing city inhabitants and provide sustainable functions, but also attract tourists.

> "Infrastructure can play a key role in identifying places, and provides an armature for transformations. Modern societies are defined by mobility. Mobility equals freedom, and freedom is associated with time: time to make money and enjoy the fruits of one's labor. Time also equals convenience. Loss of convenience results in a loss of time, money, and opportunities for recreation. Therefore, the infrastructure of space is the infrastructure of the economy and, by extension, of our culture. The identity of a town, region, state, or country is tied to the shape and form of its infrastructure." (Lukez 37)

Identity, memory and diversity, lost to the inhabitants of the modulated suburbs, can be made available by a typology that creates new social landmarks woven together by 'multivalent performances, which intensify everyday public experiences through overlapping functions and creative juxtapositions.' (Lukez 13) However these are only achievable and sustainable (financially and otherwise) when certain densities are reached.

To complete this chapter and lead into the conclusion, one final project must be shown.
Underused with the advent of trucking, New York City's Highline – an elevated train line through a number of west side warehouses – became derelict and eventually closed in the 1980s. In 2009, it finally reopened – after years of lobbying the city, design competitions and urban studies – with much fanfare. The design approach is quite simple and elegant: reuse the existing elevated track line as a connection or parkway. The corridor along which it runs went undisturbed during the re-construction process. Considered a park, portions of the Highline are heavily planted, re-naturalizing parts of the city and providing new unexpected

views of the storied landscape that is New York and its environs. It now stands as a true, award-winning example of urban re-use and of the capacity infrastructure that has to increase the value of our urban centers.

Figure 19, 20: The Highline (Greenhood, Robert. *Highline.* New York State Council on the Arts, 2010. Web. 20 August 2010)
The Highline Project rejuvenated a derelict elevated train railway as an urban green space and boardwalk. The image on the right shows how it continues below an existing hotel, sharing the same space and creating an intermodal node.

This really is the point of this thesis, namely, to illustrate the inherent potential that exists within our urban fabrics. With minimal disruption to the local environment – even intensively developed urban environments – the transformation of infrastructure can improve the infrastructure itself and benefit the larger natural and cultural environment. We can use the vertical spaces associated with urban infrastructure – consider the amount of asphalt poured in our cities – in much the same way that older cities reused the spaces above or within the structures they inherited, creating the durable palimpsests.

Chapter 6: Conclusion

New Morphology

This thesis explores opportunities and approaches to urban growth. It challenges us to invest in new ways of designing spaces and architecture within the city by returning older approaches to urban transformation. It advocates a return to a more sustainable approach to growth that builds on the matter at hand. It proposes that we create new layers of inhabitation, not just new suburbs, each of which is informed by and respectful of what has come before. It challenges us to be poetic not profligate, to make enlightened choices.

Leaning from the mistakes of the modernists I believe we should again consider vertical space as a resource – a sustainable one at that. It is buildable area that can be harnessed with a minimum of environmental damage and, if done carefully, with a minimum of social repercussions. Building vertically within existing city boundaries will focus the resources of our environments and populations into tighter areas so as not to threaten the remaining natural spaces while improving the interactions and movements of city inhabitants. Verticality can mean many things, and this thesis is certainly not advocating the extreme varieties that exist in the world today – Hong Kong or New York come to mind; very tall towers stacked close together out of necessity or, for that matter, the modernist vision of cruciform towers punctuating expansive, manicured lawn-scapes. There are also social issues to consider with verticality, not least of which is the fact that most people do not want to live in towers. We are looking for something in-between, a means of exploiting the verticality inherent in our cityscapes without further destroying our viable natural habitats. In some cases this is happening already. Projects like the Highline exploit transportation infrastructure to creating additional building while others connect future inhabitants to existing intermodal hubs by building over rapid transit/roadway connections. The major difference between these new building typologies and what is currently being built is scale; they fit into the area where it is needed or where the city has room without encroaching on adjacent sites.

In what ways does what I am proposing differ from what is currently being built, apart from the obvious. Full size lots of green spaces can be built and accommodated in vertical spaces (see figure 18, 19). Given that there is little difference in the size, only perception remains. What is that perception? Is there really any difference from walking out your front door, through your front lawn to your driveway/automobile when compared to that living in an apartment building that provides adequate green space like that of a suburban single family home – suburban backyards are just as walled in as a balcony. It has more to do with cost, it is cheaper to build or buy a suburban house than it is to own a house in the inner city, at least that is what we were told. City inhabitants are usually of lower income, struggling to emulate middle and upper

classes living by moving out to the 'better life' in the suburbs – it isn't that much better. The hidden costs of living so far away from the cultural and business centers are probably higher over time than would have been, had that person/family bought in the city in the first place.

This is not a manifesto for the complete reorientation of the way we build in cities nor a moratorium on building outside the core. Rather it is a plea that we question why we build the way we do, i.e., in a manner that separates us from each other and threatens the environment in the process. Not all infrastructure is created equal nor is it equally exploitable. Neither can all infrastructure be exploited in the same fashion. Only a careful study of existing conditions and of the impact of any new structure would have on the adjacent environment will ensure the successful integration, not unlike any carefully designed architectural form. In the end, this process will allow for additional options of places to live.

We can no longer afford to plan from a two dimensional perspective, but that three dimensional vision and understanding are required for sustainable urban interventions.

> "Most productive architectural theses are framed by their limitations: where the conditions bounding the project are transformed into the very arguments for development, where cost limitations become the opportunity to rethink program diagrams; where aesthetic preconceptions enable a close examination of the historical and cultural meanings embedded in stylistic habits; where material possibilities exist in the redeployment of common materials or objects not typically found within Sweets Catalogues."
> (Lewis & Tsurumaki & Lewis 9)

Chapter 7: Project Proposal

Intermodal

This project begins by proposing an elevated bicycle path over the O-Train rail corridor between the OC Transpo stops at Bayview and Carling Avenue. Since there are no north/south bike trails between Island Park in Westboro, to the west, and the downtown core, to the east, this is an attempt to connect the parks and trails in Lebreton Flats (and its associated cultural institutions) to Carleton University -- via the parks and trails at Dows Lake and the Experimental Farm. It would provide a link between the bike trails along the Ottawa River and those along Queen Elizabeth Drive at Dow's Lake.

At either end of this elevated bike path (i.e., at Carling Ave and at Bayview) will be a structure that will act as a hub and starting point for the elevated bike trail. Each structure will incorporate a bicycle rental station, featuring bicycles with charging packs, allowing consumers to produce electricity for the city grid and contribute to the maintenance and upkeep of the programs present in the buildings. Each building will include functions that will enhance the experience of the biker using the trail, commuters of the O-Train light rail system, local businesses and their employees and any tourists/pedestrians interested, i.e. local markets, confectionaries, and ride sharing programs.

In addition to the program identified above, Site A (Bayview Transit-way terminal) will include residential and commercial elements situated above the existing bridges spanning the O-train line, and separating LeBreton Flats from the Hintonburg/Westboro area. It will also include parking facilities for the residents as well as elevated outdoor zones for recreation and green spaces. This structure will attempt to create a meaningful urban living experience without destroying the green spaces already present on the site.

Site B, (Carling Avenue) will accommodate other programmatic elements, leveraging its location next to a tourist destination (Dows Lake) and the views possible form the site. These will include an apartment building, a coffee shop and/or a few small retail spaces, and possibly a gym. Parking will be provided in the vertical section as well, accessible by a ramp.

The primary function of Site C (residential units above and along the O-Train line)) will be to attract those who have an interest in living within the downtown core and have little use for personal transport. This site will not include parking facilities, and will be a test site for users interested only in mass transit, biking and walking being the primary means of transportation

Phase 1: Elevated bike trail and Site A

Phase 2: Site B

Phase 3: a system of vertical trails linking parts of the city. Each node will assume a different entity based the local environment, with functions/users to support. An attempt to highlight the growing underground biking culture and the more main stream focus on reducing our society's dependence on oil.

All three sites, while differing in form and function, are part of one overall scheme. Together their development will attempt to address large inconsistencies within the structure of the neighbourhoods through which the transit corridor runs.

The northern site and the residential units above the O-Train line will attempt to connect the three very different neighbourhoods separated by physical and spatial barriers. Specifically, Bayview Terminal will resolve the awkward nature of the Bayview bridges for pedestrians and the large amount of unused space separating Hintonburg from lower Chinatown. The vertical structure will provide adequate green space for growing and energy generation without encroaching on the protected parkland to the north of the site, and since this site will – with the LRT east-west expansion – become a large transitway terminal, it seems only fitting that it provide services for passengers travelling on the transit system. With the build-out of the LeBreton flats development, this structure can serve as the western gateway to that historical area.

The residential units along the O-Train line will straddle the vertical space above the line. At a basic level, they will serve to cap the ditch used by the train, allowing free movement of the inhabitants from both neighbourhoods – Hintonburg to the west and Little Italy to the east of the track – which up to this point are only accessible by a few narrow bridges. The bike trail running the length of the line from the north site to the southern one at Carling will also feature a green track expressly for pedestrians – permitting free access across the areas along the line. This area will be similar to the Highline in most respects, in that it will connect area previously disconnected and allowing growing/green space accessible by the local public.

The final site, at the southern end of the exposed O-Train line will also feature a vertical structure straddling Carling Avenue (a major east-west traffic corridor). This building will serve as the southern book end to the overall project by providing a thematic connection with the northern site to match the park lands there, namely those along Dows Lake. It also provides a physical connection between the northern part of the city of Ottawa (Le Breton Flats, Downtown, Parliament Hill, etc.) with the middle of the city, but purely for inhabitants and visitors who would rather use non-automobile methods.

Further sites have been identified along the O-Train line corridor that could potentially be used for further vertical structures or residential units. The bridge at Gladstone Street is particularly interesting as the city has decided that an additional O-Train stop is warranted at that site.

The overall theme for this project, as it related to the written portion of this thesis, becomes a test bed for how the vertical resources of a city can be used for the benefit of adjacent areas and the city as a whole. By activating derelict infrastructure within the city, like the palimpsests of older cities, one can reuse the energy already present in the existing structure for the benefit of the newer one. In this case the infrastructure in question is recently reactivated, which will only serve to increase the potential of the design. It will continue to test whether intermodal connections in a decidedly urban area function properly. Will the structure fit within the existing scale of the urban fabric – will a vertical structure in this area seem out of place? Will enough space be activated that potential funding of a project like this will be feasible? These are some of the questions that the design portion of the thesis will attempt to address.

Proof of Concept

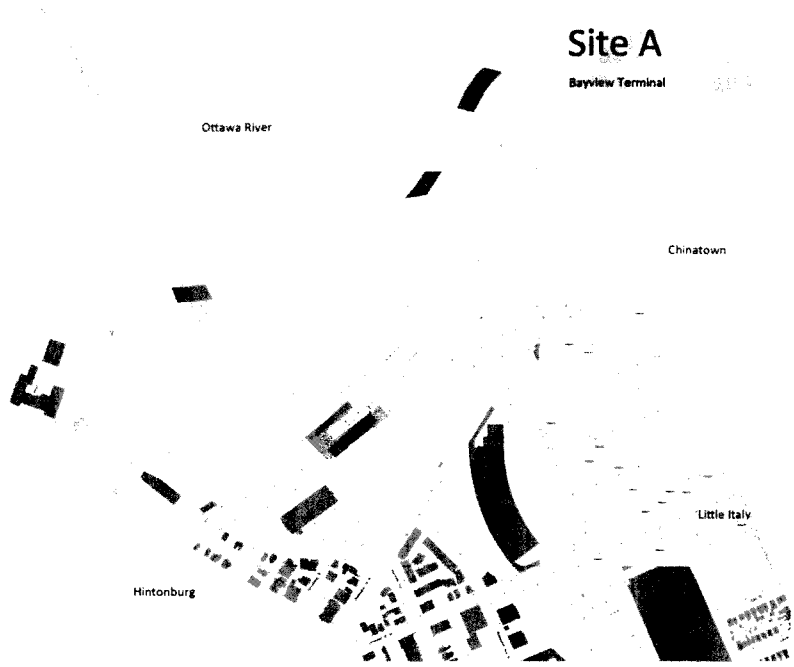

Figure 21: Site Plan of Bayview Terminal

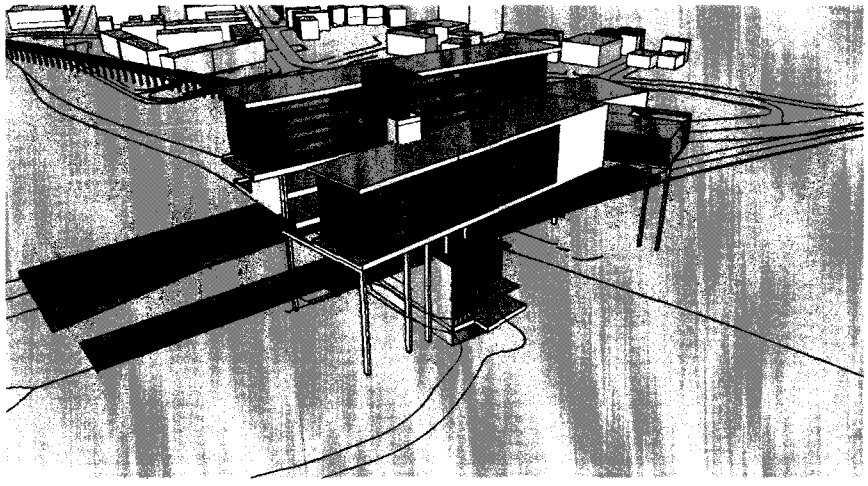

Figure 22: Image of the Bayview Terminal Residential building looking southwest along the O-Train Line. Using the vertical spaces situated above the Scott Street bridge and its associated OC Transitway Bridge (forward of the two) as a stable site for building. It connects the roadways, the existing OC transitway, O-Train terminal and the new Bike pathway (background, left) in an intermodal corridor above City Right of Way. Oriented to take advantage of the landscape views of LeBreton Flats, NCC parklands and the Ottawa River – see site plan above – Figure 22.

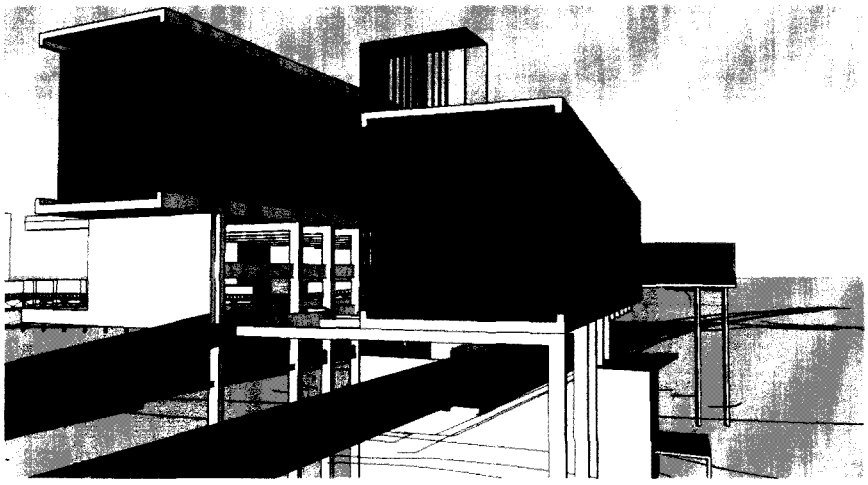

Figure 23: Image of the Bayview Terminal Residential building highlighting the structure that would be used to support the building over the existing transportation corridor. Each wing maintains the required minimum over-head height as other bridges and elevated structures. This image also helps to distinguish the 3 wings of the building. Wings One and Two are in the foreground, the higher of the two being Wing One, while the final Wing Three is in the background, protruding perpendicular from the majority of the structure.

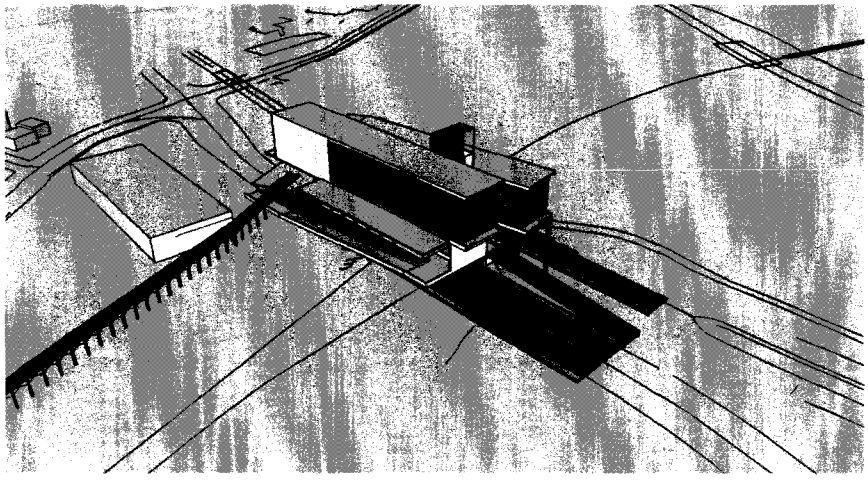

Figure 24. Image of the Bayview Terminal Residential building and the connection with the elevated bike pathway. The pathway connects vertically with wing 3 (see Figure 23) which features and outdoor covered bike parking lot – see below: Figure 25.

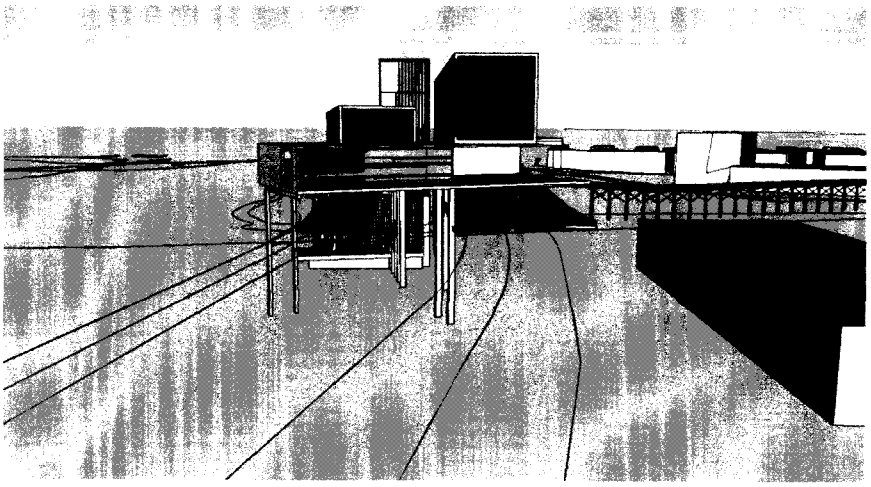

Figure 25: Bayview Terminal Buidling looking towards the downtown core of Ottawa and Parliament Hill.

Figure 26: Carling Avenue Site Plan

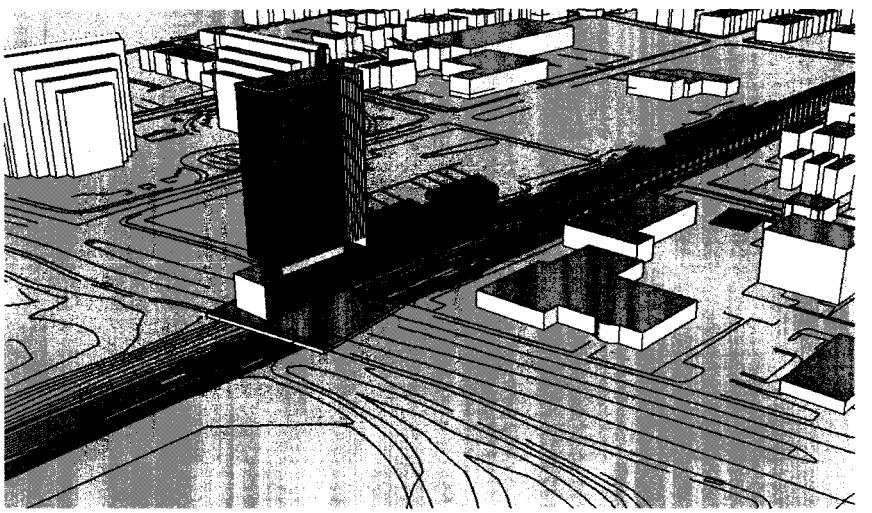

Figure 27: Carling Avenue Residential Tower looking Northwest. This image shows clearly how the tower will use the parallel right of way space above the O-Train Line corridor and the vertical space above Carling Avenue. The tower itself will be mainly residential, with some light commercial or entertainment spaces in the base of the tower – a restaurant would be ideal here, to take advantage of the site lines into Dow's Lake and parkland to the southeast (lower portion of the image). The horizontal section of the tower which follows the corridor and eventually connects with the elevated bike pathway would be completely for residential units with access to variable covered green spaces on the roof deck.

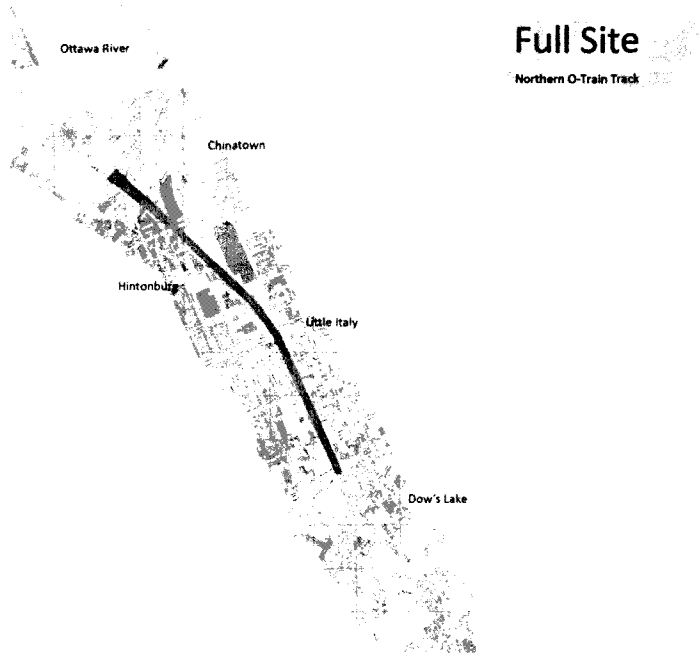

Figure 28: Total Site plan – shows the line of development along the O-Train Line.

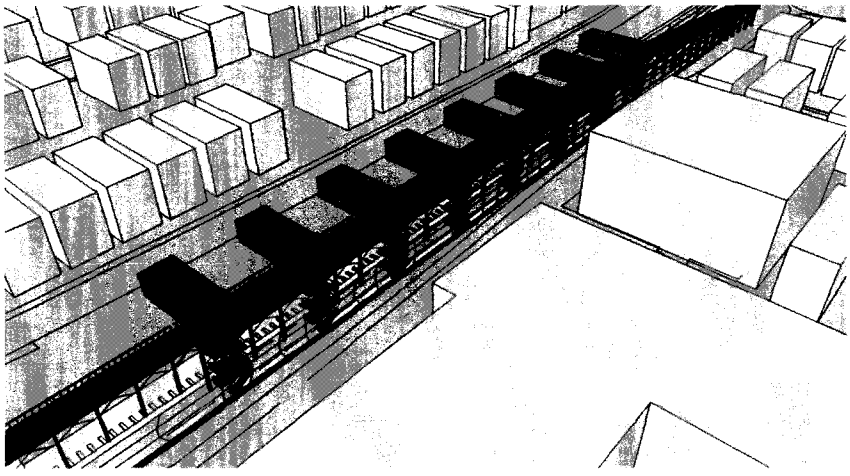

Figure 29: Container Style Residential Units. Built to the specification of Cargo Containers in the unlikely event that funding could not be achieved, a secondary, less expensive alternate would be available – could also take advantage of the existing rail line for delivery if needed. This section is located between Beech Street and the 417 Queensway – see site plan. Each unit is attached vertically above the elevated bike pathway, taking advantage of shared mechanical and circulation systems. Each unit would have access to a green roof deck which would also provide spectacular views above the existing streetscape of Preston Street (Little Italy – located to the bottom right of this image) and Hintonburg (top left of image). As stated, these units will bridge the gap between these two separate neighbourhoods by increasing density and using the vertical space above the existing physical barrier – the O-Train Corridor

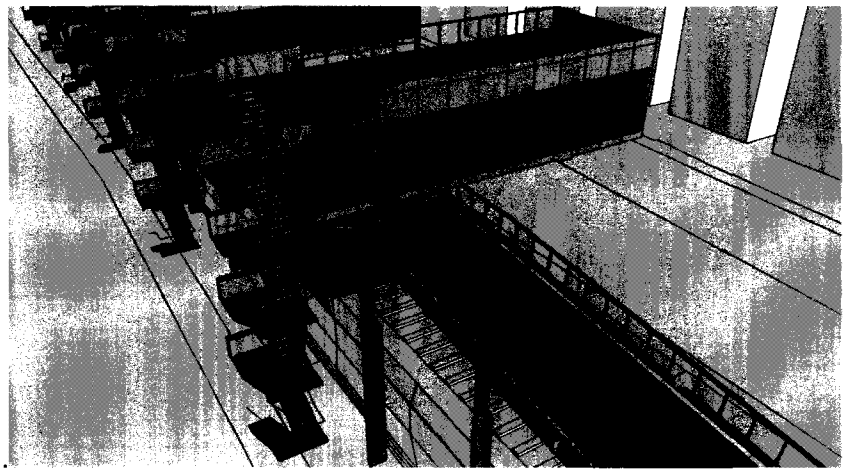

Figure 30: Perspective of the connection between the Container style residential units and the elevated bike pathway and the O-Train Corridor (grey trench located underneath the bike path)

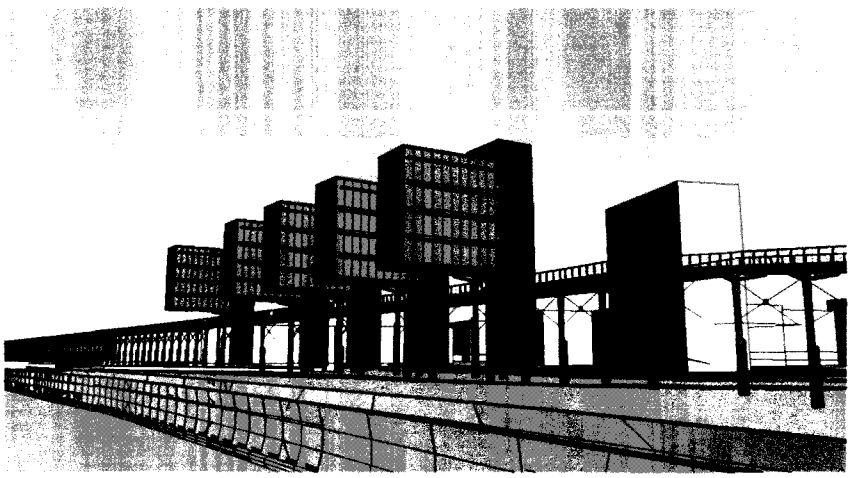

Figure 31: Perspective of the Multi-Storey Residential Units located just north of the 417 Queensway and south of Gladstone Street Bridge looking north. In an effort to lower construction costs and to increase the efficiency of the mechanical and circulation systems, this prototype features the container type residential units stacked 4 or 5 units high with a glass partition wall to screen the entrance stairways. Each tower would have access to green spaces on the roof deck.

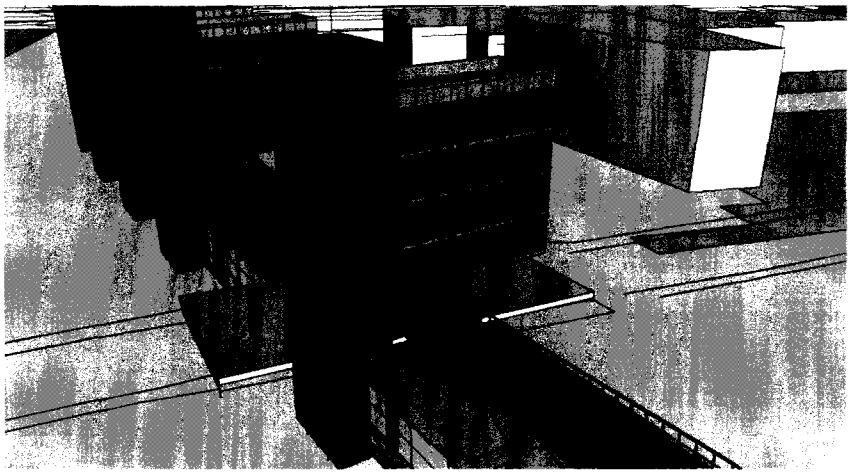

Figure 32: Perspective of the Multi-Storey Residential Units looking south. Highlights its connection with the elevated bike pathway, the O-Train Corridor (grey trench located underneath the bike path) and the existing Gladstone Street Bridge spanning the O-Train.

Chapter 8: Post-Script

This thesis set out to test the potential of the vertical and adjacent spaces occupied by or near infrastructure – be they active or derelict. In this case I feel the project was successful in identifying adequate infrastructure suitable for the program of a raised bike pathway – which would be the catalyst for increased urban residential development. It became an additional layer and identity within somewhat dense but loosely affiliated zone of the city of Ottawa. The site (the O-train corridor) therefore, acted not as a barrier between the neighbouring zones, but more of a bridge – as the increased interest in the area and the associated development that would accompany it, centered specifically on the corridor itself, would inevitably fill in the gap that delineated those zones. The intermodal connections, the functional requirements of each of the individual prototypes, work well within the northern and southern larger scale residential buildings (which I believe is inherent to any larger mixed use building anyways – due mostly to the number of residents it will attract), but, decidedly less so within the single and multi-use residential buildings that were grafted onto the new elevated bike path. Connecting with the elevated pathway became problematic except at specific points along the corridor – located near the roadways that span the corridor. It would be quite awkward for a biker to have to climb stairs to reach the pathway to continue a journey along the city pathways, and while the center stretch of the path does ramp down to pass under the Queensway, additional ramps would require a tremendous amount of space to allow access to key point along the pathway – think of the amount of space for off ramps required for any highway. As there is no existing pathway from Carling Street to LeBreton Flats anyway, this could still be considered an improvement from using the heavily trafficked roadways, it is not without its drawbacks. While I do believe, individually, each of the prototypes scale fits within their associated sites, which may be due to the nature of the infrastructures they straddle, – and in the case of the northern Bayview Terminal Building the amount of open space available – the overall scale of the entire project was prohibitive in really exploring the infrastructure itself as a site with unique characteristics and histories. For the elevated pathway itself, the idea of a pathway linking the northern and central sectors of the city was warranted, but perhaps the elevated part was too much of a leap when considering funding and construction costs. There is ample room, except in a few places where a path on grade could be built instead, but still act as an additional catalyst for the redevelopment of the area. Additionally, the sites along and above the O-Train corridor, outlined within this thesis, could really stand on their own in terms of viability for redevelopment. This would include all the sites outlined in the urban study drawing.

If I was to continue working on this thesis in the future, I still believe that an elevated network of pedestrian and biker pathways would be an interesting and perhaps vital new dimension in urban transportation infrastructure. There are currently, in many cities, studies and projects being funded to increase the amount of space made available for residents which use personal motive transport. Secondly, the vertical

spaces that are situated above large highways and expressways that bisect urban landscapes offer a wealth of potential sites for future residential intermodal towers (there are currently many projects that utilize this infrastructural space, but few of them are residential, most are institutional or commercial (i.e. The Seattle Convention Centre straddles the I-XX). I am specifically interested in these sites as they are obviously perfect nodes for an intermodal connection, but also, highways offer a site that could be utilized for future Light Rail systems.

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